REPORT OF THE 34th MEETING OF THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

CGMS-34

Shanghai, China
1-7 November 2006

Cover page photo:
Nanjing Rd and Pudong area in Shanghai; Chinese garden in Suzhou

Back cover image:
Chinese garden in Suzhou; silk factory in Suzhou; Zhouzhuang water village

Please note that this report is published together
with a CD-ROM containing an electronic version
of the report together with all working papers presented
at CGMS-34.

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CGMS MR 34

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FINAL REPORT OF THE PLENARY SESSION

A. INTRODUCTION

A.1 Welcome

The 34th CGMS meeting was officially opened by Dr Wenjian Zhang, Deputy Administrator of the China Meteorological Administration (CMA), on 2 November 2006 at 12 am in Shanghai, China. He stated that it was the third time China had hosted the CGMS meeting and that for more than 30 years CGMS had been an important and effective international body focusing on Earth observation coordination. He continued by saying that he was honoured to be the local host and hoped everybody would enjoy meeting in Shanghai, the largest city in China. CMA was the largest national meteorological organisation within the WMO framework in terms of size and that it was committed to an integrated meteorological observation system as part of its long-term strategy. To confirm this, CMA will continue the FengYun satellite programme as well as continue the coordination with other countries and organisations to maximise the benefits to users around the world. He expressed his gratitude to those who had contributed to the preparation and organisation of the meeting, to EUMETSAT for the sponsorship, and CMA's partner, the Shanghai Academy of Space Technologies. In his closing remarks, he wished the participants a successful outcome of the meeting.

On behalf of the CGMS Secretariat, Dr Lars Prahm, Director-General of EUMETSAT, also welcomed the participants to the 34th session of the CGMS. He stated he was very pleased and honoured to be working alongside the hosts CMA and its partners. He further said that CGMS was a means to further strengthen international cooperation on satellite meteorology and Earth observation at a critical time, where changing weather and climate influence all life on Earth. With the recent successful launch of EUMETSAT's first MetOp satellite, he stated that it represented a substantial milestone not only for the partnership between the United States and Europe on the Joint Initial Polar System, but also for global operational meteorology, and would result in substantial improvements for the user community. He concluded by wishing everybody a successful and fruitful meeting.

This opening session was closed by Dr Wenjian Zhang, with a wish for a very successful 34th CGMS meeting.

A.2 Election of Chairmen

Dr Wenjian Zhang, CMA, and Dr Donald Hinsman, WMO, were unanimously elected as co-Chairmen of CGMS-34 with Mr Gordon Bridge and Dr Piero Valabrega as Rapporteurs. Chairmen for the working groups had been elected at the previous CGMS meeting; Mr Marlin O Perkins for Working Group I on Telecommunications, with Mr Gordon Bridge acting as Rapporteur; Xu Jianmin for Working Group II, on Satellite Products including Satellite-Derived Winds, with

Dr Mitch Goldberg and Dr Johannes Schmetz acting as Rapporteurs; Mr Gary Davis as Chairman for Working Group III on Global Contingency Planning, with Dr Donald Hinsman as Rapporteur; and Mr Mikael Rattenborg elected as Chairman of Working Group IV on Integrated Strategy for Data Dissemination from Meteorological Satellites, with Mr Gordon Bridge acting as Rapporteur.

A.3 New CGMS Members

Following an official communication to the WMO Secretary General on its commitment to making observations from China National Space Administration (CNSA) missions available to the world community in adherence with the principles of the space based component of the WMO WWW GOS, and a subsequent communication from WMO to the CGMS Secretariat in April 2006, CNSA was unanimously nominated as a full Member of CGMS. CNSA expressed its appreciation to CGMS and introduced its responsibility and China's satellites and applications targets for the coming 5 years. It further confirmed its desire to fulfil the objectives of CGMS and to be an active partner in the WMO Global Observing System, highlighting the future sharing of its observation data with CGMS Members.

A.4 Adoption of Schedule

The schedule (see annex 1) was adopted. The meeting recalled that the four working groups had met previously on 2 and 3 November 2006.

The Secretariat provided a list of working papers submitted to CGMS-34 (see annex 2), as well as a provisional draft order of business (see annex 1), which was used as a basis for the subsequent discussions.

A.5 Nomination of Drafting Committee

The drafting of various sections of the Final Report was carried out by the Secretariat assisted by CGMS partners, based upon summaries of submitted working papers and the reports of the working groups and plenary sessions.

A.6 Review of Action Items from Previous Meetings

The Secretariat reviewed the outstanding actions from previous meetings, taking into account inputs provided in Working Papers CMA-WP-01, ESA-WP-06, EUM-WP-01, -24, JMA-WP-01, KMA-WP-01, NOAA-WP-28, -29, -40, -41, -42 and WMO-WP-01, as well as by other means of correspondence, including e-mail.

(i) Permanent actions

1. All CGMS Members to inform the Secretariat of any change in the status or plans of their satellites to allow the updating of the CGMS Tables of Satellites. The Secretariat to review the tables of current and planned polar and geostationary satellites, and to distribute this updated information, via the WWW Operational Newsletter, via Electronic Bulletin

Board, or other means as appropriate. CGMS satellite operators to update table 7 for polar-orbiting satellite equator crossing times on an annual basis. CGMS Members to update the table on polar-orbiting satellite equator crossing times as well as the table on coverage from geostationary satellites.

Related WPs: CMA-WP-02/03/04/05, ESA-WP-01/02, EUM-WP-24; JAXA-WP-01, -02, JMA-WP-02, -03, NOAA-WP-41, NASA, ROSC, ROSH by e-mail.

2. CGMS Members to update the CEOS/WMO Consolidated Database as appropriate and at each CGMS meeting.

   Closed. To be included in future updates of WMO-WP-25. ESA, JMA by e-mail.

3. All CGMS satellite operators to review the Transition Tables for LRIT/LRPT (appendix A of CGMS-31 WMO-WP-03) and provide any updates as appropriate at every CGMS plenary meeting.

   Related WPs: EUM-WP-24, JMA-WP-11, NOAA-WP-40, KMA and ROSH by e-mail

4. CGMS Members to report on anomalies from solar events at CGMS meetings.

   Related WPs: EUM-WP-02, NOAA-WP-04, ESA by e-mail

5. CGMS Members to update their relevant sections of the CGMS Consolidated Report as appropriate and to send their updates to the Secretariat at least 2 months prior to every CGMS plenary meeting.

   Closed. A final report will be made and new version made every 4-5 years thereafter. EUM-WP-14, JMA by e-mail, CMA, ESA, JAXA and NOAA by e-mail (to be provided at a later stage).

6. CGMS Members to provide information for the WMO database of satellite receiving equipment, as appropriate.

   By e-mail EUM, NOAA

7. CGMS Members to review the list of available list servers used by CGMS groups and update as appropriate.

   Related WPs: ESA by e-mail, EUM, JMA-WP-01, NOAA-WP-28

8. CGMS satellite operators to consider the IOC satellite requirements, especially the data dissemination methods, bearing in mind the ongoing formations of GOOS Regional Alliances (GRAs).

   Related WPs: ESA-WP-03, EUM-WP-02, NOAA-WP-29

9. CGMS Members to consider the WIS concept (notion of DCPC, catalogue/metadata standards, protocols) when changing/implementing processing and dissemination systems.

   Discussed in WGI. EUM, NOAA by e-mail

10. CGMS Members to consider WMO Core Metadata profiles within the context of the ISO Standard for Geographic Metadata (ISO 19115).

    By e-mail: NOAA, EUM (ongoing)

11. CGMS Members are invited to review and update the CGMS list servers on a regular basis. It is suggested that the CGMS Secretariat carry out this action at the time of the call-up of the CGMS working papers.

    Closed. Covered by permanent action 7.

(ii) Actions from CGMS-32

32.03 CGMS Members to provide points of contact responsible for updating the CGMS Consolidated Report.

Closed.

32.11 (1) CGMS Members to identify key calibration publications. (2) Calibration papers from CGMS Members should be posted on a CGMS Web site by the CGMS Secretariat.

Closed. The publications can be found at http://www.eumetsat.int/Home/Main/Publications/CGMS_Publications/SP_1149494399935?l=en

32.16 CGMS recommends that R&D agencies support, as much as possible, the IPWG request for procuring experimental data sets (e.g. by airborne campaigns) to help cloud/precipitation modelling and instrument definition. A report on the support realised for this IPWG request should be given at CGMS-33.

Closed.

(iii) Actions and Recommendations from CGMS-33

Action 33.01 CGMS Members to continue interacting with WMO (Dr Bizzarro Bizzarri < bibizzar@tin.it >) in order to resolve any doubtful or missing information needed to complete the next issue of the "Status of the space-based component of the global observing system (GOS)". Any further updates submitted as part of Agenda items B1, B2, B3, C1, C2 and C3 should be delivered if possible at least one month in advance of CGMS-34 to allow final tuning of the report before CGMS plenary. **Deadline: 15 September 2006**

Closed. CMA, ESA, EUM, JMA, KMA-WP-02, ROSH, ROSC, WMO

Action 33.02 WMO to send a copy of the "Implementation plan for the evolution of the space and surface-based sub-systems of the GOS" (WMO/TD No. 1267) to CGMS Members. **Deadline: CGMS-34**

Closed. Provided by e-mail on 10 November 2005.

Action 33.03 CGMS Members to provide feedback to WMO on the various proposals presented in WMO-WP-07 concerning the evolution of the spaced based system of the GOS. **Deadline: CGMS-34**

Closed. Discussed in WGII. EUM-WP-02 to -05, JMA-WP-03, ESA and NOAA by e-mail, WMO-WP-06

Action 33.04 WMO (Space Programme Office) to inform the WMO Tropical Cyclone Programme of the benefit of using water vapour polar winds for improving the accuracy of tropical cyclone forecasting. **Deadline: CGMS-34**

Closed. WMO SP provided a report to TCP.

Action 33.05 In response to WMO-WP-25 and EUM-WP-05, CGMS satellite operators are requested to analyse the steps needed to make their archived satellite data usable for climate studies, and report to CGMS accordingly. **Deadline: CGMS-34**

Closed. Discussed in WGII. ESA by e-mail, EUM-WP-07

Action 33.06 In response to WMO-WP-25, CGMS operators are invited to report on current efforts to establish and/or enhance aerosol products suitable for climate applications. **Deadline: CGMS-34**

Closed. Discussed in WGII. CMA-WP-02, ESA-WP-04, EUM-WP-08, JMA-WP-09, NOAA-WP-19

Action 33.07 CGMS Members are requested to support the arrangements for their high profile training events as described in the document WMO-WP-17. **Deadline: CGMS-34**

Closed. EUM-WP-12, JMA-WP-01, WMO SP built a webpage to carry out on-line registration.

Action 33.08 CMGS Members are invited to update the database of ground receiving equipment via the WMO.

Closed – addressed in permanent action 6. WMO-WP-06.

Action 33.09 CGMS Members to review and comment upon the letter to the GEO Secretariat at the very latest by Tuesday 8 November 2005. **Deadline: 8 November 2005**

Closed. EUMETSAT letter ref. EUM/SIR/LET/05/0712 of 9 November 2005 was sent to the GEO Secretariat.

Action 33.10 CGMS Members are requested to provide comments and inputs on the proposal for a new CGMS Internet site to the Secretariat by the end of 2005. Based on this input, the CGMS Secretariat to discuss with WMO a way forward. **Deadline: 31 December 2005**

Closed. JMA by e-mail, NOAA, WMO

Action 33.11 CMA to provide as a matter of urgency technical and operational parameters of the planned data transmissions in the frequency band 7750-7850 MHz to CGMS Members. **Deadline: 1 December 2005**

Closed. CMA by e-mail, EUM-WP-18

Action 33.12 EUMETSAT to perform sharing studies for X-band operations at MetOp stations and propose technical and operational measures to avoid interference. **Deadline: 1 February 2006**

Closed. EUMETSAT EUM/SES/TEN/06/0006, v1 of 24 January 2006 was sent by e-mail. EUM-WP-18, -19.

Action 33.13 WMO to provide a forum for discussion on data transmission from meteorological satellites, with a goal of resolving radio frequency conflicts, well in advance of notification to ITU, and adopting approaches to avoid them. **Deadline: CGMS-34**

Closed. Meeting held on 30 August 2006 in Geneva. EUM-WP-17, KMA by e-mail, NOAA-WP-08, WMO-WP-10.

Action 33.14 Satellite operators participating in the IDCS and WMO to each nominate an expert to the IDCS contact group, and inform the Secretariat accordingly. **Deadline: 31 December 2005**

Closed. Discussed in WGI
CMA: Zhiqing Zhang (zqzhang@nsmc.cma.gov.cn)
EUMETSAT: Sean Burns (sean.burns@eumetsat.int) and
Wil Doran (wil.doran@eumetsat.int);
JMA: Naotaka Uekiyo (uekiyo@met.kishou.go.jp);
NOAA: Marlin O Perkins (marlin.o.perkins@noaa.gov)
WMO: Jerôme Lafeuille (jlafeuille@wmo.int)

Action 33.15 CGMS Members to establish a Task Force lead by NESDIS (Dr Mitch Goldberg) with participation by EUMETSAT (Dr Johannes Schmetz), JMA (Mr. Toshiyuki Kurino), CMA (Academician Xu Jianmin) and assisted by the WMO Space Programme to prepare a draft Implementation Plan for GSICS by 1 July 2006 for review by CGMS Members by 1 August 2006 and approval at CGMS-34. **Deadlines: 1 July 2006; 1 August 2006; and CGMS-34**

Closed. Discussed in WGII. EUM, JMA, NOAA-WP-11, ROSH by e-mail, WMO-WP-27

Action 33.16 The ITWG should also help to formulate priorities for future satellite product developments related to the use of cloudy radiance in NWP. The ITWG Rapporteur should inform the ITWG co-chairs of this new action. **Deadline: CGMS-34**

Closed. Discussed in WGII

Action 33.17 CGMS Members are requested to ensure adequate participation at the upcoming 8th International Winds Workshop in Beijing from 24 – 28 April 2006. Participation from NWP centres and relevant research institutes should be encouraged and requested by CGMS operators with indications of attendance and support by 31 December 2005. **Deadline: 31 December 2005**

Closed. The workshop was held. EUM-WP-23, ESA, JMA, KMA, NOAA participated.

Action 33.18 The fire papers prompted CGMS to recommend that the WMO Space Programme Office create a web site posting all the links to real time fire detection data. **Deadline: CGMS-34**

Open
ESA, EUM, NOAA by e-mail
WMO Space Programme has initiated a review of its web-site.

Action 33.19 EUMETSAT to make the algorithm to derive the surface albedo from geostationary satellites available upon request. **Deadline: CGMS-34**

Closed. EUM-WP-22

Action 33.20 EUM, CMA, NOAA and WMO to establish a task force to draft terms of reference for a potential new working group on data handling for direct data broadcast and pertinent formats (e.g. BUFR) that could be considered at the next meeting of CGMS. **Deadline: CGMS-34**

Closed. Discussed in WGII. WMO-WP-36

Action 33.21 WMO, through the WMO Space Programme, to organise a two-day Workshop in Geneva in (2nd Quarter 2006) to facilitate regional discussions for optimised operations of geostationary (1 day) and polar-orbiting satellites (1 day) to include discussions on close cooperation on instruments for future satellite missions. Two-day agenda to be developed by CGMS Secretariat in consultation with CGMS satellite operators. **Deadline: 28 February 2006**

Closed. Workshop held 28-29 August 2006. WMO-WP-04

Action 33.22 All CGMS satellite operators to update, as a matter of urgency, the WMO generated tables indicating transition of broadcast services of satellites in polar and geostationary orbit, and inform the Secretariat accordingly. **Deadline: 31 December 2005**

Closed. To become a new permanent action. EUM-WP-24, JMA by e-mail, NOAA-WP-40, WMO-WP-20

Action 33.23 Within the context of the WMO December 2005 RARS Workshop, WMO to invite China, Japan, Korea and Australia, together with other interested CGMS partners, to specifically discuss possibilities for supporting a regional ADM Service for the Asia-Pacific Region. **Deadline: 10 December 2005**

Closed. Session held on 2 December 2005. WMO-WP-20

Action 33.24 EUMETSAT, NOAA together with WMO to develop a EUMETCast to NOAA ADM transition plan for users in South America and report details to CGMS. **Deadline: CGMS-34**

Open. EUM-WP-11, WMO-WP-20

Action 33.25 CGMS Satellite Operators to review the content of the CGMS Global Contingency Plan, as contained in WMO-WP-05, and provide WMO with comments by 1 January 2006. **Deadline: 1 January 2006**

Closed. Input and document provided.

Action 33.26 WMO to finalise and provide the CGMS Secretariat the final manuscript for publication. **Deadline: 28 February 2006**

Closed. The CGMS Global contingency Plan, v1 of 6 March 2006 was sent to plenary.

RECOMMENDATIONS

It was noted that the following recommendations had been taken into account by each Member as far as possible.

Recommendation 33.01 It is recommended that CGMS encourages its Space Agency Members to provide continuity of funding for the scientific studies, pending the establishment of a consolidated study programme once a space agency has accepted the role of the lead space agency in the implementation of the IGEOLab GEO microwave project.

ESA-WP-02

Recommendation 33.02 CGMS Members are encouraged to ensure that the description of their programmes on their websites contains an adequate level of technical information.

ESA: www.esa/int/; www.esa.int/esaEOearth.esa.int,
EUM: website regularly updated
NOAA-WP-35
WMO: WMO TD No 1267 was provided to plenary on 10 November 2006.

Recommendation 33.03 In response to WMO-WP-25, CGMS Members are encouraged to pursue the development of enhanced cloud products including cloud microphysics, recognising the GCOS requirement for improved cloud monitoring.

EUM-WP-20, NOAA-WP-31

Recommendation 33.04 CGMS Members are encouraged to define and commence the development of a climate data set from hyperspectral IR instruments (AIRS, IASI, CrIS) that is substantially reduced in terms of data volume, in order to make climate processing of long time series tractable. It might be appropriate to defer this matter to the ITWG.

EUM-WP-09
EUM-WP-32

Recommendation 33.05 CGMS Members are kindly requested to provide support to the three CGMS sponsored International Working Groups, by providing travel support etc. to selected scientists.

Support ongoing ESA, EUM, NOAA, WMO

Recommendation 33.06 CGMS Members are encouraged to provide the location of their web sites on real time fire detection to the WMO.

ESA (http://dup.esrin.esa.int/ionia/wfa/index.asp)
EUM-WP-21 (http://eumetsat.int/Home/Main/Access_to_Data/Meteosat_Meteorological_Products/Product_List/SP_1145431848902?l=en)
NOAA: EUM-WP-35

Recommendation 33.07 CGMS Members are requested to consider the production of a long-term surface albedo data set from archived VIS channel data of geostationary satellites with the help of the software developed by EUMETSAT.

EUM-WP-22

Recommendation 33.08 CGMS Members planning for next generations of geostationary meteorological satellites to consider implementing a lightning mission and to coordinate the selection of the observation areas so as to realise optimal coverage of all low and middle latitudes.

EUM-WP-05
NOAA: Intends to fly a Geostationary Lightning Mapper on the GOES-R Series to be located at 75°W and 137°W.

B. REPORT ON THE STATUS OF CURRENT SATELLITE SYSTEMS

B.1 Polar-orbiting Meteorological Satellite Systems

In CMA-WP-02, CMA reported on its polar-orbiting FY-1 satellite series. FY-1D was launched in May 2002 and has exceeded life expectancy by two years and is still operational. The satellite carries a multi-channel visible and infrared scan radiometer (MVISR) for Earth environment monitoring and the Space Environment Monitor to detect charged particles in solar winds. HRPT direct readout service data is available via S-band 1700.4 MHz.

EUMESAT reported on the status of the EUMETSAT Polar System (EPS) in EUM-WP-02. EPS is the European contribution to the Initial Joint Polar System (IJPS) established with NOAA, and the first European contribution to the follow-up Joint Polar System (JPS) expected to be formed with the US "Converged" NPOESS system. The IJPS and JPS will provide global meteorological and climate data from a series of European and American sun-synchronous polar orbiting satellites, replacing the current NOAA K-L-M series. The EPS system will be operated for an initial period of 14 years. EUMETSAT has decided to use its EUMETCast system for the real-time dissemination of MetOp products to users.

The working paper added that whilst the launch of the first MetOp satellite (MetOp-A), was delayed several times due to launcher problems and at the time of the CGMS meeting. It had been successfully launched on 19 October 2006 from Baikonur.

NOAA-WP-02 updated CGMS on the status of the POES and DMSP programmes. The POES spacecraft constellation includes two primary, one secondary, two standby and one non-operational spacecraft. These spacecraft are in circular orbits inclined at approximately 98 degrees (retrograde). The primary operational spacecraft, NOAA-18 and NOAA-17, are in sun-synchronous afternoon and morning orbits, respectively. Two secondary spacecraft, NOAA-16 and NOAA-15 provide additional payload operational data.

NOAA-18 is the primary afternoon spacecraft, and as such, it operates in an orbit with a 1:35 pm ascending node and utilises the Microwave Humidity Sounder (MHS) and the Solar Backscatter Ultraviolet Spectral Radiometer (SBUV). Since launch the High Resolution Infrared Radiation Sounder (HIRS) has experienced high noise in the long wave channels. The paper further describes the various instruments in more detail. NOAA-16 is the corresponding back-up spacecraft.

NOAA-17 is the primary spacecraft, and as such, it operates in an orbit with a 10:20 am ascending node and utilises a Solar Backscatter Ultraviolet Spectral Radiometer (SBUV). On February 15, 2003, DTR5 failed to operate and on April 28, 2003, STX3 power degraded to 2 watts. On October 28, 2003, the AMSU-A1 scan motor failed and the instrument no longer provides any data.

All other systems are operational. Description of the instrument payload is provided. NOAA-15 is the corresponding back-up spacecraft.

NOAA-12 and NOAA-14 are standby spacecraft supporting additional user data requirements, and NOAA-11 was decommissioned in 2004.

The Working Paper further reported on the six military spacecraft of the Defense Meteorological Satellite Program (DMSP) initiated via a Presidential Decision Directive in 1994, capitalising on shared resources and mission requirements of civilian and military polar-orbiting spacecraft. The current DMSP constellation consists of two primary, two secondary, and one backup operational spacecraft which are near polar orbiting, sun synchronous satellites monitoring the meteorological, oceanographic, and solar-terrestrial physics environments. It is envisaged that a single, integrated environmental satellite system designed to meet civilian and military needs would be available around 2012.

Table 1: Current Polar-Orbiting Satellites Coordinated within CGMS
(as of 7 November 2006)

Orbit type **(equatorial crossing times)**	**Satellites in orbit** (+operation mode) P=Pre-operational Op=operational B=back-up L=limited availability R= R&D	**Operator**	**Equatorial Crossing Time** A=Ascend (northward) D=Descend (southward) +Altitude	**Launch date**	**Status**
Sun-synchronous local "early morning" orbit (05:00 –07:00) (17:00 – 19:00)	FY-1D (Op)	CMA	18:50 (D) 866 km	05/2002	Functional. CHRPT.
	NOAA-15 (B)	NOAA	17:36 (A) 807 km	05/1998	Functional (intermittent problems with AVHRR, AMSU-B & HIRS)
	DMSP-F13 (Op)	NOAA	18:33 (A) 850 km	03/1995	Defence satellite. On orbit 136 months – estimate 7 months of mission life remaining. Data available to civilian users through NOAA.
	DMSP-F14 (B)	NOAA	17:58 (A) 852 km	04/1997	Defence satellite. SSMT1 (microwave temperature sounder) non-functional. SSMT2 non-functional. Only 1 functional onboard recorder. Data available to civilian users through NOAA.
	DMSP-F17 (P)	NOAA	17:30 (A) 833 km	4 Nov 2006	Defense satellite SSMIS data available to civilian users through NOAA.
Sun-synchronous local "morning" orbit (07:00 – 12:00) (19:00 – 24:00)	MetOp-A (P)	EUMETSAT	21:30 (A) 837 km	19 Oct 2006	Commissioning phase.
	NOAA-12 (L)	NOAA	17:08 (A) 804 km	05/1991	Functional (except sounding).
	NOAA-14 (B)	NOAA	21:29 (A) 845 km	12/1994	Functional. AVHRR and SBUV degraded.
	NOAA-17 (Op)	NOAA	22:19 (A) 810 km	6/2002	Functional. AMSU-A1 Failed.
	DMSP-F15 (B)	NOAA	20:10 (A) 850 km	12/1999	Defense satellite. SSMT2 (microwave water vapour sounder) non-functional. Data available to civilian users through NOAA.
	DMSP-F16 (Op)	NOAA	20:12 (A)	10/2003	Defense satellite. SSMIS. Data available to civilian users through NOAA.

Orbit type (equatorial crossing times)	Satellites in orbit (+operation mode) P=Pre-operational Op=operational B=back-up L=limited availability R= R&D	Operator	Equatorial Crossing Time A=Ascend (northward) D=Descend (southward) +Altitude	Launch date	Status
Sun-synchronous local "afternoon" orbit (12:00 – 17:00) (00:00 – 05:00)	NOAA-16 (B)	NOAA	15:26 (A) 850 km	09/2000	Functional, no APT. Intermittent problems with AVHRR.
	NOAA-18 (Op)	NOAA	13:42 (A) 854 km3	5/2005	Functional. Noise on HIRS long wave channels
	DMSP-F12 (L)	NOAA	16:01 (A) 850 km	8/1994	Defense Satellite. SSMI (microwave imager) and SSMT1 non-functional. Non-operational (no onboard recorders).

B.2 Geostationary Meteorological Satellite Systems

In CMA-WP-03 CMA reported on the status of the FY-2C geostationary satellite. FY-2C was launched on 19 October 2004 and it is the operational geostationary spacecraft at 105˚E. FY-2C carries VISSR and SEM instruments in order to obtain visible, infrared and water vapour cloud images, to broadcast S-VISSR images and low resolution images, and for data collection and space environment monitoring. In addition, details of satellite parameters, instruments, data transmission characteristics, data products and dissemination were provided.

In EUM-WP-02 EUMETSAT reported on the operation of its Meteosat System and including the EUMETSAT ATOVS Retransmission Service (EARS) and International Collection Data System (IDCS) service. The Meteosat System currently comprises five satellites: Meteosat-5, -6, -7, -8 and -9. EUMETCast was reported on separately in EUM-WP-11.

The commissioning phase of Meteosat-9 has been completed and the investigation into an anomaly in the WV6.2 channels is still ongoing. It is anticipated that a work-around solution will be able to rectify the situation.

Meteosat-8 has supported the DCP mission since 16 May 2006. Due to the anomaly found on the nominal Unified Propulsion Subsystem (UPS), the Attitude and Orbit Control Electronics (AOCE) began using the redundant unit on 18 May 2006.

Following the end of the Direct Dissemination Service (including WEFAX) on 14 June 2006, the configuration of Meteosat-7 was modified due to the drift towards a final orbital position at 57.5°E, which started on 11 July 2006. During the phase during which Meteosat-7 and Meteosat-6 were co-aligned, the Rapid Scanning Service was suspended to avoid RF interference and perturbations in the Meteosat-7 images.

The status of Meteosat-5 and 6 satellites is unchanged and the configurations of these spacecraft have remained stable.

The working paper also provided detailed information on the various spacecraft, ground segments, IDCS, service transitions, and dedicated project undertakings, such as Indian Ocean services, the EARS project, and EUMETCast South America. As for the IDCS, there were 133 international registered users using 9 of 33 available channels. In addition a large number of DCPs are used by the Aeronet programme, Roshydromet and WMO.

India reported (by correspondence) on the status of INSAT and the KALPANA-I (Metsat) satellites in IMD-WP-01.

INSAT is an operational multipurpose satellite system catering to the needs of three different services, viz Television & Radio Broadcasting, Communications and Meteorology. It is a joint venture of the Department of Telecommunications (DOT), the India Meteorological Department (IMD), Doordarshan and All India Radio (AIR). The responsibility for overall management and coordination of the INSAT system among the user agencies rests with the INSAT co-ordination committee (ICC).

All INSAT satellites are three-axis stabilised spacecrafts. The meteorological imaging capability has also been upgraded on this satellite, when compared to its predecessors, by providing a water vapour channel with 8 km resolution in the VHRR, the imaging instrument of the satellite.

KALPANA-1 was launched by India in September 2002 as a dedicated meteorological satellite for earth imagery with a three channel Very High Resolution Radiometer (VHRR) and Data Rely Transponder (DRT) for collection of meteorological and hydrological data from automatic weather stations. One more satellite INSAT-3A was launched by India in April 2003 with a 3-channel VHRR cloud imagery (Visible, Infrared and Water Vapour), Charged Coupled Device (CCD) camera (Visible, Near IR and SWIR) and a DRT payload. Both satellites are working satisfactorily and are used operationally for meteorological applications for day-to-day weather forecasting and derivation of satellite data products. The working paper then described the detailed operational status of the satellites, training undertakings and reception of NOAA and Meteosat data.

JMA reported on the status of its multi-functional transport satellites, MTSAT-1R and MTSAT-2, in JMA-WP-02.

MTSAT-1R, launched on 26 February 2005, has been operated in geostationary orbit at 140°E since 28 June 2005. The monthly percentage of successful direct broadcasting has been over 99% for all types of images since the start of MTSAT-1R operations.

JMA has undertaken a change in its operations in the eclipse period since autumn 2006. JMA conducts observations even when images are expected to be partially clipped, which has led to a decreased number of cancelled

observations during the eclipse period. MTSAT-1R suffered a Loss of Lock (LOL) of Earth pointing and attitude control on 16 April 2006 where recovery from LOL took place after approximately four hours and the imager resumed observation 20 hours after the occurrence of the event. MTSAT-1R has since operated in stable condition.

MTSAT-2, launched on 18 February 2006, went through In-Orbit Test (IOT) and has been on standby in orbit at 145˚E since 4 September 2006. JMA obtained first test images on 11 May 2006 which are available at (http://www.jma.go.jp/jma/jma-eng/satellite/NEWS/first_images2.html). MTSAT-2 is expected to take over as primary spacecraft in 2010, however during the stand-by period JMA is considering making the conduct of extra observations using MTSAT-2 rapid scanning, as part of the THORPEX regional campaign.

In NOAA-WP-03, NOAA reported on the status of its geo-synchronous meteorological satellites. The current primary satellites, GOES-12 and GOES-11, are stationed over the east and west coasts of the United States. These satellites are used to provide simultaneous images and soundings of the Western Hemisphere. GOES-10 is currently moving towards 60˚W to support coverage of South America. GOES-10 will arrive at 60˚W on or around 2 December 2006, and imaging will begin 23 November 2006. GOES-9 is in standby mode at 200˚W, and GOES-8 was deorbited on May 5, 2004. GOES-3 and GOES-7, spin-stabilized satellites from the previous GOES series, continue a track record of more than 55 years of combined service via continued support of non-NOAA users in a data relay mode (non-imaging). GOES-13 was successfully launched on 24 May 2006 and once post launch testing has finished it will be placed in storage at 105˚W.

The primary instrument payload for the current series of GOES spacecraft is the imager and sounder. The GOES spacecraft also have Space Environmental Monitor (SEM) systems to measure magnetic fields, solar x-ray flux and high-energy electrons, protons and alpha particles. GOES-12 has the new Solar X-Ray Imager (SXI) instrument, which provides real-time images (one per minute) of the Sun in the X-Ray band. A data collection system on the GOES spacecraft receives and relays environmental data sensed by widely dispersed surface platforms such as river and rain gauges, seismometers, tide gauges, buoys, ships and automatic weather stations. Platforms transmit sensor data to the satellite at regular or self-timed intervals, upon interrogation by the satellite, or in an emergency alarm mode whenever a sensor receives information exceeding a present level.

Table 2: Current Geostationary Satellites Coordinated within CGMS
(as of 4 November 2006, sorted by organisation)

Sector	Satellites currently in orbit (+type) P: Pre-operational Op: Operational B: Back-up L: Limited availability	Operator	Location	Launch date	Status
West–Pacific (108°E-180°E)	MTSAT-1R (Op)	JMA	140°E	26 Feb 2005	Fully Functional
	MTSAT-2 (B)	JMA	145°E	18 Feb 2006	Multifunctional Transport Satellite 135°E or 145°E (in-orbit back-up to MTSAT-1R until 2010) 140°E (operational from 2010)
	GOES-9 (L)	NOAA	160°E	05/1995	Operations of imaging and sounding functions have ceased. Currently (Apr '06) acting as potential backup for MTSAT-1R.
East-Pacific (180°W- 108°W)	GOES-11 (Op)	NOAA	135°W	05/2000	Operational spacecraft since 06/2006
West-Atlantic (108°W-36°W)	GOES-12 (Op)	NOAA	75°W	7/2001	Solar X-Ray Imager anomaly 9/05 under investigation
	GOES-13 (P)	NOAA	105°W	05/2006	Checkout, to be completed Dec 2006. Available operationally if needed.
	GOES-10 (B)	NOAA	Drift to 60° W	04/1997	To support South America in December 2006
	GOES-9 (L)	NOAA	200°W	05/1995	Backup spacecraft
	GOES-8 (L)	NOAA	n/a	4/1994	De-orbited May 5, 2004
East-Atlantic (36°W-36°E)	Meteosat-6 (B)	EUMETSAT	10°E	11/1993	Rapid Scanning Service minor gain anomaly on IR imager. Service to finish 01/2007.
	Meteosat-8 (Op)	EUMETSAT	3.4°W	28 Aug 2002	EUMETCast, no LRIT
	Meteosat-9 (B)	EUMETSAT	0°W	21 Dec 2005	EUMETCast. Primary back-up to Meteosat-8.
Indian Ocean (36°E-108°E)	FY-2C (Op)	CMA	105°E	10/2004	Functional
	FY-2A (B, L)	CMA	86.5°E	06/1997	
	Meteosat-5 (Op)	EUMETSAT	63°E	03/1991	IODC coverage, back-up to Meteosat-7. To be deorbited in 2007.
	Meteosat-7 (Op)	EUMETSAT	57.5°E	02/1997	Functional. IODC coverage till end 2008.

Sector	Satellites currently in orbit (+type) P: Pre-operational Op: Operational B: Back-up L: Limited availability	Operator	Location	Launch date	Status
	INSAT 2-B	IMD	111.5°E	07/1993	Not in use for meteorological services.
Indian Ocean (36°E-108°E) (continued)	INSAT 2-C	IMD	48.0°E	12/1995	Satellite for communications only.
	INSAT 2-E	IMD	83°E	04/1999	Not in use.
	INSAT 3-C	IMD	74°E	24 Jan 2002	No meteorological payload. Used for dissemination of processed meteorological data in broadcast mode in S-Band only over India and neighbouring countries. No WEFAX broadcast capability in L-band.
	Kalpana-1 (Op) (METSAT)	IMD	74°E	12 Sep 2002	Dedicated meteorological satellite. - Monitoring cyclones & monsoon - CMV Winds - OLR - Rainfall Estimation
	INSAT-3A (Op)	IMD	93.5°E	10 Apr 2003	- Monitoring cyclones & monsoon - CMV Winds - OLR - Rainfall Estimation - Mesoscale features - Flood/intense precipitation advisory - Snow detection Operational on 24 Apr 2003. A 3-channel VHRR imager and CCD payload available for use similar to INSAT-2-E.

B.3 Research and Development Satellite Systems

CNSA presented in CNSA-WP-01 the status of the Chinese space borne Earth Observation system which plays an important role in the nationwide land resources survey, ecological construction and environmental protection. The current system comprises FY-series satellites, CBERS series satellites, and the HY-1 satellites.

The CBERS series of satellites include CBERS 01, 02, 02B, 03 and 04, developed jointly by China and Brazil. The mission provides images of mid-spatial resolution to the Chinese and Brazilian remote sensing community on a continuous basis. The main applications are related to agriculture, forestry, geology, natural disaster management, hydrology, coastal mapping and other similar applications. The main payloads are the Multi-spectral Camera, Infrared Scanner Camera, and Wide Field Imager Camera.

In CNSA-WP-02 CNSA informed CGMS on the status of the HY-1 satellite program and its application in China. The Chinese first Haiyang satellite (HY-1A) is an experimental and operational satellite for detecting ocean colour and sea surface temperature. It was successfully launched on 15 May 2002. The main sensors on board include the 10-band Chinese Ocean Colour and Temperature Scanner (COCTS) as well as a 4-band CCD imager. HY-1A satellite has been operated for about two years and has monitored large sea areas around China. The National Satellite Ocean Application Service carried out a great number of applications according to the properties of the two sensors on the satellite. Data from the Satellite has found wide applications in marine resource management, marine environment monitoring and protection, marine disaster monitoring and forecasting, oceanographic research and international cooperation.

In ESA-WP-01, CGMS was informed of the status of the current European Space Agency (ESA) Earth Observation missions.

The second ERS satellite, launched in 1995, has continued to increase SAR production, and has aligned products and formats with Envisat. The limited LBR operations are being overcome by extending the network of acquisition stations. Further detailed information can be found at: http://earth.esa.int/ers/

Envisat was successfully launched on 1st March 2002. The success of the Envisat mission is well established, with a constant increase of user demand for data and services. Currently, over 1000 scientific projects are served with Envisat data. Data accessibility is constantly upgraded, through Internet and Telecom satellites multicast. Several thematic workshops and symposia have been organized, increasingly attracting participants from all over the world. Today, the mission is expected to exceed the originally foreseen 5 years lifetime. The most complete information about the Envisat mission, system, instruments, its products, user services can be found on the Envisat mission web site at http://envisat.esa.int/

The working paper also reported on the status of ESA's small satellite platform Project for On-Board Autonomy (PROBA) which is carrying the Compact High Resolution Imaging Spectrometer (CHRIS) as its principal payload. Following another successful year of exploitation in 2005, a new Science Programme has been elaborated and implemented for 2006. The 2006 programme addresses major objectives identified by ESA including support to disaster monitoring as part of the International Charter on Space and Major Disasters among others. The International Charter, which was initiated by ESA and CNES in 1999, has been providing important Earth Observation satellite data input to national

hazards post-crisis management around the world, with both increasing charter activations and participating space agencies as data providers.
CMA expressed its appreciation to ESA for making ENVISAT data and products available. CMA added that these were of great assistance when developing requirements and specifications for the next generation of satellites. WMO stressed the importance of R&D instrument data for climate monitoring purposes and hoped that much of this data would in due course become a valuable asset of the space based component of the Global Observing System.

In JAXA-WP-01 JAXA presented the overview and status of the Advanced Land Observing Satellite (ALOS) – Daichi.

The Japanese Earth observing satellite programme consists of two series of satellites: Those used mainly for atmospheric and marine observation, and those used mainly for land observation. The Advanced Land Observing Satellite (ALOS) follows the Japanese Earth Resources Satellite-1 (JERS-1) and Advanced Earth Observing Satellite (ADEOS) and will utilize advanced land-observing technology. ALOS will be used for cartography, regional observation, disaster monitoring, and resource surveying.

ALOS's objectives are in the areas of cartography, regional observation, disaster monitoring, resource surveying and technology development.

The ALOS has three remote-sensing instruments: the Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM) for digital elevation mapping, the Advanced Visible and Near Infrared Radiometer type 2 (AVNIR-2) for precise land coverage observation, and the Phased Array type L-band Synthetic Aperture Radar (PALSAR) for day-and-night and all-weather land observation. In order to fully utilise the data obtained by these sensors, the ALOS was designed with two advanced technologies: the former is the high speed and large capacity mission data handling technology, and the latter is the precision spacecraft position and attitude determination capability. They will be essential to high-resolution remote sensing satellites in the next decade.

ALOS was successfully launched on an H-IIA launch vehicle from the Tanegashima Space Center, Japan on 24 January 2006, and was renamed Daichi.

In ROSC-WP-01, Roscosmos informed CGMS of a new Russian Earth observation spacecraft "Resurs-DK1" which was launched on 15 June 2006 with a design life of at least three years. Its mission objective is the Earth's surface multi-spectral remote sensing to acquire high-quality visible images in near real-time as well as on-line data delivery via radio channel and to provide a wide range of users with value-added processed data. Due to a wide swath width (28.3km) and high resolution (1 metre in panchromatic band and 2-3m in narrow spectral bands) the "Resurs-DK1" has a high performance capability.

The payload includes two main scientific instruments:

- Payload for AntiMatter Exploration and Light-nuclei Astrophysics - PAMELA (Russia/Italy). The objective is precise measurements of primary cosmic radiation spectra (antiprotons, positrons, electrons, and light cosmic nuclei) over the ~(0.1-200) GeV energy range; and

- ARINA (Russia), a small-sized automatic scintillation spectrometer to record charged particle bursts with an objective of refining a new technique for earthquake prediction using space facilities.

Table 3: Current R & D satellites discussed within CGMS
(as of 31 October 2006, sorted by organisation)

Satellites in orbit (+operation mode)	**Operator**	**Crossing Time** A=Northw D=Southw +Altitude	**Launch date**	**Application/ instruments**	**Status, Application and other information**
PARASOL	CNES	705 km sun-synchr.	18/12/2004	POLDER	Characterisation of clouds and aerosols micro-physical and radiative properties. Data can be accessed for level 1 at <http://parasol-polder.cnes.fr/> and for level 2 and more at <http://www-icare.univ-lille1.fr/>
SPOT-5	CNES	832 km sun-synchr.	3/05/2002	DORIS, HRG, HRS, VEGETATION	Cartography, land surface, agriculture and forestry, civil planning and mapping, digital terrain models, environmental monitoring
CBERS-02	CNSA	10:30 (D) 778 km	10/2003	Multi-spectral Camera, Infrared Scanner Camera, Wide Field Imager Camera	
HY-1A	CNSA	10:30 +/-30 min (D) 798 km	05/2002	Ocean colour and temperature scanner and 4 bands CCD imager.	
ERS-1	ESA	10:30 (D) 785 km	07/1991	Altimeter, SAR, SAR-wave, ATSR, Scatterometer	Replaced by ERS-2 in Mar 2000 after an overlapping period
ERS-2	ESA	10:30 (D) 785 km	04/1995	Altimeter, SAR, SAR-wave, ATSR, Scatterometer, GOME	Due to OB recorder problems in Jun 2003, the LBR mission is ensured over ESA agreed acquisition stations. Operations funding extended till 2008.

Satellites in orbit (+operation mode)	**Operator**	**Crossing Time** A=Northw D=Southw +Altitude	**Launch date**	**Application/ instruments**	**Status, Application and other information**
ENVISAT	ESA	10:000 (D) 800 km	03/2002	10 instruments for Environment: ASAR, AATSR, MERIS, GOMOS, MIPAS, SCHIAMACHY, RA-2, MWR, DORIS	• MIPAS is operated in discontinuous scenario since January 2005. • GOMOS performs satisfactorily with reduced azimuth range, since August 2005. • RA has experienced some anomalies since Feb 2006. Workaround solutions being implemented. Operations funding extended 3 years (till 2010)
PROBA	ESA	10: 30 (D) 615 km	10/2001	CHRIS	Drifting orbit. Technology experiment. AO Science mission since 2003.
ALOS	JAXA	10:30 700km sun-synchronous	24 Jan 2006	PRISM, AVNIR-2, PALSAR	Advanced Land Observing Satellite (mapping, precise land coverage observation, disaster monitoring, resource surveying)
TRMM	JAXA/ NASA	402 km non-sun-synchr.	11/1997	Precipitation Radar equipment Advanced Microwave scanning Radiometer (AMSR-E) provided by JAXA and satellite bus and other instruments provided by NASA	Measures tropical rainfall/precipitation and radiation energy
ACRIMSAT	NASA	716 km sun-synchr.	20/12/1999	ACRIM III	Active Cavity Radiometer Irradiance Monitor Satellite Measures total solar irradiance, studies incoming solar radiation and adds measurements of ocean and atmosphere currents and temperatures as well as surface temperatures.
Aura	NASA/BNSC	705 km sun-synchr.	15/07/2004	Comprehensive measurements of atmospheric chemistry and trace gasses	

Satellites in orbit (+operation mode)	**Operator**	**Crossing Time** A=Northw D=Southw +Altitude	**Launch date**	**Application/ instruments**	**Status, Application and other information**
Terra	NASA	705 km sun-synchr.	18/12/1999	CERES, MISR, MODIS, MOPITT, ASTER	Measurement of the Earth's climate system, atmosphere, land, oceans and interactions with solar radiation
Jason-1	NASA/ CNES	1336 km non-sun-synchr.	07/12/2001	Laser retroreflector array Poseidon-2 solid state radar altimeter DORIS receiver Jason Microwave Radiometer BlackJack GPS Receiver tracking system	Ocean surface topography Follow-on mission to TOPEX/P. Monitor global ocean circulation for global climate prediction.
Aqua	NASA	705 km sun-synchr.	04/05/2002	AMSR-E, AIRS, AMSU-A, CERES, HSB, MODIS	Collects data on Earth's water cycle, precise atmospheric and oceanic measurements, and interaction with solar radiation AMSR-E provided by JAXA. HSB provided by INPE (no longer functional)
Landsat 7	NASA	705 km sun-synchr.	15/04/1999	Enhanced Thematic Mapper Plus Instrument (ETM+)	Well-calibrated, multispectral, moderate resolution, substantially cloud-free, sunlit digital images of the Earth's continental and coastal areas
NMP EO-1 (New Millennium Program Earth Observing-1)	NASA	10:01 (D) 705 km sun-synchr.	21/11/2000	Advanced Land Imager Hyperion LAC (atmospheric corrector)	Demonstrates and validates advanced technology instruments (multi and hyperspectral), spacecraft systems, and mission concepts in flight
ICESat (Ice, Cloud, and Land Elevation Satellite)	NASA	600 km circular non-sun-synchr.	Jan. 2003	Geo-science Laser Altimeter System GPS BlackJack receiver	Measures ice sheet topography, ice sheet elevation changes, cloud and aerosol heights and land topography and vegetation characteristics.
QuickSCAT (Quick Scatterometer)	NASA	803 km sun-synchr.	19/06/1999	SeaWinds	Sea surface wind speed and direction data for global climate research and operational weather forecasting and storm warning

Satellites in orbit (+operation mode)	**Operator**	**Crossing Time** A=Northw D=Southw +Altitude	**Launch date**	**Application/ instruments**	**Status, Application and other information**
SORCE (Solar Radiation and Climate Experiment)	NASA	(40˚ incl) 640 km non-sun-synchr.	25/01/2003	- XPS (Extreme Ultraviolet (XUV) Photometer System) - TIM (Total Irradiance Monitor) - SIM (Spectral Irradiance Monitor A&B) - SOLSTICE (Solar Stellar Irradiance Comparison Experiment A&B)	will provide total irradiance measurements and full spectral irradiance measurements. Continuation of ACRIMSAT total solar irradiance measurements.
TOMS - EP (Total Ozone Mapping Spectrometer - Earth Probe)	NASA	740 km sun-synchr.	02/07/1996	Total Ozone Mapping Spectrometer	Measurements of total column ozone and its variation on a daily basis
GRACE (Gravity Recovery and Climate Experiment)	NASA/ DRL	(89˚ incl) 485 km non-sun-synchr.	17/03/2002	- Star Camera Assembly - GPS BlackJack Receiver - Instruments Processing Unit - Laser Retro-Reflector Assembly - K-Band Ranging Instruments - SuperSTAR Accelerometers	Accurate global and high-resolution determination of static and time-variable components of Earth's gravity field Measurement of: - Gravitational field - GPS atmospheric and ionospheric limb sounding
SRTM (Shuttle Radar Topography Mission)	NASA	233 km non-sun-synchr.	11/02/2000 (11 day duration)	X-SAR SIR-C GPS BlackJack Receiver	Topographic mapping of the Earth. Data currently used by various Government Agencies
CALIPSO	NASA/ CNES	705 km sun-synchronous	28 Apr 2006		Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations for climate predictions
CloudSAT	NASA/ CSA	705 km sun-synchronous	28 Apr 2006		global cloud properties (applications: air quality, aviation safety, disaster management, energy and water management)
Monitor-E	ROSCOSMOS	(550 km) (10:30)	08/2005	Land Observing Satellite	Experimental exploitation

Satellites in orbit (+operation mode)	**Operator**	**Crossing Time** A=Northw D=Southw +Altitude	**Launch date**	**Application/ instruments**	**Status, Application and other information**
RESURS-DK1	ROSCOSMOS	Elliptical orbit, H_p=360km, H_a=604km, incl.=70.4°	15 Jun 2006	- Panchromatic scanner - Multi-spectral scanner - PAMELA (Italy) for primary cosmic radiation investigation - ARINA for earthquake prediction investigation	Testing in orbit and experimental exploitation

B.4 Anomalies from Solar and Other Events

In NOAA-WP-04 CGMS was provided with an update on solar activities occurring from September 2005 through September 2006. These solar activities resulted from high proton events of solar flares and Coronal Mass Ejections (CMEs). These occurrences were associated with energetic proton events of Solar Cycle 23 as it approaches its minimum, which is expected to occur during the first half of 2007. Information was provided on major activities observed from September 2005 through August 2006. Several major solar flares and geomagnetic storms occurred even as the solar cycle continued beyond the solar maximum observed around the year 2000.

The working paper further stated that it is typical for energetic electron fluxes to increase during the declining phase of the solar cycle as recurrent coronal holes produce regular intervals of high-speed solar winds that interact with the geomagnetic field. During the summary period, electron flux levels were observed at high levels (1.0E+3 pfu) about 33% of the time. Very high flux levels (5.0E+04 pfu) were observed during the summary period, as well as on 17-19 September 2005 and 17-18 April 2006.

NOAA stated that it would like to receive further feedback from other satellite operators of their experience of assessing single events upsetting their satellite systems. EUMETSAT commented that it believed that not only solar but cosmic radiation could be responsible for these types of events.

CMA also commented that it also had information on single event upsets on its FY1 and FY1A satellites and would respond accordingly to the request of NOAA.

C. REPORT ON FUTURE SATELLITE SYSTEMS

C.1 Future Polar-orbiting Meteorological Satellite Systems

In CMA-WP-04, China informed CGMS about its development of FY-3, the new series of polar-orbiting meteorological satellites. There will be 7 satellites in the series, starting with FY-3A and ending with FY-3G, and covering the period from 2007 to 2020. FY-3 will operate either the morning or afternoon orbit. Main instruments include the Medium Resolution Spectral Imager (MERSI), the Microwave Radiation Imager (MWRI), in addition to Visible and Infrared Scanning Radiometer (VISR). Sounding instruments include the Infrared Atmospheric Sounder (IRAS), the Microwave Temperature Sounder (MWTS), and Microwave Humidity Sounder (MWHS). Also, there will be a Total Ozone Unit and Solar Backscatter Ultraviolet Sounder (TOU/SBUS). There is also a Earth Radiation Budget instrument on board.

EUMETSAT provided updates in EUM-WP-04 on its plans for post-EPS which would be the continuation of the EPS operational programme, with an anticipated start of operations in 2019. The EUMETSAT Post-EPS Programme is ongoing, and the current Phase 0 activities focus on a User Consultation process and the definition and consolidation of mission requirements.

The following Application Expert Group position papers were endorsed by the EUMETSAT Council in July 2007:

- Requirements for Operational Atmospheric Chemistry Monitoring in the Post-EPS Time Frame beyond 2020;
- Post-EPS Developments on Atmospheric Sounding and Wind Profiling;
- Generic Requirements for Climate Monitoring;
- Cloud, Precipitation and Large Scale Land Surface Imaging (CPL) - Observational Requirements for Meteorology, Hydrology and Climate;
- Requirements for Ocean Observations relevant to Post-EPS.

Taking this into account, mission and programmatic requirements will follow in 2007. The mission requirements mainly contain the spectral, radiometric, and geometric specifications of the observations needed for the generation of the products identified in the Position Papers, to which traceability is maintained. The programmatic assumptions and requirements mainly address the high level programme objectives, the continuity and evolution of EPS, the co-operation framework and the role of Post-EPS within relevant international initiatives.

Furthermore, the paper stated that with EPS being part of the Initial Joint Polar System and including satellites from NOAA, both NOAA and EUMETSAT are interested in continuing cooperation leading to a future joint system.

NOAA-WP-05 discussed NOAA's future polar-orbiting meteorological satellite system. NOAA addressed the current operational system and the planned launch schedule for NOAA-N' which is foreseen for December 2007. Once it achieves orbit, NOAA-N' will be renamed NOAA-19.

Information was provided on the international polar-orbiting satellite programme coordination between EUMETSAT and NOAA. The goal of this cooperation is to provide continuity of measurements from polar orbits, cost sharing, and improved forecast and monitoring capabilities through the introduction of new technologies. An agreement is in place between NOAA and EUMETSAT on the Initial Joint Polar-orbiting Operational Satellite System (IJPS). This program will include two series of independent but fully coordinated NOAA and EUMETSAT satellites, exchange of instruments and global data, cooperation in algorithm development, and plans for real-time direct broadcast.

The working paper also discussed the development and implementation plans for NPOESS. Beginning later this decade, NPOESS spacecraft will be launched into two orbital planes to provide significantly improved operational capabilities and benefits to satisfy the critical civil and national security requirements for space-based, remotely sensed environmental data. The advanced technology visible, infrared, and microwave imagers and sounders that are being developed for NPOESS will deliver higher spatial and temporal resolution atmospheric, oceanic, terrestrial, and solar-geophysical data enabling more accurate short-term weather forecasts, as well as serving the data continuity requirements for improved global climate change assessment and prediction. The NPOESS program is on the path to creating a high performance, polar-orbiting satellite system that will be more responsive to user requirements, deliver more capability at less cost, and provide sustained, space-based measurements as a cornerstone of an Integrated Global Observing System. These activities represent a sound beginning for achieving the planned national and international operational satellite programs that will ensure continuous support to a variety of users well into the 21st century.

NOAA also discussed the newly certified NPOESS program and stated that the C1 spacecraft in the afternoon (13:30) orbit is scheduled for launch in 2013 and will carry the following instruments: VIIRS, CrIS, ATMS, OMPS, SEM, CERES, SARSAT, and ADCS. The C2 spacecraft is scheduled for launch in January 2016 and will fly the following instruments: VIIRS, MIS, SARSAT, and ADCS.

Roscosmos updated CGMS, in ROSC-WP-02, on its activities to create a new generation of hydro-meteorological polar-orbiting satellites, METEOR-M, within the framework of the Federal Space Program of Russia. The spacecraft has a wide range of onboard devices including not only meteorological instruments but also some additional observing devices for remote sensing of the Earth and for helio-geophysical parameters.

Meteor-M #1 is planned for launch in 2007, with an expected service life of at least five years. The second spacecraft, METEOR-M #2, is planned for launch end of 2008. METEOR-M #3 is to be designed as an oceanography satellite whose payload is currently under consideration and the launch thereof is planned for the end of 2010.

Table 4: Future Polar-Orbiting Satellites Coordinated within CGMS
(as of 7 November 2006)

Orbit type (equatorial crossing times)	Future additional Satellites	Operator	Crossing Time A=Ascend. (northward) D=Descend. (southward) +Altitude	Planned launch date	Other information
Sun-synchronous local "early morning" orbit (05:00 – 07:00) (17:00 – 19:00)	NPOESS-2	NOAA	05:30 (D) 833 km	01/2016	LRD (AHRPT), HRD
	NPOESS-4	NOAA	05:30 (D) 833 km	~2022	LRD (AHRPT), HRD
	DMSP-S19	NOAA	05:30 (D) 833 km	2010	(SSMI/S)
	DMSP-S20	NOAA	05:30 (D) 833 km	10/2012	(SSMI/S)
Sun-synchronous local "morning" orbit (07:00 – 12:00) (19:00 – 24:00)	FY-3A	CMA	10:00 (D) 836 km	2007	AHRPT/MPT
	FY-3C	CMA		2012	836 km
	FY-3D	CMA		2014	836 km
	FY-3E	CMA		2016	836 km
	FY-3F	CMA		2018	836 km
	FY-3G	CMA		2020	836 km
	MetOp-1	EUMETSAT	21:30 (A) 837 km	04/2011	HRPT
	MetOp-3	EUMETSAT	21:30 (A) 837 km	10/2015	HRPT
	DMSP-S18	NOAA	08:00 (D) 833 km	2008	(SSMI/S)
	NPOESS	NOAA	21:30 (A) 833 km	2011 (NET) Date will be determined by need	
	METEOR-M N1	ROS-HYDROMET	10:30 835 km	2007	HRPT
	METEOR-M N2	ROS-HYDROMET	10:30 835 km	2008	HRPT
Sun-synchronous local "afternoon" orbit (12:00 – 17:00) (00:00 – 05:00)	FY-3B	CMA	14:00 836 km	2009	AHRPT/MPT
	NOAA-N'	NOAA	14:00	2009	
	NPP-NPOESS Preparatory Project	NOAA/NASA	13:30 (A) 833 km	12/2009	(VIIRS, CrIS, ATMS, OMPS) HRD
	NPOESS-1	NOAA	13:30 (A) 833 km	01/2013	LRD(AHRPT), HRD
	NPOESS-3	NOAA	13:30 (A) 833 km	06/2019	LRD(AHRPT), HRD
Non-sun-synchronous orbit	OSTM (Ocean Surface Topography Mission)	CNES/ EUMETSAT/ NASA/ NOAA	(66° inclin.) 1336 km	06/2008	Follow-on of Jason-1 sea surface topography measurement

C.2 Future Geostationary Meteorological Satellite Systems

CMA reported in CMA-WP-05 on its continuation of the FY-2 programme with FY-2D, to be launched in December 2006, which will be followed by the FY-2E/F/G satellites that have been approved by the government. The launch schedule of future FY-2s will ensure the continuity of GEO observation at 105°E till the year 2015.

The mission and function of FY-2D/E is similar to that of FY-2C. Some improvement is foreseen with FY-2F/G, for instance, to obtain 48 imagery per day (28 full disc imagery and 20 northern hemisphere imagery) all year round. The planned launch schedule for FY-2D/E/F/G will maintain operational continuity by providing a continuous stream of satellites in orbit.

In EUM-WP-05 EUMETSAT updated CGMS on its plans for Meteosat Third Generation (MTG). It described the preparatory activities and Phase A activities aimed at assessing the feasibility of the components of the mission and the architecture of the MTG System. The objectives, organisation and plan for Phase A work were presented to, and endorsed by, the EUMETSAT Council in July 2006. Operations are planned to begin in 2015 and last for 15 years.

The EUMETSAT Council agreed to target the Phase A Industrial Studies on a Twin-Satellite and Single-platform configurations and relevant in-orbit deployment approaches, with the Combined Imager, the IR sounder and the Lightning Imager, as payload complement. The implementation of the UV/Vis (Chemistry) mission on MTG will be pursued in cooperation with the EU/ESA GMES initiative, taking advantage of Sentinels 4 and 5 planned activities. The ultimate goal will be to exploit synergies to the maximum extent and to converge toward shared requirements for these Sentinels, thus ensuring fulfilment of the EUMETSAT needs. During this phase EUMETSAT will be responsible for end-to-end system engineering and ground segment engineering, with ESA being responsible for space segment engineering. Parallel studies will be initiated with Industry in early 2007 for both the Space and Ground Segments.

EUMETSAT reported on the status of preparation of MSG-3 and MSG-4 in EUM-WP-06. MSG-3 is currently kept in storage and is scheduled for launch in 2011. Several tests and rework have been carried out resulting in modified Solid State Power Amplifiers, and the redundancy scheme was changed to improve the robustness of the raw data transmission. Work was also ongoing to define the lifetime limit of SEVIRI in a Rapid Scan mode from 7 to 10 years' lifetime. Further tests will be necessary prior to the satellite being put in long-term storage which is planned for the end of 2006.

MSG-4 has undergone several integration tests and the preparation of Thermal Vacuum and Optical Vacuum tests is ongoing at the time of writing. The MSG-4 Pre-Storage Review (PSR) is currently foreseen for March 2007 and the satellite will enter storage. MSG-4 will also have an upgraded version of the

Geostationary Earth Radiation Budget (GERB) instrument on-board. The launch date is currently foreseen for January 2013

India provided (via correspondence) CGMS with new information on its plans for future INSAT satellites with meteorological applications in IMD-WP-02. Under the INSAT-3 Programme, a new Geostationary Meteorological Satellite INSAT-3D is being developed. It will have an advanced imager with six channels and a nineteen channel sounder for the derivation of atmospheric temperature and moisture profiles. It will provide 1 km resolution imagery in the visible band and 4 km resolution imagery in the IR bands. The sampling rate of the imaging mission of INSAT-3D will be every half hour. INSAT-3D is scheduled for launch by the end of 2007 and will provide much improved capabilities to the users of meteorological data from satellites.

JMA provided a report on the preparatory activities for the follow-on satellite to MTSAT-2 in JMA-WP-03. MTSAT-2 is currently in standby mode and is planned to be operational from 2010 to 2015. The launch of the follow-on satellite is planned for the time-frame 2013-2015.

The Working Paper further reported that JMA had conducted a survey of the user requirements for an imager and sounder of the follow-on satellite, which was followed by a feasibility study of the imager and sounder missions. Based on this information and CGMS recommendations, the specification of the satellite will be made.

KMA provided an updated on the COMS programme in KMA-WP-02. Since 2003, the first multi-purpose geostationary satellite programme called Communication, Ocean and Meteorological Satellite (COMS) has been initated in cooperation with three other government ministries. Multi-missions of COMS are intended as not only meteorological and oceanic observation for the public welfare but also in-orbit test of a developed communications payload to be used for the next geosynchronous satellite.

The meteorological payload on COMS, the Meteorological Imager, is under contract with ITT Industries in the USA, and the manufacturing readiness review (MRR) was held in April 2006. Following the preliminary design review in January 2006, the critical design review of the COMS spacecraft has been scheduled for March 2007. After the successful launch of the COMS at the end of 2008, KMA will provide COMS meteorological observations and products internationally. KMA will prepare the user community, train the end-users, and provide information on COMS on a continuous basis.

In KMA-WP-03, KMA further reported on the COMS ground system at the Meteorological Satellite Center (MSC) in Korea. The COMS operation and meteorological products application service system (COMPASS) of MSC will consist of a number of functional systems such as Data Acquisition and Transmission System, Image Pre-processing System, LRIT/HRIT Generation System, COMS Meteorological Data Processing System, and Interactive Satellite Data Analysis System.

In NOAA-WP-06 NOAA reported on the status and provided an overview of the future of the GOES satellite system. The GOES-13 satellite was successfully launched on 24 May 2006 and will be in post-launch testing at 105°W until December 2006. It is scheduled for an operational acceptance review and a NOAA science test in December. By the end of December it will be placed into long term storage mode and become the primary backup for the operational GOES satellites. The GOES-O satellite has completed system integration and testing and is in ground storage at the spacecraft contractor. The GOES-O planned launch date is April 2008. The contractual option for the GOES-P satellite was exercised in the spring of 2003. GOES-P completed integration and system testing. GOES-P will be placed in ground storage in late 2006 and is planned to be launched in April 2009. The new GOES-N series ground system was delivered to NASA and will be upgraded over the next two years for NOAA.

Planning for GOES-R continued to move forward in 2006. System Program Definition and Risk Reduction (PDRR) contracts were awarded in late 2005 to Boeing, Northup Grumman and Lockheed Martin. These contracts support the definition of the end-to-end GOES-R system architecture and focus on risk reduction for identified high risk areas. The results of these PDRR contracts will also support preparations for the program implementation, or Acquisition and Operations (A&O), phase in 2007.

The new GOES-R instruments will advance operational environmental remote sensing technology by several decades. The technological advances will provide four-times the environmental information over a greater geographical location in less time, at higher resolutions, and with higher spectral content. The GOES-R program will meet NOAA's mission objectives for continuous observations of atmospheric, oceanic, climatic, solar, and space infrared and imaging data of the northern hemisphere surface and atmosphere; supporting all of NOAA’s mission goals in ecosystems, climate, weather and water, and commerce and transportation.

The GOES-R Program schedule supports a GOES-R launch readiness date late in 2014. A decision has been made that GOES-R and S will not fly the Hyperspectral Environmental Suite (HES). A study is underway to determine an analysis of alternatives for mitigation of the sounding and coastal waters imaging capabilities.

WMO commented that it hoped that NOAA would be in a position to resume flying hyperspectral instruments on its geostationary satellites in the future.

Roscosmos informed CGMS, in ROSC-WP-03, on its continued development of the second generation geostationary meteorological satellite GOMS No. 2/Electro-L. The satellite is planned to be launched in 2007 and will be placed into a geostationary orbit at 76°E. A second GOMS satellite is foreseen for 2009. The spacecraft will be three-axis stabilised and carry an MSU-GS, a multi-zonal scanner with parameters close to those of the SEVIRI, as well as standard DCS equipment. GOMS No. 2/Electro-L will also relay data between

weather centres, poll autonomous meteorological stations, receive and retransmit signals from Search and Rescue beacons of the COSPAS/SARSAT system. Furthermore, the satellite will carry seven helio-geophysical sensors. Satellite Vibration and Thermal Balance Tests performed by Lavochkin Association were ongoing at the time of writing, as well as Flight Subsystems manufacturing and acceptance testing.

In ROSC-WP-04, CGMS was informed about the space monitoring of Earth high-altitude regions by the Electro-L type satellites in Molniya orbit.

SRC Planeta and Lavochkin Association have developed proposals for the creation of future space systems for hydrometeorological monitoring of the Arctic region. The objectives of the Arctic system are similar to those of existing geostationary meteorological satellite systems, where the primary purpose is to provide information for the analysis and the forecast of weather in regional (Arctic regions) and on a global scale. Suggested design of the spacecraft Arctic-L offers capacity for mass and power supply to accommodate additional payloads, hence providing opportunities for international cooperation activities.

In WMO-WP-29 (including addendum), CGMS discussed the status of the International Geostationary Laboratory (IGeoLab). WMO recalled that the IGeoLab concept was introduced at CGMS-32 (Sochi, Russia, 17-20 May 2004) as a means to implement demonstration missions in geostationary orbit in preparation of future operational systems that would be part of the space-based component of the Global Observing System. Two test cases were selected:

- GIFTS (Geostationary Imaging Fourier Transform Spectrometer), for frequent profiling of atmospheric temperature and humidity (and, derived, wind) through infrared spectroscopy;

- GOMAS (Geostationary Observatory for Microwave Atmospheric Sounding), for frequent observation of precipitation by sounding in the millimetre and submillimetre wave ranges.

CGMS requested WMO to act as catalyst to further the IGeoLab concept. Since then, several meetings took place, and scientific and technical work made considerable progress. In summary:

As for GIFTS:

- User requirements were well established, both in NOAA (in the GOES-R framework) and in EUMETSAT (in the Meteosat 3rd Generation framework), consistently with the WMO indication of hyperspectral sounding in GEO as one of the highest priorities for the development of new generations of geostationary meteorological satellites.

- The GIFTS Engineering Demonstration Unit (EDU) has been successfully submitted to thermal vacuum tests during summer 2006, and high-quality spectra have been measured (from the ground).

- The Russian Elektro-L2 satellite (launch planned in 2010) was identified as the prime candidate to host the GIFTS mission. A preliminary analysis performed by the GIFTS Project Team and RosKosmos demonstrated that no critical issue exists as regards feasibility.

However, a considerable amount of funding is required to upgrade the EDU to a flight model. Although high-level correspondence took place among RosKosmos, NASA/NOAA and WMO, and in spite of great interest manifested at CM-6 in Buenos Aires, so far the situation of financial resources to upgrade the EDU into a flight model has not been solved. NASA has stated that, at the end of the testing activity, they could release the EDU 'as it is' to other interested parties. This, in principle, opened new opportunities. It was worth noting that, once the 'core' activity on the space segment finds its way, several CGMS members are ready to provide ancillary but necessary contributions (on the ground segment, on science, on campaigns, …).

As for GOMAS (meanwhile renamed "GEO-Microwave"):

- User requirements were well established, both in NOAA (in the GOES-R framework) and in EUMETSAT (in the Meteosat 3rd Generation framework), consistently with the WMO indication of microwave sounding from GEO as one of the high priorities for the development of new generations of geostationary meteorological satellites.

- Progress has been achieved in the development of the instrument concept based on filled-aperture antennae. In addition, alternative concepts based on synthetic aperture antennae have been proposed and are being studied, both in USA and in Europe.

- Progress also has taken place in modelling the precipitation field in the mm-submm range, supporting evidence that the information content is there. In addition, amazing results of dynamical assimilation of mm-submm brightness temperatures in cloud-resolving models are now available.

However, the basic issue of identifying a 'lead space agency' was not solved, since GOMAS failed to be selected by ESA as a candidate next Earth Explorer core mission. As a consequence of the absence of any plan to actually implement a space mission, funding of airborne campaigns and scientific studies to accumulate evidence in support of pressing for a space mission is virtually impossible. A Focus Group meeting (FG-3) held in Geneva on 29 August 2006, focused uniquely on identifying a new 'lead space agency' and defining a new roadmap. It was noted that, for the time being, the only known plan for a MW radiometer in GEO is in China, with the next generation of geostationary satellites, FY-4, specifically the 'M' (microwave) series to be parallel to the 'O' (optical) series. However, the FY-4 planning is currently at a very early stage of defining objectives and instruments types.

Notwithstanding the current impasse with both GIFTS and GEO-Microwave, there are still enough perspectives supporting the case for pursuing the IGeoLab initiative. Dr. Don Hinsman (WMO), making reference to WMO WP-29 Rev 1, noted that in the past proposed initiatives for cooperative programmes had never collected such high-level consensus as GIFTS and GEO-Microwave. He noted that demonstration missions in GEO would be necessary in order to take full benefit of upgraded capabilities for future geostationary satellites, and as a risk reduction measure before embarking such innovative payloads on a series of operational satellites, as the recent stall situation of the hyperspectral sounder on GOES-R demonstrates. In conclusion, the following was recommended:

Recommendation CGMS-34.01:
CGMS, noting that the technical work on the GIFTS payload on ground is providing excellent results, and that it appears feasible to host the payload on Elektro-L2 in 2010, invites the main concerned parties to unblock the situation enabling EDU upgrading to flight model, thus also unblocking several CGMS members willing to contribute to the project once the core space segment issue is solved. Deadline: CGMS-35

Recommendation CGMS-34.02:
CGMS, noting that marked progress has taken place in setting the scientific background and developing several technical concepts for a GEO-Microwave, invites space agencies that are considering or may consider microwave missions in geostationary orbit to accelerate their decisional process and identify a 'lead space agency' as soon as possible; and invites all Members, including user-oriented ones, to prepare contributions to the IGeoLab GEO-Microwave initiative following the identification of the 'lead space agency'. Essential contributions have already been indicated in previous CGMS sessions, as follows: provision of experimental data by airborne campaigns (CGMS-32.16), and securing funds for scientific activities (CGMS-33.01). Deadline: CGMS-35

In the discussion that followed, Dr. Jim Purdom, in his capacity as rapporteur of the IPWG, added that in the recent IPWG Workshop in Melbourne a strong recommendation was made for CGMS to pursue a demonstration mission of MW in GEO, and to support associated scientific studies and airborne campaigns.

Representatives of CNSA and CMA confirmed that preliminary thoughts are being given to a MW mission in GEO (FY-4M), defining realistic objectives and analysing the availability of suitable technologies. Dr. Bizzarri suggested that the great amount of work carried so far on GEO-Microwave on both the scientific aspects and possible technical concepts could be of great assistance in the decision-making process in CNSA and CMA, and suggested that the next Focus Group on GEO-Microwave (FG-4) could take place in

China. This was considered possible by CNSA and CMA, hence the following action was approved:

Action CGMS-34.01: CNSA/CMA and WMO to organise the 4th IGeoLab GEO-Microwave Focus Group meeting (FG-4) in China, with a goal to review scientific and technological elements in support of a possible Chinese undertaking in respect of FY-4M. Deadline: before 30 Jun 2007.

In connection with the discussion on IGeoLab, thoughts were given to new possible test cases to be introduced, following GIFTS and GEO-Microwave. In noting document ROSC WP-04 ("Space monitoring of earth high-altitude regions by Electro-L type satellites in Molniya orbit"), EUMETSAT recalled a proposal put forward in response to the NASA A.O. for ESSP missions, aiming to place an IR imager with water vapour channels for high-latitude winds determination following the experience carried out with MODIS. The discussion that followed recorded that at least Russia, EUMETSAT and NASA were interested in investigating the possible applications of Molniya orbits. Hence:

Action CGMS-34.02: WMO to convene a Task Group to determine the interest of space agencies for an IGeoLab mission based on Molniya orbits. Deadline: CGMS-35

Table 5: Future Geostationary Satellites Coordinated within CGMS
(as of 7 November 2006, sorted by organisation)

Sector	Future additional satellites	Operator	Planned launch	(Planned location) Other remarks
East-Pacific (180˚W-108˚W) and West-Atlantic (108˚W-36˚W)	MSG-3	EUMETSAT	2011	0°
	MSG-4	EUMETSAT	2013	0°
	GOES-O	NOAA	04/2008	135° W or 75° W
	GOES-P	NOAA	04/2009	135° W or 75° W
	GOES-R	NOAA	2014	135° W or 75° W
	GOES-S	NOAA	2016	135° W or 75° W
Indian Ocean (36˚E-108˚E)	FY-2D	CMA	12/2006	5 channel VISSR, LRIT To act as back-up for FY-2C at 86.5°E
	FY-2E	CMA	2009	5 channel VISSR, LRIT
	FY-2F	CMA	2011	5 channel VISSR, LRIT
	FY-2G	CMA	2013	5 channel VISSR, LRIT
	Electro-L N1	ROS-HYDROMET	2007	76°E
	Electro-L N2	ROS-HYDROMET	2009	76°E or 14.5°W (TBC)
	INSAT-3D	IMD	1st quarter 2007	Location TBD. Dedicated Meteorological mission with improved 6 channel Imager and a 19 channel Sounder.
West-Pacific (108˚E-180˚E)	MTSAT follow-on	JMA	2013-2015	140°E

Sector	Future additional satellites	Operator	Planned launch	(Planned location) Other remarks
West-Pacific (108°E-180°E) continued	COMS-1	KMA	2008	5 channel HRIT/LRIT 116.2°E or 128.2°E
	COMS-2	KMA	2014	116.2°E or 128.2°E

C.3 Future Research and Development Satellite Systems

CNSA presented in CNSA-WP-01 the status and future of the Chinese space borne Earth Observation system which plays an important role in the nationwide land resources survey, ecological construction and environmental protection.

In order to meet growing demands, the Chinese Earth Observation system will require major improvements over the next five years. China will start to implement a high-resolution Earth observation system by developing new types of sun synchronous and geostationary-orbit meteorological satellites, oceanic satellites, Earth resources satellites, small satellites for environmental protection and disaster mitigation, monitoring and forecasting. The goal is to form an all-weather, 24-hour, multi-spectral, differential-resolution Earth observation system for stable operation, and achieve stereoscopy and dynamic monitoring of the land, atmosphere and sea.

To date, the system comprises the FY-series of satellites, the CBERS series of satellites, HY-1 satellites and a small satellite constellation for environment and disaster monitoring. The HY-1B satellite is being developed for the continuation of, and as a follow-on, to HY-1A. Its mission is to observe ocean colour and sea surface temperature. The HY-1B satellite has been approved and is planned for launch in 2007. Its specifications will be adjusted for the requirement of ocean observation according to experience gained with the HY-1A satellite.

The small satellite constellation for environment and disaster monitoring is composed of optical and microwave satellites. The first stage of the constellation (HJ-1) includes two optical satellites and one SAR satellite. Its mission is to provide better information on environment and disasters with high repeat frequency and moderate spatial resolution images. HJ-1 is planned for launch in 2007-2008.

WMO commented that it was pleased to learn about the future plans of CMA and CNSA, adding that they were completely in line with the future development of the GEOSS and looked forward to these satellite systems becoming an important element of the Global Observing System. WMO was also pleased to note the emphasis placed on disaster monitoring and mitigation programmes. Furthermore, WMO noted with appreciation the willingness of CNSA to share technical information, data and products with CGMS Members and WMO Member States.

ESA-WP-02 informed CGMS of the status of the future ESA Earth Observation missions. Two of them, MSG and MetOp are in cooperation with EUMETSAT. The Living Planet Programme has three lines of implementation: Earth Explorer satellites, Earth Watch satellites, and services and applications demonstration.

After a decision on the implementation of Swarm and EarthCARE missions, a new Core Explorer is under selection. CryoSat was the first Earth Explorer satellite to be launched, but due to a launch failure the satellite was lost. The importance of Cryosat for the worldwide scientific community has led to a recovery mission, Cryosat-2, which is scheduled for launch in 2009.

The Earth Watch has included the Global Monitoring for Environment and Security (GMES) services elements since January 2002. The ESA GMES space component phase I has started after the Ministerial conference approval in December 2005 (six out of 10 portfolios selected). It includes five notional families of missions, called “sentinels”. The Earth Watch missions include those in cooperation with EUMETSAT, namely MTG and post-EPS.

WMO proposed that ESA consider providing ADM AEOLUS data to other NWP centres as well as ECMWF. ESA responded that ECMWF was currently responsible for generating the level 2 products.

Action 34.03: ESA to check whether it is envisaged that ECMWF will further distribute ADM AEOLUS level 2 data to other NWP centres

WMO added that it would be happy to assist ECMWF and the NWP Centres in this regard by enabling access to this data via the WMO IGDDS.

JAXA provided the status of the Greenhouse gases Observing Satellite (GOSAT) in JAXA-WP-02. GOSAT will monitor carbon dioxide (CO2) and methane (CH4) globally from LEO orbit and it aims to contribute to international efforts to prevent global warming, such as the Kyoto Protocol. The satellite is scheduled for launch in August 2008.

The objectives of the GOSAT mission are to contribute to environmental management by estimating the Green House Gases (GHGs) source and sink at sub-continental scale and to advance earth observation technologies for future missions. The targets of the mission are observation of CO2 density in 3-month average with 1% (4ppmv) relative accuracy at sub-continental spatial resolution during the first commitment period (2008 to 2012) of the Kyoto Protocol and reducing errors by half in identifying the GHGs source and sink at sub-continental scale with the data obtained by GOSAT, in conjunction with data gathered by ground-based instruments.

Other applications of GOSAT are to provide earth radiation data with high spectral resolution, to monitor the CH4 gas leak distribution from pipelines. The paper also provided information about the onboard sensors.

In JAXA-WP-03, CGMS was provided with an overview and the status of JAXA's Global Change Observation Mission (GCOM). The importance of long-term, global, and continuous observation of the Earth including human activity effect on climate change was pointed out (reference was made to the Third Assessment Report of the Intergovernmental Panel on Climate Change [IPCC]). To contribute to the issue, a concept study of Earth observation satellites and sensors for climate change observation was undertaken and as a result, a new system named the Global Change Observation Mission (GCOM), has been proposed.

GCOM is considered to fulfil requirements to accomplish climate change observation. It will consist of two series of medium size satellites: GCOM-W (Water) and GCOM-C (Climate, tentative). The reason they divide a large platform satellite such as Midori-II (ADEOS-II) into two mid-sized satellites, is to increase the robustness and flexibility of the system to allow for further development.

The GCOM-W satellite will mainly contribute to the observations related to the global water and energy circulation, while the GCOM-C will contribute to surface and atmospheric measurements related to the carbon cycle and radiation budget. The set of satellites is planned to be launched every four years, three times to cover 13 years' continuous observation with one year overlap. GCOM-W will carry AMSR2, with a specification almost the same as AMSR and AMSR-E. GCOM-C will carry a newly developed SGLI, which is a successor to GLI and has polarimetry and multi angle observation functions. Anticipated launch dates for GCOM-W and –C are 2010 and 2011, respectively.

JAXA commented that if there was a real-time requirement for its GOSAT and GCOM data, then it would consider these requirements and investigate the possibility for modification of its ground infrastructure to allow for distribution of data and products in due course.

Table 6: Future R&D satellites discussed within CGMS
(as of 7 November 2006, sorted by organisation)

Satellites	Operator	Crossing Time	Planned launch date	Application and other information
HJ-1A	CNSA	650 km 10:30 A	2007	
HJ-1B	CNSA	650 km 10:30 A	2007	
HJ-C	CNSA	6:00 D	2008	
CBERS-02B	CNSA/AEB	10:30 A	2007	
CRYOSAT-2	ESA	717 km Non-sun-synchronous	March 2009	Polar ice monitoring
GOCE	ESA	250 km (6:00 A)	May 2007	Gravity mission
SMOS	ESA	755 km (6:00 A)	Sept 2007	Salinity & Soil moisture
ADM-Aeolus	ESA	405 km (18:00 A)	Sept 2008	Wind profiles

Satellites	Operator	Crossing Time	Planned launch date	Application and other information
SWARM (three satellites)	ESA	2 sats at 450 km 1 sat at 530 km (drifting up to 9 hours from the lower pair)	Feb 2010	Earth interior
EarthCare	ESA/JAXA	450 km (10:30 D)	Dec 2012	Cloud, radiation, aerosols
GOSAT	JAXA & Japan's Ministry of Environment	13:00 666km sun-synchronous	08/2008	Greenhouse Gases Observing Satellite monitoring the distribution of the density of carbon dioxide
OCO	NASA	705 km sun-synchronous polar	09/2008	Orbiting Carbon Observatory (observations of atmospheric carbon dioxide)
Aquarius	NASA/CONAE	657 km sun-synchronous	07/2009	global sea surface salinity (SSS)
GPM	NASA/JAXA	407 km Non sun-synchr. (core-satellite)	2013	Global Precipitation Measurement, follow-on and expanded mission of the current on-going TRMM
GCOM-W	JAXA	699.6 km sun-synchronous	JFY2010	Global water and energy circulation
GCOM-C	JAXA	798 km Sun-synchronous	JFY2011	Carbon cycle and radiation budget (Atmosphere, Ocean, Land and Cryosphere)
LDCM (Landsat Data Continuity Mission)	NASA/US Geological Survey	828 km (at equator) sun-synchronous	01/2011	Extension of Landsat record of multispectral 30m resolution
Glory	NASA	824 km sun-synchronous	12/2008	in framework of Climate Change Research Initiative (CCRI) global distribution of natural and anthropogenic aerosols
Deep Space Climate Observatory (DSCOVR)	NASA (offices of Earth and Space Science)	L1	TBD	Measure how solar radiation affects climate by using Sun-Earth libration point L1 from which it will observe Earth
OSTM/Jason II	NASA, NOAA, CNES, EUMETSAT	1336 km non-sun synchronous	06/2008	Ocean surface topography, global ocean circulation for climate prediction, follow on to Jason I
NPP (NPOESS Preparatory Project)	NASA & IPO NOAA	824 km (10:20 D) sun-synchronous	12/2009	Application and other information: monitoring climate trends and global biological productivity
Kanopus-V	ROSCOSMOS	510-540 km sun-synchronous	TBD	Monitoring of naturally occurring and man-made extreme events

C.4 Reconfiguration of future combinations of LEO and GEO missions

WMO-WP-38 contained tables of LEO, GEO and R&D current or future satellite missions, that were updated in interaction with CGMS members, namely through the CBS/OPAG IOS Expert Team on Satellite Systems, for publication on the Satellite pages of the WMO website. Regarding the LEO satellite tables, WMO highlighted that in these tables the Early Morning category corresponded to Equatorial Crossing Times centred around 6:00 and 18:00 Local Solar Time. With this definition, future DMSP and NPOESS missions at 17:30 actually appear as Early Morning missions, in line with the general understanding. CGMS agreed to adopt this convention for future satellite tables.

D. OPERATIONAL CONTINUITY AND RELIABILITY

D.1 Global Planning, Including Orbital Positions and Reconfiguration of the Space-based Component of the GOS

WMO-WP-25 presented the latest issue of the "Status of the space-based component of the Global Observing System (GOS)" (WMO WP-25). This is the 3rd issue of this yearly report that includes descriptions of all meteorological satellites in geostationary and sun-synchronous orbits and a reach selection of R&D programmes relevant to GOS. For each programme, the following is included: 1) a short description of the programme, inclusive of some historical background, 2) the status of the currently operational satellites, 3) a description of the next satellites in the series, 4) the radio frequency plans for data transmission to the ground (only for meteorological satellites), and 5) instrument sheets for currently operational and consolidated planned payloads. The Report is now nearly complete, and the updating mechanism will no longer be based on the revision of full sections by CGMS members, but only on focused questions to specific persons. The document will be placed under configuration control at WMO and updated information will be included "*ex officio*" any time it appears (at CGMS, at CM, at WMO meetings, on the web, etc.). CGMS members will continue to get the latest version at any Session. Foreseen addition is the extension of the instrument descriptive sheets to include mention of *potential* (not *actual*) products, and evaluation of their quality. Products and their quality will be associated to the "type" of instrument (not to the specific instrument), whereas quotation of actual performances of existing instruments will continue to be provided by space agencies through a different mechanism.
The information in the document was used to assess the compliance of the current and near-future satellite programmes with WMO requirements. The main highlights are:

Meteorological constellation in GEO (WMO requirement: six satellites equally spaced):

- coverage: good (only a small gap in the Pacific Ocean);

- instruments: too few advanced imagers; a major problem is the lack of unclear plans for advanced sounders. Dr Bizzarri reminded that the purpose of hyperspectral sounding from GEO is not only temperature and humidity profiling, that may be considered sufficiently supported from LEO, but also wind profiling (from water vapour moving structures), that is first priority in any list of observations for operational meteorology. There is no valid alternative since Doppler lidar such as ADM-Aeolus will be very useful within the overall system because of its excellent accuracy but provides very poor coverage.

Meteorological constellation in LEO (WMO requirement: four satellites optimally spaced):

- coverage: currently satisfactory, but degrading in the years to come, with large temporal gaps, often much longer than the required 3 hours, in spite of the fact that there are and will be many more than four satellites; major gap in the early morning / late afternoon hours;

- instruments: very un-homogeneous for basic missions, especially as regards sounding; in addition, there are many missions that are barely implemented or not implemented at all.

The conclusion was that the WMO/CGMS “optimisation” workshop, held in Geneva, 28-29 August 2006, should be repeated, and its scope should be greatly extended to include a critical instrument comparison (for the main instrument types, the current WMO WP-25 includes comparative tables).

Dr. Don Hinsman (Rapporteur of WGIII) reported on preliminary conclusions of Working Group III (Contingency planning) where document WMO WP-04 (CGMS optimisation meeting) had been presented and discussed. Recommendations were provided for GEO orbits (a substantially good situation exists except for the uncertainty on hyperspectral sounding) and the LEO orbits, where the main problem is the gap in the early morning/late afternoon soundings, persisting in the long term because of the current lack of commitment to fly a sounding package on early-morning NPOESS satellites. Working Group III recorded considerations by the Russian Federation to move Meteor-M2 to an early morning and intention of China to fly FY-3B in the 14:00 orbit provided that FY-3A performed nominally. Considerations were also given to the need for continuity and adequate coverage of altimetry, earth radiation budget, radio-occultation sounding and sea-surface wind missions.

The follow-on discussion confirmed the need for repeating the optimisation workshop and extending its scope to comparative instrument assessment and further missions not yet focused on. Hence:

Action CGMS-34.04: WMO to organise a second Workshop on optimisation of GEO and LEO satellite plans to monitor progress in implementing the recommendations from the first Workshop and extend considerations to detailed instrument capability, taking into account the possibility to fulfil some missions through a suite of instruments and several platforms. The workshop should involve R&D agencies in addition to operationally-oriented ones. Deadline: Before CGMS-35

NOAA commented that it would be necessary to show that orbital gaps had a negative impact on operational services otherwise it would not be possible to leverage the necessary resources to rectify the situation.

WMO-WP-30 recalled recommendation S12 of the CBS Implementation Plan for Evolution of Space and Surface Sub-systems of the GOS that CGMS had reviewed in past meetings. It recommended exploring opportunities for cooperation among CGMS Members to share ground facilities in support of radio-occultation missions. WMO proposed to establish a Task Force of CGMS Members involving, if appropriate, other entities having interest and expertise in Radio-Occultation missions, with the objectives to analyze the ground facilities needed for GPS radio-occultation missions, to assess to what extent there are commonalities among these missions and scope for sharing some facilities (e.g. precise time-referencing needed for accurate signal processing), to identify the practical implications of sharing such facilities and to report to CGMS-35 with proposals for cooperation.

CGMS recognised that there was scope for useful cooperation in this respect. EUMETSAT, NOAA, ROSHYDROMET expressed readiness to participate in such a Task Force and EUMETSAT agreed to take the lead.

Action 34.05: EUMETSAT to convene and lead a Task Force to assess possibilities for sharing ground segment facilities for radio-occultation missions and report at CGMS-35. EUMETSAT point of contact Dr Kenneth Holmlund (kenneth.holmlund@eumetsat.int). Deadline: CGMS-35

D.2 Inter-regional Contingency Measures

There were no working papers presented under this item.

D.3 Long-term Global Contingency Planning

There were no working papers presented under this item.

E. SATELLITE REQUIREMENTS OF WMO PROGRAMMES

E.1 World Weather Watch

WMO-WP-06, recalled the current baseline for the WMO WWW Global Observing System (GOS), with reference to the agreed vision of the GOS to 2015, and the status of evolution of the GOS towards full implementation of this vision. It reported on recent discussions held within the joint second session of the Expert Teams on Satellite Systems (ET-SAT-2) and on Satellite Utilization and Products (ET-SUP-2), which recommended to update and redefine the scope of the GOS, in order to take fully into account the needs of climate monitoring. In view of the outcome of these discussions, the ICT-IOS had agreed that the relevant Expert Teams (ET-EGOS, ET-SAT, ET-SUP) would "initiate an update of the space-based GOS baseline with 2025 as a new horizon, and expand its scope beyond World Weather Watch in order to include sustained observations of additional variables required for climate monitoring, and ultimately address the needs of other programmes as well."

The Chairman supported the view that the scope of the GOS should encompass climate monitoring needs. EUMETSAT confirmed its readiness to contribute to an expanded GOS along these lines, recalling its mandate to support meteorology and climate monitoring. CGMS Members welcomed this decision of WMO to undertake such a redefinition of the GOS and noted that contributing to such a future expanded space-based GOS would have implications on the long-term planning of future missions for all CGMS members.

In WMO-WP-13, WMO reported on activities and requirements of the Tropical Cyclone Programme. The Panel on Tropical Cyclones (PTC) for the Bay of Bengal and the Arabian Sea at its thirty-third session (Dhaka, Bangladesh, 30 January to 4 February 2006) noted with appreciation that CGMS during its 33rd session (Tokyo, Japan, 1-4 November 2005), had taken actions in response to the requirements of the PTC forwarded to the group by the Tropical Cyclone Programme (TCP). The TCP expressed in particular three requirements: geostationary satellite coverage of the Indian Ocean, availability of TRMM data and ocean surface winds from scatterometer data. The Panel noted with appreciation that EUMETSAT plans to relocate Meteosat-7 over the Indian Ocean to allow continued coverage until 2008. However, it recalled the need for long-term coverage of the Indian Ocean area whereupon it was pleased to learn that Russia intended to ensure long-term coverage of the Indian Ocean Region, with its Electro L-N1 and N2 satellites, currently scheduled for launch in 2007 and 2009, respectively. The Panel noted the opening of the Centre of Excellence in Oman for Satellite Application Courses. The Centre was established with the kind cooperation between the Sultanate of Oman and EUMETSAT. The Panel Members were requested to participate in the courses offered by the Centre. The Regional Association V Tropical Cyclone Committee (RA V/TCC) for the South Pacific and South East Indian Ocean at its eleventh session (Adelaide, Australia, 4-8

May 2006) carried out a wide-ranging review of the Technical Plan and its Implementation Programme for 2006–2010. It rated "satellite interpretation" as one of the activities of highest priorities to be strengthened under "Training and Capacity Building". It also put great emphasis on "access to LRIT satellite information" to be improved under "Communication and Computer".

WMO briefly introduced WMO-WP-27 on the Global Space-based Inter-Calibration System (GSICS) that had been discussed within CGMS Working Group II. GSICS intends to ensure comparability of measurements provided by different satellite missions and their traceability to absolute standards. WMO reported that 5 CGMS Members (CMA, EUMETSAT, JMA, NOAA, ROSHYDROMET) had already agreed to the GSICS Implementation Plan and that activities were being initiated. CGMS was invited to complete the adoption of the Implementation Plan.

Further details on GSICS were provided by Dr Goldberg from NOAA/NESDIS, who introduced NOAA-WP-33 and NOAA-WP-011 in his capacity of Chair of the GSICS Executive Panel.

The subsequent discussion provided information on the planned calendar of activities including the GSICS Executive Panel to be convened on 21-22 January 2007, and on the preparation of a dedicated GSICS web site.

The GSICS Implementation Plan, approved by CGMS in May 2006, was presented in NOAA-WP-33. The goal of GSICS is to achieve operational inter-calibration of the space component of the World Weather Watch's Global Observing System (WWW's GOS) that addresses the climate, weather forecasting and other environmental needs of WMO Members.

The Implementation Plan describes the components of GSICS, the roles of participating agencies, a timetable for implementing the programme, and coordination with other international programs.

Timetable of Actions to Implement GSICS:

Action	**Responsibility**	**Target Date**
Submit GSICS Implementation Plan to CGMS heads of delegation for approval.	WMO	15 Apr 2006
Approval of GSICS IP	CGMS	15 May 2006
Transmit invitations to CGMS satellite agency members to attend GSICS implementation meeting (at the same time of WMO EC LVII meeting) with the aim to receive commitments for participation and nomination to the GSICS Executive Panel (EP).	WMO	15 May 2006
Convene GSICS Executive Panel (establish working groups, terms of reference) and GSICS organizational workshop	WMO	11-14 Oct 2006

Action	Responsibility	Target Date
Convene GSICS Data Management WG	GSICS	1 Dec 2006
Construct first draft of GSICS Annual Operating Plan	GSICS	1 Feb 2007
Approval of GSICS AOP at second Meeting of GSICS Executive Panel	GSICS	15 Feb 2007
Begin GSICS Initial operations	GCC & GPRCs	1 Apr 2007

The working paper further stated that successful implementation of GSICS will result in substantial benefits to the ultimate user communities of operational environmental satellite observations – the weather and climate communities – in the form of more accurate weather forecasts and reliable climate monitoring.

WMO-WP-28 reported on the implementation of the global network of Regional ATOVS Retransmission Services (RARS) in light of the outcome of the 2nd and 3rd global RARS-IGDDS workshops. It recalled that the EUMETSAT EARS was fully operational for ATOVS data with 10 HRPT stations and has initiated pilot activities for retransmission of ASCAT and IASI data from MetOp, as well as AVHRR data from MetOp and NOAA. The Asia-Pacific RARS had started pre-operational activities with contribution from China, Korea, Japan, Australia and will involve up to 15 stations by December 2006. ATOVS data from the Asia-Pacific RARS were transmitted over the GTS via Tokyo and Melbourne, and JMA reported on their value for NWP. Plans for the South-American RARS were being consolidated; in a first phase it would involve 6 HRPT stations in Brazil, concentrated by INPE/CPTEC in cooperation with INMET, and one station in Argentina through cooperation between SMN and CONAE, it was expected to become operational by the end of 2007. CGMS noted that the global RARS network planned to receive support from the EUMETSAT SAF on NWP operated by the UK Met Office for global monitoring of data consistency, and that WMO would develop a RARS website to inform the global user community. In order to continue and enhance the cooperation that has developed through the 3 global RARS workshops since 2004, it is proposed to establish a RARS Implementation Group. The paper highlighted that further action was needed to complete the global coverage, in particular towards Africa and the Pacific. Expansion to other time-critical data beyond ATOVS should also be considered, and the 15th International ATOVS Scientific Conference (ITSC) expressed recommendations in this respect. WMO expressed its deep appreciation to all parties contributing to the global RARS network that brought tremendous benefit to the NWP user community.

CGMS Members welcomed the progress made on RARS, which was considered as an extremely valuable way to enhance the benefit taken from polar-orbiting data. It strongly supported its proposed expansion, as well as the proposal to set up a RARS Implementation Group.

CGMS-34 formally adopted the GSICS Implementation Plan.

Recommendation 34.03: CGMS to pursue the geographical expansion of the global RARS network towards South-America, southern Africa and the Pacific, as well as the expansion of the RARS concept to additional time-critical parameters for NWP beyond ATOVS. Deadline: CGMS-35

Action 34.06: WMO shall set up a RARS implementation group with participation of CGMS members involved in RARS, in accordance with the draft Terms of Reference proposed in Appendix of CGMS-34 WMO-WP-28. Deadline: June 2007

E.2 Other WMO Programmes

In EUM-WP-07, EUMETSAT stated that it has been recognised and will become increasingly urgent that the vast amount of remote sensing data contained in the archives of the various operational satellite agencies is made available for reprocessing for climate study use.

Currently all satellite operators offer similar types of services, an archive and retrieval service. However, the same satellite operators offer many different ways of accessing, describing, and retrieving their datasets. To enable processing long time series for climate studies and optimisation of the user services, issues like data preservation, standardisation, and interoperability between the satellite operators need to be addressed to allow an easier and more effective processing of global datasets, in particular for the creation of global datasets. These efforts should ideally be in line with the GCOS Climate Monitoring Principles. The paper further addressed issues such as data preservation and access methods; data quality and intercalibration; data mining and access for third party algorithms; and metadata.

A prerequisite for this is that the quality of the data can be assured. In addition good calibration and intercalibration of sensor data is essential. As a result the question of easy data access and delivery of data needs to be further pursued and it is believed that CGMS could be an ideal way to consolidate this issue among satellite operators. A first step on this matter would be to recommend a common data delivery format(s).

Following the CGMS-33 recommendation 33.04, NOAA-WP-32 presented aspects on the development of a Climate Data Set from Hyperspectral IR Instruments. Constructing such data set requires the ability to reprocess the dataset frequently and easily to incorporate understanding of instrument characteristics and algorithm characteristics. NOAA has developed a number of subset files that should be of interest to the climate community. They plan on extending these datasets to IASI and CrIS. The most useful datasets found were:

- Co-location of AIRS, IASI, and CrIS radiances to operational sondes. A full set of infrared radiances (a “golfball” of IR FOV’s associated with an AMSU FOV) are saved for any sonde launched within +/- 5 hours, +/- 100 km of AIRS overpasses. Also, ECMWF and GFS model products are

saved for these scenes. Tighter co-location (e.g., +/- 1 hour) can be performed later.

- Fetch closest "golfball" to points on a uniform 3x3 degree grid for ascending and descending passes (i.e., 2 files). ECMWF and AVN products are also saved for these scenes.

The working paper further described the sonde and related products, and provided examples thereof.

WMO-WP-05 informed CGMS Members of activities within the WMO Space Programme since CGMS-33. CGMS recalled that the main thrust of the WMO Space Programme Long-term Strategy was to make an increasing contribution to the development of the WWW Global Observing System (GOS), as well as to the other WMO-supported Programmes and associated observing systems through the provision of continuously improved data, products and services, from both operational and R&D satellites, and to facilitate and promote their wider availability and meaningful utilization around the globe. Several important WMO Space Programme events have occurred since CGMS-33 including: WMO Space Programme's participation in the 5th International Global Precipitation Measurement (GPM) Planning Workshop in Tokyo; WMO hosting of the 2nd CGMS-WMO Global Workshop on RARS and IGDDS; the sixth session of the WMO Consultative Meeting on High Level Policy on Satellite Matters; WMO's attendance at the inaugural ceremony for the new Centre of Excellence in Muscat, Oman that is co-sponsored by EUMETSAT and IMD; EUMETSAT's hosting of a WMO/CGMS GSICS meeting to develop a draft GSICS Implementation Plan; WMO's participation in the North America Data Exchange Meeting hosted by NOAA/NESDIS in Silver Spring, USA; WMO's hosting of a meeting of CGMS satellite operators to review the GSICS Implementation Plan; WMO's hosting of a CGMS Optimization Workshop in Geneva; WMO's hosting of a CGMS Meeting on Frequency Coordination in Geneva; WMO's hosting of the 3rd IGDDS and RARS Workshop in Geneva; WMO's participation at the 7th Asia-Pacific Data Exchange and Utilization Meeting; and the High-Profile Training Event (HPTE). CGMS noted that more detailed information for each of the above meetings was contained in other WMO Working Papers.

In WMO-WP-16, CGMS Members were informed of discussions at the sixth session of the WMO Consultative Meetings on High Level Policy (CM-6). 2. In particular, CM-6 noted that the China National Space Administration (CNSA) had confirmed its intention to contribute to the space-based component of the WMO's GOS by providing remote sensing data from HY-1A (launched in 2002) and HY-1B (to be launched in 2006) to WMO and CGMS Members. CM-6 also noted: the plans by NOAA to move GOES-10 to enhance coverage of the Americas; the Integrated Global Data Dissemination Service (IGDDS); the International Geostationary Laboratory concept (IGeoLab) in depth and more details are included in WMO WP-29; the Global Space-based Inter-calibration System (GSICS); and the Virtual Laboratory for Satellite Data Utilization and High Profile Training Event (HPTE). CGMS Members noted

that each of the above subjects were subjects of separate WMO Working Papers. WMO-WP-16 also reported on discussions that will continue at CM-7 on the International Charter on Space and Major Disasters; Regional Specialized Satellite Centres; and the for Global Precipitation Measurement mission (GPM).

WMO-WP-17 informed CGMS Members on activities of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) and its requirements for space-based observations. Key observational requirements for JCOMM applications included Sea Surface Temperature, Ocean Topography, Ocean Vector Winds, Ocean Biology and Sea ice. JCOMM considered that there were key knowledge challenges related to Precision Gravity Field or Geoid, Salinity and high precision Sea Surface Temperature. Regarding Ocean topography, JCOMM underlined that observing shorter space and time-scale phenomena at the ocean's mesoscale are not adequately sampled by a single altimeter but required at least continuation of a TOPEX/Poseidon-class high-precision altimetry mission (eg Jason-2 and its successor), and an ERS-ENVISAT-class altimeter. JCOMM also confirmed that, for ocean surface wind fields, both polarimetric microwave imagers and scatterometers were needed to derive surface vector wind at all scales. Research is expected to provide insight regarding the potential of blended system of scatterometer and polarimetric radiometer winds.

WMO-WP-22, prepared by the Global Climate Observing System (GCOS), described recent GCOS activities relevant to CGMS, namely:

(i) the recent development of a detailed set of requirements for satellite-based climate products and datasets, supplementing the space-based component of the GCOS Implementation Plan. These climate requirements, contained in the document 'Systematic Observation Requirements for Satellite-based Products for Climate' (GCOS-107), have been used in a response by the WMO CBS IOS Expert Team on Satellite Systems (covered in WMO-WP-37), for input to the evolution of the WMO GOS in the next two decades. The GCOS requirements have also been closely considered by the Committee on Earth Observation Satellites (CEOS) in leading the preparation of a coordinated response to the GCOS Implementation Plan by those countries that support space agencies involved in global earth observation. The CEOS response, which contains a number of dedicated actions on space agencies in support of climate, was prepared at the request of the UNFCCC for COP-12/SBSTA-25 in November 2006.

(ii) conclusions and recommendations from the 12th session (April 2006) of the GCOS/WCRP Atmospheric Observations Panel for Climate (AOPC) in support of various activities of CGMS members,

(iii) the latest status of the proposed GCOS Reference Upper-air Network,

(iv) relevant results of the 14th session (October 2006) of the GCOS Steering Committee, which supported the development of GCOS-107, welcomed the response by CEOS, and supported the work towards the proposed GCOS Reference Upper-air Network, and

(v) issues from the WCRP related to CGMS.

WMO-WP-37 proposed a preliminary response to GCOS Systematic Observations Requirements for Satellite-based Products for Climate, based on the discussion of GCOS requirements by the Expert Team on Satellite Systems (ET-SAT) during its second session. This document addressed the possible response to GCOS at different levels:

- GCOS Climate Monitoring Principles and other cross-cutting recommendations
- Identification of relevant instruments to collect the required data
- Comments on the description of products and related instruments
- Suitability of current satellite plans to meet GCOS requirements

This preliminary analysis suggested that current and planned missions provide impressive capabilities to meet most of GCOS requirements, however there are anticipated gaps or risk of such gaps for some specific variables such as Earth Radiation Budget, Sea level, Sea surface winds or Global Precipitation. This pointed to the need for an optimization of the global space-based observing effort in order to ensure continuity and improve geographical and temporal sampling of the key parameters of the Earth-Ocean-Atmosphere system.

It raised the issue of re-defining the scope of the WMO Global Observing System in order to fully address climate monitoring needs beyond the operational objectives of the World Weather Watch programme, taking due account of the need for long-term sustained measurement of Essential Climate Variables.

This also referred to the necessary transition of some Earth Observation missions from R&D experimental status to a more consolidated and perennial status, which would imply close cooperation between R&D and operational agencies, and user involvement.

CGMS was invited to review this document as a basis for a possible CGMS response to GCOS and to consider the proposed actions to consult with CEOS to ensure complementary actions from CEOS and CGMS for refining this preliminary response. ESA welcomed this report and supported the view that CGMS should liaise with CEOS to avoid any duplication of effort.

CGMS agreed to consider the content of WMO-WP-37 as a preliminary CGMS response to GCOS requirements and decided on two actions:

Action 34.07: WMO, with the support of ET-SAT, to refine the response to GCOS requirements on the basis of WMO-WP-37. Deadline: CGMS-35

Action 34.08: WMO to coordinate with CEOS to ensure that CGMS and CEOS provide consistent responses to GCOS requirements and complement each other's efforts. Deadline: CGMS-35

In WMO-WP-26, WMO informed CGMS Members on current international developments regarding Disaster Risk Management and on related activities coordinated by the WMO Disaster Prevention and Mitigation Programme (DPM). A critical element of the DPM strategy was close collaboration with the space agencies, to ensure better coordination for enhanced utilization of satellite capacities (communication channels and observations). The WMO DPM Programme, in close collaboration with the WMO Space Programme, was initiating a project to review the satellite requirements in support of risk identification; risk reduction and risk transfer applications for hydro-meteorological disaster risk management. Such requirements would address utilization of satellite capacities for the entire cycle of DRM including prevention, preparedness, response and recovery. To this end, needs and gaps for satellite information for DRM applications (i.e., risk identification, risk transfer and risk reduction) for the entire cycle of DRM (prevention, preparedness, response and relief operations) would be evaluated.

In WMO-WP-32, WMO discussed the current status of the preparation of the International Polar Year 2007-2008 (IPY), the joint initiative launched by WMO and ICSU in 2003. IPY 2007-2008 should result in an intensive burst of internationally coordinated, interdisciplinary research and observations focused on the Polar Regions. Substantial progress had been made by international scientific community and Joint Committee for IPY (JC) resulting in preparation and endorsement by JC of more than 200 project proposals for IPY of which at least half would significantly improve the observational networks for atmosphere, ocean and cryosphere in Polar Regions. A preliminary subset of satellite data requirements for IPY projects had been established thanks to an Announcement of Opportunity in support of IPY issued by ESA in June 2006 and the IPY Project "Global Inter-Agency IPY Polar Snapshot Year (GIIPSY)". In order to assist in establishing a dialog between IPY projects and satellite operators to meet requirements for satellite data, products and services, the IPY Sub-Committee on Observations created a Space Task Group that consisted of representatives from satellite agencies. This group should ensure that satellite systems be used to their maximum potential for IPY purposes. CGMS Satellite operators agreed to actively participate in the IPY implementation through provision of satellite data, products and services on request and involvement in IPY projects implementation.

E.3 IOC Programmes

In IOC-WP-01, the satellite requirements of IOC programmes were described. The major observing programme of the IOC is the Global Ocean Observing System (GOOS), the ocean observing component of GEOSS. Broad community consensus has been sought in the design and planning process for GOOS, which calls for continuous high-quality observations of the oceans

from satellites and *in situ* instruments. The paper pointed out some of the challenges in maintaining satellite observations of sea ice, sea level, sea surface temperature, ocean colour, sea state, and salinity, and encouraged the members of the CGMS to work with GOOS and other IOC programmes in meeting these challenges.

F. INTERACTION WITH GEO

F.1 Applications of Meteorological Satellite Data for Environment Monitoring

The status of development and operations, including medium to long-term planning of the EUMETSAT Satellite Applications Facilities (SAF) were presented in EUM-WP-10. There are currently eight SAF projects running, five of which are in their initial operations phase until February 2007 (Support to Nowcasting and Very Short-Range Forecasting, Ocean and Sea Ice, Land Surface Analysis, Numerical Weather Prediction, Climate Monitoring). SAFs are already supporting each other via the exchange of products and expertise, as well as keeping a close contact between SAF managers and scientists.

In the period 2007-2012, the SAF network will continue their development and operations phase and will continue operations based upon Meteosat and third party products, MetOp-based product validation, development and operations of new products, including post-MSG and post-EPS.

In WMO-WP-33, WMO discussed the applications of meteorological satellite data for environment monitoring within GEOSS. It noted that GEO, as part of its 2006 Work Plan, had agreed on a specific task for non-meteorological applications of geostationary satellite data and that EUMETSAT would host the 2nd workshop on Geostationary Fire Monitoring and Applications to be held on December 4-6, 2006. Fire monitoring was relevant to the 2006 GEO Task for the implementation of a Fire Warning System at the global level (DI-06-13).

F.2 Geonetcast/EUMETCast

EUM-WP-11 presented the evolution and the actual status of the EUMETCast system architecture, services actually supported, and registration figures. Furthermore, the concept, actual status and intended evolution of GEONETCast were described, highlighting the role of EUMETCast in this system.

EUMETCast was initiated due to a power amplifier failure affecting the direct dissemination onboard Meteosat-8 during its commissioning phase in 2002. Implemented in less than six months, the dissemination of SEVIRI images started in April 2003, followed by the successive integration of additional services, constituting EUMETCast as EUMETSAT's broadcast system for environmental data. The system consists of three elements: data providers, dissemination infrastructure and the users. Europe is covered using a Ku-band system via Hotbird-6, Africa is covered using a C-band system via Atlantic Bird 3, and for a trial period (2006-2008) the Americas using C-band transponders

onboard NSS-806. The paper further described the dissemination of the various environmental data streams and products. By the end of August 2006, some 1900 users of EUMETCast reception stations had registered, of which ca 1500 had a subscription for the Meteosat Second Generation 15 minutes SEVIRI service.

The working paper continued by indicating that GEONETCast is a dissemination system under development. Global Earth Observation System of Systems (GEOSS) environmental satellite and in-situ data and products from participating Data Providers will be transmitted to users through satellites using a multicast, access-controlled, broadband capability. EUMETCast currently provides a dissemination infrastructure hosting GEONETCast. Furthermore, NOAA has the intention of establishing a dissemination system providing comprehensive coverage of the Americas known as NOAACast and initial discussions are ongoing with CMA for a potential FengYunCast system. A regular flow of NOAA data to the EUMETCast Ku-band system has been implemented, in support of demonstrations. The GEONETCast demonstration service is planned to run until end 2008, with additional data sets progressively introduced.

WMO-WP-34 reviewed GEONET-Cast and WMO's Integrated Global Data Dissemination Service (IGDDS) with regard to clarifying the relationships between them. It noted that GEONET-Cast was a system of systems for data and product dissemination based on the use of communication satellites for GEO Societal Benefit Areas (SBA) while IGDDS was the circulation scheme of space-based observation data and products for WMO Programmes that relied on ADMs, GTS and Internet and included data acquisition, data and user management and data access on request functions. IGDDS and GEO-NETCast relied on some common building blocks, and the implementation of GEONET-Cast was expected to serve IGDDS as well. In the effort to expand GEONET-Cast to serve several SBAs, it was expected that CGMS Members would keep a focus on the core requirements of IGDDS since it was designed to meet the essential operational needs of WMO Members.

F.3 CGMS and GEO/GEOSS interactions

In WMO-WP-35, WMO discussed the potential role of CGMS as a GEO Participating Organisation. CGMS recalled that WMO, as both a CGMS member and GEO Participating Organization, was already committed to meeting the needs of the SBAs for weather, water, climate and disasters. WMO Members had already formally committed that the space-based sub-system of the GOS to GEOSS and the WMO Information Service (including its component IGDDS) would be components of the Global Earth Observation System of Systems (GEOSS). For the weather, water, climate and disaster SBAs in which WMO, as an organization, had responsibility within its mandate, the WMO Space Programme would be the coordinator for the space segment.

Thus, CGMS recognised, as the coordination group for meteorological satellites, that it had a concomitant responsibility to GEO. In responding to

WMO requirements, CGMS would be *de facto* responding to GEO requirements for the weather, water, climate and disasters SBAs. CGMS recalled that CGMS-33 had agreed it should become a Participating Organization in GEO. Based on this agreement, the CGMS Secretariat had written a letter of application to the GEO Secretariat and it was anticipated that GEO-III would approve the application.

The Secretariat informed CGMS about an exchange of correspondence it had with the programme manager in the GEO Secretariat, concerning the recognition of CGMS as a participating organisation in GEO. This process is currently under review and will be discussed and decided upon at the GEO-III plenary meeting (to be held in Bonn, Germany 28-29 November 2006 to which CGMS has been invited).

G. OTHER ITEMS OF INTEREST

G.1 Training

EUM-WP-12 reported on training activities carried out by EUMETSAT over the last year. Since CGMS-33 training courses were conducted or supported in Europe, Africa and more recently South America. In late 2005, two VISITView distance learning sessions (interactive live tuition over the Internet) were held on detection of rapid cyclogenesis and severe convection monitoring. In 2006 a vast range of courses were also held, both in-situ and as distance learning sessions. This heavy schedule will continue throughout 2007.

The paper also provided a detailed description of the various training events undertaken over the last year.

NOAA-WP-23 informed CGMS of the NOAA Support for the CGMS Virtual Laboratory Focus Group (Session II). It provided the HPTE Lecture & Weather Briefing summary table for the October and November 2006 sessions. The Focus Group of the Americas will be participating in several events, including a Weather Briefing between the Americas and Portugal, where they will be hosting a workshop.

The NOAA registrations for the HPTE lectures began in late September 2006, where NOAA used its Weather Briefings from September 25 and 26 to review the HPTE lecture process. NOAA expressed its gratitude towards the team effort by Costa Rica, Brazil, COMET, CIRA and EUMETSAT to allow for three of the lectures to be done in Spanish by October, and Brazil had agreed to translate all lectures into Portuguese, prior to them being given in November 2006.

WMO WP-18 and 18 add 1 summarised activities of the CGMS Virtual Laboratory for Training in Satellite Meteorology, including events during the two week period prior to CGMS-34. CGMS endorsed two new Centers of Excellence (CoEs) that are sponsored by NOAA/NESDIS: 1) a CoE in Buenos

Aires, Argentina, for training in satellite meteorology in Spanish; and, 2) a CoE at the Center for Weather Forecast and Climate Studies of Brazil (CPTEC) to improve the use of satellite data and products in South America and African Portuguese speaking countries. CGMS applauded activities underway within the Focus Group of the Americas and encouraged other CoEs to undertake similar activity in the future. Furthermore, CGMS noted that a number of important training events had occurred at CoEs during 2006. In Oman, the first official CoE training event followed the CoE inauguration in February 2006. It was attended by 25 participants from 7 Arab countries and 7 lecturers. Training focused on the application of MSG data in the Middle East. The strength of distant learning with VISITview was demonstrated with a lecture originating from EUMETSAT headquarters. The Asia Pacific Satellite Applications Training Seminar (APSATS 2006) that focused on Use of Environmental Satellite Data in Meteorological Applications for RA V was held at the COE located at Australian Bureau of Meteorology in Melbourne, Australia. Twenty five participants from 12 countries attended the two-week workshop. The 3rd IPWG workshop was held in parallel with the APSATS 2006, with one day being a joint session with special lectures and workshops provided to APSATS participants by experts from IPWG. Six of the APSATS participants received VL electronic notebooks to take back to their Member countries. Other participants received 300 GB hard drives that contained the Virtual Resource Library as well as the APSATS course content. A Regional Training Course on the Use of Environmental Satellite Data in Meteorological Applications for RA II was held in Nanjing, with 23 participants from 19 countries attending the two-week workshop. Some of the Nanjing participants took VL electronic notebooks back to their Member countries after the training course. A demonstration of the Chinese ADM system FENYUANCAST was part of this workshop. We look forward to further information from CMA on that event. A highlight to the WMO VL training year culminated with the High Profile Training Event (HPTE). The HPTE was held during 16-27 October 2006, in conjunction with the Melbourne and Nanjing training events. Four core lectures as well as specialized Regional Lectures were presented in VISITView format during HPTE. Participation in the HPTE by WMO Members far exceeded expectations. All WMO Regions participated in HPTE and preliminary results indicate that a minimum of 121 of 187 WMO Members received HPTE lectures, with well over 1000 people receiving the lectures. An HPTE evaluation questionnaire was distributed to all registered participants and a final evaluation is expected to be presented to CGMS-35.

Action 34.09: CGMS to continue its support of the VL, its structure and goals, and requests a full report on VL implementation (from the VL Management Group Meeting in 2007) be presented to CGMS-35.

In WMO-WP-23, CGMS discussed new developments between WMO and NASA related to the GLOBE Programme that had the potential to provide a link between WMO and secondary education schools for remote sensing matters. CGMS recalled the proposal it had approved at CGMS-31 towards a Global Educational and Science Network (GESN) although noting that subsequently NASA had selected a different consortium for the GLOBE

Programme. In reviewing the previously approved GESN proposal, several CGMS satellite operators expressed concerns that any renewed commitment towards GESN may imply resource commitments and thus deferred from involvement in further GESN efforts.

G.2 Information

In WMO-WP-02, WMO informed CGMS on the status of the satellite ground-receiving database maintained by WMO. CGMS noted the recent change to the goals for implementation of the ground segment for the space-based subsystem of the GOS. In particular, the goal for each WMO Member is to have access to satellite data and products from LEO, GEO and R&D data streams through either:

- ADM receiving equipment for LEO, GEO and appropriate R&D data streams; or
- Direct Broadcast (DB) receiving equipment for polar-orbiting satellite data receivers (either APT/LRPT or HRPT/AHRPT); and,
- DB receiving equipment for geostationary satellite data receivers (either LRIT or HRIT).

The GOS implementation goal is 100% of WMO Members satisfying the above goal. CGMS noted that it is WMO's intention to update the database in 2006 through contact with WMO Permanent Representatives as well as other cited sources. A consultancy has been established with a specific task to update both the database and produce an associated WMO Space Programme Technical Document.

EUM-WP-13 provided a brief account of the EUMETSAT conferences that had taken place since the last meeting of CGMS and the ones planned for the future. Included was a summary of the EUMETSAT Satellite Data Users' Conference held in Helsinki, Finland, from 12-16 June 2006. The next Satellite Data User Conference, focusing on oceanography, will be held in Amsterdam in 2007, this time jointly organised with the American Meteorological Society and NOAA, and hosted by the Royal Netherlands Meteorological Institute (KNMI). In addition, EUMETSAT provided a list of its recently updated, and new publications.

NOAA-WP-27 provided an overview of the data compression activities NOAA is investigating to support data dissemination and archiving in the future. Considering the increase in data rates and data volumes, new advances in data compression are needed to meet the demands for real-time distribution of environmental information. NOAA has undertaken over four years of research on Satellite sensor Earth science data compression to explore how to accurately reduce data volumes. NOAA sees Earth science data compression, in the emerging near future of more powerful satellite sensors and enlarging data rates, as a tool to support CGMS members' data distribution goals. This research was undertaken to explore how to implement new data compression techniques to Earth science sensor data, and how a

level of reduction in data volume was achievable. NOAA believes the higher the reduction rate, the more data satellite operators can distribute to world nations.

NOAA discovered the compression of satellite Earth science data to be a unique problem generated by unique sensor data patterns. As a rule, new classes of compression algorithms, such as that coming out of NOAA's funded research, are outperforming the ability of conventional compression algorithms by almost a two to one factor when applied to this problem. Where conventional algorithms that might achieve a 1.5 to 1 or 2 to 1 "Lossless" reduction in data volume when applied to satellite Earth science data; new classes of algorithms, such as those emerging from NOAA research, are yielding reductions or 3;1, 4:1 and 5:1.

Considering the impact of the growth in future satellite sensor data volumes, NOAA promotes the exploration and adoption of new compression algorithms to Earth science satellite data.

WMO-WP-03 informed CGMS Members of the various list servers used by the CGMS groups, i.e. the plenary, wind, virtual laboratory and frequency. CGMS Members were requested to regularly review their contact details on the list servers and inform the CGMS Secretariat and WMO of any changes accordingly.

In WMO-WP-07, WMO informed CGMS that WMO had finalised and distributed the Report of Consultative Meetings on High-level Policy on Satellite Matters, sixth session, Buenos Aires, Argentina, 16-17 January 2006 (http://www.wmo.int/web/sat/publications/CM-6_Final_Report.doc) and that the Application of Satellite Technology Progress Report, WMO TD No. 1311 (SP-3) was now available on CD-ROM.

G.3 Consolidated Report/CGMS Web Site

EUM-WP-14 presented three proposals for the future handling of the CGMS consolidated report to ensure its updating.

One possibility would be to create a 30-year volume, CGMS 1972-2002 , and thereafter the annual meeting reports could be used for reference, whereas the consolidated report would be updated at regular, but less frequent, intervals. A second possibility would be to subject it to an intensified periodical review, and update all relevant sections via the appointed points of contact of each Member with closer follow-up and tighter deadlines. A third option could be to continue the current working process, however, absence of contributions may put into question the overall relevance in the long-term.

CGMS agreed that the first option to retain the consolidated report as a historical document spanning the first 30 years, on their understanding that there would be a new consolidated report prepared in 4-5 years' time and that the regular final reports of meetings and their tables and annexes would

continue to be posted on the web site as is the present practice. It was further agreed that ESA would propose an appropriate title of the historical consolidated report in coordination with the Secretariat.

G.4 Any Other Business

There were no topics for discussion under this item.

H. FINAL SESSION

H.1 Reports from the Working Groups

Reports from the four working groups were presented by Mr Marlin O Perkins (WG I on Telecommunications), Mr Xu Jianmin (WG II on Satellite Products), Mr Gary Davis (WG III on Global Contingency Planning) and Mr Mikael Rattenborg (WG IV on Integrated Strategy on Data Dissemination from Meteorological Satellites).

The CGMS-34 co-Chairmen took note of the reports and thanked the participants, Chairmen and Rapporteurs for their active and fruitful discussions. They endorsed the proposed actions and recommendations formulated by each working group and congratulated the four working groups for their comprehensive reports and for their achievements since the preceding meeting of CGMS.

H.2 Nomination of CGMS Representatives at WMO and Other Meetings

WMO-WP-19 recalled that CGMS should nominate a representative for the WMO Fifteenth Congress (Cg-XV) on 7-25 May 2007, and the Fifty-ninth Executive Council of WMO (EC-LIX) on 28-30 May 2007, both to be held in Geneva, Switzerland. CGMS agreed that EUMETSAT will represent CGMS at these meetings

H.3 Nomination of Chairmen of Working Groups for CGMS-35

With regard to the meetings of the Working Groups that would take place at CGMS-35 it was agreed that:

- Working Group I on Telecommunications will be chaired by Mr Marlin O. Perkins, with Mr Gordon Bridge as Rapporteur;
- Working Group II on Satellite Products including Satellite-Derived Winds will be chaired by Dr. Mi-Lim Ou, with Dr. Johannes Schmetz and Dr. Mitch Goldberg as rapporteurs;
- Working Group III on CGMS Global Contingency Planning will be chaired by Mr Gary Davis, with Dr Donald Hinsman as Rapporteur;
- Working Group IV on Integrated Strategy for Data Dissemination from Meteorological Satellites will be chaired by Mr. Mikael Rattenborg, with Mr. Gordon Bridge as Rapporteur.

H.4 Amendment of the CGMS Charter

EUM-WP-15 recalled that the membership of CGMS has recently expanded to 15 participating organisations, and the CGMS Charter needs to be amended accordingly in order to reflect the new membership of CNES, KMA and CNSA.

The Working Paper proposed the necessary amendments and it had been circulated among the CMGS Members for consideration one month prior to CGMS-34, in accordance with the relevant provision of the CGMS Charter. The amended charter is included in the relevant annex.

The amendments were unanimously agreed by CGMS.

H.5 Any Other Business

There were no working papers discussed under this topic.

H.6 Summary List of Actions from CGMS-34

(i) Permanent actions

1. All CGMS Members to inform the Secretariat of any change in the status or plans of their satellites to allow the updating of the CGMS Tables of Satellites (tables 1-7). The Secretariat to review the tables of current and planned polar and geostationary satellites, and to distribute this updated information, via the WWW Operational Newsletter, via Electronic Bulletin Board, or other means as appropriate. CGMS satellite operators to update table 7 for polar-orbiting satellite equator crossing times on an annual basis. CGMS Members to update the table on polar-orbiting satellite equator crossing times as well as the table on coverage from geostationary satellites.

2. All CGMS satellite operators to review the Transition Tables for LRIT/LRPT (appendix A of CGMS-31 WMO-WP-03) and provide any updates as appropriate at every CGMS plenary meeting.

3. CGMS Members to report on anomalies from solar events at CGMS meetings.

4. CGMS Members to provide information for the WMO database of satellite receiving equipment, as appropriate.

5. CGMS Members to review the list of available list servers used by CGMS groups and update as appropriate.

6. CGMS satellite operators to consider the IOC satellite requirements, especially the data dissemination methods, bearing in mind the ongoing formations of GOOS Regional Alliances (GRAs).

7. CGMS Members to consider the WIS concept (notion of DCPC, catalogue/metadata standards, protocols) when changing/implementing processing and dissemination systems.

8. CGMS Members to consider WMO Core Metadata profiles within the context of the ISO Standard for Geographic Metadata (ISO 19115).

New permanent action:

9. All CGMS satellite operators to update the WMO generated tables indicating transition of broadcast services of satellites in polar and geostationary orbit, and inform the Secretariat accordingly.

(ii) Actions from CGMS-33

Action 33.18 The fire papers prompted CGMS to recommend that the WMO Space Programme Office create a web site posting all the links to real time fire detection data. **Deadline: CGMS-35**

Open (WMO)

Action 33.24 EUMETSAT, NOAA together with WMO to develop a EUMETCast to NOAA ADM transition plan for users in South America and report details to CGMS. **Deadline: CGMS-35**

Open. (NOAA)

(iii) Actions and Recommendations from CGMS-34

Action 34.01 CNSA/CMA and WMO to organise the 4th IGeoLab GEO-Microwave Focus Group meeting (FG-4) in China, with a goal to review scientific and technological elements in support of a possible Chinese undertaking in respect of FY-4M. **Deadline: before 30 Jun 2007.**

Action 34.02 Action CGMS-34.02: WMO to convene a Task Group to determine the interest of space agencies for an IGeoLab mission based on Molniya orbits. **Deadline: CGMS-35**

Action 34.03 ESA to check whether it is envisaged that ECMWF will further distribute ADM AEOLUS level 2 data to other NWP centres. **Deadline: CGMS-35**

Action 34.04 WMO to organise a second Workshop on optimisation of GEO and LEO satellite plans to monitor progress in implementing the recommendations from the first Workshop and extend considerations to detailed instrument capability, taking into account the possibility to fulfil some missions through a suite of instruments and several platforms. The workshop should involve

R&D agencies in addition to operationally-oriented ones. **Deadline: Before CGMS-35**

Action 34.05 EUMETSAT to convene and lead a Task Force to assess possibilities for sharing ground segment facilities for radio-occultation missions and report at CGMS-35. EUMETSAT point of contact Dr Kenneth Holmlund (kenneth.holmlund@eumetsat.int). **Deadline: CGMS-35**

Action 34.06 WMO shall set up a RARS implementation group with participation of CGMS members involved in RARS, in accordance with the draft Terms of Reference proposed in Appendix of CGMS-34 WMO-WP-28. **Deadline: June 2007**

Action 34.07 WMO, with the support of ET-SAT, to refine the response to GCOS requirements on the basis of WMO-WP-37. **Deadline: CGMS-35**

Action 34.08 WMO to coordinate with CEOS to ensure that CGMS and CEOS provide consistent responses to GCOS requirements and complement each other's efforts. **Deadline: CGMS-35**

Action 34.09 CGMS to continue its support of the VL, its structure and goals, and requests a full report on VL implementation (from the VL Management Group Meeting in 2007) be presented to CGMS-35. **Deadline: CGMS-35**

Action 34.10 The Secretariat to contact the IPWG Chairpersons to invite inputs for WRC 2007, and whenever appropriate, to the Chair of WGI - Telecommunications, concerning the requirements for frequency bands for advanced sensors operating at frequencies above 275 GHz. **Deadline: CGMS-35**

Action 34.11 WMO to confirm nomination of a frequency management expert representing CGMS at SFCG on an annual basis (currently Mr Robert Wolf). **Deadline: CGMS-35**

Action 34.12 CGMS members to review SFCG Resolution Res A12-1R2 and inform whether this resolution shall be used by CGMS agencies. **Deadline: 31 August 2007**

Action 34.13 CGMS Secretariat, with the support of WMO, to respond to SFCG Liaison statement as soon as possible. **Deadline: 15 December 2006**

Action 34.14 CMA and KMA to consider nominating a representative to the expert group related to meteorological satellite service matters of SFCG. **Deadline: 31 December 2006**

Action 34.15 EUMETSAT to inform CGMS Members when it has determined which three IDCS channels will be allocated for Tsunami monitoring purposes. **Deadline: 31 December 2006**

Action 34.16 WMO to inform CGMS Members via the Secretariat when the ASDAR programme is terminated so that the Secretariat can reallocate ASDAR IDCS channel to other purposes. **Deadline: 31 December 2006**

Action 34.17 The Secretariat, in coordination with NOAA, to initiate the discussions of the ad hoc IDCS Working Group by proposing an agenda, schedule and priority of discussion topics, follow up of discussions and report results to CGMS on a regular basis. **Deadline: CGMS-35**

Action 34.18 CMA is requested to put the software for image enhancement and analysis on a server for download by CGMS members. **Deadline: 31 December 2006**

Action 34.19 CGMS members to explore the potential of the Open Archival Information System Reference Model (OAIS-RM) as a framework for long-term satellite information preservation for enhancing interoperability of current, future, and historical data sets, as well as for the GEOSS interoperability, and to report at CGMS 35. **Deadline: CGMS-35**

Action 34.20 NESDIS is invited to provide a paper to CGMS-35 on progress in novel studies on the height allocation of AMVs to layers. **Deadline: CGMS-35**

Action 34.21 CGMS members operating imaging instruments on polar orbiters should consider producing AMV wind products over the poles and report to CGMS-35 on the investigations. **Deadline: CGMS-35**

Action 34.22 All CGMS members producing AMV products to report on the use of the standard CGMS AMV statistics with a paper to CGMS 35. The paper should also present the co-location criteria currently in use. **Deadline: CGMS-35 (feedback from 2 co-chairs)**

Action 34.23 KMA is invited to present a tentative product generation and dissemination plan for COMS at CGMS 35. **Deadline: CGMS-35**

Action 34.24 The CGMS THORPEX Rapporteur will contact CGMS Member focal points with regards to their becoming involved in THORPEX Regional Planning activities. **Deadline: CGMS-35**

Action 34.25 NOAA is invited to report on reprocessing of AVHRR data for a new aerosol climatology over the oceans to CGMS 35. **Deadline: CGMS-35**

Action 34.26 EUMETSAT to present paper on the results of the cloud workshop held in 2005 and subsequent investigations. **Deadline: CGMS-35**

Action 34.27: WMO to set up a Task Force on Codes following the TORs spelled out in WMO-WP-36 and report progress at CGMS 35. **Deadline: CGMS-35**

Action 34.28: Each Satellite Operator is invited to nominate an expert to contribute to the WMO led Task Force on codes. **Deadline: 31 December 2006**

Action 34.29: CGMS operators to report to CGMS-35 on their future plans for using direct broadcast beyond 2015. **Deadline: CGMS-35**

RECOMMENDATIONS

Recommendation 34.01
CGMS, noting that the technical work on the GIFTS payload on ground is providing excellent results, and that it appears feasible to host the payload on Elektro-L2 in 2010, invites the main concerned parties to unblock the situation enabling EDU upgrading to flight model, thus also unblocking several CGMS members willing to contribute to the project once the core space segment issue is solved. **Deadline: CGMS-35**

Recommendation 34.02
CGMS, noting that marked progress has taken place in setting the scientific background and developing several technical concepts for a GEO-Microwave, invites space agencies that are considering or may consider microwave missions in geostationary orbit to accelerate their decisional process and identify a 'lead space agency' as soon as possible; and invites all Members, including user-oriented ones, to prepare contributions to the IGeoLab GEO-Microwave initiative following the identification of the 'lead space agency'. Essential contributions have already been indicated in previous CGMS sessions, as follows: provision of experimental data by airborne campaigns (CGMS-32.16), and securing funds for scientific activities (CGMS-33.01). **Deadline: CGMS-35**

Recommendation 34.03
CGMS to pursue the geographical expansion of the global RARS network towards South-America, southern Africa and the Pacific, as well as the expansion of the RARS concept to additional time-critical parameters for NWP beyond ATOVS. **Deadline: CGMS-35**

Recommendation 34.04
All CGMS members should make software tools useful for image enhancement and analysis available to other CGMS members and inform them accordingly. **Deadline: CGMS-35**

Recommendation 34.05
In order to assure a rapid implementation of the GSICS, CGMS Members need to assure that adequate resources (manpower, infrastructure) are made available to adhere to the agreed implementation plan. **Deadline: CGMS-35**

Recommendation 34.06
Operational archive operators to install necessary reprocessing capabilities to allow for regeneration of datasets with improved quality. This includes that archive operators provide sufficient information of data quality and calibration accuracies to the user community. **Deadline: CGMS-35**

Recommendation 34.07
Archive operators are invited to develop mechanisms and provide means to allow running of third parties algorithms. **Deadline: CGMS-35**

Recommendation 34.08
It is recommended to make further efforts toward a near-global RARS and also include the data of advanced sounders and other data critical to NWP. **Deadline: CGMS-35**

Recommendation 34.09
ITWG should foster coordinated international collaboration for future product development related to increasing the amount of data assimilated in NWP by the use of cloudy radiances (e.g. need improved cloudy radiative transfer modelling), cloud-cleared infrared radiances, and surface channels (need improved surface emissivity modelling. The ITWG Rapporteur should inform the ITWG co-chairs of this new recommendation. Status reports from each CGMS agency on these topics at the next CGMS meeting are encouraged. **Deadline: CGMS-35**

Recommendation 34.10
ITWG should foster coordinated international collaboration for future product development related to development of climate data records from TOVS and other long-term satellite series. The ITWG Rapporteur should inform the ITWG co-chairs of this new recommendation. Status reports from each CGMS agency on the generation of CDRs at the next CGMS meeting are encouraged. **Deadline: CGMS-35**

Recommendation 34.11
CGMS recommends that the status of the European contribution to the Global Precipitation Measurement (GPM) is clarified by ESA. **Deadline: CGMS-35**

Recommendation 34.12
Satellite operators should provide detailed information in near-real-time as well as quarterly assessment reports of instrument performance, particularly information should include noise assessment, spectral response characteristics (central wave number, shape and stability). **Deadline: CGMS-35**

Recommendation 34.13
Satellite operators should maintain both conical scanning microwave imagers and cross-track scanning sounders on the same satellite platform. **Deadline: CGMS-35**

Recommendation 34.14
There should be a comparison of standard methods for the height assignment of AMVs with the new measurements from instruments on the A-Train (e.g. with the cloud lidar). **Deadline: CGMS-35**

Recommendation 34.15
There should be a comparison of the operational algorithms of all satellite wind producers for the height assignment of AMVs from clouds using a common data set from SEVIRI on MSG, and the same ancillary data . **Deadline: CGMS-35**

Recommendation 34.16
An experiment should be performed to apply operational AMV retrieval algorithms to simulated images from high resolution NWP fields. **Deadline: CGMS-35**

Recommendation 34.17
Considering the positive impact on re-analyses of re-processed AMVs it is recommended to complete the global reprocessing by including all geostationary satellites. **Deadline: CGMS-35**

Recommendation 34.18
Co-Chairs of the ITWG, IWWG and IPWG to consider common topics for future joint sessions during potential parallel conduct of future workshops. **Deadline: CGMS-35**

Recommendation 34.19
NASA, ESA, CNES and ISRO to consider partnership towards the long term continuity of altimeter missions and inform CGMS-35. **Deadline: CGMS-35**

Recommendation 34.20:
CGMS to take into consideration plans for Earth radiation budget instruments on future GEO missions when evaluating the adequacy in low Earth orbit planning. **Deadline: CGMS-35**

Recommendation 34.21
NASA, ESA, JAXA, CNES, ISRO and CNSA to indicate the potential contributions their missions could make towards optimization of the polar-orbit prior to CGMS-35. **Deadline: CGMS-35**

Recommendation 34.22
The WMO Space Programme to host a Workshop to allow CGMS satellite operators (both operational and R&D) to consider how their combined plans for low Earth and geostationary missions could respond to WMO requirements. **Deadline: 31 July 2007**

Recommendation 34.23
CGMS operators should support the objectives of the IGDDS implementation plan. **Deadline: CGMS-35**

H.7 Approval of Draft Final Report

CGMS reviewed the Draft Final Report of the meeting. The Secretariat agreed to include amendments received at the meeting in a revised draft version, which would be distributed electronically to CGMS Members for final comments. It was agreed that CGMS Members would submit any further modifications to the Secretariat within two weeks, so that a finalised version can be distributed electronically after three weeks by the Secretariat. It was further agreed that the final version of the report would be provided to participants both as a hard copy document and via CD-ROM which would also contain all CGMS-34 Working Papers and presentations.

H.8 Date and Place of Next Meetings

EUM-WP-16 presented proposals for future CGMS meetings. Taking into account the expansion of the membership of CGMS and the opportunity of achieving a balanced geographical distribution for future CGMS meetings, the Secretariat submitted a proposal for the CGMS meetings for the coming years, until CGMS-42 in 2014.

The paper highlighted the geographic distribution of the CGMS membership and the current round of meetings, proposing two minor adjustments for the next round, aiming at ensuring that no two CGMS meetings take place consecutively in the same part of the world. If accepted, this proposal would represent a general indication for CGMS Members, subject to further confirmation by the candidate hosting country the year before the scheduled CGMS meeting, in line with the current practice.

CGMS was pleased to accept an offer from NOAA to host CGMS-35 in the USA, in the first half of November 2007. EUMETSAT kindly offered to host CGMS-36 in Europe in 2008 and KMA kindly offered to host CGMS-37 in Korea in 2009 (after the COMS launch).

Furthermore, CGMS noted a tentative cycle of future CGMS meetings, subject to further confirmation by the candidate hosting country the year before the scheduled CGMS meeting, in line with current practice:

- CGMS-35 in 2007 in the USA,
- CGMS-36 in 2008 in a EUMETSAT Member State,
- CGMS-37 in 2009 in Korea,
- CGMS-38 in 2010 in India,
- CGMS-39 in 2011 in Switzerland,
- CGMS-40 in 2012 in Japan,
- CGMS-41 in 2013 in the Russian Federation,
- CGMS-42 in 2014 in China.

The Co-Chairmen thanked all participants for their cooperation and fruitful participation in the 34th meeting of CGMS, adding that there had been many interesting discussions and important developments during the working group and plenary sessions. They also thanked the Rapporteurs and Secretariat for preparing the Final Report. All parties warmly thanked China for hosting the meeting in Shanghai and for the excellent organisation and cooperation with the CGMS Secretariat.

The meeting adjourned at 15:30 on 7 November 2006.

PARALLEL WORKING GROUP SESSIONS

WORKING GROUP I: TELECOMMUNICATIONS

I/0 Introduction

As agreed at CGMS-33, Mr. Marlin O. Perkins (NOAA) and Mr. Gordon Bridge (EUMETSAT) were elected as Chairman and Rapporteur, respectively, of Working Group I (WG I) on Telecommunications. WG I comprised representatives of the satellite operators from China, Japan, Russia, NOAA, Korea and EUMETSAT together with WMO (see Annex 4 for list of participants).

I/1 Co-ordination of Frequency Allocations

Preparation of future World Radio Conferences (WRC-07 and WRC 2010)

Documents NOAA-WP-07, EUM-WP-17, JMA-WP-04, WMO-WP-09, WMO-WP-11 included information related to the preparation process for the World Radio Conference 2007 (WRC-07). A summary of the inputs is included in these reports to provide information to CGMS Members who are not closely following the preparation process. The documents also contained information on progress achieved within the regional groups (such as CITEL, CEPT, and APT) dealing with WRC preparations.

Among WRC-07 agenda items, five items concern frequency bands or issues of prime interest for CGMS:

- **agenda item 1.2**: Extension of the 18 GHz METSAT allocation and protection of the 10.7 and 36 GHz EESS (passive) bands
- **agenda item 1.12**: Coordination and notification procedures for Earth Exploration Satellite Service (EESS) (active and passive) sensors
- **agenda item 1.17**: Protection of the 1.4 GHz EESS (passive) band
- **agenda item 1.20**: Unwanted emissions in EESS (passive) bands
- **agenda item 7.2**: WRC-10 agenda

In addition, whilst several agenda items currently do not directly concern meteorological interests, due to their wide open scope in terms of frequency ranges under study, in due course they will have an impact on frequency bands used for meteorological purposes:

- **agenda item 1.4:** Impact on meteorological radars related to future frequency bands for IMT-2000

- **agenda item 1.5:** Possible additional allocations for aeronautical telecommand and high bit-rate aeronautical telemetry between 3 and 30 GHz
- **agenda item 1.6:** Additional allocations for Aeronautical Mobile Service between 108 MHz and 6 GHz
- **agenda item 1.8**: High Altitude Platform Stations (HAPS) in the 28 and 31 GHz band
- **agenda item 1.18**: Pfd limits for Highly Elliptical Orbit (HEO) satellites in the frequency band 17.7-19.7 GHz
- **agenda item 1.7**: Results of ITU-R studies regarding sharing between the mobile-satellite service and the SRS (passive) in the band 1668-1668.4 MHz, and between the mobile-satellite service and the mobile service in the band 1668.4-1675 MHz in accordance with Resolution 744 (WRC-03)

WRC-07 is scheduled for the end of 2007 and the Conference Preparatory Meeting (CPM) in early 2007. The time prior to these conferences will be crucial for finalising the different positions, and support from CGMS Members via their national frequency administrations at relevant meetings will be of prime importance to support meteorological views.

Agenda items of prime interest to CGMS are:

Agenda item 1.2 (CPG/PT2)

*"to consider allocations and regulatory issues related to the Earth exploration-satellite (passive) service, space research (passive) service and the meteorological satellite service in accordance with Resolutions **746 (WRC-03)** and **742 (WRC-03)**"*

a) Issue 1: Resolution 742 (WRC-03) on protection of the passive band 36-37 GHz

As part of global passive measurements, the band 36-37 GHz is vital for the study of global water circulation since this band is able to monitor rain, snow, ocean ice and water vapour for ocean and land surfaces. Observations in the band for sensing melting snow near the surface are of very high interest. A number of passive sensors and radio altimeters are already using or are planning to use this frequency band in the near future (e.g. CMIS, MIMR, AMSR, AMSR-E, AMR, SMMR, SSM/I, SSMI/S, TMI, MEGHA-TROPIQUE and MWRS) for such measurements. These measurements are fully operational (regular use of the data, continuity of service, several usable data products) and are used on a world-wide basis. The retrieved data are used and exchanged between the meteorological organisations in all regions. The retrieved parameters are actually derived from a set of measurements performed at five frequencies which are interrelated (6, 10, 18, 24 and 36.5 GHz).

WGI supported the protection of the 36-37 GHz passive band and believed that, identification of the maximum e.i.r.p and power for fixed and mobile links could provide a means to ensure such a protection.

b) Issue 2: Resolution 746 (WRC-03) on METSAT allocation at 18 GHz

This issue addresses the requirement for bandwidth exceeding 200 MHz as currently given in RR footnote **5.519** (18.1 -18.3 GHz) for the next generation geostationary meteorological satellite, to be launched in the time frame 2015-2020.

The higher bandwidth requirements are mainly based on the use of IR and UV sounding units and high-resolution imagers with a higher repetition rate of measurements; and the number of spectral channels and the geographic resolution will also be significantly increased compared to the current generation of geostationary meteorological satellites.

The European Conference of Postal and Telecommunications Administrations (CEPT) supports the views of EUMETSAT for such an extension of the MetSat allocation by 100 MHz upwards as the prime option.

However, with regard to the direction of the extension of the 18-GHz MetSat allocation so far a clear preference has only been expressed by Europe (upwards), the Arab League (upwards), USA and Canada (both downwards). In view of possible inter-operability of MetSat systems in the long term future a common extension band throughout the ITU-R Regions would be beneficial.

JMA supported the proposal to extend the current 18.1-18.3 GHz allocation for MetSat (space-to-Earth) to 300 MHz of contiguous spectrum. The extension of the frequency bandwidth will be beneficial to meteorological satellite activities, in particular a high rate downlink for raw observation data in the next generation of geostationary meteorological satellites.

CGMS held the view that such extension will not constrain existing services provided that the same regulatory conditions as in the 18.1-18.3 GHz band (e.g. Article 21 pfd limits) are applied. CGMS does not favour one of the options over the other (18-18.1 GHz band or 18.3-18.4 GHz band) but believes that a worldwide allocation in a single band is preferred.

c) Issue 3: Resolution 746 (WRC-03) on protection of the passive band 10.6-10.68 GHz

As part of global passive measurements, the band 10.6-10.7 GHz is of primary interest to measure rain, snow, sea state and ocean wind for ocean and land surfaces. A number of sensors are already using or are planning to use this frequency band in the near future (e.g.CMIS, MIMR, AMSR, AMSR-E and TMI) for such measurements. These measurements are fully operational (regular use of the data, continuity of service, several usable data products) and are used on a world-wide basis. The retrieved data are used and exchanged between the meteorological organizations in all regions and are

actually derived from a set of measurements performed at five interrelated frequencies (6, 10, 18, 24 and 36.5 GHz).

WGI supported the protection of the 10.6-10.68 GHz passive bands (the band 10.68-10.7 GHz is covered under RR footnote 5.340). It should, however, be stressed that current deployments of FS links have in certain administrations already created significant levels of passive measurement degradation in this band. Additional constraints on the 10.6-10.68 GHz passive band would hence not be acceptable and therefore, WGI strongly encouraged the identification of the maximum power and eirp for fixed and mobile services that would protect EESS (passive) in the 10.6-10.68 GHz band.

Agenda item 1.4

*"to consider frequency-related matters for the future development of IMT-2000 and systems beyond IMT-2000 taking into account the results of ITU-R studies in accordance with Resolution **228 (Rev. WRC-03)**"*

Under agenda item 1.4, WRC-07 is requested to study spectrum requirements and potential frequency ranges suitable for the future development of IMT-2000 and systems beyond IMT-2000.

Focus is currently made on bands below 6 GHz in which a number of meteorological applications are currently operated, and in particular in the 2700-2900 MHz (meteorological radars) and the 5250-5650 MHz bands (EESS and meteorological radars).

Agenda item 1.12

*"to consider possible changes in response to Resolution **86 (Rev. Marrakesh, 2002)** of the Plenipotentiary Conference: "Advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks" in accordance to Resolution **86 (WRC-03)**"*

Resolves 1 of Resolution **86 (WRC-03)** calls for consideration of any proposals which deal with deficiencies in the advance publication, coordination and notification procedures of the Radio Regulations for space services which have either been identified by the Board and included in the Rules of Procedure or which have been identified by administrations or by the Bureau, as appropriate.

There is a significant difference between space telecommunication systems and EESS/SRS satellite systems employing active/passive sensors. WGI supported consideration by the Special Committee for regulatory/procedural matters of modifications to Appendix 4 to permit recording and publication of appropriate data pertaining to EESS and SRS active and passive sensors.

WGI supported consideration by the Special Committee for regulatory/procedural matters of modifications to Appendix 4 to permit recording and publication of appropriate data pertaining to EESS and SRS active and passive sensors.

Agenda item 1.17

*"to consider the results of ITU-R studies on compatibility between the fixed-satellite service and other services around 1.4 GHz, in accordance with Resolution **745 (WRC-03)**"*

Under agenda item 1.16 (WRC-03) and acknowledging the non-completion of technical compatibility studies, last WRC-03 made a conditional secondary allocation to FSS for MSS feeder links near 1.4 GHz. Agenda item 1.17 (WRC-07) is the follow-up on this issue and requests the ITU-R finalize these technical studies with a view to determine whether these MSS feeder links are compatible with existing services, and in particular passive service in the 1400-1427 MHz band.

For EESS, this band is a vital resource for measuring salinity and other aspects of the Earth and its atmosphere and, to that respect, is one of the passive bands quoted in footnote **5.340** that prohibits all emissions, emphasizing its particular importance for the scientific community. A number of sensors are planned to use this frequency band in the near future (SMOS and AQUARIUS) for such measurements.

From the current technical studies it seems likely that the NGSO MSS feeder links will be able to use the allocated bands only with significant constraints to protect existing services, among of which EESS (passive) in the 1400-1427 MHz band. Furthermore, no service providers are continuing to pursue opportunities or participating in relevant studies to use this allocation, which obviously indicates a lack of need for this allocation.

WGI held the view that such a secondary FSS allocation should not be confirmed at WRC-07.

Agenda item 1.20

*"to consider the results of studies, and proposals for regulatory measures, if appropriate, regarding the protection of the Earth exploration-satellite service (passive) from unwanted emissions of active services in accordance with Resolution **738 (WRC-03)"***

The issue of the protection of the Earth exploration-satellite service (passive) from unwanted emissions of active services has been on the agenda for the last three WRCs during which a large number of administrations supported regulatory measures for the protection of passive services, and in particular the inclusion of limits on the unwanted emissions of active services in the Radio Regulations.

WRC-03 did not reach agreement to take such action and a compromise solution was to continue the studies according to Resolution 738 and re-visit the issue at WRC-07.

It can be noted that such an inclusion of limits on unwanted emissions into a passive band in the RR was taken by WRC-03 to protect to protect the EESS (passive) in the band 31.3-31.5 GHz with regards to HAPS, as given in RR footnote **5.543A**.

The frequency bands under consideration are given in Resolution 738 (WRC-03), namely the 1400-1427 MHz, 23.6-24 GHz, 31.3-31.5 GHz and 50.2-50.4 GHz passive bands, are all key bands for the scientific and meteorological communities and quoted in footnote **5.340** that prohibits all emissions.
WGI supported appropriate regulatory measures in the Radio Regulations to ensure the protection of the Earth exploration satellite service (passive) from unwanted emissions. Such measures should minimize the burden on the relevant active services but the protection of the related passive bands should be a prerequisite.

Agenda item 7.2

The Preliminary agenda for the 2010 World Radio communication Conference already includes the following item:

*"2.2 to consider frequency allocations between 275 GHz and 3 000 GHz taking into account the result of ITU-R studies in accordance with Resolution **950 (WRC-03)**;"*

This agenda needs to be confirmed by WRC-07.

Several frequency bands above 275 GHz allow measurements of chemical and physical parameters which are of high interest for climatological, hyrdological and meteorological applications. There are already some sensors operated and space agencies are in process of developing new sensors operating in these bands. These sensors will be important modules in the next generation of meteorological and environmental satellites systems.

CGMS therefore recommends to maintain the original form of the agenda item and to open the table of frequencies in the Radio Regulations for frequencies above 275 GHz. Only in case that this would not be accepted by other radio services, an alternative method would be to review and revise RR footnote 5.565. In this case it would be essential that the revised footnote includes the correct frequency bands and contains proper text to ensure the adequate protection of Earth Exploration-satellite service, and Space Research (passive) service sensors.

CGMS noted that requirements on frequency bands for advanced sensors to measure hydrological parameters, are required to support the WRC-2010 preparations. CGMS was informed that the IPWG Chairpersons had offered to supply such information.

Action 34.10: The Secretariat to contact the IPWG Chairpersons to invite inputs for WRC 2007, and whenever appropriate, to the Chair of WG I - Telecommunications, concerning the requirements for frequency bands for advanced sensors operating at frequencies above 275 GHz. Deadline: CGMS-35

Agenda item 1.5

*"to consider spectrum requirements and possible additional spectrum allocations for aeronautical telecommand and high bit-rate aeronautical telemetry, in accordance with Resolution **230 (WRC-03)**"*

This agenda item includes consideration of bands in the range from 3 to 30 GHz in which a number of frequency bands are used for meteorological purposes. Projections indicate a large amount of spectrum (several hundred MHz) is required for telecommand and telemetry, including Unmanned Aeronautical Vehicles (UAV).

In particular, the band 22.5-23.6 GHz is currently under study in ITU-R as a potential long-term candidate band. This band is adjacent to the 23.6-24 GHz passive band for which compatibility difficulties regarding out-of-band emissions with aeronautical services would certainly be similar to those currently studied under agenda item 1.20. If the band 22.5-23.6 GHz were to be actually proposed, it would probably generate confusion with all the work already in progress under agenda item 1.20 concerning compatibility between Inter Satellite Service in the band 22.55-23.55 GHz and EESS (passive) in the band 23.6-24 GHz.

In addition, it should be noted that UAVs have already operated in the past by some meteorological services and that such vehicles may present interests in the future for climatological and meteorological purposes, either for research or operational use. Related detailed characteristics and needs are not determined but it is assumed that they would fit in the current general requirements made for other purposes.

WGI urged that compatibility with related applications be ensured when new allocations for aeronautical telecommand and telemetry are proposed that may affect meteorological bands. In particular, if the band 22.55-23.55 GHz is further considered, protection of the passive band at 23.6-24 GHz is required.

Agenda item 1.6

*"to consider additional allocations for the aeronautical mobile (R) service in parts of the bands between 108 MHz and 6 GHz, in accordance with Resolution **414 (WRC-03)** and, to study current satellite frequency allocations, that will support the modernization of civil aviation telecommunication systems, taking into account Resolution **415 (WRC-03)**"*

This agenda item covers the range from 108 MHz to 6 GHz in which a number of frequency bands are used for meteorological purposes.

WGI urged that compatibility with related applications be ensured when new allocations for aeronautical mobile service are proposed that may affect meteorological bands.

Agenda item 1.8

"to consider the results of ITU-R studies on technical sharing and regulatory provisions for the application of high altitude platform stations operating in the bands 27.5-28.35 GHz and 31-31.3 GHz in response to Resolution ***(145 'WRC-03),*** *and for high altitude platform stations operating in the bands 47.2-47.5 GHz and 47.9-48.2 GHz in response to Resolution* ***122 (Rev. WRC-03)****"*

WRC-03 incorporated power density limits in RR footnote **5.543A** to protect to protect the EESS (passive) in the bands 31.3-31.5 GHz with regards to HAPS operating in the Fixed Service (FS). These limits adequately protect passive satellite services operating in 31.3-31.8 GHz and are assumed to provide sufficient power for operation of ground-to-HAPS links.

WGI urged that Resolution 145 (WRC-03) should not lead to relaxation of these power density limits.

Agenda item 1.18

"to review pfd limits in the band 17.7-19.7 GHz for satellite systems using highly inclined orbits, in accordance with Resolution ***141 (WRC-03)****"*

The protection of the 18.6-18.8 GHz EESS (passive) band from FSS and FS are given in RR provisions **5.522A**, **21.5A**, **21.16.1** and **5.522B**.

In addition, the extension from 200 to 300 MHz bandwidth of current METSAT allocation is currently under study in the 18.0-18.4 GHz under agenda item 1.2 (WRC-07).

WGI held the view that the determination of power flux density (pfd) limits to be applied to Highly Elliptical Orbit (HEO) satellites in the 17.7-19.7 GHz band should not lead to any review of the abovementioned RR provisions and should also not impede the possible METSAT allocation in the 18 GHz range.

Agenda Item 1.7

"to consider the results of ITU-R studies regarding sharing between the mobile-satellite service and the SRS (passive) in the band 1668-1668.4 MHz, and between the mobile-satellite service and the mobile service in the band 1668.4-1675 MHz in accordance with Resolution ***744 (WRC-03)****"*

In this Agenda, the result of ITU-R studies will be discussed, regarding the frequency sharing condition between the Mobile Satellite Service (MSS) and Space Research Satellite (SRS) (passive) in 1668-1668.4 MHz, and that of between MSS and Mobile Service (MS) in 1668.4-1675 MHz.

JMA has used the frequency band 1672-1682 MHz in the space-to-Earth direction to downlink raw observation data from MTSAT. JMA has strongly requested protection for the 1672-1682 MHz frequency band from harmful interference by other services, since the frequency sharing would potentially be a detrimental factor to its services.

Technical Information from the Space Frequency Co-ordination Group and ITU-R

NOAA accepted the task to report SFCG results to CGMS. NOAA-WP-08 discussed inputs to SFCG-25/26. NOAA inputs to SFCG-25 summarized the April 2005 passive microwave workshop held in Silver Spring, Maryland; presented a compatibility analysis of the services allocated in the 6-7 GHz band, including EES passive; analyzed potential interference in the 7750-7850 MHz band from proposed future operations of FY 3, MetOp and NPOESS satellite networks; presented results of ambient environment and noise floor measurements in the U.S.; and provided a list of present and future radio frequency requirements of NOAA satellite networks.

NOAA inputs to SFCG-26 summarized the June 2006 passive microwave workshop held in Silver Spring, Maryland; presented alternatives for resolving 6-7 GHz band EES compatibility issues; proposed changes to the SFCG resolution covering Metsat operations in the 7750-7850 MHz band; discussed ways to protect downlinks in 25.5-27 GHz used for manned missions; and provided an updated list of present and future radio frequency requirements of NOAA satellite networks.

WMO-WP-11 summarized the 26th annual meeting of the Space Frequency Coordination Group took place at the invitation of DLR in Bonn, Germany, from 19-27 September 2006.

WMO provided an extract of the meeting results relevant for Meteorological Satellite Service (MetSat) and the Earth Exploration Satellite service (EESS passive). Several topics of interest to CGMS were included:

- Report of the Working Group 3 (EESS and MetSat)
- Extracts of SFCG Resolution Res 23-1R3 (SFCG Objectives for World Radiocommunication Conferences).
- SFCG Resolution Res 19 -7 R3 (Use of the frequency band 7750 – 7850 MHz)
- Action Item on Update/Revision of Passive Band Requirements

Other Frequency Management Issues

Satellite Frequency Networks

Currently, CMA is running two meteorological satellite frequency networks: FY-1 polar-orbiting satellite series and FY-2 geostationary satellite series. A new frequency network FY-3 will be brought into use in the end of 2007. CMA-WP-06 provided the frequency list of these networks that have been notified to ITU.

NOAA-WP-38 gave a description of current and future NOAA satellite networks as well as a list of radio frequencies used/to be used by these networks. The NOAA frequency networks includes the NOAA-K/L/M, NOAA-N/N', GOES-I/M, GOES-N/O/P, GOES-R, NPP and NPOESS spacecrafts.

Coordination of Interference Issues

EUM-WP-18 summarised the results of a detailed assessment of interference from FY-3 satellites to the MetOp Central Data Acquisition (CDA) Earth station at Svalbard around 7.8 GHz. The circumstance that the potential interference from FY-3 into the reception of the stored mission data at Svalbard during MetOp data dump transmissions is minimal, results mainly from the fact that there is a separation of equatorial crossing times between both satellite systems (MetOp: 9:30D, FY-3: 10:10D).

In this regard it should be noted that the results of the detailed interference assessment were obtained on the basis of FY-3 system characteristics as provided by CMA and CASC.

EUMETSAT noted the updated or modified FY-3 system characteristics could have an impact on the simulation results and could significantly increase the interference potential to MetOp stored mission data reception, thus requiring FY-3 to implement appropriate measures to reduce the amount of interference to an acceptable level.

Data Transmission

In examining the frequency plans of CGMS member organisations potential problems of frequency interference were detected in the frequency bands 7750 – 7850 MHz and 1698 – 1710 MHz. It was noted that those potential conflicts are discovered at a very early stage where problems are reduced due to schedule and budget impact.

CGMS-33 stressed that for future use of the frequency band 7750–7850 MHz, early coordination would be essential and SFCG Resolution 19-7R2 needs to be strictly applied. It was noted that technical discussions could not be limited to the annual meetings of CGMS and a forum to discuss plans for future systems at the earliest possible date would be necessary. CGMS-33 issued Action 33.13: "WMO to provide a forum for discussion on data transmission from meteorological satellites, with a goal of resolving radio frequency conflicts, well in advance of notification to ITU, and adopting approaches to avoid them."

WMO-WP-10 informed CGMS of the meeting of the CGMS/WMO Forum on Data Transmissions from Meteorological Satellites, 30 August 2006, at the WMO Headquarters in Geneva. The Forum issued eight recommendations to improve future frequency planning and to avoid conflicts and recommended to seek the advice of the Space Frequency Co-ordination Group (SFCG) on frequency sharing issues.

The CGMS/WMO Forum on Data Transmissions from Meteorological Satellites recommended to CGMS to initiate technical discussions with SFCG on the evaluation of the sharing studies.

WMO represented CGMS at the SFCG 26 meeting in Bonn, Germany, from 19-27 September 2006. Cooperation on technical issues of radio frequency

management was discussed and SFCG prepared a liaison statement to CGMS describing proposed cooperation (WMO-WP-12).

The main points of the liaison statement are:

- SFCG recommends that CGMS member agencies make use of the SFCG Resolution RES A12-1R2 to facilitate sharing between existing and planned meteorological satellite systems (Annex 2);

- SFCG recommends to consult the SFCG data base for information on existing systems;

- SFCG can provide a forum for technical discussions and the evaluation of sharing studies after submission of inputs on planned MetSat systems;

- In order to minimize time delays due to an unfortunate sequence of annual meetings of SFCG and CGMS SFCG proposes to nominate a coordinator which is member of both groups. This coordinator shall be nominated on a yearly base. SFCG recommends that for maximum effectiveness and fastest response in urgent situations the coordinator role would be filled by WMO. SFCG will establish a group of contributors for issues related to Meteorological Satellites with the SFCG representative to CGMS as coordinator;

- SFCG would be prepared to create a special Inter-sessional Working Group (IWG) on the topic if required at a later time. It has to be noted that such IWG can only be created at annual SFCG meetings. SFCG has established a contact group for technical support related to Metsat issues. This group presently includes experts from EUMETSAT, JAXA, NOAA, RFSA and the WMO.

WGI proposed the following actions:

Action 34.11:
WMO to confirm nomination of a frequency management expert representing CGMS at SFCG on an annual basis (currently Mr Robert Wolf). Deadline: CGMS-35

Action 34.12:
CGMS members to review SFCG Resolution Res A12-1R2 and inform whether this resolution shall be used by CGMS agencies. Deadline: 31 August 2007

Action 34.13:
CGMS Secretariat, with the support of WMO, to respond to SFCG Liaison statement as soon as possible. Deadline: 15 December 2006

Action 34.14:

CMA and KMA to consider nominating a representative to the expert group related to meteorological satellite service matters of SFCG. Deadline: 31 December 2006

COMS frequency notification process

KMA-WP-05 informed CGMS of the frequency plans and distribution networks for the COMS Meteorological Satellite. After ground processing at MSC in Korea, processed meteorological data will be disseminated to the users via COMS bent-pipe repeating. HRIT will be uplinked from MSC using 13-Meter antenna to COMS. The HRIT will be broadcasted from COMS to user stations equipped with 3.7-Meter antenna with 3 Mbps data rate. LRIT will be uplinked from MSC using 13-Meter antenna to COMS. And LRIT will be broadcasted from COMS to user stations equipped with 1.2-Meter antenna with 256 kbps data rate. Table 1 summarizes the carrier information for COMS meteorological purpose.

Table WGI-1: Carrier Information (draft) for COMS

Carrier Type	Center Frequency* (MHz)	Bandwidth (MHz)	Data rate
TC U/L	2091.765	-	-
TM D/L	2271.6	-	-
MI Data D/L	1680, 1687	6.0	6 Mbps
LRIT U/L	2037.64, 2066.34	1	256 kbps
LRIT D/L	1692.14	1	256 kbps
HRIT U/L	2040.9, 2061.6	5.2	3 Mbps
HRIT D/L	1687.4, 1695.4	5.2	3 Mbps

* The frequency above may be confirmed taking into account the coordination results with the adjacent satellite networks.

Considering the ITU filing for the COMS networks, the Coordination Information for COMS satellite networks with two orbital locations, 116.2E and 128.2E were submitted to the ITU in August 2004. It is noted that one of two orbital locations will be used for the first generation COMS satellite and the other orbital location will be envisaged for the follow-on satellite in the future.

ROSH-WP-01 reported on frequency plans of future Russian satellites in sunsynchronous orbit (series METEOR-M) and in geostationary orbit (series ELEKTRO-L). The first satellite of the series Meteor-M is planned for launch on sunsynchronous orbit in December 2007 and the satellite Meteor-M N2 is planned for launch in 2008. The global data will be stored on board and transmitted in X-band using two frequencies: 8128 & 8320 MHz with a bandwidth 32 MHz. Meteor-M direct-transmission standards are similar to NOAA's HRPT for the whole information at full resolution in digital form (and additionally data from DCP's) at S-band frequencies. The LRPT (Low Resolution Picture Transmission) for selected information at frequencies: 137.91 or 137.1 MHz; bandwidth: 150 kHz. The Data Collection Platform (DCP) uplink

frequency is 401.9 – 402.0 MHz at 400 bps. In addition, Meteor-M N2 will re-transmit data from DCP's to geostationary satellite Elektro-L.

The first geostationary satellite of new series Elektro-L is planned for launch in 2007 and the satellite Elektro-L N2 is planned for launch in 2009. Elektro-L data will be transmitted in real time to the Raw Data Acquisition Station allocated at SRC Planeta, Moscow for MSU-GS (10-channels VIS/IR imaging radiometer) and HMS (Heliogeophysical Measurements System). The data downlink is 7500 MHz; bandwidth 60 MHz. After processing data will be transmitted to Elektro-L for retransmission via the HRIT (frequency: 1691.0 MHz; bandwidth: 2 MHz) and LRIT (similar to MSG, GOES and MTSAT). The Elektro-L Data Collection Service (DCS), to relay *in situ* observations from Data Collection Platforms (DCP) at fixed times and the GEOSAR (Geostationary Search And Rescue), to relay distress signals from beacons at 406 MHz to stations of the international COSPAS/SARSAT Search & Rescue system

I/2 Telecommunication Techniques

EUM-WP-19 provided an overview of the prototyping activities performed by EUMETSAT for optimising performances for a High Rate DCP System using the Meteosat Second Generation satellites. The optimisation process has considered all relevant satellite channel impairments. Its design has focused on Bandwidth Efficient Modulation schemes (as per CCSDS recommendations) and it is also proposing a Forward Error Correction mechanism that shall allow improving system performance while decreasing power requirements on the Data Collection Platform side.

Also, EUMETSAT briefly summarised the status of the special studies performed for a potential overlay DCP system using Code Division Multiple Access –CDMA- through the same DCP transponder.

I/3 Co-ordination of International Data Collection & Distribution

I/3.1 Status and Problems of the IDCS

NOAA-WP-10 presented a status report on the performance of the International Data Collection System (IDCS). Due to indefinite delays in the deployment of DAPS II, NOAA will be utilizing the Channel Interference Monitoring System (CIMS) in a stand alone mode. This system, which will enable better monitoring and evaluation of the international channels, has been evaluated and the final acceptance is due within the next few months. As of the beginning of August 2006, the NOAA database contained only 288 International DCPs (IDCP) active on 11 of the 33 international channels.

CGMS noted a request from NOAA for 4 IDCS channels to be allocated to provide a back-channel for environmental information and related messages in response to warning information relayed via RANET to users located in a disaster region in the field of view of GOES-W. WGI noted that this request,

was somewhat outside the normal operating conditions of the IDCS. Thus this request was withdrawn.

JMA-WP-05 reported on the current number of registered Data Collection Platforms within the MTSAT IDCS the operational status of the system, and interference to MTSAT IDCS channels. As of the end of August 2006, 64 IDCPs are registered with the MTSAT IDCS, and they are operated on eight out of the 33 international channels. The registered IDCPs consist of 57 IDCPs on ships and seven on aircraft (Aircraft to Satellite Data Relay (ASDAR)). Channels 6, 7, 10, 14, 15, 16 and 20 are assigned to ships, and channel 18 to ASDAR. The status of interference to the MTSAT IDCS channels from August 2005 to July 2006. In this period, harmful interferences that could cause data collection failure were detected in two out of 33 IDCS channels, i.e. channels 2 and 33.

JMA-WP-06 reported on the current status and future plans of tidal/tsunami data collection using Data Collection System (DCS) of MTSAT-1R. After the Indian Ocean Tsunami in December 2004, three new tidal/tsunami DCPs started transmission of observed data. Reporting intervals of three existing DCPs have been shortened so as to report increased number of data. More than 70 time-slots on five RDCP channels are occupied by DCPs which have been inactive for quite a long period. JMA is now requesting operators of these DCPs to return the time-slots and channels if the DCPs are no longer operated. In the long term, it could be one of practical solutions for JMA to allocate tidal/tsunami DCPs to some international channels of MTSAT-DCS.

In order to enhance user support, JMA established a website on MTSAT-DCS in April 2006. In addition, JMA plans to establish another website to show collected DCP data. JMA also plans to send collected DCP data by e-mail to DCP operators in 2007.

As of the beginning of September 2006, EUMETSAT (in EUM-WP-03) reported there were 133 International DCP (IDCP) registered worldwide for regular use of the IDCS, using 9 of the 33 channels available (see below). In addition, the following DCP programmes use further International channels for regional purposes:

- 60 DCP allocated on channels I23 and 24, operated by the Aeronet programme.
- 20 DCP allocated on channels I25 and I26, operated by ROSHYDROMET.
- 181 DCP allocated on channels I27-I33, operated by WMO agro-meteorological and hydro-meteorological networks.

Globally, the total number of IDCP allocated on individual IDCS channels is:

Channel	06	07	12	13	14	15	16	18	20	23	24	25	26	27	28	29	30	31	32	33
No.	12	26	17	6	8	9	34	9	12	30	30	20	0	45	29	12	31	31	14	19
	Regular IDCS									Aero		ROS		WMO Networks						

It will be recalled that channels I23-I24 (Aeronet), I27-I33 (WMO networks) and I25-I26 (Planeta/ROSHYDROMET) are being used within the Meteosat IDCS, on a temporary basis, with the special agreement of CGMS and, in addition, IDCS Channels I08, I09, I11 are being used for the IOTWS transmission via Meteosat-5 (see later section 4.2) with the agreement of CGMS.

Despite the earlier failure of an SSPA on board MSG-1, the 33 IDCS channels (with 3KHz spacing) are currently supported by that satellite. MSG-2 can be used as a backup for this service should the need arise in the future.

Following the termination of direct broadcast service from Meteosat-7, there is no longer any DCPRS service and all DCP messages are relayed via EUMETCast and the GTS.

EUMETSAT also recalled the use of Meteosat-5, located at 63 degrees E over the Indian Ocean to support the Indian Ocean Tsunami Warning System (IOTWS) monitoring network, where DCPs using International channels 8, 9 and 11, with the earlier agreement of CGMS, are transmitting every 15 minutes via Meteosat-5. The DCP messages are relayed as bulletins to the GTS via the Fucino (Italy) ground station and EUMETSAT control centre in Darmstadt.

There are currently 30 DCPs assigned to the IOTWS, but the number is expected to increase in the near future, hence the recent EUMETSAT request to CGMS seeking approval for up to three additional channels to be allocated for this purpose (I17, I19 and I21) are currently being checked for interference. WGI recommended adoption of the additional channels mentioned above for Tsunami Monitoring (subject to satisfactory performance). WMO supported the use of these channels for Tsunami monitoring. It was also agreed that further implementation of IDCS activities would be coordinated by the ad hoc Working Group on IDCS (see I/4).

Action 34.15: EUMETSAT to inform CGMS Members when it has determined which three IDCS channels will be allocated for Tsunami monitoring purposes. Deadline: 31 December 2006

CGMS was very pleased to note that in the event of a problem with a Meteosat located over the Indian Ocean, both CMA and JMA stated that they would be willing supply back-up IOTWS DCP data relay services using either their FenYung or MTSAT satellites, respectively, and using the IDCS channels agreed for this purpose.

CGMS was invited to note the following:

Meteosat-7 will be relocated to the IODC position around 63°E during 2006 to take over from Meteosat-5 which will be de-orbited in 2007. Meteosat-7 cannot support the DCS service during the eclipse period (up to 2 hours per day for the two 42 day eclipse seasons), due to a satellite amplifier limitation. Meteosat-5 can act as the back-up during these periods until it is de-orbited in

early mid 2007. A back-up strategy, using a relocated Meteosat-6, is currently under review.

I/3.2 Ships, Including ASAP

WMO-WP-14 provided a status report on ASAP operations over the last year. SOT/ASAPP has been attempting to increase the global coverage of ASAP ships but has had difficulty doing so due, mainly, to the high cost associated with operating such systems. However, the North Atlantic and Mediterranean is now better covered thanks to continuing efforts of the E-ASAP Programme, which is also targeting ships operating in sensitive areas for weather prediction. Three new E-ASAP units were procured and installed during 2004/2005 and by 2005 a total of 17 E-ASAP ships had produced 4200 upper air messages. During the next phase of the E-ASAP programme development (2007-2011) the objective is to produce 5800 upper air soundings from 18 ships. It is also planned to increase the level of managerial and operational integration of national ASAP units into the programme. In addition E-ASAP aims to contribute to the World Weather Watch by providing up to 10% of additional soundings outside of the European (EUCOS) areas of direct interest, and also makes contributions to the Ekofisk and OWS Mike oceanic upper air platforms. Results of the E-ASAP OSE on the impact of ASAPs in the Atlantic will be available in 2006. High telecommunication costs do prevent from transmitting the high-resolution data in real-time in BUFR format. ASAP monitoring continues to be routinely performed by ECMWF and Météo-France. The WRAP (World Re-occurring ASAP Programme) was officially terminated in April 2005 because of the difficulties in maintaining a viable and cost effective service.

I/3.3 ASDAR

No working papers were presented under this topic.

JMA, noting the fact that there were no Working Papers, recalled that in the Working Group I discussions WMO informally said that the ASDAR programme is coming to an end. When this happens, JMA wished to propose to CGMS that the IDCS channel used for ASDAR over recent years is re-assigned for other IDCS purposes. Perhaps WMO could kindly indicate when this might be possible.

Action 34.16: WMO to inform CGMS Members via the Secretariat when the ASDAR programme is terminated so that the Secretariat can reallocate ASDAR IDCS channel to other purposes. Deadline: 31 December 2006

I/3.4 Dissemination of DCP Messages (GTS or Other Means)

No working papers were presented under this topic.

I/4 Future Use of the IDCS

Considering discussions from CGMS-33 relating to the potential future use of the IDCS, EUM-WP-03 also discussed the following related issues:

- Future requirements for the number of channels dedicated to IDCS - Many satellite operators now use the IDCS channels for regional purposes, ostensibly on a temporary basis. There are far fewer truly mobile DCPs using more than one satellite on the international channels.
- Several IDCS Channels are not being used according to specification, e.g. many allocated DCP belonging to major networks are no longer transmitting, although they are still allocated. EUMETSAT is planning to introduce a tougher “channel policing” policy and CGMS may wish to consider adopting similar practice.
- The allocation of specific IDCS channels for disaster monitoring, such as the IODC and Pacific Tsunami monitoring network(s)

WGI members were reminded that the IDCS is a valuable asset of CGMS which should be maintained, at least into the medium term, and possibly even into the long term. In addition, they were reminded that at CGMS-33, each participating satellite operator, together with WMO, was asked to provide a representative for an ad hoc IDCS Working Gruop which would be created, to address management issues relating to disaster monitoring systems, the need, or otherwise, for a common IDCS certification process, to address the medium and longer term development of the IDCS, and other tasks that might be assigned to it by CGMS and its WG on Telecommunications. It was expected that this contact group will carry out its business mainly by email and will report to WG I on a regular basis.

Action 34.17
The Secretariat, in coordination with NOAA, to initiate the discussions of the ad hoc IDCS Working Group by proposing an agenda, schedule and priority of discussion topics, follow up of discussions and report results to CGMS on a regular basis. Deadline: CGMS-35

I/5 Search and Rescue (S&R)

There were no Working Papers discussed under this agenda item.

WORKING GROUP II: SATELLITE PRODUCTS INCLUDING SATELLITE DERIVED WINDS

II/0 Introduction

Working Group II on Satellite Products was chaired by Prof. Xu Jianmin, CMA, and Johannes Schmetz, EUMETSAT, assisted as secretary. 48 working papers were presented and discussed. Several of these papers were in response to actions from CGMS-33. The International TOVS Working Group, the International Precipitation Working Group, and the International Winds Working Group held meetings in 2006 and detailed reports from those meetings were presented. All past actions were successfully addressed and closed. 11 new actions and 15 recommendations have been suggested.

II/1 Image Processing Techniques

CMA-WP-07 described an advanced visualisation method for remote sensing imagery. It explained that with the availability of more than 256 quantization levels only the highest 8-bits are typically used to display the images in black and white. In order to have a sharp visualization of infrared and water-vapour channels, an improved method based on non-linear compression technique is proposed for FY-2C. The method enhances features in the imagery, thus adequately representing the high detection capability of the instruments. The method has good potential to help the image interpretation of forecasters. CMA offered to make the software to CGMS members; the WG also requested other CGMS members to make similar software.

Action 34.18: CMA is requested to put the software for image enhancement and analysis on a server for download by CGMS members. Deadline: 31 December 2006

Recommendation 34.04: All CGMS members should make software tools useful for image enhancement and analysis available to other CGMS members and inform them accordingly. Deadline: CGMS-35

II/2 Satellite Data Calibration and Validation

JMA-WP-07 reported on the HRIT imagery data from MTSAT-1R. Information on the quality is available on the Web page of MSC at: (http://mscweb.kishou.go.jp/monitoring/mtsat_monit.html).

The Web page provides information on navigation as evaluated by a landmark analysis and on calibration of the infrared channels through a comparison with brightness temperature comparison between MTSAT-1R and the NOAA satellites. This working paper introduced the Web page, and the methods to generate the information shown on the page. CGMS WG II took note and commented that the information supports the needs of GSICS (Global Satellite Intercalibration System).

WMO-WP-27 reported on GSICS implementation activities conducted in response to CGMS Action 33.15. The Task Force established at CGMS 33 had a meeting in Darmstadt on 15-16 March 2006. The draft Implementation Plan was finalised on 5 April and sent to all CGMS Members for review and approval. Only positive feedback was received, with no request for change. CGMS Members were invited to a GSICS Implementation meeting held in Geneva on 23 June 2006. At this meeting CMA, EUMETSAT, JMA, NOAA and ROSHYDROMET formally agreed to contribute to GSICS and nominated representatives in the GSICS Executive Panel.

CGMS Members are invited to complete the adoption of the GSICS Implementation Plan, as already adopted by 5 satellite operators and WMO, with the understanding that the GSICS Executive Panel may agree to further evolutions of this first version of the plan. In the discussion it was iterated that the focus of the work in the first year is on geo-to-leo satellite intercalibration and on a proper presentation of results on web sites. The discussions also emphasized the important role of research space agencies in GSICS as they can greatly contribute to increase the quality of the satellite intercalibration on the basis high performance research satellites. The comments of CGMS reflected the overwhelmingly positive responses to GSICS and concluded with the following recommendation:

Recommendation 34.05: In order to assure a rapid implementation of the GSICS, CGMS Members need to assure that adequate resources (manpower, infrastructure) are made available to adhere to the agreed implementation plan. Deadline: CGMS-35

NOAA-WP-11, WMO-WP-27 informed the group on the Global Space-Based Inter-Calibration System (GSICS). The concept and strategy for a Global Space-based Inter-calibration System were submitted by WMO and endorsed by the Coordination Group of Meteorological Satellites (CGMS) at its 33rd meeting (CGMS-33) held in Tokyo, Japan, on 1-4 November 2005. The goal is to achieve operational inter-calibration of the space component of the World Weather Watch's Global Observing System (WWW's GOS) that addresses the climate, weather forecasting and other environmental needs of WMO Members. This Implementation Plan describes the components of GSICS, the roles of participating agencies, a timetable for implementing the program, and coordination with other international programmes.

The GSICS consists of a GSICS Executive Panel, GSICS Coordination Centre (GCC), and GSICS Processing and Research Centers (GPRCs). GSICS also includes critical calibration support segments (CSS). Some CSS are performed directly by GSICS participating agencies while others are performed by external contributing entities. The GSICS Executive Panel first meeting was held October 11-13, 2006, will be responsible for Monitoring and Evaluation of GSICS and will conduct annual progress reviews of the program. To assist in the coordination, planning and implementation of the research and data management activities of GSICS, the WMO will also form a GSICS Research Working Group and a GSICS Data Working Group.

The GSICS Coordination Centre (GCC) will located at NOAA/NESDIS The GCC will coordinate the specifications for collocated data requirements (satellite-to-satellite, satellite-to-reference sites), specifications on collocation criteria, sampling frequency, formats, reporting times, methodology for instrument intercomparisons, and archiving and access of collocated data. The GCC will transmit satellite collocation times and locations to satellite operators, it will receive intercalibration results and reports from satellite agencies and reference sites and will maintain a central archive for the intercalibration collocations. All data will be accessible by the GPRCs.

A GSICS Processing and Research Center (GPRC) will be located at each operational satellite agency. The GPRC will have access to all data collected by the GCC. The GPRCs will conduct instrument calibration and validation activities, which includes pre-launch characterization. Each GPRC will focus on calibration activities based on priorities established by their respective satellite agencies. Inter-satellite calibration will use collocated satellite observations and overlapping satellite records to achieve comparability of sensors on different satellites. Pre-launch characterization and calibration will engage the national standard laboratories of participating countries to insure that pre-launch calibrations are traceable to the accepted international standards. Each GPRC will also support research activities in the framework of the distributed research component of GSICS, coordinated by the GSICS Research Working Group (GRWG).

In 2007 the GSICS Executive Panel will develop its first annual operating plan, which will include the commissioning of routine satellite intercalibration of operational instruments in polar orbit. In 2008, GSICS expects to include routine intercalibration of GEO and LEO instruments, using AIRS and IASI as a reference for the broadband radiometers on the GEO satellites.

NOAA-WP-39 described the intercalibration of satellite radiances, which leads to an improved knowledge of calibration, is important for various global applications where data from more than one instrument are combined or compared. Comparisons between geostationary imagers and the high spectral-resolution Atmospheric InfraRed Sounder (AIRS), polar-orbiting on Aqua, provide an accurate estimate over existing intercalibration techniques. The high spectral-resolution nature of such an instrument allows more accurate comparisons of measured radiances to other instruments sharing the same spectral regions. AIRS has been proven to have absolute calibration accuracies of 0.1K in most bands. A caveat is that AIRS does not have complete spectral coverage, however complete spectral coverage is provided by IASI on MetOp.

In the discussion JMA thanked NOAA for this work and expressed the wish to acquire the software tools also for application to IASI. It was stated that the matter will be discussed in 1st meeting of GRWG.

In NOAA-WP-17, Working Group II was informed that the calibration accuracy of satellite radiances is critical for both numerical weather prediction and

climate change detection. In the last few years, NOAA/NESDIS has developed a system for the intersatellite calibration of polar-orbiting satellites using the Simultaneous Nadir Overpass (SNO) / Simultaneous Conical Overpass (SCO) (for conical microwave scanners). Studies have shown that this system can be used for the intersatellite calibration of microwave, infrared, and visible/near-infrared radiometers with small uncertainties. It is also recommended that an on-orbit calibration reference network should be established using the SNO/SCO method. This will allow us to link the calibration of all operational radiometers to better serve the NWP and climate community. The Working Group commended NESDIS on the excellent and pioneering work.

NOAA-WP-18 provided a report from the Achieving Satellite Instrument Calibration for Climate Change ($ASIC^3$) workshop for CGMS consideration. $ASIC^3$ brought together some 100 participants, including experts in satellite instrument calibration, metrology scientists from the U.S. and U.K. national standards institutes, and remote sensing specialists. The workshop developed two overarching recommendations as well as a large number of technical recommendations on advancing the state of climate monitoring from satellite instruments. Overarching recommendation from the workshop are: 1) Conduct a set of satellite benchmark missions to create irrefutable records and calibrate other satellite sensors. Benchmark measurements in the context of long-term climate monitoring, 2) Establish a U.S. Joint Center for Satellite Instrument Calibration (JCSIC).The Center would be organized by NOAA, NASA, and NIST (and possibly other national agencies) and would be a distributed center, i.e. the Center's program would be conducted at the partner agencies. The JCSIC would be the US contribution to GSICS. The benefits of implementing the recommendations of the $ASIC^3$ Workshop would be: 1) Early, irrefutable detection of climate change 2) Verification of climate model predictions and 3) Achieving the societal benefit goals of the Global Earth Observation System of Systems (GEOSS), in particular, understanding, assessing, predicting, mitigating, and adapting to climate variability and change.

NOAA-WP-19 offered its perspective on the steps needed to make archived satellite data usable for climate studies. The scientific aspects of this issue were summarized in NOAA's input to CGMS-32 Action 30.09 and so the response focused on specific archival issues that address long-term preservation and interoperability of satellite data. NOAA recommended that CGMS members explore adoption of the Open Archival Information System Reference Model (OAIS-RM) as a framework for long-term satellite information preservation.

EUM-WP-07 highlighted the huge amount of remote sensing data contained in the archives of the various operational satellite agencies which is being made available for reprocessing. A prerequisite for this is that the quality of the data can be assured. In addition good calibration and intercalibration of sensor data is essential. The question of easy data access and delivery of data needed to be further pursued and like NOAA in WP 19 suggested to explore adoption of the Open Archival Information System Reference Model.

In addition the provision of suitable mechanisms for allowing third parties to execute their products generation and enhancement algorithms at the archive centres should be established.

CMA-WP-11 reported that the current amount of satellite raw data and products archived in CMA/NSMC exceeded 85TB. Data reprocessing began in 2004 at NSMC with efforts to store the data onto new media, check the quality, relocate and recalibrate data for each orbit. CMA/NSMC will use the reprocessed data to produce long time series TBB, OLR, SST, vegetation Index and so on. CMA/NSMC disseminates the data and products through DVB-S, internet, or deliver by special arrangement on the requests of users.

Resulting from the above presentations it was to formulate the following set of recommendations:

Action 34.19: CGMS members to explore the potential of the Open Archival Information System Reference Model (OAIS-RM) as a framework for long-term satellite information preservation for enhancing interoperability of current, future, and historical data sets, as well as for the GEOSS interoperability, and to report at CGMS 35. Deadline: CGMS-35

Recommendation 34.06: Operational archive operators to install necessary reprocessing capabilities to allow for regeneration of datasets with improved quality. This includes that archive operators provide sufficient information of data quality and calibration accuracies to the user community. Deadline: CGMS-35

Recommendation 34.07: Archive operators are invited to develop mechanisms and provide means to allow running of third parties algorithms. Deadline: CGMS-35

II/3 Vertical Sounding and ITWG Matters

CMA-WP-08 provided an overview of the ATOVS (Advanced TIROS-N Operational Vertical Sounder) data as processed operationally at NSMC (National Satellite Meteorological Center) since the first ATOVS suit with the successful launch of NOAA-15. The ATOVS products, including radiance products and retrieved products, have been used in CMA NWP model with data assimilation. The operational pre-processed algorithm is AAPP (ATOVS and AVHRR Pre-processing Package) and the operational retrieval algorithm is IAPP (International ATOVS Processing Package) in NSMC. According to the data source, three types of ATOVS data are pre-processed, retrieved and assimilated into NWP. There are Regional HRPT ATOVS data, NESDIS global ATOVS data, HRPT ATOVS data in northern Hemisphere from EUMETCast. Currently NSMC receives and processes the measurements from ATOVS onboard the NOAA-16/18 satellites.

JMA-WP-08 introduced the activities of JMA for ATOVS data exchange. JMA started providing the ATOVS data received at the Meteorological Satellite Center in Tokyo on 7 June 2006, and Syowa Station on the Antarctica on 21 August 2006. The Working Group and especially WMO expressed an appreciation of the efforts by JMA.

The document KMA-WP-06 reported on the status of receiving, processing, utilizing of ATOVS in KMA, and the data exchanging in the program of Asia-Pacific RARS (Regional ATOVS Re-transmission Services). Applications for NWP are currently in a research mode. As future plan it was mentioned that the ATOVS data would be used in regional NWP models to improve weather forecasts

KMA-WP-07 described the utilization of ATOVS data in KMA's NWP system. TOVS data have been assimilated in the global model since 1999 using the 1dVar technique. Currently, the ATOVS level 1d radiance data are assimilated using a global 3dVar. Based on the monitoring results, only the AMSU data is assimilated currently.

The upper most level of the global model is extended up to 0.4 hPa from 10hPa and the impact of ATOVS data is proved to be quite stronger because the ATOVS data is the only observation available above the troposphere. The Korea Meteorological Administration (KMA) has updated the ATOVS usage in its NWP system. In the future KMA will test the FGAT (First Guess at Appropriate Time) for the ATOVS direct assimilation and plans to go operational by the end of this year. The regional 3dVar and global 3dVar will be merged into the unified 3dVar and will be in operation in 2007. From discussion in the working group it emerged that the benefit to regional NWP, is expected to be fairly high. The broader discussions of the Working Group led to the following recommendation:

Recommendation 34.08: It is recommended to make further efforts toward a near-global RARS and also include the data of advanced sounders and other data critical to NWP. Deadline: CGMS-35

NOAA-WP-12 reported on the fifteenth International TOVS Study Conference, ITSC XIV, was held close to the town of Maratea in southern Italy from 4 – 10 October 2006. The ITSC-XV presentations, Working Group meetings and discussions documented significant gains in many areas and noted areas for future activity. Highlights included:

1. Many NWP centres are now assimilating radiances from the advanced infrared sounder, AIRS, and getting significant positive forecast impacts. The use of the warmest field of view, in the AMSU-A footprint, recommended at the last conference has replaced the centre field of view used initially. Work on assimilated cloud-cleared radiances to increase yield is being planned.
2. Many NWP centres are ready to assimilate IASI radiances once they become available with the help of NESDIS who have provided a simulated

IASI dataset. A channel sub-set of about 300 IASI radiances has been identified for distribution to NWP centres on the GTS.

3. It was noted that the SSM/I sensor on DMSP-F15 was no longer being used by users due to the beacon interference with the 23GHz channel. A process to clean up the data was presented at the conference which should be made available to the users to allow them to assess if they can start to use data from this satellite again.

4. The community software packages for processing locally received ATOVS data have been upgraded to allow data to be processed from MetOp, including IASI. The updates will shortly be available for free distribution to users. This kind of ATOVS processing software has been essential in the use of ATOVS data by the meteorological community.

5. A freely available software package for processing locally received MODIS and AIRS data is being used by many countries for imagery and for Level 2 products. This IMAPP software also adds applications from AMSR-E. Future development of DB packages for MetOp -IASI, NPP AND NPOESS are also planned.

6. The group was pleased to note that the Integrated Program Office (IPO) has decided to put NPP into a PM ascending orbit as recommended by the ITWG at ITSC-XIV to provide continuity with Aqua/AIRS. This will help to ensure at least long term atmospheric sounder coverage in 2 orbits.

7. The group supported the continuing efforts to develop the GCOS Atmospheric Reference Observation Network (GARON) for climate with the primary objective of creating long term records of critical upper air measurements and associated error characteristics to support their continuing integration in climate applications and research.

8. The time series of (A)TOVS now exceeds 27 years and the quality and number of climate products continues to grow. One sign of the importance of climate studies to society, is that there are now efforts emerging to support the routine, operational production of TOVS Climate Data Records at several centers.

There were several specific actions and recommendations to the CGMS. They are itemised below:

1. The group urged space agencies to provide documentation on data formats well before launch to allow similar community software packages to be developed for planned new satellites (e.g. FY-3 and NPP).

2. The results of new observing system experiments presented at ITSC-XV demonstrate that satellite data have a large impact on weather forecast accuracy and promising new results suggest the potential for future enhancements in the use of satellite sounder and imager data. It is crucial

that future instruments as a baseline maintain, and if cost effective improve upon, the quality of AMSU and AIRS.

3. It was recognised that high spectral resolution imaging radiometers on geostationary platforms are likely to be an important part of the future global observing system. It was recommended that a demonstration mission be conducted in the near future. GIFTS is the best current option for such a mission.

4. The group was concerned that critical climate monitoring instruments have been removed from NPOESS, specifically the loss of CrIS/ATMS in the 0530 orbit plane, removal of the limb instrument for ozone monitoring, and the Earth Radiation Budget sensors. Removal of CrIS/ATMS in the 0530 orbit seriously affects the monitoring of the diurnal cycle and provides no backup contingency for assuring continuity of at least two advanced sounder systems. The removal of ERBS breaks the climate series of a 30 year continuous climate sensor time series. CGMS members should express concern.

5. An important issue for consideration is that when MODIS is retired, according to current plans, there will not be an imager in polar orbit with a channel in the water vapor band. This will degrade the accuracy of any polar cloud track winds. Space agencies are urged to consider the best means for providing a polar orbiting imager with water vapor channels along with the conventional VIS and IR channels.

6. A presentation on the need to foster training on remote sensing measurement systems and products to young scientists was given and the group agreed to enhance its efforts in education and training through a dedicated section of the web site. A workshop to co-ordinate satellite meteorology training was also proposed along with the possibility of certification of some courses. Satellite provider agencies were encouraged to continue and expand their support for education and training of the next generation of remote sensing scientists.

7. The Regional ATOVS Retransmission Service, RARS, has been significantly developed since ITSC-XIV. The EUMETSAT EARS service has continued to expand and more NWP centres are using the EARS data. The Asia-Pacific RARS has started operations and NWP centres are already beginning to assimilate ATOVS data from this new data stream. RARS networks in S. America and Africa are being planned. The group encouraged WMO and the space agencies to continue to develop this ATOVS retransmission service as a low cost means of providing more timely ATOVS data over most of the globe.

CGMS thanked the ITWG for its work on behalf of improved utilisation of remote sensing data and noted the recommendations from ITWG. The discussion concluded with two recommendations:

Recommendation 34.09: ITWG should foster coordinated international collaboration for future product development related to increasing the amount of data assimilated in NWP by the use of cloudy radiances (e.g. need improved cloudy radiative transfer modelling), cloud-cleared infrared radiances, and surface channels (need improved surface emissivity modelling. The ITWG Rapporteur should inform the ITWG co-chairs of this new recommendation. Status reports from each CGMS agency on these topics at the next CGMS meeting are encouraged. Deadline: CGMS-35

Recommendation 34.10: ITWG should foster coordinated international collaboration for future product development related to development of climate data records from TOVS and other long-term satellite series. The ITWG Rapporteur should inform the ITWG co-chairs of this new recommendation. Status reports from each CGMS agency on the generation of CDRs at the next CGMS meeting are encouraged. Deadline: CGMS-35

NOAA-WP-13 summarised the status of NOAA/NESDIS GOES Soundings. The NOAA/NESDIS operational Geostationary Operational Environmental Satellite (GOES) East (GOES-12 at 75 W) and West (GOES-11 at 135 W) soundings (retrievals) are produced hourly at approximately 10 km nominal resolution (1x1 Field of View (FOV)) in clear skies over North America and adjacent oceans. On 3 November 2005, NOAA/NESDIS began generating operational retrievals at the new Single FOV (SFOV) resolution. Previously, the NOAA/NESDIS operational retrievals had been 5x5 FOVs in size. SFOV retrievals show details not seen in coarser resolution retrievals. On another note, GOES-11 replaced GOES-10 as the operational GOES West satellite on 21 June 2006. GOES-13, launched on 24 May 2006, is currently undergoing post-launch engineering testing. Preliminary estimates show that the GOES-13 signal-to-noise ratio is the best of any of the GOES Sounders to date. This is due to the new spacecraft bus that allows the detectors to function at much colder temperatures. More analysis of GOES-13 data will be done during the science post-launch test slated for December 2006.

NOAA-WP-34 responded to CGMS Action 33.16 concerned with the priorities for future satellite product developments related to the use of cloudy radiance in NWP. The comprehensive actions include: a) Development of a fast a community radiative transfer model (CRTM), b) Construct sets of high-quality satellite and associated in-situ observations, c) Improve modelling of moist physical processes in cloud resolving models, d) Exploit millimeter-wave sounding channels with improved sensitivity to snow and drizzle to retrieve these variables. e) Standardize 1dvar processing capability that retrieves all hydrometeors profiles, f) Alternative experiments called cloud-cleared radiance process have been demonstrated successfully for improved uses of infrared sounding data in NWP models.

II/4 Precipitation and IPWG Matters

CMA-WP-09 explained there are two kinds of satellite rainfall estimate products at NSMC. The first one is FY-2C operational rainfall estimate product using the satellite rainfall estimate and the fusing technique developed by NSMC. Based on hourly rainfall estimate using the FY-2C Infrared measurements, the product is created every 6 hours by fusing with the surface observed 6-hour-accumulated raingauge rainfall amount. The FY-2C rainfall estimate product is validated by the matching data of the unused surface rain gauge data. The validation results show that the correlation efficient is greater than 90%, and the relative error is below 30%. The algorithm is embodied by International Precipitation Working Group (IPWG) and is released by IPWG network. The second kind of product is the rain rate of Typhoons using microwave measurements. It became operational in June 2006. Based on operationally received microwave measurements from NOAA AMSU-B. Comparing the estimated rain rate of Typhoon with the Hong Kong Radar rain rate, the rain belt and the large rain area are very close. During this summer, NSMC integrated a visualisation system including ATOVS sounding products and AMSU-B retrieved rain rates, for which many weather forecaster showed great interest.

WMO WP-15 informed CGMS Members on the status and activities of the International Precipitation Working Group (IPWG). The paper pointed out that areas of particular interest were being intensively investigated by IPWW. In the area of GPCP Assessment future possibilities for improved global precipitation are addressed in a recently published book titled “Assessment of Global Precipitation.” With respect to Solid Precipitation, the 1st “IPWG/GPM/GRP Workshop on Modelling of Snowfall” was held in October, 2005, in Madison, Wisconsin, where eight high priority recommendations for future focus were formulated. Validation Studies have received considerable attention: 1) an extensive project to validate and intercompare operational and semi-operational satellite rainfall estimates has results routinely posted to the IPWG Validation website; and, 2) the Program for the Evaluation of High Resolution Precipitation Products (PEHRPP), which consists of four validation studies is well underway. The week immediately preceding CGMS-34, the 3rd Workshop of the International Precipitation Working Group was hosted by the Australian Bureau of Meteorology in Melbourne, Australia, with results reported in WMO WP-14 ADD1. Nearly 60 attendees representing 15 countries participated in 3 days of presentations, followed by 1 ½ days of working groups. The three working groups addressed operational applications, research activities, and validation. The workshop was held in parallel with the 2006 Asia Pacific Satellite Application Training Seminar (APSATS-2006) with a one day joint session where IPWG scientists provided lectures and workshops for the APSATS participants. The IPWG looks forward to three science workshops: 1) a PEHRPP workshop at WMO in Geneva in late 2007; 2) a second workshop on the assimilation of precipitation observations into NWP in 2007; and, 3) a second snow and cold season workshop in 2008.

The 3rd IPWG Science Workshop also expressed keen interest in frequency management issues, future geostationary microwave, the Global Precipitation Mission, and future satellite planning which are addressed in CGMS-34 Plenary. The IPWG felt that the following recommendations should be brought forward to CGMS 34:

Noting the request from the IPWG for European support to GPM in the form a European GPM mission designed to measure snow and light rain, CGMS felt that the matter deserves clarification and formulated the following recommendation.

Recommendation 34.11: CGMS recommends that the status of the European contribution to the Global Precipitation Measurement (GPM) is clarified by ESA. Deadline: CGMS-35

Noting the need for documentation of current and future sensor characteristics;

Recommendation 34.12: Satellite operators should provide detailed information in near-real-time as well as quarterly assessment reports of instrument performance, particularly information should include noise assessment, spectral response characteristics (central wave number, shape and stability). Deadline: CGMS-35

Noting the importance of microwave sensor blending techniques for precipitation retrievals and assessment as well as and data assimilation;

Recommendation 34.13: Satellite operators should maintain both conical scanning microwave imagers and cross-track scanning sounders on the same satellite platform. **Deadline: CGMS-35**

Noting the importance of its science working groups in furthering the work of CGMS through science workshops where international expertise at the highest level is brought forth through leveraging much of the expertise at an exceptionally high cost-benefit ratio; this is also reflected in a recommendation from CGMS.

II/5 Atmospheric Motion Vectors and IWWG Matters

IMD-WP-03 was only submitted in writing to CGMS-34 but not verbally presented. The paper described the current status of Cloud Motion Vectors (CMVs) and Water Vapour Winds (WVWs) derived from KALPANA-1 and INSAT-3A satellites. It provided an update on the status and developments of the satellite winds at India Meteorological Department, India. Cloud Motion Vectors are being derived operationally using KALPANA-1 and INSAT-3A IR data. CMVs at 00 and 07 UTC are derived from Kalpana-1 and 12 UTC CMVs from INSAT-3A IR data. These CMVs are regularly put on GTS and also stored by the UK Met office for monitoring. Simultaneously these CMVs are also put in BUFR format regularly at 00 UTC and 07:30 UTC. These CMVs

are now covering a larger area (45°S to 45°N and 40°E to 140°E). Efforts are also being made to derive the CMVs using Visible data at least once a day. Water Vapour Winds from Kalpana-1 data have also been derived regularly at 00Z and 07:30 UTC in test mode. Validations of these winds are in progress.

NOAA-WP-14 summarised the current NOAA/NESDIS operational wind product suite that includes the high density cloud-drift winds from the GOES imager, water vapor motion winds derived from the GOES sounder, and cloud-drift and water vapor winds from the MODIS instrument aboard NASA's Terra and Aqua satellites. Research and development activities involving new satellite-derived wind products and improvements to existing satellite-derived wind products were also summarised.

During the period 2005-2006, some changes to the operational NOAA/NESDIS processing environment took place. Starting on 21 June 2006, GOES-11 replaced GOES-10 as the western operational geostationary satellite. AMVs generated from GOES-11 are very similar to those generated from GOES-10 since the spectral coverage and resolution of the GOES-11 imager and sounder instruments are very similar to the spectral coverage and resolution of the GOES-10 image and sounder instruments. On 17 March 2006, NOAA/NESDIS ceased production of the low-level "picture-triplet" cloud-drift wind products. Beginning on 19 September 2006, NOAA/NESDIS began distributing the Terra and Aqua MODIS AMVs over the GTS. This distribution path gave operational Numerical Weather Prediction (NWP) centers easy access to these AMV products.

In the near future, NOAA/NESDIS will begin testing the generation of AMVs on an hourly basis instead of a three hourly basis.

EUM-WP-23 summarised the outcome of the 8th International Winds Workshop (IWW8). This workshop took place from 24 - 28 April 2006 in Beijing, China and was hosted by CMA. The paper presented i) the response of IWW8 to actions from previous CGMS meetings, ii) findings and recommendations of IWW8, iii) other issues related to International Winds Working Group, such as the establishment of a dedicated web site and a discussion of the format and utility of the standard CGMS comparisons between AMVs and radiosondes.

WG II welcomed the progress being reported at IWW8 notably on height assignment. It noted with satisfaction the broad participation of the NWP community. In the discussion it echoed the excellent possibilities for the validation of height assignment offered by instruments on the A-Train such as the cloud lidar; CGMS also took note of the pioneering work at CIMSS/NESDIS on treating AMVs as representative for an atmospheric layer. It was also mentioned that the usefulness of the well-established CGMS AMV statistics against radiosondes had been questioned, because the recent non-availability of the statistics did not raise concern. However this would not necessarily challenge the usefulness of the standard CGMS AMV statistics as the statistics are routinely circulated to CGMS operators.

From the various recommendations of IWW8 CGMS concluded and formulated the following actions and recommendations:

Recommendation 34.14: There should be a comparison of standard methods for the height assignment of AMVs with the new measurements from instruments on the A-Train (e.g. with the cloud lidar). Deadline: CGMS-35

Recommendation 34.15: There should be a comparison of the operational algorithms of all satellite wind producers for the height assignment of AMVs from clouds using a common data set from SEVIRI on MSG, and the same ancillary data . Deadline: CGMS-35

Recommendation 34.16: An experiment should be performed to apply operational AMV retrieval algorithms to simulated images from high resolution NWP fields. Deadline: CGMS-35

Recommendation 34.17: Considering the positive impact on re-analyses of re-processed AMVs it is recommended to complete the global reprocessing by including all geostationary satellites. Deadline: CGMS-35

Action 34.20: NESDIS is invited to provide a paper to CGMS-35 on progress in novel studies on the height allocation of AMVs to layers. Deadline: CGMS-35

Action 34.21: CGMS members operating imaging instruments on polar orbiters should consider producing AMV wind products over the poles and report to CGMS-35 on the investigations. Deadline: CGMS-35

Action 34.22: All CGMS members producing AMV products to report on the use of the standard CGMS AMV statistics with a paper to CGMS 35. The paper should also present the co-location criteria currently in use. Deadline: CGMS-35 (feedback from 2 co-chairs)

JMA-WP-10 gave the status of operational Atmospheric Motion Vector (AMV) products of JMA. With the commencement of MTSAT-1R operation, JMA started deriving 6-hourly AMVs for full disk from three successive MTSAT-1R images of 15-minute intervals instead of 30-minute intervals. The quality of AMVs is comparable to that of AMVs derived from GOES-9 or GMS-5. JMA continues improvement of algorithm to reduce wind speed bias focusing on height assignment. In addition to 6-hourly AMVs, JMA newly started deriving hourly AMVs over northern hemisphere. The status of hourly AMVs is also summarised in this paper.

The statistics of MTSAT-1R AMVs are available at the following website:
http://mscweb.kishou.go.jp/library/report/inter_com_amv/

WG II commented that results look very promising and encouraged further progress.

II/6 Other Parameters and Products

NOAA-WP-16 summarised the status of the community radiative transfer model (CRTM) at the Joint Center for Satellite Data Assimilation. The CRTM has accommodated the growing requirements in direct assimilation of satellite radiances under clear and cloudy conditions and will soon include some critical components for air quality and trace gas data assimilation. The first version of CRTM has been recently implemented into NOAA and NASA research and operational data assimilation systems. It was noted that significant additional research and development is needed to provide accurate radiative transfer capabilities for all sky conditions. This will enable the assimilation of more data in very active meteorological regions and is expected to significantly improve forecast accuracy.

With ESA-WP-05 CGMS was informed about the ERS and Envisat data access, in particular in NRT. This includes data from the following instruments: MERIS, (A)ATSR, MIPAS, GOMOS, SCIAMACHY, DORIS, Altimeter, (A)SAR, GOME, Wind Scatterometer. Working group II raised the question of data access through the EUMETCast system for a wider community. It also mentioned that the EUMETSAT African User Forum expressed an interest in MERIS ocean colour and AATSR SST.

KMA-WP-08 reported on the status of the COMS Meteorological Data Processing System (CMDPS), which is developing in KMA to support the COMS operational meteorological application. CMDPS is designed to extract 16 baseline products operationally. CGMS congratulated KMA on the work and expressed an interest to learn more about the tentative plans for product generation and dissemination.

Action 34.23: KMA is invited to present a tentative product generation and dissemination plan for COMS at CGMS 35. Deadline: CGMS-35

NOAA-WP-15 described the state of readiness of the operational and research communities that will use Global Positioning System Radio Occultation (GPSRO) observations for numerical weather prediction, climate monitoring, and space weather analysis provided by real-time platforms such has COSMIC and MetOp/GRAS. The common expectation is that that the most immediate impact of high density, operationally-delivered RO profiles will be realized in the realm of NWP. However, there are many who contend that the most significant long-term impact of RO observations will be in the realm of climate studies. The continuity of full data availability after the COSMIC demonstration period ends in April 2008 is identified as the most significant outstanding issue. Also a follow-on mission to COSMIC is needed. MetOp satellites will each include a GRAS instrument and provide longer term continuity, however the number of soundings will be lower than from the COSMIC constellation.

WMO-WP-31 informed CGMS Members on the status and activities of THORPEX. The paper pointed out that of particular interest to CGMS Members was that under the auspices of THORPEX, regional and global projects and experiments will be carried out to: 1) target satellite and in situ observations to design the strategy for interactive forecasting and observation, thus contributing to the evolution of the WMO Global Observing System (GOS); 2) create and evaluate systems for the assimilation of targeted observations from satellites and in situ measurements; and, 3) demonstrate societal and economic benefits of improved forecasts, by improving decision-support tools, which utilize advanced forecasting products to benefit directly social and economic sectors. Of interest was THORPEX planning for future Regional Plans campaigns and experiments in which all satellite operators should become involved. To that end, CGMS Members identified focal points within their agencies for THORPEX related satellite issues.

Action 34.24: The CGMS THORPEX Rapporteur will contact CGMS Member focal points with regards to their becoming involved in THORPEX Regional Planning activities. Deadline: CGMS-35

Document ROSH-WP-02 presented an overview of Roshydromet/SRC PLANETA activities in the area of satellite data routine processing and derivation of operational products. The satellite's informational products are used by Roshydromet in various application areas, including operational meteorology, NWP, hydrology, agrometeorology, hazards (fires, floods) and pollutions monitoring, climatological studies. Examples of some satellite products were demonstrated. Working group II took note with appreciation.

II/6.1 Ocean Related Parameters

ESA-WP-03 informed CGMS about the ocean related parameters provided or planned by ESA missions: ERS, Envisat, Explorer and GMES Space program. With regard to current missions the paper lists the relevant information and products nicely in tabular from. ESA also mentioned the ongoing work on the definition of and arrangements for the missions that will encompass the GMES (Global Monitoring or the Environment and Security) Space Program. They are aimed to provide data for operational services to cover a number of sectors. The Sentinel-3 is the ocean monitoring mission and will embark the instruments to measure SST, ocean colour and sea surface heights.

NOAA-WP-26 was the executive summary report from a workshop held June 5-7, 2006 at the Tropical Prediction Center (TPC)/National Hurricane Center (NHC) in Miami, FL. The workshop documented (1) the utilization and impact of presently available satellite OSVW data in the production and use of operational marine weather analyses, forecasts and warnings at NOAA, (2) the OSVW operational requirements within NOAA based on actual experience and phenomena observed, and (3) a preliminary exploration of sensor/mission concepts that would be capable of meeting requirements.

The workshop findings are summarized as follows:

1) QuikSCAT vector wind measurements are fully integrated, and heavily used, in the routine workflow of the national centres and coastal forecast offices.

2) Nearly eight years of operational experience with satellite vector wind data has highlighted the need for product improvements in the following areas to support the present needs of NOAA operational forecasters and centres:

   a) Measurement accuracy and quality
   b) Measurement spatial and temporal ("revisit") resolution, and latency
   c) Data product provisioning and training

3) The workshop participants focused on the essential vector wind product requirements.

Establishing an operational satellite OSVW data stream and closing the OSVW capability gaps will result in more accurate warnings, watches and short-term forecasts; improved analyses, model initializations, and atmospheric forcing of ocean models; and a better understanding of coastal and oceanic phenomena. In the discussion it was stated that the community is concerned because of future plans on replacing a scatterometer with passive micro-wave polarimeters.

II/6.2 Fire Related Parameters

EUM-WP-21 presented the EUMETSAT developments since summer 2005 on an operational fire detection module, which has since then undergone several improvements. The algorithm mainly uses the MSG SEVIRI 3.9 um channel for determination whether in an image pixel a very warm target (fire) is most certainly or potentially present. The product is available in GRIB2 and ASCII format via the EUM web site and will soon be disseminated via EUMETCast. The product will also be available on the EUMETSAT web site by the end of 2006.

NOAA-WP-35 described the North American development and implementation of operational and research environmental satellite derived fire products which has grown appreciably in the last 10 years with applications in hazards monitoring, fire weather forecasting, climate change, emissions monitoring, aerosol and trace gas transport modeling, air quality, and land-use and land-cover change detection. A number of universities and government agencies have supported web sites to display archived and real-time fire products and applications. The paper lists ten web sites that have been in existence for some time and have demonstrated importance and sustained interest.

ESA had indicated by e-mail to the Secretariat and WMO the internet address of NRT fire monitoring information.

II/6.3 Cloud and Dust Related Parameters

In CMA-WP-10 NSMC reported on several cloud products. Those are a cloud mask product, a high cloud product, a cloud type product, a cloud amount product, and a cloud phase product. A multi-channel threshold method is used for the cloud mask product. The thresholds are determined by the dynamic histogram threshold method and experience. The maximum brightness temperature over 15 days is used to detect clear pixel as background. The water vapor channel brightness temperature and the IR brightness are used to identify high cloud product. The Cloud type product is made using a clustering method; cloud types are classified according to a regression technique between IR and WV channel brightness temperature. The cloud types are cumulonimbus, altostratus, cirrus and middle and low cloud.
A neural network technology is used to classify cloud.

ESA-WP-04 informed CGMS about the capabilities of actual and future ESA EO satellites for aerosol sensing. The excellent performance of several instruments (e.g.MERIS) was highlighted. The first Explorer Mission to provide information about aerosols is ADM-Aeolus, which carries an ALADIN instrument to provide wind profiles, delivering also information about backscatter and extinction coefficient. Furthermore the Working Group was informed about the future EarthCare mission in cooperation with JAXA, which will provide comprehensive information on aerosol and cloud with the help of a backscatter lidar, a cloud radar and a multi-spectral radiometer.

EUM-WP-20 described an optimum estimation method to derive a number of cloud and cloud microphysical products from the Meteosat Second Generation (MSG) multi-channel imagery. This method is currently developed and tested at EUMETSAT. The paper had been written in response to Recommendation 33.03 which in turn responded to the GCOS requirement for improved cloud monitoring.

Discussions in the WG also referred to the potential of the method to delineate areas of strong convective storms which could be of help to automatic nowcasting applications.

JMA-WP-09 had been prepared in relation to Action 33.06 from CGMS-33, and reported on the status of MSC's aerosol products and future plans. Aerosol products are generated from data of MTSAT-1R/JAMI and NOAA-18/AVHRR. In these products, two parameters on atmospheric aerosol are calculated, i.e. aerosol optical depth (AOD) at 500 nm and Ångström exponent. These parameters are retrieved in the vicinity of Japan over cloud-free sea. MSC has been developing aerosol products over land around Japan since April 2006, and continues improving these products to make them more suitable for climate applications. This paper also reported on the status of

MSC's dust monitoring product. This product contains information on dust retrieved from MTSAT-1R/JAMI infrared (11 micron and 12 micron) data.

NOAA-WP-30 reported on current efforts to establish and/or enhance aerosol products suitable for climate applications. CGMS was informed that NOAA is working to better understand the spatial and temporal distribution of aerosols in the atmosphere using current and future NOAA instruments. NOAA operates a real-time aerosol optical depth (AOD) environmental data record (EDR) for retrievals over the ocean which has historically been used for SST correction. Additionally, work has included retrieving AOD from the entire AVHRR record (e.g., the Pathfinder Atmosphere project which spans 1981-2000) toward creating an AOD climate data record (CDR). Current work is attempting to bridge the EDR/CDR gap to better understand differences and create CDRs in real time. New reprocessing capabilities also allow the improvement of AOD CDRs. Toward this end, NOAA is working to understand how the aerosol retrievals from these new sensors will affect our current understanding of aerosol climatology by using current satellites flown by NASA and Europe as a surrogate for future NOAA missions.

Action 34.25: NOAA is invited to report on reprocessing of AVHRR data for a new aerosol climatology over the oceans to CGMS 35. Deadline: CGMS-35

In KMA-WP-09 a report is provided on Cloud Amount Estimation as operated at KMA. Hemispheric Cloud Amount is calculated using geostationary satellite data. This report summarizes the algorithm and shows verification result for three months of 2005.

NOAA-WP-20 summarized the current state of cloud climatologies and suggests some future work. On 6-7 July 2006, a second GEWEX Cloud Product Assessment workshop was held in Madison, Wisconsin. Long-term cloud datasets used to assess the GRP (i.e., ISCCP) cloud products were provided from the NOAA-HIRS, TOVS Path-A/Path-B and polar TOVS, PATMOS-X, SAGE and surface observations. Long-term cloud changes and their sources in the different datasets were presented. It was noted that the intercomparisons were more successful if one carefully accounted for satellite orbital drifts, especially the NOAA polar afternoon satellites, and also for changes in location of geostationary satellites. In addition, cloud datasets were presented from the new generation of instruments MODIS, MISR and AIRS onboard the NASA Earth Observing System (EOS) platforms that began operation in 2000 and thereafter; climatological averages within the selected regions are in progress due to the ongoing reprocessing of the entire Aqua and Terra data stream with updated algorithms. Key results from the workshop included: i) Clouds cover about 68% (±5%) of the Earth's surface, with 5% to 12% more cloudiness over ocean than over land, ii) Seasonal cycles of cloud amount seem to be well correlated by most datasets, except over polar land, iii) Most cloud products exhibit similar seasonal cycles of cloud amount in the polar regions, though the magnitudes can differ by 10-15% during the day and 20-30% during the cold, dark winter months, iv)

Subvisible cirrus are identified only by SAGE, which accounts for another 15% in the amount of high cloud, v) Surface observations show up to 25% more low cloud amounts than the satellite retrievals in regions with large values of high cloud amounts (as in the tropics), vi) Long-term variations of ISCCP high, midlevel and low cloud amount are partly influenced by the changing locations of geostationary satellites over time.

Future work will include investigation and evaluation of apparent differences in climatological averages as well as their regional, seasonal and diurnal variations.

CGMS WG II took note of the results with great interest and encouraged such workshops in the future.
In the discussion EUMETSAT informed CGMS about a similar workshop held in Sweden at SMHI in May 2005. CGMS expressed interest and requested to be informed.

Action 34.26: EUMETSAT to present paper on the results of the cloud workshop held in 2005 and subsequent investigations. Deadline: CGMS-35

NOAA-WP-31 outlined current and planned activities to improve their ability to estimate cloud properties including cloud microphysics from satellite imager data. These techniques include improvements in the NOAA operational AVHRR cloud processing system (CLAVR-x). The system has adopted the latest models for ice crystal scattering developed for the NASA Goddard MODIS cloud products. In recognition of the need to monitor cloud microphysics throughout the day, NOAA has developed infrared-only approaches to estimate cloud optical thickness and cloud particle size. In recognition of the need to monitor cloud microphysics throughout the day, NOAA continues to develop methods to optimally combine imager and infrared hyperspectral sounder data for optimal cloud product generation.

EUM-WP-08 described the current work at EUMETSAT with the goal to derive operational aerosol products over land and over the ocean from SEVIRI on Meteosat Second Generation. Currently two different approaches are adopted over land (optimum estimation technique) and over the ocean (threshold technique). The paper responded to Action 33.06.

II/6.4 Surface Albedo

EUM-WP-22 reported on the temporal and spatial evaluation of surface albedo derived from geostationary meteorological satellites. The temporal evaluation is performed for a Meteosat satellite at zero degree longitude, analysing times series of surface albedo over a limited number of targets. For the spatial evaluation, the broadband global surface albedo product derived from five geostationary spacecrafts has been compared with the MODIS product derived during the overlapping compositing period, i.e. 1–10 May 2001.

It was recalled that the surface albedo retrieval algorithm could be made available to the CGMS members upon request for the processing of their own archived data **(see CGMS Action 33.19).**

II/6.5 Other Parameters

In EUM-WP-09 a report was provided on the potential of hyper-spectral infrared sounding instruments to provide climate data records. Hyper-spectral instruments like the Atmospheric Infrared Sounder (AIRS), flying on the AQUA satellite, and the forthcoming interferometers IASI (Infrared Atmospheric Sounding Interferometer) on MetOp and CrIS (Cross Track Infrared Sounder) on NPOESS provide the means to pursue relevant and comprehensive climate monitoring. The advantage of high-spectral resolution spectrometers is the inherently good instrument characterisation and the possibility for very accurate calibration. A potential problem is the high data volume which calls for a real-time production of a reduced data set.

NOAA-WP-37 reported on the workshop on Assimilation of Satellite Cloud and Precipitation Observations in Numerical Weather Prediction Models.) held on 2-4 May 2005 in Lansdowne, VA. The purpose of the workshop was to address the following problem. Satellites provide over 90 % of the data ingested by today's weather forecast models. Most of the satellite data (more than 75 %), however, are discarded because they are cloud- or rain-affected or redundant. These excluded observations contain potentially useful information about clouds and precipitation properties that could benefit NWP forecasts. The sensitive regions where numerical forecasts tend to be most influenced by initial condition error often coincide with the presence of clouds. It is precisely these regions where much of the satellite data currently cannot be used, either because the infra-red (IR) sounders and IR and visible (VIS) imagers cannot penetrate the clouds or because the models cannot adequately assimilate cloud or precipitation information. Advances in the assimilation of satellite observations of clouds and precipitation together with improved observations of these regions hopefully will lead to more accurate predictions of clouds and precipitation and more accurate weather forecasts in general.

II/7 Coordination of Code Forms for Satellite Data

WMO-WP-08 explained the last additions to satellite data GRIB 2 and BUFR codes recommended by the CBS/Expert Team on Data Representation and Codes and to be approved by the next extraordinary session of CBS in November 2006 CBS for their immediate experimental use and with a view to their full operational implementation on 7 November 2007. It also contains a proposed set of additions for GHRSST data but these are still awaiting full validation.

WMO-WP-36 highlighted that CGMS was regularly faced with the need to develop updates to BUFR tables in order to accommodate new data types originating from new satellites and instruments. Recalling CGMS Action 32.17

and 33.20, WMO proposed to establish a working group to deal with this issue and submitted draft Terms of Reference for such a group. CGMS WG II agreed that update to codes had to be properly addressed and that this should best be performed in the framework of a Task Force of experts from CGMS satellite operators. On the basis of the proposed Terms of Reference, it recommended that WMO sets up such a Task Force for a limited period and that each Satellite Operator nominates an expert to contribute to this important work.

In the discussion it was also pointed out that the generation of satellite-based products often required ancillary data that were not easily available and it was suggested that, in such cases, a request be formulated to the data relevant provider to make this data available over the GTS.

Action 34.27: WMO to set up a Task Force on Codes following the TORs spelled out in WMO-WP-36 and report progress at CGMS 35. Deadline: CGMS-35

Action 34.28: Each Satellite Operator is invited to nominate an expert to contribute to the WMO led Task Force on codes. Deadline: 31 December 2006

II/8 Conclusion and Preparation of WG Report

WGII concluded with thanks from the chairman to all participants for open and fruitful discussions.

CGMS was sad to hear that Dr. Guy Rochard passed away; Guy will be remembered as a wonderful colleague and strong supporter and initiator in many fields in satellite meteorology.

With regard to a possible parallel conduct of future ITWG, IWWG and IPWG, WGII felt that the idea may have value and recommended that the Co-Chairs of these three Working Groups evaluate the usefulness and consider common topics for joint sessions.

Recommendation 34.18: Co-Chairs of the ITWG, IWWG and IPWG to consider common topics for future joint sessions during potential parallel conduct of future workshops. Deadline: CGMS-35

Last but not least it was mentioned that the good dialogue between CGMS and each of the working groups (TOVS, Winds, and Precipitation) substantiated again in lively discussions at CGMS and fostered several actions and recommendations.

WORKING GROUP III: GLOBAL CONTINGENCY PLANNING

III/0 Introduction

As agreed at CGMS-33, Mr. Gary Davis from NOAA was elected Chairman of Working Group III (WGIII) on contingency planning, with Dr. Don Hinsman, from WMO, appointed as Rapporteur. WGIII comprised representatives of the satellite operators from China, Japan, Russia, USA, Korea, and EUMETSAT together with representatives from WMO (see Annex 4 for the list of participants).

Working Group III on Global Contingency Planning met during CGMS-34 and reviewed the results and recommendations in WMO WP-04. The Working Group was informed that in response to CGMS Action 33.21, WMO had organized a Workshop on 28-29 August 2006 with the aim to review plans for geostationary and low-Earth orbit satellites and identify potential scope for optimization of both orbits and instruments. While the plans for the next two decades developed by individual agencies would provide extremely valuable contributions to global observation, the net sum of all these plans would not necessarily provide the full benefit that could be expected since there were overlaps on some aspects and gaps and deficiencies on other aspects in terms of the orbits and instruments. The Workshop was convinced that some adjustment of the plans and a closer cooperation towards data quality and availability would allow a better response to WMO requirements and a corresponding improvement in the overall benefit would be realized. Reciprocally, essential WMO requirements were unlikely to be met without such adjustments with a strong level of cooperation. Thus, the August Workshop had made a series of recommendations for low Earth and geostationary orbits that were discussed by Working Group III.

The Working Group considered equator crossing times for low Earth orbiting satellites and instruments for: imagers (VIS, IR and MW); sounders (IR and MW); altimetry; Earth radiation budget; ocean surface winds; and Radio Occultation. In particular, the Working Group considered the following main recommendations from the Workshop for adjusting the plans in LEO orbit and provided additional information as noted in each section entitled “CGMS Progress and Plans”:

- Consider with priority a sounding package in the early morning orbit, e.g. through moving a mid-am mission to early am;

  CGMS Progress and Plans – The Russian Federation agreed to consider the possibility of flying a polar-orbiting satellite with a sounding capability in the early am orbit. In doing so, the Russian Federation stressed that it could only do so after the launch and commissioning of METEOR 3M N1, i.e. only for METEOR 3M N2 and later satellites. The Working Group noted that if the Russian Federation were to consider such a move, its satellite would be the only one with a sounder in the early am orbit.

- Consolidating early pm missions

  CGMS Progress and Plans – CMA indicated its intentions to fly FY-3B in an early pm orbit and that was still considering equator crossing times for subsequent missions.

- Contingency

  CGMS Progress and Plans – Working Group III noted with the indications made by the Russian Federation and CMA that 5 operational polar-orbiting satellites with sounding capability in three orbital planes (early am; mid am; and early pm) would provide sufficient redundancy for contingency planning.

- Secure continuity for one ocean altimetry series;

  CGMS Progress and Plans – NOAA and EUMETSAT have committed to lead efforts towards an operational JASON-2 Follow-on. Additionally, NOAA and NASA have commenced a dialogue for an enhanced altimeter. ESA indicated preliminary considerations to add ocean altimetry as a supplementary objective for the ice shelf monitoring mission Cryosat-2. The Russian Federation indicated that it was considering a dedicated mission with altimetry and a SAR. The Working Group recommended that other R&D space agencies, in particular NASA, ESA, CNES and ISRO consider participating in altimeter missions as a follow on to JASON-2.

Recommendation 34.19: NASA, ESA, CNES and ISRO to consider partnership towards the long term continuity of altimeter missions and inform CGMS-35. Deadline: CGMS-35

- Clarify/confirm continuity of ERB and review complementary contributions of GEO/LEO satellites for ERB measurements;

  CGMS Progress and Plans – CMA noted that FY-3A and FY-3B would have Earth radiation budget instruments and it was considering similar instruments for follow-on FY-3 missions although it this time it was not possible to confirm.

  CGMS Progress and Plans – The Working Group agreed that it would be important to take into consideration plans for Earth radiation budget instruments on future GEO missions.

Recommendation 34.20: CGMS to take into consideration plans for Earth radiation budget instruments on future GEO missions when evaluating the adequacy in low Earth orbit planning. Deadline: CGMS-35

- Review formulation of requirements for RO sounding, implement dedicated ROS missions, and consider cooperation on RO ground support networks;

  CGMS Progress and Plans – NOAA indicated that it had commenced a dialogue with UCAR for a follow-on RO mission to COSMIC. The Working Group noted that access to COSMIC data was freely available through the UCAR ftp server after user registration and that the availability of COSMIC data was excellent for utilization in the UK Meteorological Office forecast model.

- Consider with urgency a gap-filler for sea surface wind measurements until 2016-2020.

As a general recommendation, the Working Group agreed that discussion for optimization of the polar-orbit would be enhanced if all R&D space agencies participated in future Workshops. In particular, NASA, ESA, JAXA, CNES, ISRO and CNSA should indicate potential contributions their missions could make towards optimization of the polar-orbit. Such participation would further enhance CGMS and WMO efforts to address the transition from R&D to operational systems in a more systematic and planned manner.

Recommendation 34.21: NASA, ESA, JAXA, CNES, ISRO and CNSA to indicate the potential contributions their missions could make towards optimization of the polar-orbit prior to CGMS-35. Deadline: CGMS-35

With regard to the geostationary orbit, the Working Group considered potential back-up scenarios towards a global CGMS contingency plan for geostationary orbit. In order to provide the necessary robustness required for an operational geostationary constellation (in the WMO context with guaranteed continuity of service), CGMS satellite operators agreed to Table WGIII-1 that indicates both the nominal six positions for the space-based component of the GOS in geostationary orbit and additional satellites that would provide back-up - once their baseline configuration had been achieved - in response to a request from a space agency responsible for a nominal position to implement a contingency plan.

The Working Group noted that with the agreement by CGMS satellite operators as indicated in Table 1-III a truly global contingency plan for geostationary orbit had been achieved.

In addition, CGMS satellite operators, in considering the WMO vision for the GOS and WMO requirements, agreed that all future series of geostationary satellites should provide for the ability for hyper-spectral sounding.

The Working Group agreed that the following points were essential to both LEO and GEO:

- Full and timely access and data exchange is absolutely essential. Data exchange should be through the IGDSS for data and products from both operational and R&D missions; and
- There is a need for harmonized data quality through consistent global calibration within GSICS.

In summary, the Working Group agreed that the indications by CGMS satellite operators for both low Earth and geostationary orbits had achieved a significant milestone towards a global contingency plan for the space component of the GOS.

The Working Group also noted that further discussions were required to take into consideration the combined plans for low Earth and geostationary missions in responding to WMO requirements, e.g. the ability for Earth radiation budget observations as noted above. Thus, it agreed that a Workshop should be convened to discuss the matter.

Recommendation 34.22: The WMO Space Programme to host a Workshop to allow CGMS satellite operators (both operational and R&D) to consider how their combined plans for low Earth and geostationary missions could respond to WMO requirements. Deadline: 31 July 2006

Table WGIII-1: CGMS Global Contingency Plan positions
(as of 4 November 2006)

Region	Nominal operator(s)	Nominal locations	
		Nominal	Operationally available
Americas and East Pacific	USA (NOAA)	135° W 75°W	105°W 60°W
Europe and Africa	EUMETSAT	0°	10°E 3.4°W
Indian Ocean Asia and West Pacific	Russian Federation, China and Japan	76°E 105°E 140°E	57°E (EUMETSAT) 86.5°E (China) 128.2°E (Korea) 93°E (India)

In NOAA WP-09, the Working Group noted the latest information related to polar-orbiting equator crossing times for polar-orbiting satellites as contained in Table 7 below.

Table 7: Polar-Orbiting Satellite Equator Crossing Times

(as of 4 November 2006)

Satellite	Service	Start	EOL	Equator Cross-time	Frequency (MHz)	BW MHz	Data rate (Mb/s)
FY-1D	CHRPT	2002	2004	0650	1704.5	6.8	4.2
FY-3A	AHRPT	2007	2010	1000-1020	1704.5	6.8	4.2
FY-3B	AHRPT	2009	2012	1340-1400	1704.5	6.8	4.2
FY-3C	AHRPT	2011	2014	TBD	1704.5	6.8	4.2
FY-3D	AHRPT	2011	2014	TBD	1704.5	6.8	4.2
FY-3E	AHRPT	2014	2017	TBD	1704.5	6.8	4.2
FY-3F	AHRPT	2014	2017	TBD	1704.5	6.8	4.2
FY-3G	AHRPT	2017	2020	TBD	1704.5	6.8	4.2
FY-3H	AHRPT	2017	2020	TBD	1704.5	6.8	4.2
FY-3A	MPT	2007	2010	1010	7775	45	18.7
FY-3B	MPT	2009	2012	1340-1400	7775	45	18.7
FY-3C	MPT	2011	2014	TBD	7775	45	18.7
FY-3D	MPT	2011	2014	TBD	7775	45	18.7
FY-3E	MPT	2014	2017	TBD	7775	45	18.7
FY-3F	MPT	2014	2017	TBD	7775	45	18.7
FY-3G	MPT	2017	2020	TBD	7775	45	18.7
FY-3H	MPT	2017	2020	TBD	7775	45	18.7
FY-3A	DPT	2007	2010	1000-1020	8145	149	93
FY-3B	DPT	2009	2012	1340-1400	8145	149	93
FY-3C	DPT	2011	2014	TBD	8145	149	93
FY-3D	DPT	2011	2014	TBD	8145	149	93
FY-3E	DPT	2014	2017	TBD	8145	149	93
FY-3F	DPT	2014	2017	TBD	8145	149	93
FY-3G	DPT	2017	2020	TBD	8145	149	93
FY-3H	DPT	2017	2020	TBD	8145	149	93
Meteor-M N1	LRPT	2007	2011	1030	137.9 / 137.1	0.15	0.080
Meteor-M N1	HRPT	2007	2011	1030	1700	2	0.665
Meteor-M N1	Raw	2007	2011	1030	8128/8320	32-250	16.4-122.88
Meteor-M N2	LRPT	2008	2012	1030	137.9 / 137.1	0.15	0.080
Meteor-M N2	HRPT	2008	2012	1030	1700	2	0.665
Meteor-M N2	Raw	2008	2012	1030	8128/8320	32-250	16.4-122.88
MetOp-A	LRPT	2006	2011	0930D	137.1/137.9125*	.150	.072
MetOp-1	LRPT	2009	2014	0930D	137.1/137.9125*	.150	.072
MetOp-3	LRPT	2015	2020	0930D	137.1/137.9125*	.150	.072
MetOp-A	HRPT	2006	2011	0930D	1701.3/1707.0*	4.5	3.5
MetOp-1	HRPT	2009	2014	0930D	1701.3/1707.0*	4.5	3.5
MetOp-3	HRPT	2015	2020	0930D	1701.3/1707.0*	4.5	3.5
MetOp-A	GDS	2006	2011	0930D	7800	63	70
MetOp-1	GDS	2009	2014	0930D	7800	63	70
MetOp-3	GDS	2015	2020	0930D	7800	63	70
NPP	HRD	2009	2013	1030D	7812	30	15
NPP	SMD	2009	2013	1030D	8212.5	300	300
NPOESS-1	LRD	2013	2019	1330A	1707	6.0	3.88
NPOESS-2	LRD	2016	2021	0530D	1707	6.0	3.88
NPOESS-3	LRD	2019	2025	1330A	1707	6.0	3.88
NPOESS-4	LRD	2021	2027	0530D	1707	6.0	3.88

Satellite	Service	Start	EOL	Equator Cross-time	Frequency (MHz)	BW MHz	Data rate (Mb/s)
NPOESS-1	HRD	2013	2019	1330A	7834	32	20
NPOESS-2	HRD	2016	2021	0530D	7834	32	20
NPOESS-3	HRD	2019	2025	1330A	7834	32	20
NPOESS-4	HRD	2021	2027	0530D	7834	32	20
NPOESS-1	SMD	2013	2019	1330A	26700	300	150
NPOESS-2	SMD	2016	2021	0530D	26700	300	150
NPOESS-3	SMD	2019	2025	1330A	26700	300	150
NPOESS-4	SMD	2021	2027	0530D	26700	300	150
NOAA-15	APT	1998	2001	0730	137.5 / 137.62	.038	.0017
NOAA-15	BTX	1998	2001	0730	137.35 / 137.77	.046	.00832
NOAA-15	HRPT	1998	2001	0730	1702.5	2.66	.665
NOAA-15	GAC	1998	2001	0730	2247.5	5.32	2.66
NOAA-16	APT	2000	2004	1400	Failed	.038	.017
NOAA-16	BTX	2000	2004	1400	137.35 / 137.77	.046	.00832
NOAA-16	HRPT	2000	2004	1400	1698	2.66	.665
NOAA-16	GAC/LAC	2000	2004	1400	1698 / 1702.5 (1707 Failed)	5.32	2.66
NOAA-17	APT	2002	2006	1000	137.50 / 137.62	.038	.017
NOAA-17	BTX	2002	2006	1000	137.35 / 137.77	.046	.00832
NOAA-17	HRPT	2002	2006	1000	1698	2.66	.665
NOAA-17	GAC/LAC	2002	2006	1000	1698 / 1702.5 / 1707	5.32	2.66
NOAA-18	APT	2005	2009	1400	137.1 / 137.9125	.038	.017
NOAA-18	BTX	2005	2009	1400	137.35 / 137.77	.046	.00832
NOAA-18	HRPT	2005	2009	1400	1698 / 1707	2.66	.665
NOAA-18	GAC/LAC	2005	2009	1400	1698 / 1702.5 / 1707	5.32	2.66
NOAA-N’	APT	2008	2012	1400	137.1 / 137.9125	.038	.017
NOAA-N’	BTX	2008	2012	1400	137.35 / 137.77	.046	.00832
NOAA-N’	HRPT	2008	2012	1400	1698 / 1707	2.66	.665
NOAA-N’	GAC/LAC	2008	2012	1400	1698 / 1702.5 / 1707	5.32	2.66

*EUMETSAT/MetOp: Backup frequency.

WORKING GROUP IV: INTEGRATED STRATEGY FOR DATA DISSEMINATION FROM METEOROLOGICAL SATELLITES

IV/0 Introduction

As agreed at CGMS-33, Dr. Mikael Rattenborg from EUMETSAT was elected Chairman of Working Group IV (WG IV) on Integrated Strategy for Data Dissemination from Meteorological Satellites, with Mr. Gordon Bridge, also from EUMETSAT, appointed as Rapporteur. WG IV comprised representatives of the satellite operators from China, Japan, Russia, USA, Korea, and EUMETSAT together with the representative from WMO (see Annex 4 for the list of participants).

IV/1 Coordination of Data Dissemination

The meeting commenced with a live demonstration of the FengYungCast data dissemination system by CMA. The demonstration included the rebroadcast of MTSAT, FenYung, together with EUMETSAT satellite data which was transferred to a reception station in western China via EUMETCast and, in parallel, via a special ftp data transfer between EUMETSAT and CMA, established specifically for the CGMS demonstration

In CMA-WP-12, CMA recalled that it had described its ShineTek DVB system developed to disseminate the meteorological satellite data received by China Meteorological Satellite Ground System at CGMS-33 (CMA-WP-17 refers). Furthermore. at the WMO December 2005 RARS Workshop, the Chinese delegate suggested that the ShineTek DVB system could be used for regional exchange of meteorological satellite data and products. However, the potential for regional use is limited by the coverage of Ku-band of Sina-1 satellite used by ShineTek DVB for data transmission. Hence, update for the ShineTek DVB system is being conducted. The new system uses the C-band of AisaStar-4 satellite at 122.2˚E to transmit data; the coverage is therefore improved to include the west pacific. The new version of ShineTek DVB system is named as FengyunCast.

WMO expressed its appreciation to CMA for its successful and timely efforts to implement a truly regional broadcast system, and offered its services to CMA should assistance be required to develop a global user interface.

KMA-WP-04 reported on the plan of COMS MI data dissemination for users. For meteorological observation using COMS MI (Communication, Ocean, and Meteorological Satellite, Meteorological Imager), three modes might be performed as followings (for example).

Table WGIV-1: COMS MI Observation Modes

Observation Mode	Observation Area	Observation Interval
Full Disk Mode	Full earth disk	Every 3 hour
Regional Mode	Asia and Pacific in Northern Hemisphere	Every 30 min
	Extended Northern Hemisphere	Every 30 min
	Limited Southern Hemisphere	Every 30 min
Local Mode	1000km x 1000km	Every 10 min (Severe Weather case)

For the full disk mode it will be observed every 3 hour, and for three different regional modes, it will be performed at every 30 minute, respectively. In the case of severe weather, the local observation mode would be performed close to every 10 minute.

For meteorological applications, 16 products (Level 2) such as cloud motion wind, cloud distribution, Asian Dust, fog, etc. are under development by the Korean Meteorological Research Institute/KMA using MI observation data. These data are used for weather forecasters as well as the inputs of NWP.

Data Dissemination Plan

The observation data will be disseminated via an L-band (1695.4-1692.14 MHz) transmitting antenna in HRIT (High Rate Information Transmission) and LRIT (Low Rate Information Transmission) format. In case of LRIT, other additional data including NWP and Level 2 products might be provided to users as well as the image data.

Basically, the HRIT/LRIT data will be distributed to the users within 15 minute from the end of each observation. An example of the dissemination schedule is shown in figure 2 of KMA-WP-04.

Both domestic and foreign users can receive the HRIT/LRIT data using MDUS (Medium-scale Data Utilization Station) and SDUS (Small-scale Data Utilization Station).

KMA also has the plan to disseminate COMS data via internet using a website (to be implemented by KMA by 2009) in real time or non-real time.

WMO–WP-20 introduced the Integrated Global Data Dissemination Service (IGDDS) Implementation Plan that described the technical and programmatic baseline for the IGDDS. The plan recalled the background and agreed scope of IGDDS, listed high-level requirements, existing assets, risk factors, proposed actions and organization to implement this project, in full consistency with ongoing developments of the WMO Information System (WIS). Highlights of this Implementation Plan had been presented to the

CBS/OPAG ISS/Expert Team on WIS and GTS Communication Technique and Structure (ET-CTS) in April 2006 in Tokyo, were reviewed at the IGDDS-RARS workshop on 31 August-1 September 2006 in Geneva and presented at the joint second session of CBS/OPAG IOS/Expert Teams on Satellite Utilization and Products (ET-SUP-2) and on Satellite Systems (ET-SAT-2). The plan was further reviewed in detail by ET-SUP-2 who had endorsed the plan, while expressing useful comments calling upon a more detailed definition of each task, with a precise assignment of responsibilities, and regular reporting to relevant stakeholders. ET-SUP 2 also welcomed the risk analysis and suggested to monitor additional risk areas.

WGIV noted that IGDDS was a project within the WIS with the specific goal to ensure that the access to satellite-based data and products could meet the needs of WMO programmes. The discussion highlighted that IGDDS should guarantee a quality of service and that the quality of products delivered through this service should be traceable. It was clarified that some of the components used by IGDDS would not be dedicated to satellite-based products since they would also support wider applications within the WIS or as part of GEONETCAST, and that it was thus essential to clearly identify the requirements to be fulfilled to allow such shared components to serve the particular needs of IGDDS.

WGIV expressed its support for the IGDDS Implementation Plan. It was noted that an IGDDS Implementation Group would be established, comprised of representatives of operators of IGDDS components and WMO Secretariat, in charge of refining the Plan and monitoring its implementation.

Recommendation 34.23: CGMS operators should support the objectives of the IGDDS implementation plan

WMO expressed its deep appreciation to CGMS Members for the progress made towards the implementation of IGDDS, in particular with EUMETCast by EUMETSAT, with FengYunCast by CMA, and with the development of Internet dissemination by JMA. The discussion also recalled the essential and continuing need for Direct Broadcast within IGDDS, while being aware that this may not be the main mechanism to transmit the full datasets originating from future satellites.

WMO-WP-21 provided an update on the WMO Information System (WIS) that is expected to widely expand the functionalities of the GTS through increased interoperability with other parties, use of various transmission means, combination of routine time-critical dissemination (PUSH) and on-request data discovery and retrieval (PULL), catalogue and metadata management along ISO standards. It was indicated that WIS was being developed two phases through a range of pilot projects conducted by WMO Members throughout the globe. The WIS structure would include 3 levels: Global Information Service Centres (GISC), Data Collection and Product Centres (DCPC) and National Centres (NC).

IV/1.1/IV1.2 Dissemination of Satellite Images and Products

JMA-WP-11 presented a summary of the preparatory studies on data dissemination of the MTSAT follow-on satellites. JMA will continue the HRIT and LRIT direct broadcasting services at least until around 2015 when MTSAT-2 stops operating, and also continue to provide satellite imagery through the Internet to the NMHSs registered to JMA in addition to the direct broadcasting service.

JMA has investigated future data dissemination methods in the course of the feasibility studies for the follow-on satellite. JMA has started to look into the feasibility of using the Internet and commercial communication satellites, since the S-band currently used is insufficient for the direct broadcasting of large amount of data. The Internet is a part of the advanced data dissemination method providing an advanced, cost effective network environment. Future data dissemination methods should be discussed from the viewpoint of availability and cost-effectiveness.

WGIV noted that all satellite operators were committed to continuing the HRIT/LRIT broadcasts and agreed that at CGMSXXXV there should be a more general discussion of the future usage of Direct Broadcast from satellites beyond the 2015.

Action 34.29: CGMS operators to report to CGMS-35 on their future plans for using direct broadcast beyond 2015. Deadline: CGMS-35

NOAA-WP-21 provided the status of the Low Rate Information Transmission (LRIT) on the GOES I-M spacecraft. With effect from 3 October 2005, LRIT broadcast has been operational on both GOES-east and GOES-west spacecraft. NOAA continues to work with users and vendors to resolve anomalies in the LRIT broadcast and assess the quality and reliability of the service. Current planning is focused upon improving data dissemination in the future and providing low cost systems to acquire the NOAA broadcasts. Improvements in the service include additional in-situ observations and more hydro-meteorological information.

Now that NOAA's LRIT is operational on both the GOES-east and GOES-west spacecrafts, immediate plans include continuing the transition from the 128 kbps to 256 kbps broadcast during the GOES-N era.

Other items being considered for future implementation include expanding the product suite, adding higher resolution imagery (e.g. 1km), adding other compression algorithms (e.g. JPEG2000, zip), improving navigation information, and adding a web server for LRIT files. Though these are some of the ideas for future enhancements, by no means is LRIT restricted in this scope. As he LRIT matures and becomes more utilized by the user community, so shall the capabilities offered.

CGMS noted that EUMETSAT had recently implemented an LRIT broadcast service using its new Meteosat-9 satellite (this service is not, however, available from Meteosat-8 due to a failed Solid State Power Amplifier (SSPA).

IV/2 Development of the Integrated Strategy for Data Dissemination from Meteorological Satellites

In NOAA-WP-22, NOAA informed CGMS that its Alternative Dissemination Methods (ADM) System is an on-going development of a communications system for the dissemination of environmental satellite data from NOAA, EUMETSAT, JMA, and research satellites. The current development of the NOAA ADM is based on a two year ADM Study conducted by NESDIS. ADM will function as a supplement to Direct Readout broadcast systems from environmental satellites. The ADM can be accomplished via Digital Video Broadcasting-Satellite (DVB-S), Landline, and/or Internet infrastructures, depending on the connectivity available to the user. NOAA is now in the second year of the development phase of ADM, and has the following prototypes available for demonstration: ADM User Terminal (currently receiving satellite data at 10.23 Mbps), ADM Control Center Software, and ADM Network Management Center (IP Encapsulator, Modulator, …). Further development of prototypes is proceeding. One demonstration of the ADM User Terminal has been given. Two demonstrations of the ADM Control Center Software have been given. The possibility of a satellite demonstration of ADM is being considered. NOAA ADM applications to and support of the GEO-NETCast global disaster relief network are being investigated. A Systems Requirements Document, Statement of Work, and Costing have been completed by the NESDIS ADM Team in order to support NOAA decision making as to how best the NOAA ADM can support GEO-NETCast or other projects.

CGMS noted that this ADM development was still in its concept phase whilst firm requirements were being established. CGMS also recalled that EUMETSAT only had approval to operate a EUMETCast South America service till 2008 unless third party funding was identified or other partners could provide the required service. WMO recalled action 33.24 from CGMS-33 calling upon NOAA, EUMETSAT and WMO to ensure a transition from EUMETCast to a NOAA ADM for users in South America. CGMS noted with appreciation that EUMETSAT had already proposed to NOAA cooperation for providing continuity of an ADM service over South America beyond 2008.

ANNEXES:

DRAFT ORDER OF BUSINESS OF THE 34TH CGMS MEETING
2-7 November 2006

---------- WORKING GROUP SESSIONS ----------

WORKING GROUP I: TELECOMMUNICATIONS

I/1 Coordination of frequency allocations: SFCG, ITU and WRC activities
I/2 Telecommunication techniques
I/3 Coordination of International Data Collection & Distribution
I/3.1 Status and Problems of IDCS
I/3.2 Ships, including ASAP
I/3.3 ASDAR
I/3.4 Dissemination of DCP messages (GTS or other means)
I/4 Future Use of IDCS
I/5 Search and Rescue (S&R)

WORKING GROUP II: SATELLITE PRODUCTS INCLUDING SATELLITE DERIVED WINDS

II/1 Image processing techniques
II/2 Satellite Data Calibration and Validation
II/3 Vertical sounding and ITWG matters
II/4 Precipitation and IPWG matters
II/5 Atmospheric Motion Vectors and IWWG matters
II/6 Other parameters and products
II/6.1 Ocean related parameters
II/6.2 Fire related parameters
II/6.3 Cloud and dust related parameters
II/6.4 Surface Albedo
II/6.5 Other parameters
II/7 Coordination of code forms for satellite Data
II/8 Coordination of data formats for the Archive and Retrieval of Satellite Data
II/9.1 International Workshop on Winds
II/9.2 Wind Statistics
II/9.3 Procedures for the exchange of inter-comparison data
II/9.4 Derivation of Wind Vectors
II/10 Applications of Meteorological Satellite Data for Environment Monitoring
II/11 Conclusion and preparation of WG report

WORKING GROUP III: CONTINGENCY PLANNING

III/1 Revised GOS baseline for geostationary satellites
III/2 CGMS Global Contingency Plan for geostationary orbit
III/3 Revised GOS baseline for polar-orbiting satellites
III/4 CGMS Contingency plan for operational oceanographic satellites
III/5 GCOS Climate Monitoring IGL
III/6 Conclusion and preparation of WG report

WORKING GROUP IV: INTEGRATED STRATEGY FOR DATA DISSEMINATION FROM METEOROLOGICAL SATELLITES

IV/1 Coordination of Data Dissemination
IV/1.1 Dissemination of satellite images
IV/1.2 Dissemination of satellite products
IV/1.3 Global exchange of satellite data
IV/2 Development of the Integrated Strategy for Data Dissemination from Meteorological Satellites
IV/3 Dissemination of Meteorological non-satellite data via satellite

---------- PLENARY SESSION ----------

A. INTRODUCTION

A.1 Welcome
A.2 Election of Chairmen
A.3 New CGMS Members
A.4 Adoption of Agenda
A.5 Nomination of Drafting Committee
A.6 Review of Action Items

B. REPORT ON THE STATUS OF CURRENT SATELLITE SYSTEMS

B.1 Polar Orbiting Meteorological Satellite Systems
B.2 Geostationary Meteorological Satellite Systems
B.3 Research and Development Satellite Systems
B.4 Anomalies from solar and other events

C. REPORT ON FUTURE SATELLITE SYSTEMS

C.1 Future Polar Orbiting Meteorological Satellite Systems
C.2 Future Geostationary Meteorological Satellite Systems
C.3 Future Research and Development Satellite Systems
C.4 Reconfiguration of future combinations of LEO and GEO missions

D. OPERATIONAL CONTINUITY AND RELIABILITY

D.1 Global planning, including orbital positions
D.2 Inter-regional contingency measures
D.3 Long-term global contingency planning

E. SATELLITE REQUIREMENTS OF WMO AND IOC PROGRAMMES

E.1 World Weather Watch
E.2 Other WMO Programmes
E.3 IOC Programmes

F. INTERACTION WITH GEO

F.1 Applications of Meteorological Satellite Data for Environment Monitoring
F.2 Geonetcast/EUMETCast
F.3 CGMS and GEO/GEOSS interactions

G. OTHER ITEMS OF INTEREST

G.1 Training
G.2 Information
G.3 Consolidated report/CGMS web site
G.4 Any other business

H. FINAL SESSION

H.1 Reports from the Working Groups
H.2 Nomination of CGMS Representatives at WMO and other meetings
H.3 Nomination of Chairmen of Working Groups for 35th CGMS
H.4 Amendment of the CGMS charter
H.5 Any Other Business
H.6 Summary List of Actions from 34th CGMS
H.7 Approval of Draft Final Report
H.8 Date and place of next meetings

WORKING PAPERS SUBMITTED TO CGMS-34

CMA

CMA-WP-01	Review of Action Items	A.6
CMA-WP-02	Status of FY-1D Polar Orbiting Satellite	B.1
CMA-WP-03	Status of FY-2C Geo-stationary Satellite	B.2
CMA-WP-04	FY-3 Polar Orbiting Satellite Program	C.1
CMA-WP-05	Plan for Future FY-2 Satellite	C.2
CMA-WP-06	CMA Satellite Frequency Networks	I/1
CMA-WP-07	Improved Visualization Method for Infrared and Water Vapor Channels of FY-2C Satellite	II/1
CMA-WP-08	ATOVS Study in CMA	II/3
CMA-WP-09	Satellite Precipitation Estimation in CMA	II/4
CMA-WP-10	Cloud and Aerosol Study in CMA	II/6.3
CMA-WP-11	Meteorological Satellite Data Archive and Re-processing in NSMC/CMA	II/??
CMA-WP-12	Development of FengyunCast	IV/1

CNSA

CNSA-WP-01	Status and future of Chinese Space borne Earth Observation system	B.3 & C.3
CNSA-WP-02	HY-1 satellite program and its application in China	B.3

ESA

ESA-WP-01	Status of current ESA earth Observation missions	B.3
ESA-WP-02	Status of the future ESA Earth Observation missions	C.3
ESA-WP-03	Oceanographic information provided by ESA EO missions	II/6.1
ESA-WP-04	Aerosol information provided by ESA EO Missions	II/6.3
ESA-WP-05	Access to ERS and Envisat LBR data	II/6
ESA-WP-06	List of ESA actions	A.6

EUMETSAT

EUM-WP-01	Review of Action Items	A.6
EUM-WP-02	Status of the EUMETSAT Polar System (EPS)	B.1
EUM-WP-03	Status of the Meteosat System (incl MSG-2)	B.2 & I/3.1
EUM-WP-04	Plans for Post-EPS	C.1
EUM-WP-05	Plans for Meteosat Third Generation (MTG)	C.2
EUM-WP-06	Status of preparations for MSG-3 and MSG-4	C.2
EUM-WP-07	Availability and usability of archived satellite data for climate studies [A33.05]	E.2
EUM-WP-08	Development/enhancements of aerosol products from MSG Seviri [A33.06]	II/9.1
EUM-WP-09	Report on climate data set from hyperspectral IR instruments [R33.04]	II/6.5

EUM-WP-10	Status of the EUMETSAT Satellite Applications Facilities	F.1
EUM-WP-11	Report on EUMETCast including GEONETCast [A33.24]	F.2
EUM-WP-12	Report on EUMETSAT Training Activities [A33.07]	G.1
EUM-WP-13	EUMETSAT Conferences and Publications	G.2
EUM-WP-14	CGMS Consolidated Report	G.3
EUM-WP-15	Proposal for amendment of the CGMS charter	H.4
EUM-WP-16	Proposal for future meetings	H.8
EUM-WP-17	General frequency management topics	I/1
EUM-WP-18	Assessment of interference from FY-3 satellites to the MetOp CDA Earth Station at Svalbard around 7.8 GHz [A33.12, A33.13]	I/1
EUM-WP-19	Status of EUMETSAT high rate DCP prototyping	I/2
EUM-WP-20	Enhanced cloud products including cloud microphysics [R33.03]	II/6.3
EUM-WP-21	Real time fire monitoring data from EUMETSAT [R33.06]	II/6.2
EUM-WP-22	Temporal and spatial evaluation of surface albedo derived from geostationary satellite observations [R33.07]	II/6.4
EUM-WP-23	Report on IWW8	II/9.1
EUM-WP-24	Satellite tables – EUMETSAT input (permanent actions 1 and 3)	A.6

IMD

IMD-WP-01	Current Operational Satellites of India	B.2
IMD-WP-02	Future plans of INSAT satellites for meteorological applications	C.2
IMD-WP-03	Current status of Cloud Motion Vectors (CMVs) and Water Vapour Winds (WVWs) derived from KALPANA-1 and INSAT-3A satellites	II/5

IOC

IOC-WP-01	Satellite Requirements of IOC programmes	E.3

JAXA

JAXA-WP-01	Status of Advanced Land Observing Satellite (ALOS) - Daichi	B.3
JAXA-WP-02	Status of Greenhouse gases Observing Satellite (GOSAT)	C.3
JAXA-WP-03	Status of Global Change Observation Mission (GCOM)	C.3

JMA

JMA-WP-01	Review of Action Items	A.6
JMA-WP-02	Status of the Multi-functional Transport Satellites	B.2
JMA-WP-03	Plans for the Follow-on Satellite to MTSAT	C.2
JMA-WP-04	JMA's Preparatory Activities for WRC-07	I/1
JMA-WP-05	Status of the IDCS	I/3.1
JMA-WP-06	Tidal/Tsunami Data Collection using Data Collection System of MTSAT (MTSAT-DCS)	I/3.1
JMA-WP-07	Monitoring Web Page of MTSAT-1R Navigation and Calibration	II/2
JMA-WP-08	JMA's Activities for ATOVS Data Exchange	II/3
JMA-WP-09	Status of Aerosol Products at MSC	II/6.3
JMA-WP-10	Atmospheric Motion Vector Product in JMA	II/9.2
JMA-WP-11	Data Dissemination on the Follow-on Satellites to MTSAT	IV/1.1&2

KMA

KMA-WP-01	Review of Action Items	A.6
KMA-WP-02	Update on COMS Program	C.2
KMA-WP-03	Status of COMS Ground System at Meteorological Satellite Center of KMA	C.2 (III/1)
KMA-WP-04	COMS Data Dissemination Plan	IV/1
KMA-WP-05	Frequency Plan for COMS Meteorological Data	I/1
KMA-WP-06	KMA Activities for Asia-Pacific RARS	II/3
KMA-WP-07	Report on NWP Utilization of ATOVS Data at KMA	II/3
KMA-WP-08	Status on COMS Data Processing System (CMDPS)	II/6
KMA-WP-09	Operational Cloud Amount Estimation of KMA with Geostationary Satellite Data	II/6.3

NOAA

NOAA-WP-01	Review CGMS-33 Action Items	A.6
NOAA-WP-02	Polar Orbiting Operational Environmental Satellite (POES)	B.1
NOAA-WP-03	Geostationary Operational Environmental Satellite (GOES)	B.2
NOAA-WP-04	Anomalies from Solar Events	B.4
NOAA-WP-05	Future Polar Orbiting Meteorological Satellite System	C.1
NOAA-WP-06	Report on the status of future Geostationary Meteorological Satellite System	C.2
NOAA-WP-07	Preparation for WRC 2008	I/1
NOAA-WP-08	Technical Input to the Space Frequency Coordination Group and ITU-R	I/1
NOAA-WP-09	NOAA Table of Polar-orbiting Satellite Equator Crossing Times and Frequencies	III.2
NOAA-WP-10	Status of the IDCS	1/3.1
NOAA-WP-11	Report from the Global Satellite-Based Inter-Calibration System (GSICS) Executive Panel	II/2
NOAA-WP-12	Report from the International TOVS Working Group	II/3
NOAA-WP-13	2005/2006 Report on NOAA/NESDIS GOES Soundings	II/3
NOAA-WP-14	2005/2006 Report on NOAA/NESDIS Satellite Derived Winds	II/9.4
NOAA-WP-15	The Second GPS Radio Occultation Data Users Workshop: Summary and Aftermath	II/6
NOAA-WP-16	Report on Community Radiative Transfer Model (CRTM) Developed at US Joint Center for Satellite Data Assimilation (JCSDA)	II/5
NOAA-WP-17	Report on Inter-satellite Calibration at NOAA/NESDIS	II/6
NOAA-WP-18	Report from the Third Workshop on Achieving Satellite Instrument Calibration for Climate Change (ASIC)	II/10
NOAA-WP-19	Requirements for Archived Satellite Data to be Usable for Climate Studies	II/10
NOAA-WP-20	Assessment of Global Cloud Cover and Properties – Summary from the Cloud Climatology Assessment Workshop held 6-7 July 2006 in Madison, Wisconsin	II/6.3
NOAA-WP-21	The Current Status of the GOES LRIT Service	IV/1
NOAA-WP-22	Update on the NOAA Alternative Dissemination Methods (ADM) System	IV/2
NOAA-WP-23	NOAA Support for the CGMS Virtual Laboratory Focus Group (Session II)	G.1

NOAA-WP-24	Updates for the CEOS/WMO Database	II/6.1
NOAA-WP-25	Data Compression	III/2
NOAA-WP-26	Ocean Surface Vectors	II/6.1
NOAA-WP-27	Data Compression	G.2
NOAA-WP-28	NOAA Updates to the CGMS List Servers and Distribution List	A.6
NOAA-WP-29	Consideration for the IOC Satellite Requirements	A.6
NOAA-WP-30	NOAA (STAR/NCDC) Aerosol Remote Sensing Research	II/2
NOAA-WP-31	Current and Planned Development of Enhanced Cloud Products	II/6.3
NOAA-WP-32	Development of a Climate Data Set from Hyperspectral IR Instruments	E.2
NOAA-WP-33	The GSICS Implementation Plan	E.2
NOAA-WP-34	Priorities for Future Satellite Product Developments Related to the Use of Cloudy Radiance in NWP	II/3
NOAA-WP-35	Location of NOAA Websites on Real-time Fire Detection	II/6.2
NOAA-WP-36	Draft Terms of Reference for a New Working Group on Data Handling for Direct Broadcast and Relevant Formats	II/7
NOAA-WP-37	Assimilation of Satellite Cloud and Precipitation Observation in Numerical Weather Prediction Models: Report of an International Workshop	II/7
NOAA-WP-38	Current and Future NOAA Satellite Networks	I/1
NOAA-WP-39	Intercalibration of Geostationary Imagers via High Spectral Resolution AIRS Data	II/2
NOAA-WP-40	Status of LRIT/LRPT Conversion	A.6
NOAA-WP-41	NOAA Table of Satellites	A.6

ROSCOSMOS

ROSC-WP-01	Research and development satellite systems	B.3
ROSC-WP-02	Future polar orbiting meteorological satellite systems	C.1
ROSC-WP-03	Future geostationary meteorological satellite systems	C.2
ROSC-WP-04	Space monitoring of earth high-altitude regions by the Electro-L type satellites in Molniya orbit	C.2

ROSHYDROMET

ROSH-WP-01	Frequency plan of Russian Meteorological Satellites	I/1
ROSH-WP-02	Satellite products and application: ROSHYDROMET activities	II/6

Annex 2

WMO

WMO-WP-01	Review of actions from previous CGMS meetings	A.6
WMO-WP-02	Satellite ground receiving database	G.2
WMO-WP-03	CGMS List Servers and Home Pages	G.2
WMO-WP-04	CGMS Optimization Meetings	III/1 and III/3
WMO-WP-05	WMO Space Programme	E.2
WMO-WP-06	Evolution of the WWW Global Observing System	E.1
WMO-WP-07	Review of satellite related WMO publications and website	G.2
WMO-WP-08	WMO Code Form Changes	II/7
WMO-WP-09	Radio Frequency Matters	I/1
WMO-WP-10	Report of the CGMS/WMO Forum on Data Transmissions from Meteorological Satellites	I/1
WMO-WP-11	Report on SFCG-26	I/1
WMO-WP-12	Co-operation between SFCG and CGMS on radio frequency issues	I/1
WMO-WP-13	Tropical Cyclone Programme Requirements	E.1
WMO-WP-14	ASAP Status report	I/3.2
WMO-WP-15	International Precipitation Working Group	II/4
WMO-WP-16	WMO Consultative Meetings on High-level Policy on Satellite Matters	E.2
WMO-WP-17	Other Programmes, Joint WMO/IOC Technical Commission	E.2
WMO-WP-18	Virtual Laboratory Focus Group	G.1
WMO-WP-19	Nomination of CGMS Representatives at other WMO Meetings	H.2
WMO-WP-20	IGDDS	IV/1
WMO-WP-21	WIS	IV/1
WMO-WP-22	GCOS Climate Monitoring Requirements	E.2
WMO-WP-23	Global Education and Science Network (GESN)	G.1
WMO-WP-24	Cancelled	
WMO-WP-25	Status of the Space-based Component of the GOS	D.1
WMO-WP-26	Disaster Prevention and Mitigation Programme	E.2
WMO-WP-27	Global Space-based Inter-Calibration System (GSICS)	II/2 & E.1
WMO-WP-28	Global RARS Network	E.1
WMO-WP-29	International Geostationary Laboratory (IGeoLab)	C.2
WMO-WP-30	Cooperation on radio-occultation ground segment	D.1
WMO-WP-31	THORPEX, A Global Atmospheric Research Programme	II/4
WMO-WP-32	International Polar Year (IPY)	E.2
WMO-WP-33	Applications of Meteorological Satellite Data for Environment Monitoring	F.1
WMO-WP-34	GEONetcast/EUMETCast	F.2
WMO-WP-35	CGMS and GEO/GEOSS interactions	F.3
WMO-WP-36	Proposal for a Working Group on Codes	II/7
WMO-WP-37	Preliminary response to GCOS requirements for satellite-based products	E.2
WMO-WP38	List of Satellites Contributing to the WMO Space-based Global Observing System	C.4

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APPENDIX: GENERAL CGMS INFORMATION

1. Charter for CGMS
2. CGMS Membership
3. Addresses for Procuring Archive Data
4. Contact List for Operational Engineering Matters
5. Address List for Distribution of CGMS Documents
6. E-mail List Servers
7. Glossary

CHARTER FOR THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES (CGMS)[1]

PREAMBLE

RECALLING that the Coordination on Geostationary Meteorological Satellites (CGMS) has met annually as an informal body since September 1972 when representatives of the United States (National Oceanic and Atmospheric Administration), the European Space Research Organisation (now the European Space Agency), and Japan (Japan Meteorological Agency) met to consider common interests relating to the design, operation and use of these agencies planned meteorological satellites,

RECALLING that the Union of Soviet Socialist Republics (State Committee for Hydrometeorology), India (India Meteorological Department) and the People's Republic of China (State Meteorological Administration) initiated development of geostationary satellites and joined CGMS in 1973, 1978, and 1986 respectively,

RECOGNIZING that the World Meteorological Organisation (WMO) as a representative of the meteorological satellite data user community has participated in CGMS since 1974,

NOTING that the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) has, with effect from January 1987, taken over responsibility from ESA for the METEOSAT satellite system and the current Secretariat of CGMS,

CONSIDERING that CGMS has served as an effective forum through which independent agency plans have been informally harmonised to meet common mission objectives and produce certain compatible data products from geostationary meteorological satellites for users around the world,

RECALLING that the USA, the USSR, and the China have launched polar-orbiting meteorological satellites, that Europe has initiated plans to launch an operational polar-orbiting mission and that the polar and geostationary meteorological satellite systems together form a basic element of the space based portion of the WMO Global Observing System,

BEING AWARE of the concern expressed by the WMO Executive Council Panel of Experts over the lack of guaranteed continuity in the polar-orbit and its recommendation that there should be greater cooperation between operational meteorological satellite operators world-wide, so that a more effective utilisation of these operational systems, through the coordination and standardisation of many services provided, can be assured,

[1] This Charter was amended at CGMS-31 to take into account the new membership of ESA, NASA, JAXA and Roscosmos. It was further amended at CGMS-34 to take into account the new membership of CNES (since CGMS-32), KMA (since CGMS-33), and CNSA.

RECOGNIZING the importance of operational meteorological satellites for monitoring and detection of climate change,

RECOGNIZING the expansion of the space-based component of the WMO's World Weather Watch Global Observing System to include Research & Development missions and the commitment of the National Aeronautics and Space Administration (NASA), European Space Agency (ESA), Russian Aviation and Space Agency (Rosaviakosmos) and the National Space Development Agency of Japan (NASDA) to make observations from its missions available to the world community at the 2nd session of the WMO Consultative Meetings on High Level Policy on Satellite matters in February 2002,

NOTING the expansion of CGMS at CGMS-31 to include NASA, ESA, Rosaviakosmos and the Japan Aerospace Exploration Agency (JAXA) as full members to improve coordination between operational meteorological and R&D satellite operators,

NOTING the further expansion of CGMS at CGMS-32 to include CNES, at CGMS-33 to include KMA, and at CGMS-34 to include CNSA, following to their commitment to make observations from their missions available to the world community in full adherence with the space-based component of the WMO's World Weather Watch Global Observing System,

AND RECOGNIZING the need to update the purpose and objectives of CGMS,

AGREE

I. To change the name of CGMS to the Coordination Group for Meteorological Satellites

II. To adopt a Charter, establishing Terms of Reference for CGMS, as follows:

OBJECTIVES

a) CGMS provides a forum for the exchange of technical information on geostationary and polar-orbiting meteorological satellite systems and research & development missions, such as reporting on current meteorological satellite status and future plans, telecommunications matters, operations, intercalibration of sensors, processing algorithms, products and their validation, data transmission formats and future data transmission standards.

b) CGMS harmonises to the extent possible meteorological satellite mission parameters such as orbits, sensors, and data formats and downlink frequencies.

c) CGMS encourages complementarity, compatibility and possible mutual back-up in the event of system failure through cooperative mission planning, compatible meteorological data products and services and the coordination of space and data related activities, thus complementing the work of other international satellite coordinating mechanisms.

MEMBERSHIP

d) CGMS Membership is open to all operators of meteorological satellites, to prospective operators having a clear commitment to develop and operate such satellites, and to the WMO, because of its unique role as representative of the world meteorological data user community. Further CGMS Membership is open to space agencies operating R&D satellite systems that have the potential to contribute to WMO and supported programmes.

e) The status of observer will be open to representatives of international organisations or groups who have declared an intent, supported by detailed system definition studies, to establish a meteorological satellite observing system. Once formal approval of the system is declared, membership of CGMS can be requested by the observer.

   Within two years of becoming an observer, observers will report on progress being made towards the feasibility of securing national approval of a system. At that time CGMS Members may review the continued participation by each Observer.

f) The current Membership of CGMS is listed in an annex to this charter.

g) The addition of new Members and Observers will be by consensus of existing CGMS Members.

ORGANISATION

h) CGMS will meet in plenary session annually. Ad hoc Working Groups to consider specific issues in detail might be convened at the request of any Member provided that written notification is received and approved by the Membership at least 1 month in advance and all Members agree. Such Working Groups will report to the next meeting of CGMS.

i) One Member, on a voluntary basis, will serve as the Secretariat of CGMS.

j) Provisional meeting venues, dates and draft agenda for plenary meetings will be distributed by the Secretariat 6 months in advance of the meeting, for approval by the Members. An agreed Agenda will be circulated to each Member 3 months in advance of the meeting.

k) Plenary Meetings of CGMS will be chaired by each of the Members in turn, the Chairman being proposed by the host country or organisation.

l) The Host of any CGMS meeting, assisted by the Secretariat, will be responsible for logistical support required by the meeting. Minutes will be prepared by the Secretariat, which will also serve as the repository of CGMS records. The Secretariat will also track action items adopted at meetings and provide CGMS Members with a status report on these and any other outstanding actions, four months prior to a meeting and again at the meeting itself.

PROCEDURE

m) The approval of recommendations, findings, plans, reports, minutes of meetings, the establishment of Working Groups will require the consensus of Members. Observers may participate fully in CGMS discussions and have their views included in reports, minutes etc., however, the approval of an observer will not be required to establish consensus.

n) Recommendations, findings, plans and reports will be non-binding on Members or Observers.

o) Once consensus has been reached amongst Members on recommendations, findings, plans and reports, minutes of meetings or other such information from CGMS, or its Working Groups, this information may be made publicly available.

p) Areas of cooperation identified by CGMS will be the subject of agreement between the relevant Members.

COORDINATION

q) The work of CGMS will be coordinated, as appropriate, with the World Meteorological Organisation and its relevant bodies, and with other international satellite coordination mechanisms, in particular the Committee on Earth Observation Satellites (CEOS) and the Earth Observation International Coordination Working Group (EO-ICWG) and the Space Frequency Coordination Group (SFCG).

Organisations wishing to receive information or advice from the CGMS should contact the Secretariat; which will pass the request on to all Members and coordinate an appropriate response, including documentation or representation by the relevant CGMS Members.

AMENDMENT

r) These Terms of Reference may be amended or modified by consensus of the Members. Proposals for amendments should be in the hands of the Members at least one month prior to a plenary meeting of CGMS.

EFFECTIVE DATE AND DURATION

s) These Terms of Reference will become effective upon adoption by consensus of all CGMS Members and will remain in effect unless or until terminated by the consensus of CGMS Members.

MEMBERSHIP OF CGMS

The current Membership of CGMS is:

CMA	joined 1989
CNES	joined in 2004
CNSA	joined in 2006
ESA	re-joined in 2003
EUMETSAT	joined 1987, currently CGMS Secretariat
IMD	joined 1979
IOC/UNESCO	joined in 2001
JAXA	joined in 2003
JMA	founder member, 1972
KMA	joined in 2005
NASA	joined in 2003
NOAA	founder member, 1972
ROSCOSMOS (formerly Rosaviakosmos)	joined in 2003
ROSHYDROMET	joined 1973
WMO	joined 1973

In some cases delegates are supported by other Agencies, for example SRC Planeta (with Roshydromet), and ISRO (with IMD).

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GLOSSARY

AAPP	AVHRR and ATOVS Processing Package
AATSR	Advanced Along Track Scanning Radiometer
ABI	Advanced Baseline Imager (GOES-R)
ABS	Advanced Baseline Sounder (GOES-R)
ACARS	Automated Communications Addressing and Reporting System
ACC	ASAP Coordinating Committee
ACRIMSAT	Active Cavity Radiometer Irradiance Monitor Satellite (NASA)
ADC	Atlantic Data Coverage
ADEOS-II	Advanced Earth Observing Satellite-II (JAXA)
ADM	Atmospheric Dynamics Mission (ESA)
ADM	Alternative Dissemination Methods
ADM	Advance Dissemination Means (WMO)
AERONET	Remote-sensing aerosol monitoring network programme
AIRS	Advanced IR Sounder
AHRPT	Advanced High Rate Picture Transmission
ALOS	Advanced Land Observing Satellite (JAXA)
AMDAR	Aircraft Meteorological Data Relay
AMR	Altimetry Microwave Radiometer
AMS	American Meteorological Society
AMSR	Advanced Microwave Scanning Radiometer
AMSR-E	Advanced Microwave Scanning Radiometer (modified version on ADEOS-II)
AMSU	Advanced Microwave Sounding Unit
AMV	Atmospheric Motion Vectors
AOCE	Attitude and Orbit Control Electronics
AOPC	Atmospheric Observation Panel for Climate (GCOS)
APSATS	Asian-Pacific Satellite Training
APT	Asia-Pacific Telecommunity (WRC)
APT	Automatic Picture Transmission
Aqua	Earth's water cycle observing mission (NASA)
Aquarius	global sea surface salinity measuring mission (NASA)
ARGOS	Data Collection and Location System
ARINA	scientific payload on Resurs-DK1 for earth quake prediction
ASAP	Automated Shipboard Aerological Programme
ASCAT	C-band dual swath scatterometer (MetOp)
ASCII	American Standard Code for Information Interchange
ASDAR	Aircraft to Satellite Data Relay
ASICs	Application Specific Integrated Circuits
ATMS	Advanced Technology Microwave Sounder
ATOVS	Advanced TOVS
ATSR	Along Track Scan Radiometer (ERS, ESA)
Aura	Mission measuring atmospheric chemistry and trace gases (NASA)
AVHRR	Advanced Very High Resolution Radiometer
AVNIR	Advanced Visible and Near Infrared Radiometer type 2 (ALOS, JAXA)

Baumanets	R&D space technology satellite primarily for students (Roscosmos)
BBC	Black Body Calibration (Meteosat)
BCCP	Business Continuity and Contingency Plan (USA)
GMD	Basic Meteorological Data
BMTC	Australia Bureau of Meteorology Training Centre
BTD	Brightness Temperature Differences
BUFR	Binary Universal Form for data Representation
BSS	Broadcasting Satellite Service
CAL	Computer Aided Learning
CALIPSO	Cloud-Aerosol Lidar and Infrared Pathfinder Satellite (NASA/CNES)
CART	Cloud and Radiation Test-bed
CAS	Commission for Atmospheric Sciences (WMO)
CboM	Commonwealth Bureau of Meteorology Australia
CBS	Commission for Basic Systems
CCD	Charged Couple Device (INSAT-2E)
CCIR	Consultative Committee on International Radio
CCRI	Climate Change Research Initiative
CCSDS	Consultative Committee on Space Data Systems
CD	Compact Disc
CDMA	Code Division Multiple Access
CDS	Climate Data Set (EUMETSAT)
CEOS	Committee on Earth Observation Satellites
CEPT	Conference Européenne des Postes et Télécommunications/European Conference of Postal and Telecommunications Administrations
Cg	WMO Congress
CGMS	Coordination Group for Meteorological Satellites
CHAMP	German EO Satellite
CHRIS	Compact High Resolution Imaging Spectrometer (PROBA, ESA)
CHRPT	Chinese HRPT (FY-1C and D)
CI	Convective Initiation (NOAA)
CIIS	Common Instrument Interface Studies
CIMS	GOES Channel Interference Monitoring System
CIMSS	Cooperative Institute of Meteorological Satellite Studies, Univ. Wisconsin
CIS	Commonwealth of Independent States
CITEL	Inter-American Telecommunication Commission
CLARE	Cloud Lidar And Radar Experiment
CLASS	Comprehensive Large-Array Stewardship System (NOAA)
CloudSat	Global cloud property measuring satellite (NASA/CSA)
CLS	Collecte Localisation Satellites (Toulouse)
CM	WMO Consultative Meetings on High-Level Policy on Satellite Matters
CMA	China Meteorological Administration
CMD	Cyclone Warning Dissemination Service
CME	Coronal Mass Ejections
CMIS	Conical Scanning Microwave Imager/Sounder

CM-SAF	Satellite Application Facility on Climate Monitoring (EUMETSAT)
CMP	Climate Monitoring Principles (GCOS)
CMS	Centre de Météorologie Spatiale (Lannion)
CMV	Cloud Motion Vector
CMW	Cloud Motion Wind
CNR	Consiglio Nazionale delle Ricerche (Italy)
CNSA	China National Space Administration
COEs	Centres of Excellence (WMO)
COMS	Communication, Ocean and Meteorological Satellite (KMA)
CONAE	Comisión Nacional de Actividades Espaciales (Argentina)
COOP	Coastal Oceans Observations Panel (GOOS)
COP	Conference of the Parties (GCOS)
COSPAR	Committee on Space Research
COSPAS/ SARSAT	International satellite system for search and rescue (SAR)
CPM	Conference Preparatory Meeting (WRC)
CR	CGMS Consolidated Report
CrIS	Cross track Infrared Sounder
CRYOSAT	Polar Ice Monitoring Programme (ESA)
DAPS	DCS Automated Processing System (USA)
DCP	Data Collection Platform
DCPC	Data Collection and Processing Centres
DCRS	Collaboration on Global Frequency Allocation harmonization
DCS	Data Collection System
DCWDS	Digital Cyclone Warning Dissemination System (India)
DIF	Directory Interchange Format
DMSP	Defense Meteorological Satellite Program (USA)
DOD	Department of Defense (USA)
DOMSAT	Domestic telecommunications relay Satellite (USA)
DPI	Derived Product Images (USA)
DPM	WMO Natural Disaster Prevention and Mitigation Programme
DPT	Delayed Picture Transmission
DR	Direct Readout services (ADM)
DRS	DCP Retransmission System (Meteosat)
DRT	Data Relay Transponder (INSAT)
DSB	Direct Soundings Broadcast
DSCOVR	Deep Space Climate Observatory (NASA)
DUS	Data Utilisation Station (USA) (Japan)
DVB	Direct Video Broadcast
DWS	Disaster Warning System (India)
EARS	EUMETSAT ATOVS Retransmission Service
EarthCARE	Cloud & aerosol mission (ESA)
EBB	Electronic Bulletin Board
EC	Executive Council (WMO)
ECP	European Common Proposal (CEPT)
ECT	Equator crossing time
ECV	Essential Climate Variables

ECMWF	European Centre for Medium-Range Weather Forecasts
EDR	Environmental Data Records (NPOESS)
EDU	Engineering Development Unit
EEIS	EUMETSAT External Information System
EESS	Earth Exploration Satellite Service (Frequency Management)
EIRP	Effective isotropically-radiated power
ELEKTRO	Geostationary meteorological satellite
EMWIN	Emergency Manager Weather Information Network (NOAA)
ENVISAT	ESA polar satellite for environment monitoring
EO	Earth Observation
EOS	Earth Observation System
EPA	US Environmental Protection Agency
EPS	EUMETSAT Polar System
ERBE	Earth Radiation Budget Experiment
ERBS	Earth Radiation Budget Satellite (NASA)
ERS	ESA Remote Sensing Satellite
ESA	European Space Agency
ESCAP	Economic and Social Commission for Asia and the Pacific, UN
ESJWG	Earth Sciences Joint Working Group
ESOC	European Space Operations Centre (ESA)
ET-ODRRGOS	Expert Team on Observational Data Requirements and Redesign of the GOS
ET-EGOS	Expert Team on Evolution of the Global Observing System (WMO)
ET-SAT	OPAG IOS Expert Team on Satellite Systems (WMO)
ET-SUP	OPAG IOS Expert Team on Satellite Utilisation and Products (WMO)
EU	European Union
EUCOS	EUMETNET Composite Observing System
EUMETCast	EUMETSAT Satellite Data Dissemination System
EUMETNET	The Network of European Meteorological Services
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAA	Federal Aviation Authority (USA)
FAO	Food and Agriculture Organisation (UN)
FENGYUNCast	FENGYUN Satellite Data Dissemination System
FOV	Field of View (NOAA)
FTP	File Transfer Protocol
FWIS	Future WMO Information Systems (CBS Inter-Programme Task Team)
FXTS	Facsimile Transmission System (USA)
FY-1	Polar-orbiting Meteorological Satellite (PRC)
FY-2	Future Geostationary Meteorological Satellite (PRC)
FY-3	Second generation of Polar-orbiting Meteorological Satellite (PRC)
GAW	Global Atmosphere Watch (WMO Atmospheric Research Environment Programme)
GCOM	Global Change Observation Mission (NASDA)
GCOS	Global Climate Observing System

GDPT	Chinese Delayed Picture Transmission Format (Global Data) (FY-1C)
GDS	Ground Data System
GEO	inter-governmental Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GERB	Geostationary Earth Radiation Budget (MSG, EUMETSAT)
GESN	Global Education and Science Network
GEWEX	GEWEX Radiation Panel (NOAA)
GIFTS	Geosynchronous Imaging Fourier Transform Spectrometer (GOES-R)
GIMTACS	GOES I-M Telemetry and Command System
GLI	Generation Global Imager (GCOM)
GLM	Geostationary Lightning Mapper (GOES, NOAA)
GLOBUS	multichannel scanning radiometer (Meteor-3M N2)
Glory	CCRI global distribution of natural and anthropogenic aerosols mission (NASA)
GMES	Global Monitoring for Environment and Security (EU)
GMR	GOES-Meteosat Relay
GMS	Geostationary Meteorological Satellite (Japan)
GNSS	Global Navigation Satellite System
GOCE	Gravity Field and Steady State Ocean Circulation Explorer (ESA)
GOES	Geostationary Operational Environmental Satellite (USA)
GOME	Global Ozone Monitoring Experiment (MetOp, ERS)
GOMS	Geostationary Operational Meteorological Satellite (Russ. Fed.)
GOMAS	Geostationary Observatory for Microwave Atmospheric Sounding (WMO)
GOOS	Global Ocean Observing System
GOS	Global Observing System
GOSAT	Greenhouse Gases Observing Satellite (JAXA/Jap. Min. of Environment)
GSLMP	Global Sea Level Monitoring Programme
GPCP	Global Precipitation Climatology Project
GPM	Global Precipitation Measurement (JAXA/NASA)
GPS	Global Positioning System
GRA	GOOS Regional Alliances
GRACE	Gravity Recovery and Climate Experiment (NASA/DLR)
GRAS	GNSS Receiver for Atmospheric Sounding
GRIB	Numerical weather prediction data in gridpoint form, expressed in binary
GSICS	Global Satellite Intercalibration System
GTS	Global Telecommunication System
GVAR	GOES Variable (data format) (USA)
HAPS	High Altitude Platform System
HDF	Hierarchical Data Format
HDFS	High Density Fixed Service
HDFSS	High Density Fixed Satellite Systems
HDR	High Data Rate
HEO	Highly Elliptical Orbit

HES	Hyperspectral Environmental Suite (GOES, NOAA)
HiRID	High Resolution Imager Data
HIRS	High Resolution Infrared Sounder
HR	High Resolution
HRD	High Rate Data (NPOESS, USA)
HRDCP	High Rate DCP
HRPT	High Rate Picture Transmission
HSRS	High Spectral Resolution Sounder (MSG)
HWR	Hydrology and Water Resource Programme (WMO)
HYDROS	Hydrosphere State Mission (NASA)
ICESat	Ice Cloud and Land Elevation Satellite (NASA)
ICI	Inversion Coupled Imager (India)
ICSC	CAS International Core Steering Committee (ICSC) (THORPEX)
ICWG	International Coordination Working Group (EO)
IDCP	International DCP
IDCS	International Data Collection System
IDDI	Infra-red Difference Dust Index
IDN	International Directory Network (CEOS)
IDPS	Interface Data Processing Segment (NPOESS)
IFRB	International Frequency Registration Board
IGACO	Integrated Global Atmospheric Chemistry Observations (IGOS)
IGDDS	Integrated Global Data Dissemination Service
IGEOLab	International Geostationary Laboratory concept
IGL	International Geostationary Laboratory
IJPS	Initial Joint Polar-orbiting Operational Satellite System
IKFS-2	advanced IR atmospheric sounder
IMT-2000	International Mobile Telecommunication 2000 (before FPLMTS)
INSAT	Indian geostationary satellite
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IODC	Indian Ocean Data Collection
IOP	Initial Operations Phase (SAF, EUMETSAT)
IOTWS	Indian Ocean Tsunami Warning Service
IPO	Integrated Program Office (NOAA)
IPOMS	International Polar-orbiting Meteorological Satellite Group
IPWG	International Precipitation Working Group
IPY	International Polar Year (TIGGE/THORPEX)
IQGSE	Image Quality Ground Support Equipment (EUMETSAT)
IR	Infrared
IRAS	Infrared Atmospheric Sounder (FY-3, CMA)
IRTS	Infrared Temperature Sounder (EPS)
IRW	Infrared Window
ISS	Information Systems and Services
ISCCP	International Satellite Cloud Climatology Project
ISADP	Integrated System for the ATOVS Data Processing
ISWMR	SAF Integrated Satellite Wind Monitoring Report (EUMETSAT)
ISY	International Space Year
ITSC	International TOVS Study Conference
ITT	Invitation to Tender

ITU	International Telecommunication Union
ITWG	International TOVS Working Group
IVOS	Infrared and Visible Optical System Calibration (CEOS WGCV)
IWW	International Winds Workshop
IWWG	International Winds Workshop Group
JASON	Ocean surface Topography follow-on mission to TOPEX/POSEIDON (CNES/NASA)
JAXA	Japan Aeronautic Exploration Agency (name change of NASDA)
JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
JCSDA	Joint Centre for Satellite Data Assimilation
JMA	Japan Meteorological Agency
JRA-25	“Japanese Re-Analysis 25 years" JMA research project of long-range re-analysis of global atmosphere
JSC	Joint Scientific Committee (WCRP)
KARI	Korea Aerospace Research Institute
KLIMAT	scanning Infrared radiometer on Meteor-3M N1 (Russia)
KMA	Korea Meteorological Administration
KNMI	the Royal Dutch Meteorological Institute
KOMPAS	Microsatellite, earthquake investigations (Roscosmos)
LAN	Local Area Networks (Telecommunication)
Landsat	NASA Earth observing Satellite
LBR	Low Bit Rate
LCL	Latch Current Limiter
LDCM	Landsat Data Continuity Mission (NASA/US Geological Survey)
LDPT	Chinese Delayed Picture Transmission Format (Local Data Coverage) FY-1C
LEOP	Launch and Early Operations Phase
LR	Low Resolution
LRD	Low Rate Data (NPOESS, USA)
LRIT	Low Rate Information Transmission
LRPT	Low Rate Picture Transmission
LSPIM	Land Surface Processes and Interactions Mission (ESA)
LST	Local Solar Time
MAP	Mesoscale Alpine Experiment
MAP-SST	Merged Atlantic Product - Sea Surface Temperature (SAF, EUMETSAT)
MARF	Meteorological Archive and Retrieval Facility (EUMETSAT)
MBWG	MSG Biosphere Working Group
MCP	Meteorological Communications Package
MCUT	Multi-Constellation User Terminal (NOAA)
MDD	Meteorological Data Distribution (Meteosat)
MDUS	Medium-scale Data Utilization Station (for GMS S-VISSR)
MEGHA-TROPIQUE	CNES/ISRO mission

MERIS	Medium Resolution Imaging Spectrometer (ENVISAT)
MERSI	Medium Resolution Spectral Imager (FY-3, CMA)
MetAids	Meteorological Aids Service (frequency regulation)
MetOp	Future European meteorological polar-orbiting satellite
METEOR	Polar-orbiting meteorological satellite (Roshydromet)
Meteosat	Geostationary meteorological satellite (EUMETSAT)
METSAT	Indian geostationary meteorological satellite
MetSat	meteorological satellite systems (frequency regulation)
MHS	Microwave Humidity Sounder (EPS)
MIEC	Meteorological Information Extraction Centre (ESOC)
MIMR	Multi-frequency Imaging Microwave radiometer
MIVZA	microwave scanning radiometer (Meteor 3M N1)
MOCC	Meteosat Operational Control Centre (ESOC)
MODIS	Moderate Resolution Imaging Spectroradiometer (NOAA)
MOP	Meteosat Operational Programme
MONITOR-E	Land Observing Satellite (Roscosmos)
MPEF	Meteorological Products Extraction Facility (EUMETSAT)
MSC	Meteorological Satellite Centre (Japan)
MSC-CAL	Computer Aided Learning system by MSC/JMA
MSG	Meteosat Second Generation
MSM	Meso-Scale Model
MSMR	Multichannel Scanning Microwave Radiometer (OCEANSAT-1)
MSS	Mobile Satellite Services (frequency regulation)
MSU	Microwave Sounding Unit
MTG	Meteosat Third Generation
MTP	Meteosat Transition Programme
MTS	Microwave Temperature Sounder (EPS)
MTSAT	Multi-functional Transport Satellite (Japan)
MTVZA	microwave scanning radiometer (Meteor 3M N1)
MVIS	Multi-channel VIS and IR Radiometer (FY-1C and D of PRC)
MWHS	Microwave Humidity Sounder
MWR	Microwave Radiometer (ERS, ESA)
MWRI	Microwave Radiation Imager (FY-3, CMA)
MWRS	Microwave Radiometers
MWTS	Microwave Temperature Sounder (FY-3, CMA)
NASA	National Aeronautics and Space Agency
NASDA	National Space Development Agency of Japan (changed to JAXA in 2003)
NEDT	Noise Equivalent Delta Temperature
NESDIS	National Environmental Satellite Data and Information Service
NGDC	National Geophysical Data Centre (USA)
NGSO	Non-geostationary systems
NIST	US National Institute of Standards and Technology
NMC	National Meteorological Centre
NMHS	National Meteorological & Hydrological Service
NMP EO-1	New Millennium Program Earth Observing Mission (NASA)
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service (USA)

NPOESS	National Polar-orbiting Operational Environmental Satellite System (USA)
NPP	NPOESS Preparatory Project
NSMC	National Satellite Meteorological Center of CMA (PRC)
NTIA	National Telecommunications and Information Agency (USA)
NWP	Numerical Weather Prediction
NWS	National Weather Service (USA)
OCAP	Operational Consortium of ASDAR Participants
OCEANSAT	Indian satellite for ocean applications
OCO	Orbiting Carbon Observatory (NASA)
OLR	Outgoing Longwave Radiation
OOPC	Oceans Observations Panel for Climate (GOOS)
OPAG-IOS	Open Programme Area Group in Integrated Observing Systems (successor of CBS WG on Satellites)
OSE	Operational System Experiments (ET-ODRRGOS)
OSSE	Observing System Simulation Experiments (ET-ODRRGOS)
OSTM	Ocean Surface Topography Mission (Jason-2) (CNES/NASA/ NOAA/EUMETSAT)
OWSE-AF	Operational WWW Systems Evaluation for Africa
PALSAR	Phased Array type L-band Synthetic Aperture Radar ((ALOS, JAXA)
PAMELA	AntiMatter Exploration and Light-nuclei Astrophysics
PATMOS	AVHRR Pathfinder Atmosphere (NOAA)
PC	Personal Computer
PMW	Passive Microwave
POEM	Polar-orbiting Earth Observation Mission (ESA)
POES	Polar-orbiting Operational Environmental Satellite (USA)
PR	Precipitation Radar (on TRMM, JAXA)
PRC	People's Republic of China
PRISM	Panchromatic Remote-sensing Instrument for Stereo Mapping (ALOS, JAXA)
PROBA	Project for On-Board Autonomy (ESA EO satellite)
PTT	Post Telegraph and Telecommunications authority
PTWC	Pacific Tsunami Warning Centre
QI	Quality Indices (EUMETSAT)
QuikSCAT	Quik Scatterometer (NASA)
RA	Regional Association of WMO
RARS	Regional ATOVS Re-transmission System (WMO)
RAMSDIS	Menu-driven system for analysing digital satellite imagery (McIDAS, USA)
RAOBS	Radiosonde Observations
RASA	Russian Aviation and Space Agency
RDCP	Regional DCP (Japan)
RDR	Raw Data Records (NPOESS)
Resurs-DK	Russian land observing satellite (Roscosmos)

RFI	Radio Frequency Interference
RLAN	new wireless LANs
RMS	Root Mean Square
RMTC	Regional Meteorological Training Centre (WMO)
Roscosmos	[Russian] Federal Space Agency
Roshydromet	Russian Federal Service for Hydrometeorology and Environmental Monitoring
RSB	Reflective Solar Bands (MODIS NOAA)
RSMC	Regional Specialised Meteorological Centre
RSO	Rapid Scan Operations (NOAA)
RSS	Rapid Scan Service (EUMETSAT)
RT	Radiative Transfer
S&R	Search and Rescue mission
SAF	Satellite Application Facility (EUMETSAT)
SAFISY	Space Agency Forum on the ISY
SAGE III	Stratospheric Aerosol and Gas Experiment (NASA)
SAM	Satellite Anomaly Manager
SAR	Synthetic Aperture Radar (ERS ESA)
SARA	Short Range Automotive Radar (frequency management)
SARSAT	Search And Rescue, Satellite supported facility
SAST	Shanghai Academy of Space Technologies.
SATAID	Satellite Animation and Interactive Diagnosis (Japan)
SATOB	WMO code for Satellite Observation
SBA	Societal Benefit Area
SBSTA	UNFCCC Subsidiary Body for Scientific and Technology Advice
SBUS	Solar Backscatter Ultraviolet Sounder (FY-3, CMA)
SBUV	Solar Backscattered Ultra Violet (ozone)
SD	Solar Diffuser (MODIS)
SDR	Sensor Data Records (NPOESS)
SEAS	Shipboard Environmental (data) Acquisition System
SEC	Space Environment Center (NOAA)
SEISS	Space Environmental In-Situ Suite (GOES, NOAA)
SEM	Space Environment Monitor (GOES)
SEVIRI	Spinning Enhanced Visible and Infrared Imager (MSG)
S-FAX	S-band facsimile broadcast of FY-2 (PRC)
SFCG	Space Frequency Coordination Group
SGLI	Second Generation Global Imager (CGOM-B1)
SG-RFC	Steering Group on Radio Frequency Coordination
SICH-1M	Russian oceanographic satellite (Roscosmos)
SIS	Solar Imaging Suite (GOES, NOAA)
SMA	State Meteorological Administration (PRC)
SMD	Stored Mission Data (NPOESS)
SMOS	Soil Moisture and Ocean Salinity (ESA)
SORCE	Solar Radiation and Climate Experiment (NASA)
SOT	Ship Observation Team (JCOMM)
SP	Space Programme (WMO)
SRR	Automotive Short-Range Radars (frequency management)
SRF	Spectral Response Function

SRS	Space Research Service (frequency regulation)
SRSO	Super-Rapid-Scan Operations
SRTM	Shuttle Radar Topography Mission (NASA)
SSM/I	Special Sensor Microwave/Imager (NOAA)
SSMI/S	Special Sensor Microwave Imager/Sounder (NOAA)
SSMR	Scanning Multispectral Microwave Radiometer
SSMT1	microwave temperature sounder (NOAA)
SSMT2	microwave water vapour sounder (NOAA)
SSP	Sub-Satellite Point
SST	Sea Surface Temperature
SSU	Stratospheric Sounding Unit
STC	Semi-Transparent Correction (NOAA)
S-VISSR	Stretched VISSR
SWARM	Earth Observation mission (ESA)
SXI	Solar X-Ray Imager (GOES-12)
TERRA	Earth climate measuring satellite (NASA)
TD	Technical Document (WMO)
THORPEX	International global atmospheric r & d programme (WMO CAS)
TIGGE	THORPEX Interactive Grand Global Ensemble
TIROS	Television Infrared Observation Satellite
TMI	TRMM Microwave Imager
TOMS	Total Ozone Mapping Spectrometer (NASA)
TOR	Terms of Reference
TOU	Total Ozone Unit (FY-3, CMA)
TOVS	TIROS Operational Vertical Sounder
TPW	Total Precipitable Water (NOAA)
TRMM	Tropical Rainfall Measuring Mission (NASA, JAXA)
TTC	Telemetry Tracking Control
UARS	Upper Atmosphere Research Satellite (NASA)
U-MARF	United Meteorological Archive Retrieval Facility (EUMETSAT)
UHF	Ultra High Frequency
UK	United Kingdom
UMTS	Universal Mobile Telecom System
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNISPACE	United Nations Space Conference
UN-OOSA	UN Office of Outer Space Affairs
USA	United States of America
UPS	Unified Propulsion Subsystem
UTC	Universal Time Coordinated
UWB	Ultra Wide Band
VAS	VISSR Atmospheric Sounder
VGT	Vegetation
VHF	Very High Frequency
VHRR	Very High Resolution Radiometer
VIIRS	Visible Infrared Imaging Radiometer Suite

VIRSR	Visible and Infrared Scanning Radiometer (EPS)
VIS	Visible channel
VISITView	VL tool
VISSR	Visible and Infrared Spin Scan Radiometer
VL	Virtual Laboratory (training concept)
VL-FG	VL Focus Group Meeting
VLSI	Very Large Scale Integrated circuit
VPN-PP	WIS Virtual Private Network Pilot Project
VTX	VHF transmitter (NOAA)
WALEX	WAter vapour Lidar EXperiment
WARC	World Administrative Radio Conference
WCRP	World Climate Research Programme
WCS	WMO Core Standards
WEFAX	Weather facsimile
WG	Working Group
WGNE	Working Group on Numerical Experimentation
WHyCOS	World Hydrological Cycle Observing System (HWR, WMO)
WIS	WMO Information System
WMO	World Meteorological Organization
WP	Working Paper
WRC	World Radio Conference
WV	Water Vapour
WVMW	Water Vapour Motion Winds
WWW	World Weather Watch
X-ADC	Extended Atlantic Data Coverage
Y2K	Year 2000 compatibility
ZAP	Z-axis Precession Mode (GOES)
ZAMG	Zentralanstalt für Meteorologie und Geodynamik (Austrian NMHS)