ANNUAL SUMMARY
OF
GLOBAL TROPICAL CYCLONE SEASON

2000

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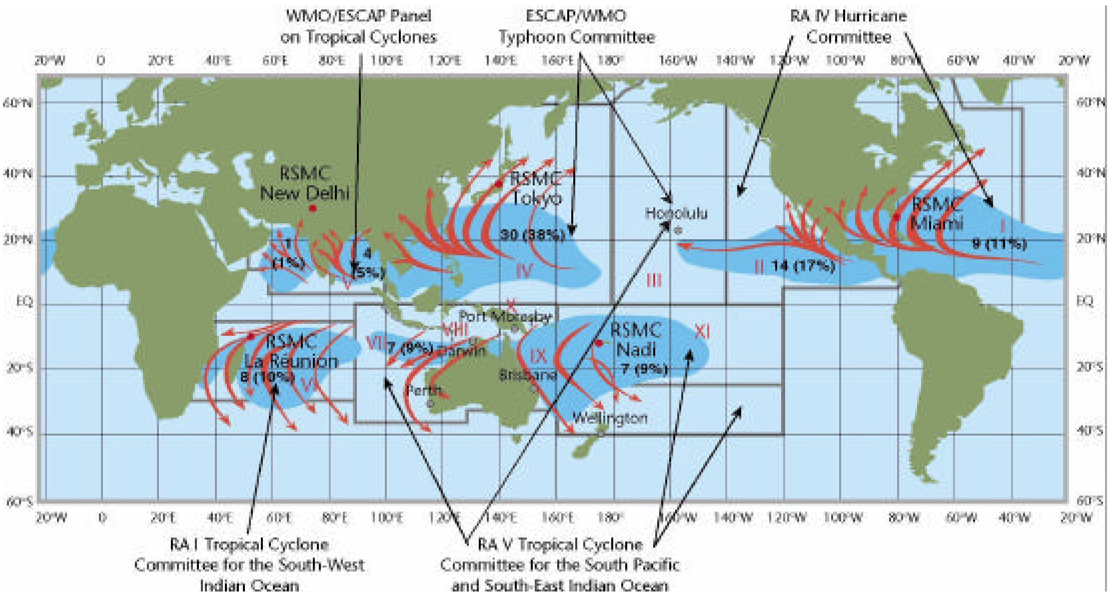


SECRETARIAT OF THE WORLD METEOROLOGICAL ORGANIZATION - GENEVA - SWITZERLAND

2000 Edition

CONTENTS

INTRODUCTION

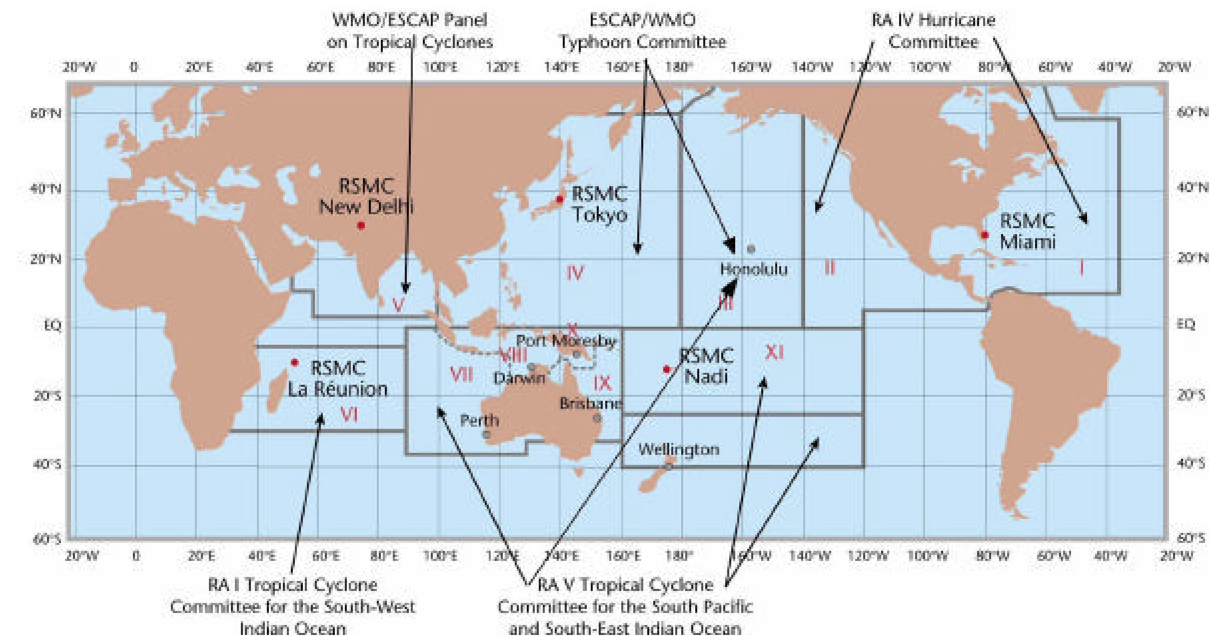
About 80 tropical cyclones form annually over warm tropical oceans. When they develop and attain an intensity with surface wind speed exceeding 118 km/h, they are called hurricanes in the western hemisphere, typhoons in the western North Pacific region and severe tropical cyclones, tropical cyclones or similar names in other regions.

Such tropical cyclones are among the most devastating of all natural hazards. Their potential for wrecking havoc caused by their violent winds, torrential rainfall and associated storm surges, floods, tornadoes and mud slides is exacerbated by the length and width of the areas they affect, their severity, frequency of occurrence and the vulnerability of the impacted areas. Every year several tropical cyclones cause sudden-onset disasters of varying harshness, with loss of life, human suffering, destruction of property, severe disruption of normal activities and set-back to social and economic advances.

However, a particularly important aspect of tropical cyclones, as distinct from most other natural hazards, is the availability of operational systems for monitoring, forecasting and warning of all tropical cyclones, everywhere in the world, as a basis for preparedness action and, hence, disaster mitigation.

As a result of international cooperation and coordination, and with the aid of meteorology and modern technology, such as satellites, weather radars and computers, all tropical cyclones around the globe are now being monitored from their early stages of formation and throughout their lifetime. Five centres designated by the World Meteorological Organization (WMO) as Regional Specialized Meteorological Centres (RSMCs) and located in La Réunion, Miami, Nadi (Fiji), New Delhi and Tokyo, as well as other centres of national Meteorological Services carry out these activities. These centres also provide forecasts on the behaviour of tropical cyclones, their movement and changes in intensity and on associated phenomena - principally storm surges and flash floods.

Timely official warnings for national territory are contained in releases issued by the national Meteorological Services for dissemination to all those who are threatened. The activities are coordinated at the global and regional levels by the WMO through its World Weather Watch and Tropical Cyclone Programmes.



List of Tropical Cyclone RSMCs

I and II Caribbean Sea, Gulf of Mexico, North Atlantic and eastern North Pacific Oceans:
RSMC Miami - Hurricane Center/NOAA/NWS National Hurricane Center, USA.
http://www.nhc.noaa.gov/products.html

IV Western North Pacific Ocean and South China Sea:
RSMC Tokyo - Typhoon Center/Japan Meteorological Agency.
http://ddb.kishou.go.jp/typhoon/cyclone/cyclone.html

V Bay of Bengal and the Arabian Sea:
RSMC - tropical cyclones New Delhi/India Meteorological Department.
http://www.imd.ernet.in/services/cyclone/cyclone-warning-services.htm

VI South-West Indian Ocean:
RSMC La Réunion - Tropical Cyclone Centre /Météo-France.
http://www.meteo.fr/temps/domtom/reunion/cyclone_cart/sous_panneaux.html

XI South-West Pacific Ocean:
RSMC Nadi - Tropical Cyclone Centre /Fiji Meteorological Service.
http://www.met.gov.fj/advisories.html

List of Tropical Cyclone Warning Centres with regional responsibility

III Central North Pacific Ocean:
Central Pacific Hurricane Center - Honolulu/NOAA/NWS, USA.

http://www.nws.noaa.gov/pr/hnl/cphc/pages/cphc.shtml

VII South-East Indian Ocean:
TCWC - Perth/Bureau of Meteorology (Western Australia region), Australia.
http://www.bom.gov.au/weather/wa

VIII Arafura Sea and the Gulf of Carpenteria:
TCWC - Darwin/Bureau of Meteorology, Australia.
http://www.bom.gov.au/weather/nt/inside/cyclone/cyclone.shtml

IX Coral Sea:
TCWC - Brisbane /Bureau of Meteorology, Australia.
http://www.bom.gov.au/weather/gld/cyclone.shtml

X Solomon Sea and Gulf of Papua:
TCWC - Port Moresby/National Weather Service, Papua New Guinea.
(to be established soon)

XII Tasman Sea:
TCWC - Wellington/Meteorological Service of New Zealand, Ltd.
http://www.metservice.co.nz/forecasts/high_seas.asp

Tropical cyclones do not occur in other regions.

MONITORING, FORECASTING AND WARNING OF TROPICAL CYCLONES

The monitoring, forecasting and warning of tropical cyclones are carried out within the framework of the WMO's World Weather Watch (WWW), which is a unique achievement in international cooperation. The operation of the Programme is based on the fundamental concept that each of the approximately 185 participating countries and territories, which are Members of WMO, undertakes according to its means, to meet certain responsibilities in the agreed global scheme so that all countries may benefit from the consolidated efforts. The main purpose of the WWW is to ensure that the national Meteorological Service of each Member has access to the information it needs to provide effective services.

The WWW has three main components: the Global Observing, Telecommunications and Data-processing Systems - GOS, GTS and GDPS. About 10,000 land-based stations, 8,000 ships and other marine stations, and in the order of 3,000 aircraft, together with 8 geostationary and polar-orbiting meteorological satellites of the composite GOS measure or observe the meteorological elements and provide the data needed for analyzing and forecasting the weather and meteorological phenomena.

The GTS, the arteries and veins of the WWW, is a worldwide system for the rapid exchange of these data and of processed information, including analyses and forecasts, which are produced by the GDPS. The latter component comprises a network of three World Meteorological Centres, WMCs, and 34 Regional Specialized Meteorological Centres, RSMCs, each with specified tasks and roles. These include the supplying of products and guidance for the third group of centres, the national Meteorological Services which have the responsibility for providing weather services, in particular severe weather warning, to meet operational needs.

Five of the RSMCs are directly concerned with tropical cyclones. These RSMCs carry out monitoring and forecasting of tropical cyclones and issue information for the international community including the international media, in addition to providing advisory information and guidance to national Meteorological Services. The provision of tropical cyclone warnings for national territory and coastal waters is, basically, a national responsibility. Such official warnings are contained in advisories issued by the national Meteorological Service.

There has been significant improvement in the monitoring and forecasting of tropical cyclones over the years resulting from developments of the WWW and advances in technology and related fields. Examples are:

- The network of geostationary and polar-orbiting meteorological satellites and other satellites providing meteorological information which enable improved and continuous monitoring, especially over data-sparse ocean areas, from the early stages of formation of the tropical cyclone;

- Advances in the capabilities of meteorological satellites, providing higher-resolution imagery, measurement of additional parameters such as water vapour, sea surface temperature and cloud motion vectors at various altitudes, and grid point values for ingestion in numerical prediction models;

- Satellite-based communications providing links with greater reliability and higher speed;

- Technological developments in super computers, other large computers and PCs (Personal Computers) capable of handling greater volumes of data at faster speeds and with improved affordability, as needed for many activities from numerical weather prediction - NWP, to more routine activities of the operational services;

- Scientific advances in the understanding and modelling (including NWP) of tropical cyclones and their environment;

- Technological advances in instruments and equipment such as Doppler cyclone monitoring radar which gives radar imagery and also the wind field in tropical cyclones;

- Hurricane reconnaissance aircraft.


GLOBAL NETWORK OF TROPICAL CYCLONE
MONITORING, FORECASTING AND WARNING SYSTEMS
WORLD WEATHER WATCH
REGIONAL TROPICAL CYCLONE CENTRES
MIAMI
REUNION
TOKYO
NEW DELHI
NADI
NATIONAL METEOROLOGICAL CENTRES
GENERAL PUBLIC
LOCAL GOVERNMENT
CIVIL DEFENCE AGENCIES

TROPICAL CYCLONE RSMCs

Five centres, each operated on a cooperative basis by its country's national Meteorological Service, and located in La Réunion, Miami, Nadi (Fiji), New Delhi and Tokyo, have been formally designated by the WMO as Regional Specialized Meteorological Centres (RSMCs) with activity specialization in tropical cyclone analysis, tracking and forecasting. They have specific assigned roles and international and regional responsibilities under the WWW and the Tropical Cyclone Programmes.

The WMO's Tropical Cyclone Programme (TCP) promotes the development of regionally coordinated systems to mitigate tropical cyclone disasters. The areas of activity range from the application of meteorology, based on the WWW, and hydrology, through promotion of risk evaluations, response to warnings and establishment of disaster prevention and preparedness measures. Emphasis is placed on the provision of reliable forecasts of tropical cyclone tracks and intensity, associated weather conditions and phenomena along with timely warnings, covering all tropical cyclone prone areas. In this latter connection, each of the five regional bodies of the TCP has drawn up an Operational Plan with the respective tropical cyclone RSMC as a core feature. The plans are designed to ensure full coordination and, taking advantage of the high level of cooperation which has been generated, to record the agreed comprehensive arrangements for operational meteorological services to support tropical cyclone disaster mitigation.

The tropical cyclone RSMCs were selected on the basis of the unanimous proposals of the TCP regional bodies, with participation of the Meteorological Services of all tropical cyclone-prone countries in the particular region, the evaluation and certification, under the WWW by experts in operational meteorology from many countries, of the facilities and capabilities of the centre to carry out its role and the formal approval of the WMO's Executive Council.

The specialized functions of the tropical cyclone RSMCs are, principally, the detection, monitoring and track and intensity forecasting of all tropical cyclones in its region, the provision of these first level basic information to the international community including the international media and the provision of real-time advisory information and guidance to the national Meteorological Services in its region. Their functions also include responsibility for deciding when to assign names to tropical cyclones, the training of tropical cyclone forecasters of the national Meteorological Services, preparing operational performance statistics and annual summaries of tropical cyclone seasons, a central role in tropical cyclone data archival, tropical cyclone research and involvement in activities for public awareness of tropical cyclones. In practical terms, the series of the TCP's "Tropical Cyclone RSMCs Technical Coordination Meetings" serves as an effective mechanism for inter-regional and overall technical coordination of the programme.

All the tropical cyclone RSMCs have been designated by the International Civil Aviation Organization as ICAO Tropical Cyclone Advisory Centres with the task of providing specialized tropical cyclone advisory services for the aviation community. These centres have also been assigned a key role in the provision of information and warnings of tropical cyclones, through the Global Maritime Distress and Safety System, for ships on the high seas and other marine interests in tropical cyclone prone areas.

Each of the tropical cyclone RSMCs is co-located with and forms part of their National Meteorological Centre, of Fiji, India and Japan, or the Regional Meteorological Service of Météo-France in La Réunion or the USA National Weather Service's Tropical Prediction Center. All are supported by their respective national Meteorological Service and have cooperative arrangements with other Services and Institutions such as, for example, meteorological research facilities. All these RSMCs have been upgrading their expertise, meteorological equipment, computer systems, scientific knowledge and techniques and other facilities towards improvement of their services. The rate of progress by RSMC Nadi was augmented by technical cooperation projects with Australia, Japan, New Zealand, USA and other Members of WMO or groups of Members. These RSMCs all have highly trained and well experienced staff and other facilities that have been described as state-of-the-art meteorological equipment and computer systems.

For example, all tropical cyclone RSMCs have high speed satellite links to the GTS, real time access to high resolution imagery and digital data from geostationary satellites and polar-orbiting meteorological satellites, 10 cm cyclone monitoring radars and receive model outputs and forecasts from numerical weather prediction models run on large high speed computers. All are highly computerized with software to process satellite data (calibration, navigation, zoom, enhancement, overlaying, etc.) and radar data (looping, merging, track analysis, rainfall quantification, etc.) message switching, data display and analysis, forecast preparation, product delivery and even for more routine functions. This allows automation and application of many techniques, speed and reliability in task performance and time for tropical cyclone specialist staff to concentrate on tasks requiring their knowledge and experience.

Each of the tropical cyclone RSMCs serves as a national tropical cyclone warning centre for their respective country. All are continuing to further enhance their facilities and capabilities and to provide more effective services to meet their national, regional and international commitments.

Some aspects related to the facilities and work of each of the tropical cyclone RSMCs are briefly mentioned below.

RSMC La Réunion - Tropical Cyclone Centre

The main circuit, an umbilical cord for the centre is its high speed satellite link with the Central Service of Météo-France in Toulouse. It permits access to all the databases of Météo-France and, in particular, to the French (ARPEGE) and ECMWF (European Centre for Medium-range Weather Forecasting) global models outputs.

The centre is equipped with MDD and DRS data reception station and system which allow reception of products from the meteorological centres in Bracknell, Rome, Toulouse and collection of data from numerous weather stations in its region. It receives real-time data from the European geostationary satellite METEOSAT, the USA's TIROS polar orbiting satellites and the European remote-sensing satellite.

Computer software, SYNERGIE, developed by Météo-France, facilitates the cross-analysis of all available meteorological information and supports the work of the forecaster in many ways.

Cyclone track and intensity forecasting rely to a great extent on the numerical models outputs, such as from the French ARPEGE series of global and limited area spectral models.

The centre provides training for cyclone forecasters in its region, including a biennial course for Southern Hemisphere forecasters.

RSMC Miami - Hurricane Center/USA National Hurricane Center

The centre has been carrying out several of its current functions over the past many years, with continuing development of its facilities and improvement in its services, nationally and to the regions it serves. In some respects, it has been a pioneer and leader in these fields.

Technologies supporting hurricane detection, monitoring, forecasting and warning by the centre include:

- USA-NOAA geostationary meteorological satellites GOES-E and GOES-W parked normally over 75°W and 135°W, providing the RSMC with high-quality visible and infra-red imagery at standard operational intervals of 30 minutes and possibility of updates as frequently as every 5 minutes during hurricane warning situations;

- USA-TIROS polar orbiting satellites;

- Doppler radar network, most of which are installed by the USA National Weather Service over national territory;

- USA-aircraft reconnaissance of hurricanes in the Atlantic, Gulf of Mexico and Caribbean areas, including turbo-prop low altitude flights into hurricanes and the newer Gulfstream IV high-altitude jet for measuring the steering currents on the periphery;

- USA advanced computer/telecommunications weather interactive processing system, AWIPS, to help forecasters analyse storms and prepare and disseminate forecasts and warnings.

The centre relies on several techniques, mostly NWP, to prepare guidance to the forecasters and it cooperates with research and operational activities within and outside NOAA in the further development and testing of the models and techniques. It provides training for tropical cyclone forecasters from all the tropical cyclone-prone regions.

RSMC Nadi - Tropical Cyclone Centre

One of the major features of the functions of the centre is the provision of not only information and advisory services for its region, but of full tropical cyclone forecast and warning services for eight countries and territories and special advisory services for two countries in its region.

Tropical cyclone alerts and warnings are issued in the form of Special Weather Bulletins at least every six hours and usually at three-hourly intervals for warnings, to the national Meteorological Services of the country under threat. Special Advisory Bulletins are issued to two countries at least every six hours during threat of a tropical cyclone, to assist their national Meteorological Services in preparing local warnings.

The centre receives high-resolution data in real-time from the Japanese GMS geostationary meteorological satellite, the USA GOES-W geostationary and NOAA polar-orbiting meteorological satellites.

The computer system installed, called Fiji Integrated Meteorological System, FIMS, is a complete meteorological system comprising from data collection through forecast preparation to product delivery. The communication network was the most recent available on the market in architecture and design at the time of its installation in 1998. There is a direct high-speed link with the WMC Melbourne and a planned direct link with WMC Washington.

The centre was moved into a new building in 1998 and has been utilizing the modernized meteorological equipment and facilities since then.

RSMC - tropical cyclones New Delhi

There are two peak periods for tropical cyclones in the Bay of Bengal and Arabian Sea areas, the post-monsoon and the pre-monsoon months.

A Regional Telecommunications Hub on the GTS is co-located with the RSMC New Delhi. In addition to meteorological data and products received on the GTS, the centre receives support from the application program satellite imagery from the Indian INSAT geostationary satellite located over the Indian Ocean. These data are used for the detection, analysis and tracking of tropical cyclones in the region and also to assist in forecasting their movement and intensity.

The center applies all the standard techniques in tropical cyclone forecasting. NWP forecasts are made using an advanced high-resolution multi-level primitive equation model run in operational mode on the India Meteorological Department's super-computer system. The numerical guidance provided by the model serves to enhance the degree of confidence in the synoptic forecasts.

Special attention is being given to storm surges associated with tropical cyclones in this region, which constitute one of the world's foremost natural hazards, due to the shallow bathymetry and the large range of the astronomical tide. The forecast track, size and intensity of the tropical cyclone itself are of vital importance, in conjunction with numerical storm surge model output and pre-computed nomograms for storm surge forecasting.

RSMC Tokyo - Typhoon Center

A Regional Telecommunications Hub on the Main Telecommunications Network of the GTS is co-located with RSMC Tokyo.

The center operationally analyses the synoptic observations, data from the Japanese geostationary meteorological satellite, GMS, which provides excellent coverage of the region, other meteorological satellites and weather radars. Forecasts made operationally, particularly those for longer periods up to 72 hours, rely heavily on the products of NWP models at the Japan Meteorological Agency, JMA. The Typhoon Model (TYM) and the Global Spectral Model (GSM) are used for the prediction of tropical cyclones. These advanced models are nevertheless under constant revision. Forecast verification reveal a long-term trend of improving forecast and numerical guidance for forecasters in track forecasts and in storm surge prediction.

The synoptic field and sea surface temperature distribution are taken into account, especially for intensity forecasting. A new method of modifying numerical model output to get 48 hour and 72 hour intensity forecasts is planned for early implementation operationally.

RSMC Tokyo staff members serve as resource persons in international training seminars on typhoon monitoring and forecasting, hosted by JMA for the benefit of other national Meteorological Services in the typhoon region.

TROPICAL CYCLONE WARNING CENTRES

WITH REGIONAL RESPONSIBILITY

The tropical cyclone warning centres with regional responsibility are operated by and are part of the USA-NOAA National Weather Service's facility in Honolulu, Hawaii, the Australian Bureau of Meteorology, the National Weather Service of Papua New Guinea and the Meteorological Service of New Zealand Ltd. Their functions include the detection, monitoring and track and intensity forecasting of all tropical cyclones in their respective region and the provision of these first level basic information to the international community, in addition to provision of local warnings to meet their national responsibilities. Their functions also include assigning names to tropical cyclones forming within their region. TCWC Port Moresby has responsibility for a comparatively small region in which only a few tropical cyclones form, and for activities as outlined above, primarily the provision of local warning services. The three Australian centres and the Honolulu centre are directly linked to WMC Melbourne and WMC Washington respectively and are fully supported by their national Meteorological Service. The Wellington centre is also fully supported by its national Meteorological Service. They provide, additionally, information and warning for marine interests in their regions. TCWC Brisbane has been designated as an ICAO Tropical Cyclone Advisory Centre and provides specialized tropical cyclone advisory services for the aviation community.

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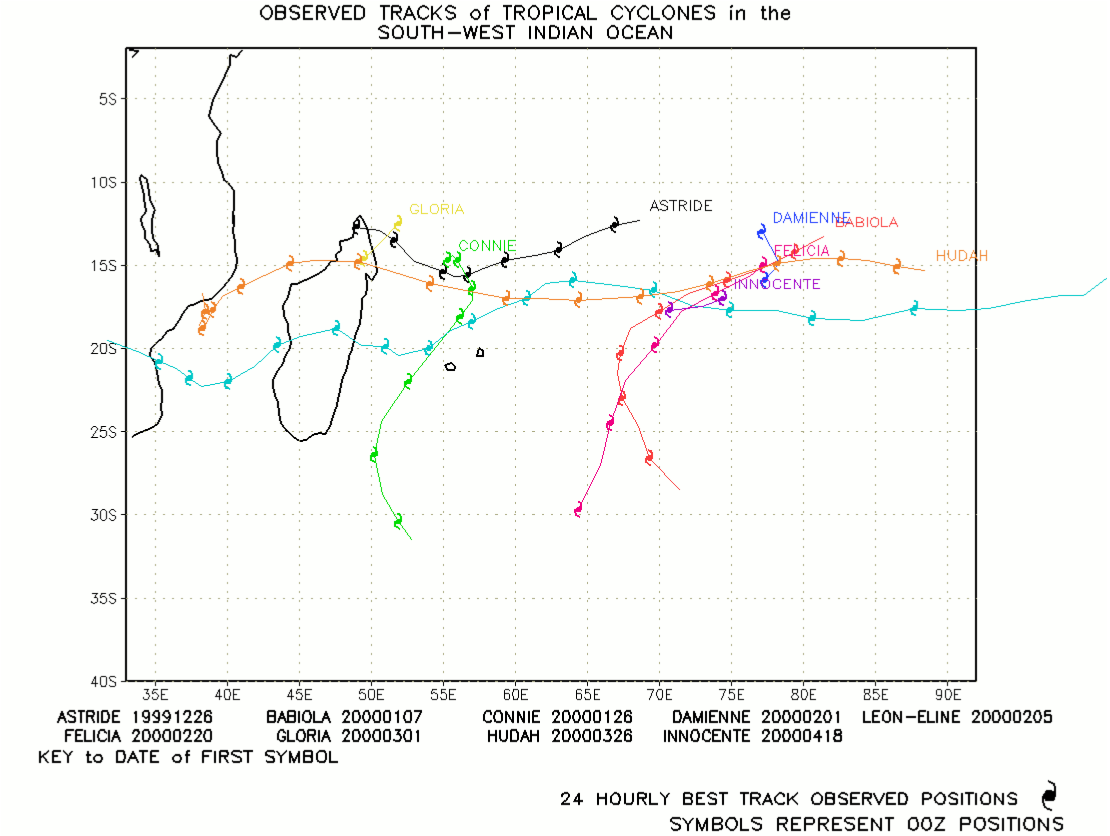
RSMC La Réunion - Tropical Cyclone Centre

Director: Mr Dominique Landais



Classification of Cyclonic Disturbances

Low pressure area: region of the atmosphere in which the pressures are lower than those of the surrounding region at the same level and where the cloud masses do not appear to be organized.

Extra-tropical disturbance: synoptic scale low pressure area outside of the tropics.

Sub-tropical disturbance: synoptic scale low pressure area having during its life, characteristics which could belong to both tropical and extra-tropical depressions. In the South West Indian Ocean, the genesis of such system is regularly observed over the South of Mozambique Channel.

Zone of disturbed weather: non frontal synoptic scale low pressure area originating in the tropics or sub-tropics with enhanced convection and light surface winds.

Tropical wave: trough or cyclonic curvature maximum in the trade wind easterlies or equatorial westerlies. The wave may reach maximum amplitude in the lower middle troposphere, or may be the reflexion of an upper-troposphere cold low or equatorial extension of a mid-latitude trough.

Tropical disturbance: generic term for a non-frontal synoptic scale low pressure area, originating over tropical or sub-tropical waters with organized convection and definite cyclonic surface wind circulation (wind estimated to be not exceeding 27 knots (50 km/h, force 6 in the Beaufort scale)).

Tropical depression: tropical disturbance in which the maximum of the average wind speed is estimated to be in the range 28 to 33 knots (51 to 62 km/h, force 7 in the Beaufort scale).

Moderate tropical storm: tropical disturbance in which the maximum of the average wind speed is estimated to be in the range 34 to 47 knots (63 to 88 km/h, force 8 or 9 in the Beaufort scale).

Severe tropical storm: tropical disturbance in which the maximum of the average wind speed is estimated to be in the range 48 to 63 knots (89 to 117 km/h, force 10 or 11 in the Beaufort scale).

Tropical cyclone: tropical disturbance in which the maximum of the average wind speed is estimated to be in the range 64 to 89 knots (118 to 165 km/h, force 12 in the Beaufort scale).

Intense tropical cyclone: tropical disturbance in which the maximum of the average wind speed is estimated to be in the range 90 to 115 knots (166 to 212 km/h).

Very intense tropical cyclone: tropical disturbance in which the maximum of the average wind speed is estimated to exceed 115 knots (212 km/h).

Cyclone Season

Period of the year during which most of the tropical disturbances occur. In the South- West Indian Ocean, this period is between 1 November and 30 April (For Mauritius and Seychelles: this period is between 1 November and 15 May).

RSMC LA REUNION - TROPICAL CYCLONE CENTER

SUMMARY

The Cyclone Season 1999-2000 in the South-West Indian Ocean

After two quiet cyclone seasons, the 1999-2000 season in the South-West Indian Ocean turned out to be an active one. This above normal activity is not due to a large number of tropical depressions, but rather to the high number of cyclone days resulting from the occurrence of cyclones Eline and Hudah. The performance of Eline is exceptional; it started in the extreme end of the south-east Indian Ocean and dissipated over Namibia.

The 1999-2000 season will be remembered for a very long time for several reasons: the depressions were more intense than suual; the most intense of these depressions affected populated regions like Madagascar, Mozambique and even Zimbabwe. High winds and severe floods due to Eline, Gloria and Hudah affected these countries, causing high death toll, heavy economic loses and health problems.

The cyclone season 1999-2000 ended at the same time as the precedent one (24^{th} of April), but started earlier (23^{rd} of December 1999). Although the start of the 1999-2000 season was earlier than the two previous one, it is nonetheless a late started when compared to the normal data which is about mid-December.

During the four months that lasted the present season, there were 14 depressions for which bulletins were issued; exactly the same number as durin the 1998-1999 season, but two less than during the 1997-1998 season; both seasons considered as less active than normal. One of the 14 systems influenced the SWIO only marginally and it can be considered that only 13 systems were of significant interest to the area under the responsibility of the RSMC La Réunion.

Of the 13 systems only 11 were retained as being significant (significant systems are those that have attained the depression stage for at least 24 hours). This means that the number of disturbances that evolved into mature depressions were particularly high, contrary to the two previous seasons when many of the systems did not evolve into mature depressions.

Of the 11 depressions, 9 attained the storm intensity and were named, 4 of those reached the cyclone stage. These two last figures correspond to the normal in the S.W.I.O. basin. However, it must be noted that one hybrid system was not named in spite of the fact that it reached a stage when it should have been named. This system (number 13), which interested the southern part of the Mozambique Channel, was classified as a subtropical depression, but could also have been considered as a tropical storm.

Although the number of systems observed is close to the normal, the present season can be taken as being more active than normal if one considers the number of cyclone days, where cyclone day is taken to be a disturbance of at least storm intensity. For the present season, the number of storm days is 61, compared to a median of 48, more than double the number attained during the precedent season.

The disturbances were well distributed as far as intensity is concerned, with nonetheless the peak shifting towards the more intense cyclones, in line with the above comments. There was one depression, two moderate storms, three severe storms, one cyclone, two intense cyclones, one very intense cyclone and one subtropical depression. The systems were also well distributed throughout the season, with the peak frequency between mid-February and beginning of March.

It must also be noted that the distribution of the areas of formation of the disturbances were fairly well distributed, contrary to what happened during the precedent season. It is worth mentioning that only one system originated north of latitude 10^{o} South, and that the Mozambique Channel was devoid of any formation, except that the reintensification of Eline and Hudah could be considered as second birth.

Even if three disturbances had parabolic or pseudoparabolic trajectories (Babiola, Connie and Felicia), those with zonal trajectories dominated the season. These long and zonal tracks brough many systems into the western part of the basin, where are concentrated almost all the the inhabited lands and thus exposing them to an increase in the risks of being affected by cyclones. The Mascarenes Islands, Réunion Island and to a lesser extent Mauritius, which benefited from the rainfall associated with the storms which visited the western part of the basin, suffered little when compared to Madagascar, Mozambique and Zimbabwe.

With Eline, Mozambique had experienced the most powerful cyclone of recent time. Although data, before the use of satellite picture for the estimation of intensity of cyclones, were not reliable, it can be stated with fairly good confidence that Mozambique did not suffer directly from such an intense cyclone for the last few decades. More than the wind, it was the torrential rainfall associated with Eline which was responsible for most of the damages and victims; the number of victioms is still unknown. The destruction associated with Eline was felt well inside the African continent, with many victims even in Zimbabwe.

After having been spared by cyclones for the last two years, Madagascar, a natural target for them, suffered from three direct hits; this is reminiscence of the nightmare suffered by Madagascar during the 1993-1994 cyclone season, when four cyclones caused death and great suffering. This time, two intense cyclones (Eline and Hudah) struck near the towns of Mahanoro and Antalaha causing dozens of death. Severe storm Gloria, hitting the region less than two weeks later, when the soil was still saturated, was responsible for deadly flooding causing as many victims as Eline. This event, together with the destruction made by Eline in Mozambique and Zimbabwe, show that cyclonic rain, by affecting a larger area than cyclonic wind, is an important component of the risks associated with cyclones.

Althoug Eline was less intense than Hudah, the most intense of the season, and had a similar life history (zonal trajectory, landfall in Madagascar at an intense stage, reintensification in the Mozambique Channel and landfall in Mozambique), it will remain as **the** phenomenon of the season and even of the recent decades for a good part of Southern Africa. The pictures of the floods and of the victims were shown in all parts of the world and were the main headline for days on. Its exceptional duration of 29 days (the whole month of February), its extraordinary trip of some 11,000 km (more than a quarter of the earth's circumference) and its fury when it hit inhabited lands when it was at its maximum intensity made it an awesome storm to be remembered for a very long time.

List of the Tropical Cyclones in 2000

Tropical Cyclone		**Duration**		**Min Central Pressure (hPa)**	**Max Wind* (kph)**
TT	Astride	23 Dec	03 Jan		
CT	Babiola	02 Jan	14 Jan		
CT	Connie	24 Jan	02 Feb		
TT	Damienne	30 Jan	03 Feb		
CT	Eline	01 Feb	29 Feb		
TT	Felicia	18 Feb	26 Feb		
TT	Gloria	27 Feb	10 Mar		
DT	No. 9	29 Feb	11 Mar		
CT	Hudah	24 Mar	08 Apr		
DT	No. 13	07 Apr	15 Apr		
DR	Innocente	12 Apr	24 Apr		

* 10 minute wind

SEVERE TROPICAL STORM ASTRIDE
23 DECEMBER - 3 JANUARY

It is for the third consecutive year that the cyclone season starts very late in the SWIO. The first depression was typical of one occurring at the beginning of the season: it was moderate, its relatively zonal trajectory allowed it to cross the northern part of Madagascar and to end up in the Mozambique Channel.

It was only on the 23rd of December that the first disturbance appeared to the southeast of Diego Garcia. Initially, the system moved fairly rapidly towards the south, then changing to southwest and at night on the 24th assumed a westerly track. It intensified slowly and was named Astride when it became moderate late during the day on Christmas. At night, the system became a severe storm.

During the two following days, Astride underwent spectacular diurnal convective variations and late at night on the 27th was downgraded to a moderate storm. On the 29th, the system, having reached its southernmost location, started to move towards the west northwest while intensifying into a severe storm.

Astride passed at about 70 km to the northeast of Tromelin early in the morning of the 30th. The highest 10 minute average wind speed was 10 kph and the highest gust was 127 kph. Afterward, Astride headed towards the northwest while starting to weaken under the effect of windshear from the north. It crossed the northern tip of Madagascar, between Vohemar and Antsiranana, on the 31st of December as a system in between the depression and moderate storm intensity, without significant damages.

While crossing Madagascar, Astride continued to weaken and on New Year day it emerged as a weak system into the Mozambique Channel, just north of Nosy-Be. Astride showed some sign of reintensification late during the day. In the early morning of the 2nd of January, the system passed to the southeast of Mayotte. Inspite of its modest intensity, Astride generated heavy raindfall and gale force winds over the island.

Astride became temporarily moderate while moving towards the west southwest. Once again, the system weakened while approaching the coasts of Mozambique. It made landfall in the early morning of the 3rd, close to the mouth of the Lurio river, south of the town of Pemba, as a tropical depression. Finally, Astride dissipated inland, after causing significant rainfall even as far as Malawi.

TROPICAL CYCLONE BABIOLA
2 - 14 JANUARY

As from the 1st of January 2000, there was indication of a cyclonic circulation within the ITCZ, near longitude 80° East. Initially, the movement of the system, upgraded to tropical disturbance on the 3rd, was slow and erratic and there was not much change in its intensity. It was only late at night on the 5th, that convection stretching over a diameter of about 600 km developed. The system continued to intensify and was named Babiola in the morning of the 6th when it became a moderate storm. The movement continued to be slow and erratic and Babiola was still at almost the same position as it was three days before.

During the day on the 6th, Babiola was moving towards the west southwest, and this movement brought it in a region where upper level divergence was becoming more favourable for development. As a result, the system started to develop at a near climatological rate, reaching the tropical cyclone stage at night on the 8th and its maximum intensity as a full fledge cyclone at night on the 9th while approaching latitude 20° South. Afterwards, Babiola under the influence of a trough located to its southwest, started to recurve in a classical manner, first towards the south, then towards the south southeast, passing at about 400 km to the west of Rodriguez.

As from the period 10 to January, Babiola came under the influence of the strong northwesterly winds associated with the trough. The resulting vertical shear caused Babiola to weaken and eventually became an extra-tropical depression on the 12th, while heading towards the southeast. An anticyclonic cell moved rapidly south of Babiola; this caused the depression to decelerate, while increasing its vorticity.

The extra-tropical depression ex-Babiola intensified temporarily and accelerating ahead of a cold front, passed at about 30 km to the west of Amsterdam island at night on the 14th. Finally, the depression merged with the cold front and was carried away by the mid-latitude circulation.

INTENSE TROPICAL CYCLONE CONNIE
24 JANUARY - 2 FEBRUARY

On the 22nd of January, a mass of cloud situated to the northeast of Tromelin was put under close watch. At that stage, the environment was not favourable to development due to moderate easterly shear. Gradually, with the decrease of the shear, convective activities became better organized along latitude 15S, between 55 and 60E and by late night on the 24th, the system occupied a diameter of about 550 km. During the day on the 25th, the disturbance developed further and reached the moderate stage at night and was named Connie.

The intensity of Connie remained stationary for the following 24 hours and it was only late during the day of the 26th that started a period of rapid intensification. In the morning of the 27th, only 48 hours after becoming a tropical disturbance, Connie was a tropical cyclone. Later at night, Connie became an intense cyclone. At that time, the cyclone, having completed a loop, was at the same position it occupied two and a half days before. In that position, Connie represented a potential threat for both La Reunion and Mauritius.

Up to the morning of the 28th, Connie adopted a very slow south southeasterly track which would bring it to the east of Mauritius, then situated at only 380 km from the centre. The presence of a strong ridge to the southeast of Connie, and responsible for its slow movement, caused the cyclone to change its course towards the south and afterwards towards the southwest. Late during the day on the 28th, Connie attained its maximum intensity, with an estimated central pressure of 930 hPa, and with a 10 minute average wind speed of about 180 kph and maximum gust of the order of 250 kph around an eye which had contracted. As from the following night, Connie started to weaken due to an increase in the north to northwest vertical wind shear.

At the end of the night of the 28th, Connie, being guided by a ridge, accelerated suddenly towards the southwest at more than 20 kph. On that track, the strong wind of Connie did not affect Mauritius; but the associated rainfall (a total amount equivalent to the monthly mean of January) was beneficial. Reunion also was spared a direct hit: Connie, by then a tropical cyclone, passed at about 130 km to the northwest of the Island late in the afternoon of the 29th. The highest gust recorded on the coast was 130 kph and was 150 kph over the high grounds. Although the heavy rainfall amounts (as is normally the case during a cyclone in Reunion) associated with Connie (locally more than 80 mm of rainfall in 24 hours) caused significant flooding, they were welcome. Damages were limited, but one person died due to being imprudent. Electricity supply was affected, with some 40,000 homes having to do without it.

In the morning of the 30th, Connie, then a severe tropical storm, moved away fairly rapidly on the same southwesterly track. After moving around the subtropical ridge, Connie reduced its speed and started to track southeast towards a polar trough. Maintaining its tropical characteristics and even intensifying slightly late at night on the 30th, Connie approached latitude 30S as a severe storm late in the afternoon of the 31st. Afterwards, Connie became extratropical and started to weaken due to northwesterly shear. The system crossed latitude 30S late at night of the 31st of January and was caught away by a following polar trough during the day on the 2nd of February.

MODERATE TROPICAL STORM DAMIENNE
30 JANUARY – 3 FEBRUARY

Of a rather weak and brief existence, Damienne formed within the monsoon trough 300 km to the south of Diego Garcia at the end of January 2000. It tracked towards the southeast during its initial life and reached minimal tropical storm intensity in the early morning of the 1st of February. After benefiting from another slight intensification, it encountered a hostile northerly shear on the following night, while recurving to the southwest, on the eastern side of a Tropical Upper Tropospheric Trough (TUTT).

The dismantled Damienne then continued to dissipate slowly over the following days. The residual low surfed west northwestwards on the northern edge of an anticyclone and could be traced until the 7th of February, when it disappeared close to the northeastern shoreline of Madagascar.

Intense Tropical Cyclone Leon/Eline
1 - 29 February

On the 01st of February, a new tropical disturbance appeared in the extreme eastern part of the southern Indian ocean. The persisting convection associated with the disturbance, initially located at about 250 Km to the south of the Indonesian island of

Bali, rapidly appeared suspicious. At that point in time, no one would have ever imagine the exceptional fate of that embryonic disturbance, which after travelling for more than 11 000 Km (more than a quater of the circumference of the earth), would end up, one month later, on the sand of the Namibian Kalahari! This record longevity, on its own, is sufficient to classify the system as memorable. But due to the fact that the system became one of the deadliest cyclones of the last decades and, in particular, one of the most intense to hit Mozambique in recent history, its notoriety went beyond the simple meteorological context.

In the morning of the 4th, the disturbance intensified into a moderate storm and was named LEON by the Australian Tropical Cyclone Warning Centre at Perth. Leon intensified rapidly and 24 hours later, late at night on the 05th of February, was classified as a tropical cyclone by Perth. Since its genesis, Leon had been travelling along a general west-south-west direction, but during its intensification it moved more towards the south-west. At dawn, on the 06th, intensification stopped and Leon reached its first peak intensity; afterwards Leon started to weaken due to an increasing vertical north-easterly wind shear. It was as a moderate tropical storm that Leon crossed the longitude 90º East at night on the 08th and entered the RSMC of La Reunion.

Renamed ELINE, the storm, situated at the northern edge of a strong sud-tropical anticyclone and having moved rapidly towards the west at more than 30 Km/hr since the the previous day, temporarily encounterd less unfavourable conditions. It intensified slightly during the day on the 9th, then, once again, showed signs of shearing which faded late at night on the 11th. These fluctuations were limited in amplitude and during all that period Eline stayed as a moderate tropical storm.

It was only late during the day on the 13th of February that things started to really evolve. Eline, which had slowed down slightly and adopted a south-westerly track, started to intensify significantly and was upgraded to a severe tropical storm at night. Its intensity stayed more or less stationary during 48 hours, that is until it passed at its nearest point at about 160 Km to the north-west of La Reunion late at night on the 15th. The island was grazed by the central part of the storm and its influence was moderate and slightly less than those caused by Connie three weeks before, when heavy rain and gusts of 100 to 120 Km/hr were experienced (locally, more than 800 mm of rain were recorded in 24 hours over the high grounds)

Eline acquired an eye and became a cyclone in the morning of the 16th. Simultaneously, the storm changed its track and moved towards the west-north-west and thus became a direct threat to the eastren coasts of Madagascar. Twelve hours before making landfall, Eline intensified markedly and it was as an intense cyclone that, on the night of the 17th of February, it struck Madagascar near the town of Mahanoro which was badly damaged. In spite of weakening overland, the system remained virulent far inland, and the capital Antananarivo experienced unusually strong winds of the order of 100 Km/hr.

After leaving the central part of Madagascar, Eline left behind a death toll of 64. There were more than 10 000 homeless people and half a million people were affected. When the system emerged in the Channel, it had of course weakened but was still a depression. Its potential for intensification was still important and did not take long to intensify. The warm water of the Mozambique Channel, together with more favourable atmospheric conditions were conducive to the reintensification of Eline into a severe storm as from the end of the night of the 18th. At that moment Eline was passing close to the north of Europa island, where a gust of 115 Km/hr was recorded.

The intensification, which was moderate until the morning of the 21st , became explosive. Eline, which in the afternoon of the 20th changed to a west-north-west track, intensified brutally and dramatically 24 hours before landing on the African coasts.The central pressre was estimated to have decreased by 45 hPa during that interval and it was at its peak intensity that Eline struck at the Mozambique coast early during the day of the 22nd of February, some 80 Km to the south of the city of Beira. At that time Eline was an intense cyclone with wind gusts in excess of 260 Km/hr.

It was the rain, more than the winds, which was disastrous. Already weakened by deadly floods associated with early-season rainfall, Mozambique would endure catastrophic consequences, with a large part of the Central and Southern parts of the country remaining submerged under water. The victims were in hundereds and massive and urgent humanitarian aids were needed to help the large number of people affected and those who were isolated on small islets formed by the flooding. Even Zimbabwe, situated far inland, was not spared.

In fact, the rain associated with Eline lasted until the end of the month. This system showed unlimited stamina, staying quite active for another week while at the same time continuing its journey into the central part of Southern Africa. After Zimbabwe, the remnants of the depression crossed Botswana and finally dissipated on the 29th over the south-east part of Namibia.

SEVERE TROPICAL STORM FELICIA
18 – 26 FEBRUARY

This system did not receive the attention required due to the highly publicized Eline. Because Felicia evolved from a monsoon depression, a fairly rare event in the SWIO, it should have received a bit more attention. In fact, it was from a monsoon depression situated to the southeast of Diego Garcia that Felicia started to develop on the 18th of January.

The typical structure of this type of system (a fairly large central area with light winds surrounded by a ring of fairly strong winds) lasted until the 20th. The strongest winds were of the order of 20 to 25 knots over most of the circulation, locally reaching gale force in the southern semi-circle. During that period, fairly chaotic and fluctuating convective activities evolved around multiple low pressure areas scattered throughout the large area occupied by the monsoon depression. It was only late at night on the 20th that, under the influence of a trade wind surge originating from a strong sub-tropical high situated to the south of the depression, the convection re-organized and became concentrated around the centre of the system.

The vertical easterly to northeasterly wind shear, which hindered the development of Felicia, decreased and from then on conditions were favourable for intensification of the system for the following 48 hours. Felicia, which was prematurely baptized on the 20th of February was analysed as a moderate storm in the afternoon of the 21st and reached a maximum intensity of severe tropical storm late at night on the 22nd.

Moving in a southwesterly direction at 25 to 30 kph since its naming, Felicia passed at about 500 km to the southeast of Rodriguez in the afternoon of the 22nd. Due to the presence of a trough in the upper air to the south of the Mascarenes since several days, Felicia moved south southwestward. On approaching the latitude 25S, Felicia came under the influence of a strong north northwest upper flow and was sheared during the day on the 23rd.

Afterwards, Felicia weakened rapidly and became extra-tropical. The residual low pressure area slowed down near a barometric col, then made a loop south of latitude 30S and finally filled up in a tropical area.

MODERATE TROPICAL STORM GLORIA
27 FEBRUARY – 10 MARCH

This system formed on the 26th of February from a cloud mass within the ITCZ at about 1000 km to the northeast of Mauritius. During the following 48 hours, the system did not develop due to an easterly vertical wind shear, and it was only late at night on the 28th that it was upgraded to tropical depression. After an initial westward movement, the system moved towards the west northwest and passed at more than 350 km to the north of Tromelin. Soon after, it moved westward and late at night on the 29th, under the influence of a ridge, turned southwestward at a reduced speed.

This change in trajectory was accompanied by the intensification of the system due to the weakening of the easterly vertical wind shear. The system was analysed as being moderate late at night and was named early in the morning of the 1st of March when it was situated about 150 km from Vohemar on the northeast coast of Madagascar. The close vicinity of the northeast of Madagascar did not allow the system enough time to intensify significantly. After accelerating a bit, Gloria made landfall late at night on the 1st of March at about 10 km to the north of the town of Sambava where 10 people reportedly died. Severe tropical storm Gloria was then at its maxmium intensity with 10 minute mean wind less than 100 kph.

Gloria then moved inland over the high grounds of the north, but still maintaining a well-defined structure up to the dawn of the 3rd of March and where it generated heavy rainfall. Afterwards, the system kept on disintegrating, but local rainfall continued during the following days and some heavy falls were recorded, even over areas very far from the centre of the residual depression (at Mananjary, on the eastern coast, 500 mm of rain were recorded over a period of three days).

These heavy rainfall, occurring only two weeks after those already generated by Eline, caused severe flooding and killer landslides. Initial press releases spoke of a provisional death toll of 66, greater than that caused by Eline. To these victims, one must add the number of people without shelter and the serious socio-economic problems, such as a deterioration of food security and health problems, in particular, an upsurge in cholera and paludisme.

After crossing Madagascar for more than 48 hours, Gloria had weakened considerably that it was just a weak circulation and at dawn on the 4th of March when it emerged in the Mozambique Channel it could not recuperate. This did not prevent catastrophic rumours, that Mozambique was on the point of being hit by another cyclone, to circulate!

From the 4th to the 9th of March, the weak circulation crossed the Mozambique Channel slowly in a general southwest direction. On approaching the Mozambique coast, the system showed some signs of regeneration and was classified temporarily as a tropical disturbance. It did not have time to develop further and made landfall near the town of Inhambane during the night of the 8th and 9th. It dissipated 48 hours afterwards, not before having generated some rainfall to the north of Maputo.

TROPICAL DEPRESSION NO. 9
29 FEBRUARY – 11 MARCH

By the end of February, the monsoon trough was at its maximum activity and with the month changing, a surge in perturbed activities was noted in the SWIO. In addition to tropical storms Gloria (northeast of Madagascar) and Norman (northwest of Australia), two depressions, denoted by Number 9 and Number 10, were evolving in the SWIO. None of the two systems reached the moderate stage, but as Number 9 lasted for more than 24 hours as a depression it was retained for description in the annual cyclonic report.

System Number 9 was the first to appear on the 28th of February in the eastern part of the SWIO. On the following day, it was classified as a tropical disturbance, while 1300 km to its west system Number 10 was developing to the south of Diego Garcia. In spite of the separating distance, both were affected by similar easterly wind shear and appeared as twin sisters with the same shearing characteristics. System Number 9 was more mature and was classified as a minimal tropical depression.

System Number 10 did not last long. On the following night, the low level circulation tended to move away from the area of convection, indicating an increase in vertical shear. The situation continued up to the 3rd, then the convection disappeared and the low dissipated on the 5th on the western edge of Number 9. This system resisted to the unfavourable conditions, inspite of a temporary destruction of the convection on the previous day; a situation which led one to believe that Number 9 would end up as Number 10.

The trajectory of Number 9 was very erratic. After moving towards the southwest and the west northwest, it moved back towards the east southeast to almost the longitude 80E, probably under the influence of the approaching cyclone Norman situated then at not more than 1500 km to the southeast. The two weakening depressions would, from then on, evolve together under the Fujiwhara effect. On the 9th, system Number 9 was downgradedto tropical disturbance and it existed as a low level circulation, gradually losing its vorticity. During the following night, the disturbance recut its initial trajectory, then decelerated significantly in the morning of the 8th, while moving towards the northeast. This deceleration corresponded to a simultaneous change in the trajectory of Norman, which stayed almost stationary for more than 24 hours during the time when it was being sheared, before its low level centre moved towards the west northwest late during the night of the 8th of March. The two disturbances, one moving west northwest and the other moving east southeast, pass one below the other at a distance of about 900 km late at night on the 9th. Between the 10th and the 11th, both disturbances dissipated near the longitude 90E, the limit between the southeast and the SWIO.

VERY INTENSE TROPICAL CYCLONE HUDAH
24 MARCH – 8 APRIL

Lasting for about 16 days, Hudah had a life histry almost similar to Eline a few weeks before. Hudah crossed fairly rapidly the whole of the SWIO basin from east to west, affecting successively Madagascar and Mozambique as a tropical cyclone. However, Hudah was less of a killer than Eline because, luckily, each time it weakened before it made landfall. But this fourth and last cyclone of the season 1999-2000 was the most intense and, due to the very intense stage reached, was one of the most intense of the last decade.

Hudah originated in the Australian area of responsibility from the only zone of convection which then existed within the ITCZ. It was named on the 25th of March just after having reached the moderate stage, as soon as it crossed over into the SWIO basin.

Hudah moved in a general westerly direction and became a cyclone late at night on the 26th and reached its first maximum intensity in the morning of the 29th. It maintained the same intensity for some time, before engaging in its final intensification stage late at night on the 30th to become on the 1st of Aoril a very intense cyclone, a rare event (estimated central pressure 905 hPa, a 10-minute wind speed of 220 kph and gusts of the order of 310 kph).

During the night of the 1st of April, Tromelin Island, situated at a distance of 35 km north of the centre, went through the external eyewall of Hudah and recorded gusts of 180 kph. The classical eye cycle associated with the weakening of the cyclone started on the 1st and ended on the 2nd, with the disappearing of the internal eyewall in favour of the external one, and resulting in a small increase in the radius of the final eye.

As a result, it is as an intense cyclone that Hudah landed on the northeast coast of Madagascar at the start of the night of the 2nd, destroying a large part of the town of Antalaha and causing the death of at least 24 people and more than 30,000 disaster victims. Just before the destruction of the synoptic station, gusts of the order of 185 kph and a minimum pressure of 955.2 hPa were recorded. Further south, the town of Maroantsetra, constructed at the end of the Bay of Antongil, was completely flooded.

Hudah weakened significantly during the crossing of Madagascar, but after emerging in the Mozambique Channel it regenerated, similar to Eline, Hudah, having avoided a premature landing on the Mozambique coast on the 5th, was upgraded to a tropical cyclone at the beginning of the night, then once again reached a peak intensity early during the day on the 7th. After turning to the south on the 5th, Hudah remained stationary for some time before turning to the north, late at night on the 6th and finally made landfall in the morning of the 8th near the town of Pebane, causing the death of four persons. According to the Meteorological Service of Mozambique, gusts of the order of 185 kph could have been experienced. Hudah was then a minimal tropical cyclone, having significantly weakened prior to making landfall. Afterwards, the system continued to move inland towards the north and dissipated late at night on the 8th of April. Due to its rapid dissipation, the rainfall amounts associated with Hudah were greatly reduced and could not be compared with those of Eline.

SUBTROPICAL DEPRESSION NUMBER 13
7 – 15 APRIL

On the 6th of April, a wavy cold front was present to the south of the Mozambique Channel. On the 7th, a small low pressure area formed on its northern extremity situated to the east of the coastal frontier separating South Africa from Mozambique. On the satellite picture, the system which appeared to be insignificant (compared to the presence of tropical cyclone Hudah in the middle of the Mozambique Channel) and probably of short duration would undergo development which is considered atypical and unknown during recent period.

On the 8th, the small low became detached from the front, which dissipated near latitude 30S, and started to move northwards. It was better defined than the previous day and was a low level feature with some convection in its southeast sector. There was no development on the 9th, but on the 10th convective activities were enhanced near the centre of the depression. The development of this typically subtropical depression, evolving in a region under the influence of both tropical and baroclinic regimes (with an upper air trough over the system), was a matter for consideration.

In the morning of the 11th, the system did not evolve, it was during the day that marked intensification was noted. Convective cloud bands became more organized, indicating development of the system. On the 12th, a ring of more prominent cloud developed around a small clear area and gave the impression of the formation of an eye. Throughout the day, the eye, well-defined but ragged, continued to develop and reached its maximum definition at night.

This hybrid depression was presenting all the characteristics of a purely tropical system, except for the facts that the convections present were anormal both qualitatively and qualitatively; deep convections were few and did not reach great heights. The coldest cloud tops had temperature of about –50C, hence much warmer than those observed in purely tropical systems. As a result, estimating the maximum wind speeds of such a system was a problem. The maximum wind speeds must have at least reached gale force and should have been named.

At the time of intensification, the system was almost stationary at about 60 km from the coast of Moambique, northeast of the town of Inhambane (observed winds were moderate and the minimum pressure was 1007 hPa). Soon after the depression started to move towards the southeast, then towards the east southeast. Simultaneously, the eye dissipated fairly rapidly and the effect of shearing started to be felt late at night of the 12th of April. It was only after 24 hours that the disturbance dissipated and finally filled up to the south of Madagascar.

MODERATE TROPICAL STORM INNOCENTE
12 – 24 APRIL

The last system of the season started as a low pressure area on the 8th of April, just after the start of the preceeding system in the Mozambique Channel, far away to the southwest of Indonesia. On the 10th, a closed circulation could be detected around a pressure minimum, situated at about 400 km to the northeast of the Cocos Island.

Cyclogenesis was very slow because the scattered convective clouds could not organize themselves compactly around the centre. At the same time, a fairly marked shear line became established in the vicinity of the system (oriented in a northwest/southeast direction), between the northwest monsoon flow and the intensifying trade regime. Multiple and short-lived low pressure areas developed and decayed within the axis of the shear line. The low pressure circulation moved fairly rapidly towards the west southwest, crossed the longitude 90E late at night on the 12th and entered the CMRS area of responsibility. At almost the same moment, the cloud system showed for the first time some signs of definite organization and it was upgraded to the depression stage during the day on the 13th.

This initial intensification was kept in check because the northeast shear was still present and maintained the low level circulation near the border of the cloud mass. The system oscillated between the disturbance and depression stages and maintained its inherent asymmetric wind distribution, with weak wind speed in the northern sectors and fairly strong winds, extending to about 400 km in the southern sectors.

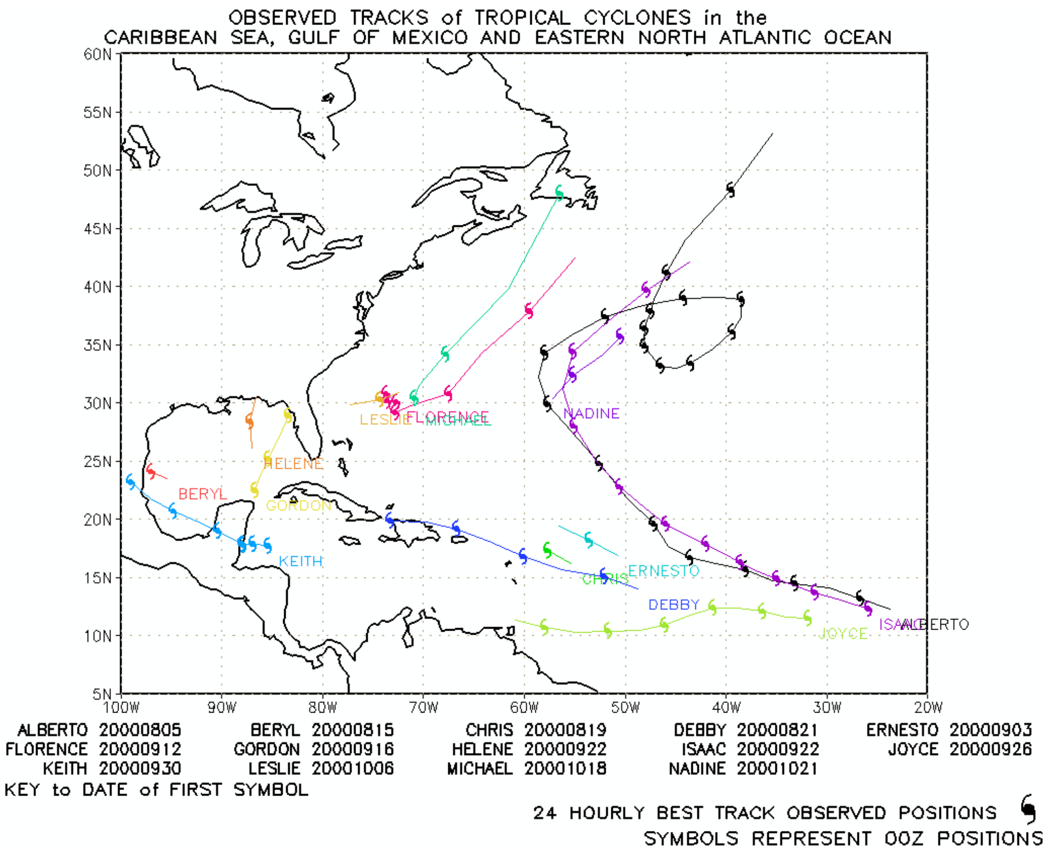
The system weakened into a disturbance on the 14th and changed its direction and moved towards the south southwest, then towards the southwest. In doing so, the system approached an upper ridge where the shear was weak and this allowed it to intensify slowly to reach the moderate stage on the 17th. Innocente did not intensify further and reached its maximum intensity during the following hours.

Afterwards, Innocente moved towards the west southwest and came into an area affected by crippling wind shear which weakened it permanently. Late at night on the 18th, Innocente was downgraded to a depression. The convection got eroded very rapidly and the system was just a large circulation with medium and low level clouds around a small vortex and which persisted for a few days.

Ex-Innocente moved towards the west northwest and while filling up gradually, it passed near Tromelin Island on the 24th of April. Some night convections, which existed close to the centre, extended further away mainly towards the south as from the 23rd. The air mass south of the system became unstable over a vast area which extended to more than 1000 km. This caused unstable weather conditions over the Mascarenes with heavy thundery showers at times over Mauritius and Reunion. In Mauritius, significant amounts of rainfall (ranging from 250 o 400 mm, and comparable to those recorded during Connie) were recorded over the Central and Eastern areas, causing some damages to agriculture.

RSMC Miami - Hurricane Center

Director: Mr Max Mayfield



2000 Edition

Classification of Cyclonic Disturbances

Tropical Cyclone A non-frontal cyclone of synoptic scale, developing over tropical or subtropical waters and having a definite organized surface circulation.

A. Hurricane — A warm core tropical cyclone in which maximum average surface wind (one-minute mean) is 118 km/h (74 mph) (64 knots) or greater.

B. Tropical storm — A well organized warm-core tropical cyclone in which the maximum average surface wind (one-minute mean) is in the range 63-117 km/h (39-73 mph) (34-63 knots) inclusive.

C. Tropical depression — A tropical cyclone in which the maximum average surface wind (one minute mean) is 62 km/h (38 mph) (33 knots) or less.

Subtropical cyclone A low pressure system, developing over subtropical waters which initially contains few tropical characteristics. With time the subtropical cyclone can become tropical.

A. Subtropical Storm — A subtropical cyclone in which the maximum sustained surface wind is 63 km/h (39 mph) (34 knots) or greater.

B. Subtropical depression — A subtropical cyclone in which the maximum sustained surface wind is less than 63 km/h (39 mph) (34 knots).

Tropical wave A trough or cyclonic curvature maximum in the trade wind easterlies or equatorial westerlies. The wave may reach maximum amplitude in the lower middle troposphere, or may be the reflection of an upper-troposphere cold low or equatorial extension of a mid-latitude trough.

Tropical disturbance A discrete system of apparently organized convection originating in the tropics or sub-tropics, having a non-frontal migratory character and having maintained its identity for at least 24 hours.

Hurricane season

The portion of the year having a relatively high incidence of hurricanes. In the Atlantic, Caribbean and the Gulf of Mexico, it is the period from 01 June to 30 November, and in the East Pacific, from 15 May to 30 November.

RSMC MIAMI - HURRICANE CENTER

Summary

2000 Edition

Tropical cyclone activity in the Atlantic basin was above average in the year 2000. Including an unnamed subtropical storm that occurred in late October, there were fifteen cyclones of at least tropical storm strength. Of these, eight became hurricanes, and three. Alberto, Isaac and Keith became major hurricanes (category three or higher on the Saffir-Simpson Hurricane Scale) with wind speeds of 111 mph or higher. The long-term (1950-1999) average is approximately ten tropical storms of which six become hurricanes. In addition to these systems, there were four depressions that failed to reach tropical storm strength. With the exception of Keith, most of the activity occurred over water of the Atlantic north of 25 degrees latitude and those systems that affected land were significantly weakened by hostile environment prior to landfall. Atlantic tropical cyclones were directly responsible for 49 deaths and most of them resulted from Gordon and Keith. Keith, the most destructive hurricane of the season, made landfall in Belize and the eastern Yucatan Peninsula of Mexico in early October and a few days later hit northeast Mexico as a weaker hurricane. Table 1 lists the named tropical cyclones and the unnamed subtropical storm, along with their dates, maximum sustained wind speed, minimum sea level pressure, U.S. dollar damages, and direct deaths.

The National Hurricane Center (NHC) average official forecast errors in 2000 were a little lower than the previous 10-year average.

List of the Tropical Cyclones in 2000

Tropical Cyclone		**Duration**		**Min Central Pressure (hPa)**	**Max Wind* (mph)**
H	Alberto	03 Aug	23 Aug	950	125
TS	Beryl	13 Aug	15 Aug	1007	50
TS	Chris	17 Aug	19 Aug	1008	40
H	Debby	19 Aug	24 Aug	991	85
TS	Ernesto	01 Sep	03 Sep	1004	50
H	Florence	10 Sep	17 Sep	985	80
H	Gordon	14 Sep	18 Sep	981	75
TS	Helene	15 Sep	25 Sep	986	70
H	Isaac	21 Sep	01 Oct	943	140
H	Joyce	25 Sep	02 Oct	975	90
H	Keith	28 Sep	06 Oct	939	140
TS	Leslie	04 Oct	07 Oct	1006	45
H	Michael	15 Oct	19 Oct	965	100
TS	Nadine	19 Oct	21 Oct	999	60
ST	Unnamed	25 Oct	29 Oct	976	65

* 1 minute wind

HURRICANE ALBERTO
3 - 23 AUGUST

Hurricane Alberto was the third longest-lived tropical cyclone on record in the Atlantic basin. A classical Cape Verde hurricane formed in the eastern tropical Atlantic just off the African coast on August 3rd, moved west to west-northwest for the next several days becoming a hurricane early on the 6th. Alberto turned northwestward on the 8th and weakened to a tropical storm the next day in increasing southwesterly wind shear. The environment became favorable again and Alberto regained hurricane strength on the 10th and reached its peak intensity of 125 mph on the 12th. During this period, Alberto began a large, week-long, clockwise loop between Bermuda and the Azores. During the loop it again weakened into a tropical storm but then attained hurricane status for a third time. Alberto finally became extratropical on the 23rd while heading north-northeastward about 900 miles southwest of Reykjavik Iceland.

TROPICAL STORM BERYL
13 - 15 AUGUST

Tropical Storm Beryl formed in the southwestern Gulf of Mexico on the afternoon of August 13th from an area of low pressure spawned by a tropical wave. In contrast to the powerful and long-lived Alberto, however, Beryl had only a weak and brief existence as a poorly-organized tropical storm. With most of its strongest winds occurring in rain bands south of the center, the tropical storm moved west-northwestward and made landfall in northeast Mexico about 35 miles north of La Pesca shortly after midnight on the 15th with 50 mph winds. One death, reported from flooding was reported in northeast Mexico associated with flooding. No damage estimates are available.

TROPICAL STORM CHRIS
17 - 19 AUGUST

Tropical Storm Chris was a short-lived storm. It developed in the western Atlantic about 700 miles east of the Lesser Antilles on August 17th and based on satellite intensity estimates, it briefly reached tropical storm status early in the morning of the 18th. Chris weakened rapidly as the vertical wind shear increased and dissipated on the 19th north of the Leeward Islands.

HURRICANE DEBBY
19 - 24 AUGUST

Hurricane Debby formed from a strong tropical wave on August 18th about 1000 miles east of the Windward Islands. Embedded briefly within a favorable environment, Debby became a hurricane early on the 21st while centered about 500 miles east of the Lesser Antilles and it reached its peak intensity of 85 mph later that day. Fortunately, vertical wind shear increased and Debby weakened to a 75 mph before it passed over the northernmost Leeward Islands and the British Virgin islands early on the 22nd. Wind gusts to hurricane force were reported in St. Barthelemy. Moving to the west-northwest, Debby' center passed about 35 miles north of the northern coast of Puerto Rico later on the 22nd. Debby continued rapidly westward near the northern coast of Hispaniola, where wind shear separated the center from the deep convection and Debby rapidly weakened to a tropical storm. Debby crossed the Windward Passage and moved just south of the south coast of eastern Cuba on the 24th, where it dissipated. There were no direct deaths attributed to Debby. Heavy rainfall caused $500,000 dollars of damage in Puerto Rico and some damage in the Dominican Republic. However, as Debby dissipated it did produce beneficial rains over eastern Cuba.

TROPICAL STORM ERNESTO
1 - 3 SEPTEMBER

Tropical Storm Ernesto was very similar to Chris in its origin, track and structure. A depression formed from a tropical wave about 1000 miles east of the Lesser Antilles on September 1st and strengthened to Tropical Storm Ernesto on the 2nd. Strong and persistent vertical wind shear prevented the storm from further development and Ernesto deteriorated into a tropical wave on the 3rd while centered well north of the Leeward Islands.

HURRICANE FLORENCE
10 - 17 SEPTEMBER

Hurricane Florence developed from an area of low pressure associated with a frontal zone on the 8th of September. The low gradually separated from the front and became a subtropical depression about 370 miles west-southwest of Bermuda on September 11th. Data from the Air Force hurricane hunters and satellites indicated that the system became a tropical depression, tropical storm and hurricane in quick succession on the 11th. Florence moved little and then ingested dry air and briefly weakened to a tropical storm for 12 hours on the 12th. Debby recovered and became a hurricane for the second time later on the 12th and with little motion it weakened again to tropical storm status, probably due to local reduction of the sea-surface temperatures caused by upwelling and increased vertical wind shear. Florence moved eastward and then east-northeastward and on the 15th, it regained hurricane status for the third time. Florence passed about 75 miles to the northwest of Bermuda on the 16th producing sustained tropical storm force winds there, and shortly thereafter reached its peak intensity of 80 mph. Florence merged with an extratropical cyclone south of Newfoundland late on the 17th. Although hundred of miles away from the U.S. at any time, Florence produced rip currents that were responsible for three deaths in North Carolina.

HURRICANE GORDON
14 - 18 SEPTEMBER

Hurricane Gordon was the first of the seasons' two land-falling tropical storms in the United States. It formed near the northern coast of the Yucatan peninsula on September 14th from a tropical wave that was tracked across the Caribbean Sea for a few days. Gordon drifted northward and north-northeastward into the Gulf of Mexico while intensified steadily. It became a minimal Hurricane with peak winds of 80 mph about 250 miles south of Apalachicola Florida but vertical wind shear weakened Gordon to a 65-mph tropical storm before it made landfall near Cedar Key, Florida on the evening of the 17th. The storm dumped heavy rain in the southeast U.S. and produced a few tornadoes across Central and South Florida. Gordon merged with a cold front over the Southeast U.S. and became extratropical on the 18th. Twenty-three deaths have been attributed to Gordon in Guatemala as a result of flooding. It is possible that some or all of these deaths occurred before the system became a tropical cyclone. In the United States, Gordon was responsible for $11 million in damage, and the death of a surfer who drowned in heavy seas near Pensacola, Florida.

TROPICAL STORM HELENE
15 - 25 SEPTEMBER

Tropical Storm Helene originated as a tropical depression about 600 miles east of the Leeward Islands on September 15th but weakened the next day before reaching the Caribbean Sea. The remnants of the depression brought heavy rain and gusty winds to the northern Leeward Islands on the 17th. It continued as a strong tropical wave through the Caribbean Sea and a tropical depression re-formed on the 19th about 100 miles east of Grand Cayman. It crossed western Cuba as a very weak system and moved into the eastern Gulf of Mexico where an Air Force reconnaissance plane indicated that a tropical storm had formed on the 21st. Helene accelerated toward the north and reached a maximum intensity of 70 mph later that day. However, intensification ended abruptly when vertical wind shear increased, and Helene began to weaken, making landfall near Fort Walton Beach, Florida on the morning of the 22nd with maximum sustained winds of only 40 mph. Flooding was reported across the Florida Panhandle and Georgia with 8-10 inches of rain recorded in the Tallahassee area. The storm weakened to a depression and moved northeast across the southeastern states. With the center of the depression still over land, in eastern North Carolina, the system began to reintensify on the 23rd, and regained tropical storm status before moving back out into the Atlantic. The revived Helene moved rapidly northeastward and hourly reports from the ship Neptune Olivine indicated that the storm reached peak winds of 70 mph and a minimum pressure of 988 mb on the 25th. The storm was absorbed by a cold front the next day. A tornado associated with Helene killed one person in South Carolina. Damage estimates in the U.S. are $16 million.

HURRICANE ISAAC
21 SEPTEMBER - 1 OCTOBER

Hurricane Isaac, a Cape Verde hurricane and the second major hurricane of the season, resembled Alberto in its history. It became a depression about 250 miles south the Cape Verde Islands on September 21st, and strengthened into a tropical storm the next day while moving west-northwestward. Isaac rapidly became a hurricane on the 23rd and strengthened further into a major hurricane early on the 28th. The storm remained a powerful hurricane as it began to turn more northwestward, reaching a maximum intensity of 140 mph late on the 28th. The hurricane recurved out to sea well east of Bermuda and became extratropical over the open Atlantic on October 1st . Isaac continued as a vigorous extratropical storm for several days and eventually affected portions of the British Isles. Swells produced by Isaac were responsible for one death by drowning after a boat capsized in Moriches Inlet, Long Island.

HURRICANE JOYCE

25 SEPTEMBER - 1 OCTOBER

Hurricane Joyce was another potential Cape Verde hurricane that formed in a similar location to Alberto and Isaac. However, on the contrary to Alberto and Isaac, it moved westward over the deep tropics and encountered the persistent hostile shear that hat earlier dismantled Chris, Debby and Ernesto, and nearly destroyed the system that ultimately became Helene. Joyce formed from a tropical wave about 400 miles southwest of the Cape Verde Islands on September 25th and became a tropical storm the next day. Satellite images indicated that Joyce developed an eye a peak intensity of 90 mph early on the 28th. The environment of Joyce was particularly dry, which may have contributed to the gradual weakening that ensued. Joyce moved through the southern Windward Islands as a minimal tropical storm on October 1st and dissipated in the southeastern Caribbean Sea on the 2nd. There are no deaths and no reports of damage attributed to Joyce.

HURRICANE KEITH
28 SEPTEMBER - 6 OCTOBER

Hurricane Keith formed from a tropical wave that began to develop in the western Caribbean Sea on September 27th and became a depression about 70 miles northeast of Cape Gracias a Dios Nicaragua on the 28th. Data from a reconnaissance aircraft on the 29th indicated that the depression had become a tropical storm while moving slowly northwestward. Thereafter, Keith went under an explosive deepening and the pressure fell from 1000 mb to 939 mb in about 37 hours. By October 1st, it was already a category four hurricane on the SSHS with peak winds of 140 mph, and a minimum central pressure of 939 mb. When the eyewall of the hurricane first moved over Ambergis Cay and Caye Caulker, Belize, Keith had weakened but was still a category three hurricane with winds of 125 mph. Keith moved erratically and weakened while battering the coastal islands of Belize on the 1st and 2nd but eventually, it made landfall in mainland Belize as a tropical storm on the 3rd. It weakened to a depression while crossing the Yucatan peninsula later on the 3rd regained tropical storm strength over the Bay of Campeche late on the 4th. Keith became a hurricane again on the 5th with its maximum winds reached 90 mph at landfall just north of Tampico, Mexico and finally dissipated over northeastern Mexico on the 6th. Keith's slow track through the northwestern Caribbean resulted in devastating rainfall over Belize and other portions of Central America. The system is blamed for 19 deaths: 5 in Belize, 12 in Nicaragua, 1 in Honduras, and 1 in Mexico. Damage to agriculture, property, and tourism in Belize is estimated at $200 million.

TROPICAL STORM LESLIE
4 - 7 OCTOBER

Tropical Storm Leslie developed from a subtropical depression off the east coast of Florida. Leslie nor the subtropical depression caused any damage or casualties. However, the precursor disturbance which appears to have come from the northwestern Caribbean combined with a stalled frontal zone produced very heavy rainfall of about 12 to 18 inches over south Florida on October 2nd and 3rd. Flood damage estimates are at $950 million and three deaths in South Florida were indirectly attributable to the flooding. The disturbance moved over the eastern Gulf of Mexico and across Florida and a reconnaissance plane could not clearly define a closed circulation during that period. However, it then became better organized on the 4th and became a subtropical depression just east of Orlando, Florida while moving eastward away from the coast. On the 5th, data from a reconnaissance plane indicated that the system had acquired tropical characteristics and strengthened into Tropical Storm Leslie about 230 miles east of St. Augustine, Florida . Leslie passed about 250 miles west of Bermuda without consequences on the 7th, and became extratropical later that day.

HURRICANE MICHAEL
15 - 19 OCTOBER

Hurricane Michael originated from a non-tropical low pressure system that lingered over warm waters about 450 miles northeast of the Bahamas for several days. Satellite imagery indicated that the low developed into a subtropical depression on October 15th, a subtropical storm on the 16th, and then became a tropical storm the next day when convection increased near the center. After acquiring tropical characteristics, data from a reconnaissance aircraft indicated that Michael was nearly hurricane strength and by the next day, the crew from the reconnaissance plane reported a circular eye and falling pressure. Michel began to move rapidly north-northeastward toward the Canadian Maritime provinces and based on observations from the ship MSC Xingang, Michael reached a peak intensity of 100 mph and minimum pressure of 965 mb early on the 19th while located about 75 miles east of Sable Island, Nova Scotia. It then weakened slightly and became extratropical just prior to landfall in Newfoundland with 85 mph on the 19th. There were no deaths attributed to Michael and damage is reported to be minor.

TROPICAL STORM NADINE
19 - 21 OCTOBER

Tropical Storm Nadine formed from the interaction of a tropical wave and a strong upper-trough about 500 miles southeast of Bermuda on October 19th. As a tropical depression it moved northward to northeastward passing well east of Bermuda as a tropical storm on the 20th. Based on satellite estimates, Nadine reached its peak intensity of 60 mph later that day. It then accelerated northeastward becoming an extratropical cyclone early on the 22nd well to the southeast of Newfoundland.

Unnamed Subtropical Storm
25 - 29 OCTOBER

A post-analysis of yet another non-tropical low indicate that the system became a subtropical storm just east of the Turks and Caicos Islands on October 25th. The system moved generally northward and passed about halfway between Bermuda and the U.S. east coast on the 27th. The system was overtaken near Sable Island, Nova Scotia by a strong cold front early on the 29th, just after the system had reached its peak intensity of 65 mph and a minimum pressure of 992 mb.

2000 Atlantic Hurricane Damage Statistics

number in series	name	class *	dates **	U.S. damage ($millions)	direct deaths
2	Beryl	T	13-15 Aug		1
4	Debby	H	19-24 Aug	0.5	
6	Florence	H	10-17 Sep		3
7	Gordon	H	14-18 Sep	10.8	24[1]
8	Helene	T	15-25 Sep	16	1
9	Isaac	H	21 Sep-1 Oct		1
11	Keith	H	28 Sep-6 Oct		19+5
12	Leslie	T	4-7 Oct	***	

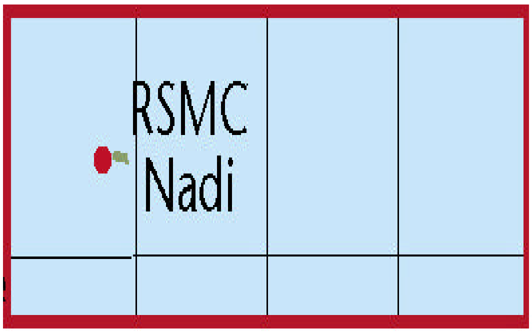
*T: *tropical storm, wind speed 39-73 mph. H: hurricane wind speed 74 mph or higher.*

ST: subtropical storm, wind speed 39-73 mph.

*** Dates begin at 0000 UTC and include tropical depression stage (wind speed less that 39 mph).*

**** Although neither Leslie nor the subtropical depression from which it formed were responsible for any damage, a precursor disturbance combined with a stalled frontal zone produced $950 million flooding damage in south Florida.*

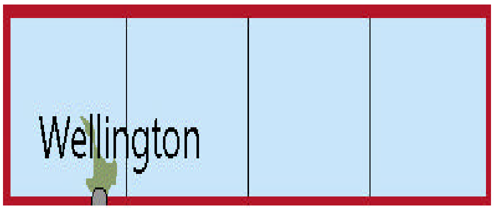
1 This figure could include deaths that occurred prior to tropical cyclone genesis.



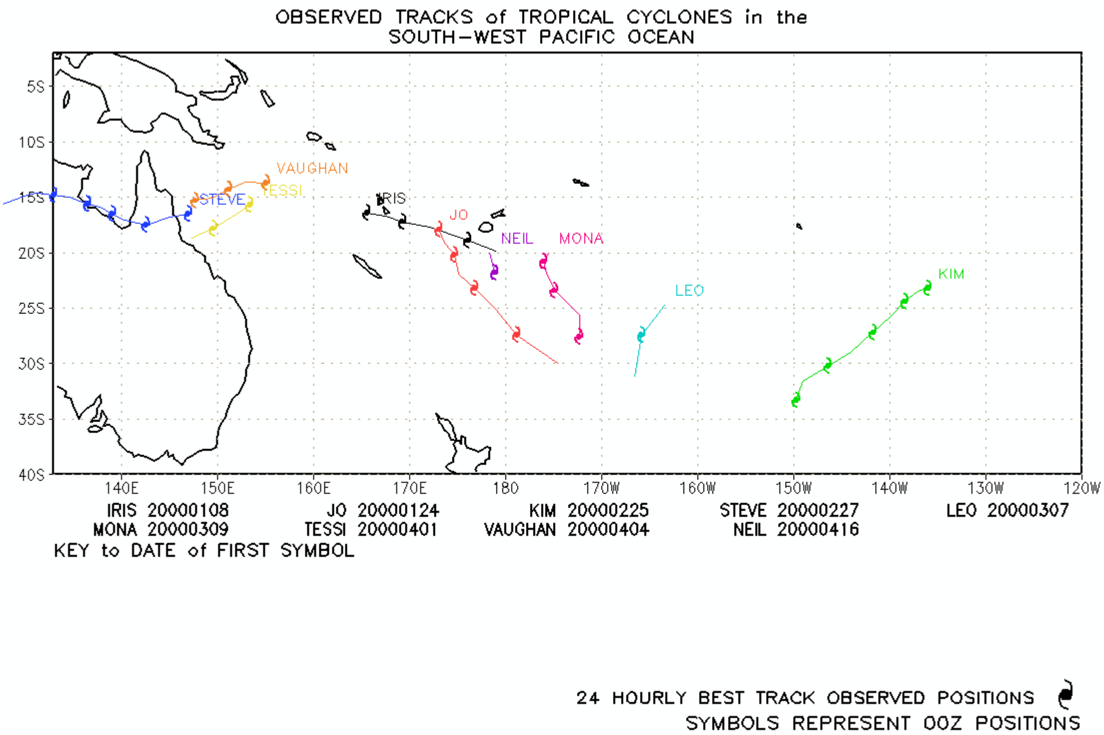
RSMC Nadi - Tropical Cyclone Centre

Director: Mr Rajendra Prasad

TCWC - Brisbane



TCWC - Wellington



Classification of Cyclonic Disturbances

	English		French
	Classification of weather disturbances		**Classification des perturbations météorologiques**
	Tropical depression	< 34 knots	Dépression tropicale faible
34 knots ≤	Tropical cyclone (gale)	< 48 knots	Dépression tropicale modérée
48 knots ≤	Tropical cyclone (storm)	< 64 knots	Dépression tropicale forte
64 knots ≤	Tropical cyclone (hurricane) Severe tropical cyclone		Cyclone tropical

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*	Used by Fiji
**	Used by Australia and Papua New Guinea
+	Used by Australia and Fiji
***	Used by Australia

Cyclone Season*:* The period of the year with a relatively high incidence of tropical cyclones. In the South Pacific and South-East Indian Ocean, it is the period from 1 November to 30 April. (Note: cyclones occasionally occur outside of this period.)

Special Advisories for National Meteorological Centres

RSMC Nadi-Tropical Cyclone Centre** is responsible for providing special advisory messages for use by the Vanuatu Tropical Cyclone Operational Centre, the Samoa National Meteorological Service and the US National Weather Service Office (WSO) Pago Pago, American Samoa in the preparation of warnings and advices.

Brisbane Tropical Cyclone Warning Centre (TCWC) is responsible for providing special advisory messages for use by National Meteorological Centre in Solomon Islands in the preparation of warnings and advises.

FORECASTS AND WARNINGS FOR THE OPEN SEA

In accordance with Annex VI of WMO Technical Regulations (WMO Manual on Marine Meteorological Services), the responsibility for the preparation of marine tropical cyclone forecasts and warnings in the South Pacific and South-east Indian Ocean is shared amongst Members as follows:

Warning centre with prime responsibility	Boundary of area
Brisbane TCWC*	05S 160E, 08S 155E, 12S 155E, 12S 147E, 09S 144E, 10S 141E, 14S 138E, 32S 138E, 32S 160E, 05S 160E.
Darwin TCWC*+	EQ 125E, 15S 125E, 15S 129E, 32S 129E, 32S 138E, 14S 138E, 10S 141E, EQ 141E, EQ 125E.
RSMC Nadi	25S 160E, 25S 120W, EQ 120W, EQ 160E, 25S 160E.
Perth TCWC	10S 090E, 36S 090E, 36S 129E, 15S 129E, 15S 125E, 10S 125E, 10S 090E.
Port Moresby TCWC	EQ 141E, 10S 141E, 09S 144E, 12S 147E, 2S 155E, 08S 155E, 05S 160E, EQ 160E, EQ 141E.
Wellington	25S 160E, 25S 120W, 40S 120W, 40S 160E, 25S 160E.

RSMC NADI-TROPICAL CYCLONE CENTRE

SUMMARY

Since the 1997-98 season, arguably the most active for the region in the last 20 years, there was a marked decrease in tropical cyclone activity in Nadi's Area of Responsibility (AOR), as we entered the new millenium. In 1997-98, there were fifteen tropical cyclones; 1998-99, seven (eighth became a cyclone in New Zealand's AOR) and 1999-2000, down to six. This season then, was just a little below average, as far as the number was concerned. Of the six, four cyclones attained hurricane force intensity.

A rather moderately warm ENSO episode prevailed through the 1999-2000 season, following a period of five to six months near neutral conditions. Monthly values of the Southern Oscillation Index (SOI) were +13 in November, +13 in December, +5 in January, +13 in February, +5 in March and +17 in April. This sinusoidal pattern was reflected in the constant shifts in the genesis trough, throughout the season, which may have influenced, to a greater degree, the seasonal total. Two of the six tropical cyclones originated west of 180°, in the Coral Sea area. Two of the other four formed closer to the 180° meridian while the other pair, further to the east.

List of the Tropical Cyclones in 2000

Tropical Cyclone		**Duration**		**Min Central Pressure (hPa)**	**Max Wind (kt)**
STC	Iris	07 Jan	10 Jan		70
TC	Jo	24 Jan	27 Jan		60
STC	Kim	24 Feb	29 Feb		95
TC	Leo	06 Mar	08 Mar		50
STC	Mona	08 Mar	11 Mar		75
TC	Neil	15 Apr	16 Apr		40

SEVERE TROPICAL CYCLONE IRIS
7 - 10 January 2000

Tropical Cyclone Iris was the first tropical cyclone of the new millenium, in RSMC Nadi's area of responsibility (AOR). It was a small and compact system (midget), attaining peak intensity of hurricane force. Iris was a well-behaved cyclone, having a general southeasterly track. The system moved across Vanuatu, but weakened considerably as it slipped just south of Fiji, where it finally dissipated. Damage to Vanuatu was minimal, even though the centre came to within 60 miles (extent of gales) of the island of Epi.

Iris developed from a quasi-stationary monsoon trough, in a moderately sheared environment, just northwest of Espiritu Santo, in Vanuatu, on the 3rd of January. Three days later, after surviving shear and diurnal influence, overall organisation began to improve significantly. The system continued to intensify, and by 07/0000 [1]UTC, the low level circulation centre (LLCC) began to move under the deep convection. In retrospect, the system should have probably been named by 07/0600 UTC, after Quickscat data indicated 1-minute average winds of 35 to 40 knots surrounding the centre. Overnight, with weakening shear and adiabatic cooling, the depression intensified further consequently forming a compact central dense overcast (CDO).

Iris then rapidly intensified to storm category by 07/1200 UTC and reaching hurricane intensity by 08/0000 UTC. It peaked around 08/0600 UTC, while located about 130 miles northwest of Port Vila and tracking east-southeastward at 8 knots. The cyclone moved close to or over the island of Epi overnight, but its compactness was quite evident as recorded winds over Vila, about 60 miles due south, were only 15 to 20 knots. By 08/1200 UTC, the cyclone began to weaken rapidly to storm force, the intensity it maintained for the next 24 hours.

Under strengthening steering field and vertical shear, Iris gradually accelerated eastward as it left Vanuatu, tracking more and more south of east and also becoming more and more asymmetric as it moved closer towards Fiji. By 09/1800 UTC, Iris had weakened to a gale while located about 210 miles west-southwest of Nadi and moving east-southeastward at 13 knots. Under extreme shear and hostile environment, the cyclone was downgraded to a depression after 10/0000 UTC, finally dissipating about 150 miles southeast of Fiji, 12 hours later.

Damage, in Vanuatu and/or Fiji, was either minimal or negligible, apart from heavy swells.

TROPICAL CYCLONE JO
23 - 27 January 2000

Jo, the second cyclone in RSMC Nadi's AOR this season, developed off a similar environment as Iris. It was a "normal" system, which steadily tracked south-southeast before exiting Nadi's AOR, on a southeast course. The cyclone attained a peak intensity of hurricane force winds, but, fortunately, did not directly affect any inhabited land area.

A weak disturbance was first identified over the northern parts of Vanuatu on the 19th, embedded in an active and slow-moving monsoon trough. For the next 24 hours, it was subjected to very strong northwest shear and diurnal variations, which arrested development. This was despite pressure falls in a fairly extensive area, at the surface. At 21/2100 UTC, the llcc was located by visible imagery about 300 miles northeast of Port Vila and about 340 miles northwest of Nadi. Till 24/1800 UTC, the system's overall organisation displayed a marked increase, with convective tops cooling further, outflow improving significantly and spiral bands wrapping more tightly around the llcc. Consequently, it was named Tropical Cyclone Jo at 24/0000 UTC, while about 240 miles west of Nadi and moving southeast at 10 knots.

At a normal rate of intensification, Jo reached storm category at 24/1800 UTC, with gales fanning out to within 80 miles of the centre. However, Jo's peak intensity was somewhat controlled by a persistent warm air intrusion, which relentlessly stayed with the cyclone for most of its life inside Nadi's AOR. Locating the llcc was also made the more difficult by this environmental entrainment. Jo briefly peaked around 26/0000 UTC, while situated about 350 miles south of Nadi and beginning to trek southeast. It finally moved out of Nadi's AOR around 26/1200 UTC.

Jo's closest approach to Fiji was late on the 24^{th}. Till the 26^{th}, near-gale force winds (10-minute average winds of 32 knots with gusts to 50 knots), enhanced by squally rainbands associated with the cyclone, lashed the western parts of Viti Levu and nearby smaller islands to the south, inducing flash flooding. Fortunately, there was no major river flooding. Damage to Fiji, was minimal.

SEVERE TROPICAL CYCLONE KIM
23 - 29 February 2000

Kim was an aseasonal hybrid, which gradually gained a warm-core structure as it trekked westwards through the French Polynesia. The cyclone followed a general west-southwest track during its entire life in Nadi's AOR. Kim attained cyclone status, farther south than usual, closer to the Nadi/Wellington border. It had a peak intensity of hurricane force, but fortunately, the French territory was spared any direct effects of the destructive storm and/or very destructive hurricane force winds.

RSMC Nadi began monitoring a cold-cored tropical depression, located about 60 miles east-southeast of Rikitea or about 270 miles northwest of Pitcairn Island around 23/0000 UTC and moving slowly westwards. At 23/1800 UTC, the llcc was clearly exposed and displaced slightly northwest of the deep convection. For the next 24 hours, development was somehow halted. However, after 24/0000 UTC, surface convergence and upper divergence over the system significantly increased and by 24/1200 UTC, convection virtually had erupted over the llcc with spiral bands better organised and wrapping with more curvature. At 24/1800 UTC, it was named Tropical Cyclone Kim while located about 40 miles west of Rikitea or about 200 miles southeast of Mururoa and moving westwards about 05 knots.

Kim attained storm force at 25/0000 UTC and reached hurricane intensity 12 hours later. Kim intensified further overnight with deep convection cooling further and the rather broad eye becoming well-defined and contracting. After 26/0000 UTC, the cyclone gradually accelerated under the strengthening mid-level north-easterly steering regime towards New Zealand's AOR. Primary responsibility for warnings on Tropical Cyclone Kim was handed over to RSMC Wellington after 26/0600 UTC. Kim reached its peak around 26/1200 UTC, while in New Zealand's AOR and on a steady southwest course.

According to Meteo France in French Polynesia, the only visible damage was some uprooted trees and a few less substantial homes, which lost their corrugated iron roofing.

TROPICAL CYCLONE LEO
5 - 9 March 2000

Like Kim, which developed farther east and south than usual, Leo attained cyclone status near the Nadi/Wellington border, after tracking steadily southwest, since its inception in the vicinity of the French Polynesia. Maximum intensity reached was storm category. Leo did not directly affect or move near any populated land area.

14F was first identified by RSMC Nadi as a tropical disturbance around 04/0600 UTC, while quasi-stationary about 60 miles west-northwest of French Polynesia under a tropical upper tropospheric trough (TUTT). For the next 48 hours, overall convective activity increased steadily as the system moved southwest through the Southern Cook Islands, which registered significant falls in atmospheric pressure. After 06/0000 UTC, some weakening was apparent, under increasing shear. However, 6 hours later, the system went through a very remarkable, almost explosive development. Consequently, it was named at 06/1200 UTC, some 320 miles west-southwest of Mangaia, moving steadily southwest. Once named, Leo accelerated out of Nadi's AOR.

Leo peaked around 07/0000 UTC with 50 knots close to the centre, becoming extra-tropical, a day later. While still a depression Leo passed over the small island of Mangaia (southwest of Rarotonga) between 1200 and 1800 UTC on 5 March, where damage incurred, if any would be very minor.

SEVERE TROPICAL CYCLONE MONA
7 - 13 March 2000

Tropical Cyclone Mona developed closer to the 180-degree longitude, over Tonga. It initially assumed a southwesterly track, intensifying as it moved through the Kingdom, before eventually turning southeast, just to the west of Tongatapu, towards Wellington's AOR. Mona attained a peak intensity of hurricane category. Mona did not satisfy the wind/pressure relationship typical of "normal" cyclones - well corroborated by reports received from Vavau, Haapai, Fuamotu and Nukualofa. Also, the existence of strong gradients outward from the centre was quite evident. This basically qualifies Mona as a small (or even midget) cyclone.

While activity associated with Leo erupted, around 06/0900 UTC, another tropical disturbance was identified about 70 miles south of Apia, Western Samoa, along the SPCZ and drifting slowly southwestward. The system was lying under the 250-hPa outflow centre with good divergence. By 07/0600 UTC, it had developed into a tropical depression, prompting issuance of gale warnings, in certain sectors only. The depression was then located about 120 miles southeast of Niuatoputapu, in Northern Tonga, and moving southward at about 5 knots.

At 07/1800 UTC the system was located near Vavau, now better organised, and moving slowly southwestward. Special Weather Bulletins (SWB) for Tonga were then issued, updated every 3 hours, especially for damaging gales for Vavau, Haapai, and Tongatapu groups and nearby smaller islands. Amidst shear and diurnal effects, the depression continued to develop through the 8th. After 08/0600 UTC, the llcc began moving under the dense overcast, which had apparently erupted, aided by good outflow channels in all quadrants. Hence, at 08/1200 UTC, it was named Tropical Cyclone Mona with gale force intensity while slow-moving about 40 miles west of Haapai. With the anticipation of the cyclone moving south-southwest, under the northeast steering regime, the whole Tongatapu Group was subsequently put on Storm Warning in the 7th SWB for Tonga, which was issued around 08/1500 UTC. Mona attained storm intensity by 08/1800 UTC while located about 110 miles west-southwest of Haapai, or 30 miles northwest of Tongatapu, and moving south-southwestward at 5 knots. The cyclone intensified further after 09/0000 UTC, with an eye gradually forming, as it turned more towards the south. Caught under a northwest steering field, Mona then accelerated towards the southeast, into Wellington's AOR.

Damage, especially in Vavau and Haapai groups, was mainly to crops, primarily banana, breadfruit and coconut plantations. In Tongatapu moderate damage was sustained by houses (mainly those of poorer construction) and by some school buildings. The unofficial damage assessment, according to the Tongan National Disaster Management Office, totaled Tongan $6 million. Of this amount T$4.7 million was to agriculture alone. A police patrol boat also sank off Eua Island in the Tongatapu Group. Surge/swell also affected Tongatapu.

Strongest winds/lowest pressures experienced are given below: Vavau: 07/1900 UTC, 10-min winds 34 knots/Gust 54 knots, Pressure 999 hPa Haapai: 08/1100 UTC, 10-min winds 30 knots/Gust 45 knots, Pressure 1003 hPa Fua'motu Airport (Tongatapu): 08/1500 & 09/1500 UTC, 10-min winds 50 knots/Gust 75 knots, Pressure 999 hPa Nuku'alofa (Capital of Tonga, on Tongatapu): 08/1500 & 09/1500 UTC, 10-min winds 44 knots/Gust 65 knots, Pressure 998 hPa.

TROPICAL CYCLONE NEIL
15 - 16 April 2000

Tropical Cyclone Neil was the sixth cyclone to form in RSMC Nadi's AOR this season. It was a small and short-lived system, which only lasted 18 hours as a cyclone. Neil maintained a southwest track, as a depression, diagonally across Fiji, but began turning southwards south of Kadavu, about 12 hours before it was named. As a cyclone, Neil did not directly affect any populated land area. The cyclone reached a peak intensity of gale force.

19F was first identified while embedded in a slow-moving trough of low pressure just northeast of Fiji, around 12/1200 UTC, and drifting slowly southwest. After 13/0600 UTC, it developed into a tropical depression, about 60 miles northeast of Vanuabalavu island, with convection immediately around the centre, increasing.

Though it was then located just south of the 250-hPa ridge, shear was still minimal. Through till the 15th, overall organisation gradually improved and convective tops cooled further as the systems slipped under the 250-hPa outflow. A warm SST sustained development, subsequently enhancing its potential to attaining cyclone status within the next 12 to 24 hours.

Overnight, further cooling took place, and at 15/1800 UTC, it was eventually named, while about 80 miles southeast of Kadavu and moving slowly southwards. Shear gained prominence through the 16th, effectively displacing the deep convection some 30 to 40 miles to the southeast of the llcc. This was exacerbated by the approach of a sharp 250-hPa trough, upstream. After 16/0600 UTC, it was quite apparent that shear was not going to relent. Steering was also pushing the cyclone into cooler SSTs. Finally succumbing, Neil was downgraded to a depression at 16/1200 UTC, about 220 miles south-southeast of Kadavu while moving southeast.

Damage attributable to Neil was minimal, though marginal gales affected Kadavu and Ono-i-Lau islands. During the passage of Neil, torrential rain was experienced over some parts of Fiji while strong winds affected most places. There was one fatality, due to drowning, but not directly associated with the cyclone.

Note: Distances are in nautical miles and wind speeds are 10-minute averages.

TCWC - BRISBANE

TROPICAL CYCLONES STEVE
27 February - 9 March
(Brisbane /Darwin /Perth TCWCs)

By late February, monsoonal conditions extended across Australia and into the southwest Pacific, and a small circulation formed east of Willis Island on 25 February. The low moved west and deepened, and was named *Steve* on the morning of 27 February. *Steve* developed rapidly in close proximity to the Queensland coast, reaching peak intensity of 32 m/s (62 kn), before making landfall near Cairns and weakening as it tracked inland. The low crossed Cape York Peninsula as a rain depression then re-intensified to cyclone status, reaching near storm force in the southern Gulf of Carpentaria. *Steve* crossed the Northern Territory coast north of Port McArthur on 1 March and weakened. The residual depression travelled westward across northern Australia under the influence of a strong middle-level ridge, eventually moving offshore west of Broome in Western Australia and re-intensifying into a tropical cyclone on 5 March. *Steve* moved west-southwest parallel to the coast before moving inland near Mardie on 6 March. Early on 8 March, *Steve* again moved out to sea re-intensifying and reaching its most westward point before moving slowly around the mid-level ridge. *Steve's* final landfall was over Shark Bay on 9 March. The decaying cyclone then accelerated overland to the southeast and became extra-tropical, traversing southern Western Australia and moving into the Great Australian Bight on 12 March.

Steve had a significant impact over a large area of Australia. While crossing Cape York Peninsula it caused major flooding between Cairns and Mareeba, with a record flood level of 12.4 metres at Mareeba on 28 February. Ninety people were evacuated from the town and the railway bridge was washed away. The winds caused building damage and many trees and powerlines were brought down in the district; winds and floods also caused severe crop damage. Across the Northern Territory, strong squalls produced mainly minor damage, however widespread flooding from heavy rain was experienced in the Katherine, Daly and Victoria River regions. Several communities were evacuated and numerous roads and highways were cut. Over Western Australia, ex-*Steve* continued to produce heavy falls in the Kimberley with greater than 300 mm recorded in the Eighty Mile Beach area. Many communities remained isolated for up to two weeks. Several sites reported highest-on-record daily rainfall amounts including Mandora (281 mm on 6 March) and Mount Narryer (152 mm on 9 March). Carnarvon reported its highest March daily rainfall (100.6 mm on 9 March). The Gascoyne River recorded its highest flood level since 1961. Flooding also occurred along the southern coast of Western Australia near Esperance where a number of roads and bridges were washed away.

TROPICAL CYCLONE TESSI
2 - 3 April
(Brisbane TCWC)

Tessi was first identified as a tropical low in the northern Coral Sea on 31 March. The low travelled towards the southwest and intensified to tropical cyclone strength early on 2 April. *Tessi* continued to track west-southwest, reaching its peak intensity of 30 m/s (59 kn) close to the Queensland coast. The cyclone crossed the coast about 75 kilometres to the northwest of Townsville early on 3 April and rapidly weakened overland. *Tessi* caused widespread wind damage to trees and powerlines and high seas destroyed boats and caused coastal erosion around the city. A significant landslide in a Townsville suburb destroyed two homes and required the evacuation of another 50 households. Townsville Airport recorded a maximum wind gust of 36 m/s (70 kn) and its highest April daily rainfall of 271.6 mm in the 24 hours to 9 am on 3 April.

TROPICAL CYCLONE VAUGHAN
3-6 April
(Brisbane TCWC)

A monsoon low was identified near New Caledonia on 29 March and initially moved southwest before commencing a north and then northwest track. The low intensified rapidly due to favourable upper outflow and was named *Vaughan* on 3 April. The cyclone tracked westward across the Coral Sea towards north Queensland, reaching peak intensity of 30 m/s (58 kn) on 5 April before rapidly weakening, being downgraded to a tropical low the following day. The low was responsible for heavy rainfall along the north Queensland coast.

TCWC WELLINGTON

SUMMARY

This cyclone season started relatively late in the South-West Pacific area: 75% of the seasons start before 25 December but the first system *Iris* began to form on 6 January. However, it is not as unusual for the New Caledonia-Vanuatu area as 75% of their cyclone seasons start before 10 January.

Three of the phenomena that were observed occurred east of 180. One of them even formed in the extreme east, south of the Gambier Islands, which is quite rare especially as it was considered to be a La Nina year. The other depressions formed west of 180. One of them, *Steve*, followed an unusual chart: it formed in the Pacific Ocean and disintegrated in the Indian Ocean.

This season was a typical one throughout the Pacific basin as far as the total number of phenomena was concerned. However, there was a slight difference with the averages, due to the fact that there were fewer hurricanes and more storm force tropical cyclones in the 1999-2000 season.

List of the Tropical Cyclones in 2000

Tropical Cyclone		**Duration**		**Min Central Pressure (hPa)**	**Max Wind (kt)**
	Jo	26 Jan	02 Feb	974	60
	Kim	26 Feb	03 Mar	935	90
	Leo	06 Mar	10 Mar	985	50
	Mona	10 Mar	14 Mar	960	75
	Neil	17 Apr	20 Apr	996	35

TROPICAL CYCLONE JO
26 January- 2 February

Tropical cyclone Jo crossed into the Wellington area near 25°South 179°East at 261200 UTC January while moving southeast at marginal hurricane intensity. Jo was now trekking over the vast, open South Pacific Ocean. In the absence of major shearing, Jo spun down very slowly over the cooler seas and was able to maintain its tropical cyclone status until 280000 UTC. Late on the 28^{th}, extratropical cyclone Jo recurved southwards and on the 29^{th} January became much slower moving. From January 30^{th} to February 2^{nd}, the transformed low shifted very slowly eastwards before decaying just north of 45°South and near 135°West.

SEVERE TROPICAL CYCLONE KIM
23 February - 3 March

Tropical cyclone Kim peaked with 10-minute average winds estimated to be 90 knots near the Nadi/Wellington boundary at 139.5°West on the 26^{th} UTC while sporting a very well defined eye in the satellite imagery. On the 27^{th} UTC Kim's eye became increasing cloud filled and by the end of that day, the eye was no longer visible in the satellite imagery. Kim continued to track southwestwards over the open waters of the Southeast Pacific until 1200 UTC on 28 February while its intensity declined slowly over the progressively colder seas. After this time, Kim was steered on a slightly more southerly course until 1800 UTC on 1March when it was picked up by a high latitude trough and shunted quickly southeast. Kim survived as a tropical cyclone as far as 35°South. The remains of Kim eventually decayed near 47.5°South 132.5°West on March 3rd.

TROPICAL CYCLONE LEO
4 - 10 March

Tropical cyclone Leo was named near 163.4°West at 061200 UTC almost on the Nadi/Wellington boundary as it was drifting southwestwards. Leo reached peak intensity of 50 knots soon after entering the Wellington area and an upper level trough to the southwest quickly nudged the cyclone onto a southerly course. Leo eventually lost tropical cyclone status near 36.0°South 165.2°West at 080000 UTC and shortly afterwards recurved onto a southeast track. The low formerly cyclone Leo was picked up by a strong westerly flow and eventually disappeared into the icy sub-Antarctic waters on the 10th.

SEVERE TROPICAL CYCLONE MONA
6 - 14 March

After affecting southern Tonga, Mona reached peak intensity of 75 knots around 100600 UTC just a few hours before crossing the Nadi/Wellington boundary. During the following 24 hours, Mona moved on a southerly course over open sea as a new upper low developed southwest of the cyclone. The tropical cyclone weakened steadily as its upper cloud canopy with warming tops sheared sufficiently to expose its low-level centre in the satellite imagery at 110300 UTC. Thereafter, Mona became difficult to trace in the imagery as cloud spawned by the developing upper low spread out into the southern semicircle of the cyclone. Mona's status as a tropical cyclone was retained until 111200 UTC when it was centred just north of 30°South and near 172°West. On the 12th UTC, the old cyclone vortex combined with the newly formed cloud band to produce a new low east of New Zealand. On the 13th, the extratropical low shifted quickly southeast until it was no longer untrackable south of 50°South and near 140°West.

TROPICAL CYCLONE NEIL
15 - 20 April

Tropical Cyclone Neil had already dissipated as a tropical cyclone before shifting into the Wellington area late on the 17th UTC. However, a low was still evident for a while with gales in the southeastern semicircle. On the 20th, this low slid around the northwest flank of an intense South Pacific high and was eventually absorbed into a developing low near the Chatham Islands, east of New Zealand on the 21st.

VERIFICATION STATISTICS - RSMC NADI

Position forecast verification statistics for each cyclone (**Table 1**) were derived by comparing the initial and forecast positions (given in warnings issued by RSMC Nadi-TCC) with post analysis ‘best track’ positions. It must be noted here, that the

Australian Tropical Cyclone Workstation (ATCW) verification programme, which is used by RSMC Nadi, is sensitive to insufficient data. Consequently, we could not verify, beyond the initial positions, tropical cyclones *Leo* and *Neil*. These systems were named very close to our common boundary with RSMC Wellington, with *Neil* only surviving a mere 18 hours, as a cyclone.

However, overall, initial position errors were similar to previous seasons, except for a relatively large error contributed by *Leo*. This error was due to difficulty in tracking the low-level circulation centre, while being subjected to strong vertical shear.

At 12 hours, the aggregate revealed persistence slightly better than forecasts, similar to the 98/99 season, but showing improvement compared to the 96/97 and 97/98 seasons. This was despite relatively large errors associated with *Iris* and *Mona*; attributed to difficulties in forecasting their re-curvature, exacerbated by their small and compact nature.

At 24-hours, forecasts showed skill over persistence. Compared with the previous three seasons, the former showed significant improvement, despite the relatively large errors by *Iris* and *Mona.*

Table 1. Position forecast verification statistics for official warnings issued by RSMC Nadi. Forecast positions are verified against the official best track. Persistence errors (in brackets) are included for comparison. *Leo* and *Neil* could not be verified beyond 0 hours due insufficient data.

Lead-time	0 hours		12 hours		24 hours	
Name	Mean error (km)	Number	Mean error (km)	Number	Mean error (km)	Number
Iris	15	17	119(92)	9	236(267)	7
Jo	35	19	118(120)	12	185(226)	10
Kim	9	16	55(63)	11	116(196)	9
Leo	70	14	-	-	-	-
Mona	39	18	130(139)	11	216(293)	9
Neil	14	8	-	-	-	-
Aggregate	31	92	115(112)	48	190(245)	34

In **Table 2**, the radius of the circles (centred on the centroid of the errors) containing 50% of the operational initial positions, is smaller than 0.5 degree of latitude (55.5 km) for all cases, except for *Leo*. Therefore the warning positions could have been given as "Position Good", most of the time.

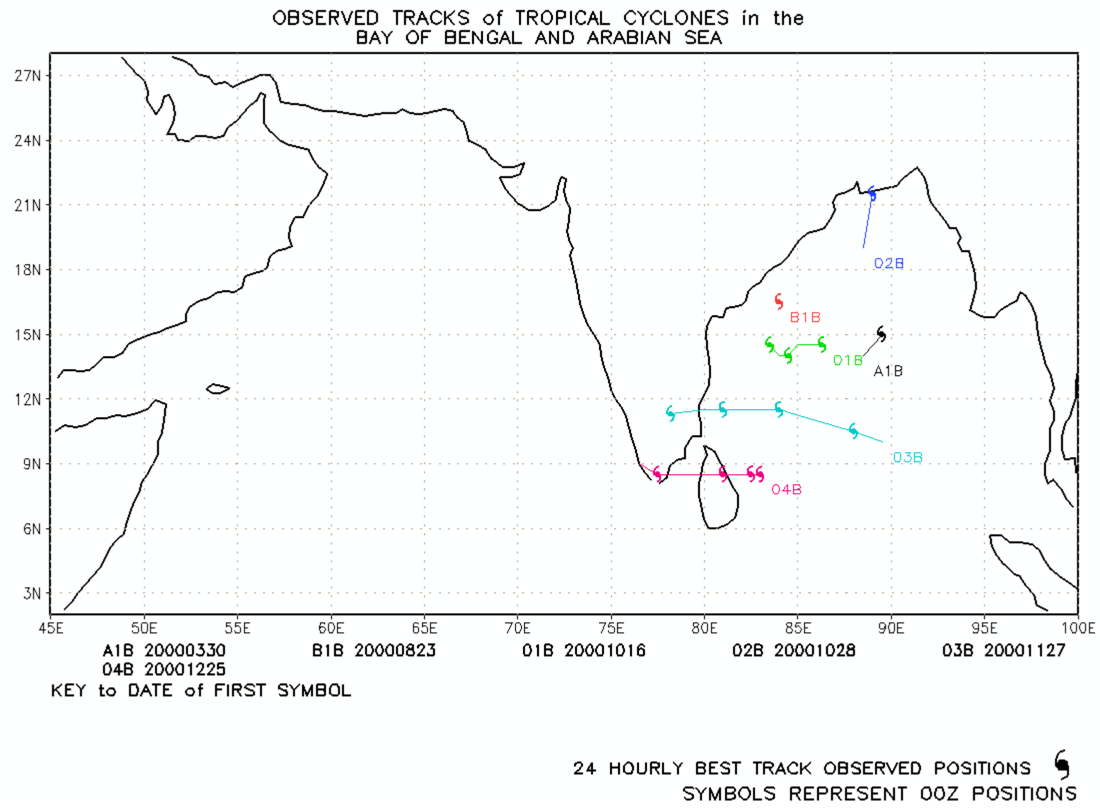
The forecast error centroids and size of the radius of the 50% circle (centred on the centroid of the errors) indicate bias and consistency of bias in the forecast positions. For example *Iris* and *Jo*, consistently ran east of the expected track, so the centroids are biased to the west. *Mona's* large westerly bias, at 24 hours, was due to the difficulty in forecasting its turn towards the southeast when it was steadily moving southwest.

Table 2. **Centroid of errors for initial (0-hour lead time), 12-hour and 24-hour forecast positions given in warnings issued by RSMC Nadi with the radius of the circle enclosing 50% of the positions. All distances are in kilometres. *Leo* and *Neil* could not be verified beyond 0 hours due insufficient data.**

Lead-time	0 hours		12 hours		24 hours	
Name	Centroid E-wd, N-wd	Radius of 50% circle	Centroid E-wd, N-wd	Radius of 50% circle	Centroid E-wd, N-wd	Radius of 50% circle
Iris	-7, 1	15	-82, -13	85	-227, 16	86
Jo	-18, 5	33	-67, 17	92	-108, 62	117
Kim	2, 1	9	27, 27	39	59, 79	69
Leo	22, 27	72	-	-	-	-
Mona	11, -4	39	-52, -12	107	-141, 69	149
Neil	-5, 0	12	-	-	-	-
Aggregate	1, 5	40	-42, 13	106	-95, 51	151

RSMC tropical cyclones
New Delhi

Director: Mr S.R. Kalsi



Classification of Cyclonic Disturbances

Classifications of cyclonic disturbances for the Bay of Bengal and the Arabian Sea region for the exchange of messages among the Panel countries are given below:

	Weather system	Maximum wind speed
1.	Low pressure area	Wind speed less than 17 kt (31 km/h)
2.	Depression	Wind speed between 17 and 27 kt (31 and 51 km/h)
3.	Deep depression	Wind speed between 28 and 33 kt (52 and 61 km/h)
4.	Cyclonic storm	Wind speed between 34 and 47 kt (62 and 88 km/h)
5.	Severe cyclonic storm	Wind speed between 48 and 63 kt (89 and 118 km/h)
6.	Very severe cyclonic storm	Wind speed between 64 and 119 kt (119 and 221 km/h)

7.	Super cyclonic storm	Wind speed 120 kt and above (222 km/h)

Cyclone Season

The periods April to May and October to December during which most of the cyclonic storms occur in the Bay of Bengal and Arabian Sea.

The periods April to May and October to mid-December during which most of the cyclonic storms occur in the Bay of Bengal and Arabian Sea.

RSMC TROPICAL CYCLONES NEW DELHI

SUMMARY

The North Indian Ocean witnessed a decrease in the number of tropical disturbances during 2000 (5 cyclones and one depression) as compared to 1999 (4 cyclones & 4 depressions). The significant feature of the year was the development of a very severe cyclonic storm in the Bay of Bengal that first made landfall over Sri Lanka and later over India. The cyclonic activity was absent in the pre-monsoon months of April and May and also during the monsoon months of June, July and September. No cyclo-genesis took place in the Arabian Sea during this year. Though the sea surface temperatures were near normal over the Arabian Sea , it was the lack of suitable upper air wind and vorticity patterns that prevented the cyclogenetic activity in this region. Two of the five cyclones that developed over the Bay of Bengal weakened over the sea itself. Two cyclones crossed Indian coasts. Only one cyclone each crossed Bangladesh and Sri Lanka coast.

The convective activity over the central Bay of Bengal was generally subdued during the month of October though it was pronounced in the south Bay of Bengal. This is evident from the mean Outgoing Longwave Radiation (OLR) field derived from INSAT-1D IR data that shows that one convective maxima was located over Sumatra and another over the Gulf of Thailand extending into neighbouring land areas. The position was no different in the subsequent months of November and December in which the convective maxima shifted relatively southwards. In

comparison to this higher OLR upwelled from central and north Bay of Bengal in 1998 in which two cyclones formed in quick succession in the month of November.

List of the Tropical Cyclones in 2000

Tropical Cyclone	**Duration**		**Min Central Pressure (hPa)**	**Max Wind (kt)**
CS BOB	27 Mar	30 Mar	998	45
CS BOB	15 Oct	19 Oct	996	35
CS BOB	25 Oct	28 Oct	998	35
VSCS BOB	26 Nov	30 Nov	958	102
VSCS BOB	23 Dec	28 Dec	970	90

CS - Cyclomic Storm
VSCS - Very Severe Cyclonic Storm
BOB - Bay of Bengal

CYCLONIC STORM OVER THE BAY OF BENGAL
27 - 30 MARCH
BOB 00 01 03 27 30

It was an unusual development in which a depression formed over south-east Bay of Bengal on 27 March. While moving initially northwestwards and later northward it intensified into a cyclonic storm over east central Bay of Bengal on 29 March. The development could not be sustained and the cyclonic storm weakend into a depression and later dissipated over east central Bay of Bengal on 30 March.

The third week of March 2000 witnessed enhanced convective activity in the equatorial Bay of Bengal. The maximum cloud zone associated with it drifted northward and reached the latitude belt 5-10 degree north in the subsequent week. In this active equatorial trough a low pressure area formed over south-east Bay of Bengal on 27 March that concentrated into a depression at 271200 UTC near Lat. 7.5^0 N / Long. 90.0^0 E.

It was still an innocuous system that moved in a north-westerly direction and lay centred at 280300 UTC near Lat. 10.0^0 N / Long. 88.5^0 E. A ship VVKG (7.3^0 N/82.6^0 E) reported wind of 310^0/30 kts and pressure 1010.3 hPa at 280300 UTC The movement of the system slowed down as it intensified into a deep depression and lay centred at 290300 UTC near Lat. 13.0^0 N / Long. 88.0^0 E. A ship SHIP (11.1^0 N / 82.5^0 E) reported wind of 020^0/25 Kts and pressure of 1008.5 hPa. Thereafter the system changed its course and started moving in a north-easterly direction. It continued to intensify further and reached the minimal cyclone intensity (T-2.5) at 291200 UTC when it was centred near Lat. 14.0^0 N / Long.88.5^0 E. At 300300 UTC the ship SHIP (15.1^0 N / 83.0^0 E) reported wind of 020^0 / 20 kts and pressure of 1008.7 hPa. At this stage the system came under the influence of strong upper air westerly flow and got sheared off. It weakened and dissipated over east central Bay of Bengal on the afternoon of 30 March.

Development of a cyclonic storm in the North Indian Ocean in the month of March is rare. In the history of the cyclonic storms in the Bay of Bengal (since 1877) cyclonic storms had developed earlier in March in the year 1907, 1924, 1925 and 1928. Except the cyclone of the year 1907 which crossed Sri Lanka coast, all others dissipated over the sea.

WEATHER REALISED

In association with the system widespread rainfall occurred in Andaman and Nicobar Islands. Realised cumulative rainfall for the period 27-31 March was 23 cm at Hut Bay (43364), 18 cm at Port Blair (43333) and 15 cm at Car Nicobar (43367).

DAMAGE

No damage to life and property was reported.

DEPRESSION OVER THE BAY OF BENGAL
23 - 24 AUGUST

No monsoon depression formed over the Bay of Bengal in the first two months of the south-west monsoon season. Season’s first depression formed on 23 August over west-central Bay. It crossed Andhra Pradesh coast north of Machilipatnam and led to an intense rainstorm leading to floods that submerged many areas even in Hyderabad City.

Initial cyclogenesis took place on 22 August when a well marked low pressure area developed over west central Bay that concentrated into a depression in the morning of 23 August over west-central Bay of Bengal close to Andhra Pradesh coast with its centre near Lat. 16.5 N/ Long. 83.5 E. It crossed Andhra Pradesh coast near Kakinada (43189) by the midnight of 23 August and weakened into a well marked low pressure area over Telengana region of Andhra Pradesh and neighbourhood. Continuing to move in a north-westerly direction the well marked low pressure area dissipated over south Gujarat coast and neighbourhood on 28 August.

WEATHER REALISED

Under the influence of this depression heavy to very heavy rainfall occurred in Rayalaseema. Isolated heavy rainfall also occurred in rest Andhra Pradesh, Marathawada and Madhya Maharashtra. Hyderabad recorded exceptionally heavy rainfall of 24 cm on 24 August.

DAMAGE

In association with the depression, heavy rains were reported from districts in the central parts of Andhra Pradesh State of India. Hydrabad city received exceptionally heavy rain of 24 cm. In the above districts 131 deaths have been reported due to wall collapse, drowning, etc. As per the preliminary estimates, about 8651 houses were fully damaged, 27026 houses partly damaged in 2886 villages/ towns . 98079 people were evacuated and kept in 189 relief camps. About 5368 cattle were reported as lost and 2389 roads of Panchayati Raj, R & B and National High Ways were damaged over a distance of 7435 km disrupting traffic. 1578 minor irregation and Panchayati Raj tanks breached. An estimated 1,77,987 hectares paddy and other crops were damaged in the affected districts. Due to heavy rains 902 power transformers were damaged. 28 sub-stations 787 distribution transformers were damaged. 33 KV lines numbering 225 and 11 KV lines numbering 6000 are damaged. Preliminary estimate of a loss of Rs. 776.75 crores was reported by the government of Andhra Pradesh.

CYCLONIC STORM OVER THE BAY OF BENGAL
15 - 19 OCTOBER
BOB 00 02 10 15 19

A depression formed over eastern parts of west central Bay of Bengal on 15 October. Moving in a westerly direction it intensified into a cyclonic storm over central parts of west central Bay of Bengal on 17 October. However, it weakend over the sea itself on 19 October without making landfall.

The monsoon shear zone was active over the south Bay of Bengal in the beginning of October 2000. It shifted northward towards the end of second week of October. In this active shear zone a low pressure area formed ‘ in- situ’ over central and adjoining south Bay of Bengal on 12 October. It persisted, moved westward and became well marked over east central Bay of Bengal on 14 October and concentrated into a depression at 150000 UTC that lay centred near Lat 14.5^0 N / Long 88.5^0 E.

The INSAT imagery showed a shear pattern in which deep layer cluster was seen to the west of the low level circulation centre in the visible satellite imagery. In the infrared cloud imagery the low level circulation centre was not seen. The subsequent satellite imagery confirmed that this circulation centre had come closer to the dense convection. It was upgraded to the stage of a deep depression at 151800 UTC near Lat 14.5^0 N/ Long 86.5^0 E. A Ship ATJW at 13.2^0 N/ 84.8^0 E reported wind 230^0/35 kts and pressure 1000.2 hPa at 160600 UTC. Another ship VTZJ (11.4^0 N/ 91.7^0 E) reported wind 240^0/08 kts. After 161200 UTC the system took a west-south-westerly course and intensified into a cyclonic storm at 170000 UTC near Lat 14.0^0 N /Long 84.5^0 E. A ship VWXG at 13.5^0 N/ 84.3^0 E reported wind of 210^0/30 Kts and pressure of 997.2 hPa at 170600 UTC. A Buoy at lat.13.9^0 N/ long.83.2^0 E reported wind of 033^0 / 20 Kts. The system continued to display the shear band pattern. As the vertical wind shear over the system increased, it weakened over the sea itself during next 3 days.

WEATHER REALISED

Under the influence of this system widespread rainfall with isolated heavy rain occurred over coastal areas of Andhra Pradesh and Orissa.

DAMAGE

As the system weakened over the sea itself, No damage to life and property was reported.

CYCLONIC STORM THE BAY OF BENGAL
25 - 28 OCTOBER
BOB 00 03 10 25 28

A depression developed in the East Central Bay of Bengal on 25 October. Moving initially in a northwesterly direction and later northward, it intensified into a cyclonic storm on 27 October. It eventually re-curved northeastwards and crossed Bangladesh coast in the morning of 28 October.

The seasonal trough was active between 10^0 N and 15^0 N latitudes in the Bay towards the end of October. In this active trough zone a low pressure area formed 'in -situ' over North Andaman Sea on 24 October that became well marked in the morning on 25 October. It concentrated into a depression over North Andaman Sea and adjoining East Central and Southeast Bay of Bengal at 250900 UTC near lat. 13.5^0 N / Long. 93.0^0 E.

The system initially moved in a north-westerly direction. The amount of intense convection in the inner area of the depression increased in the afternoon of 26

October. The system became a deep depression at 270300 UTC when it was centred near Lat. 18.0^0 N / Long. 88.5^0 E. . At this stage the buoy at $12.2^{`0}$ N / 90.8^0 E reported wind 184^0 /12 kt and pressure 1010.2 hPa . Another buoy at 18.5^0 N/ 87.5^0 E indicated wind 360^0 /13 kt and pressure 1002.1 hPa. The third bouy at 14.0^0 N /83.2^0 E reported wind 010^0 / 06 kt and pressure 1008.1 hPa . These observations were found very useful as they enabled the analyst to draw 4 isobars, at 2 hPa interval, around the system centre. The northern buoy continued to provide valuable data as the storm moved further northward. There was another surge of deep convection in the inner area in the afternoon on 27 October and a comma cloud system could be seen at night in the satellite imagery. The system further intensified into a cyclonic storm at 271800 UTC near Lat 20.5^0 N / Long 88.5^0 E. The cyclonic storm eventually re-curved north-eastward and crossed Bangladesh coast around 280300 UTC near Mongla (lat. 23.0^0 N / long. 89.0^0 E). It rapidly weakened into a low pressure area over north Bangladesh.

WEATHER REALISED

In association with the system widespread rainfall occurred in Andaman and Nicobar Islands. Fairly widespread rainfall with isolated heavy falls also occurred over north-east India.

DAMAGE

[Source: Government of Meghalaya]

The system severely affected six of the seven districts of the state of Meghalaya in India. It caused extensive damage to infra-structure, standing crops and plantation. Hundreds of houses were damaged rendering thousands of people homeless. It also caused loss of a large number of livestock. The preliminary estimate of total damage was of the order of Rs. 60 crores.

VERY SEVERE CYCLONIC STORM OVER THE BAY OF BENGAL
26 - 30 November
BOB 00 04 11 26 30

A depression formed in the south-east Bay of Bengal on 26 November that initially moved northwestwards and intensified into a cyclonic storm on 27 November. While moving almost westwards later, the system further intensified into a very severe cyclonic storm on 28 November when it was located more than 300 km away from north Tamil Nadu coast. However, it weakend before crossing the coast near Cuddalore and activated the north-east monsoon rainfall in some areas of Tamil Nadu for about two days.

An upper air cyclonic circulation lay over South Andaman Sea on 24 November. It culminated into a low pressure on 25 November when the satellite picture showed increase in the extent and depth of convection. A solid cloud cluster indicating central dense overcast (CDO) with embedded low level circulation centre was seen in the visible satellite imagery at 260300 UTC which indicated that a depression had formed near lat.8.5 ^{0} N / long. 91.5^0 E.

The depression moved north-north-westward and intensified into a deep depression. A buoy at lat. 12.1^0 N / long.90.7^0 E reported north-easterly wind of about 25 knots at 261500 UTC. The system acquired the stage of cyclonic storm at 270900 UTC when it lay centred near lat. 11.0^0 N / long. 86.5^0 E. The CDO pattern continued on 27 November and became more marked with outflow seen in all quadrants. The easterly surge strengthened the convergence in the inflow band from the north. The system was upgraded to the stage of a severe cyclonic storm at 280000 UTC near lat.11.5 ^{0} N / long. 84.0^0 E.

The system further intensified into a very severe cyclonic storm at 280600 UTC near lat.11.5 ^{0} N/ long. 83.0^0 E. The cyclone came within the range of Cyclone Detection Radars (CDR) at Chennai and Karaikal at 280800 UTC. CDR Karaikal reported open 'eye' at 280800 UTC and closed elliptical 'eye' from 281100 UTC. CDR Chennai reported 'open eye' from 281400 UTC onwards with 'eye' wall 20 km . The eye in the satellite imagery got warmed up to – 16^0 C with surrounding cold convection with cloud top temperature in the range of –70^0 C to –75^0 C. Around this time CDR Karaikal reported closed circular 'eye' near lat.11.4 ^{0} N/ long. 81.6^0 E and CDR Chennai reported 'eye' near lat.11.5 ^{0} N / long. 81.5^0 E with eyewall 20 km wide. Thereafter the cyclone weakened as it interacted with the land.

The cyclone crossed the coast south of Cuddalore (43329) at 291130 UTC as a very severe cyclonic storm uprooting big trees at various places in and around Pondicherry and Cuddalore areas, Cuddalore Observatory reported surface pressure of 983.1 hPa. The touring officer indicated that this cyclone crossed just south of Cuddalore. Thus the central pressure is estimated as 978 hPa at the time of landfall . However, the winds experienced over the coastal areas were reported to be of the order of 110-120 Kmph.

This cyclone after land fall drifted south-westwards and weakened into a depression at 300300 UTC near Kodaikanal (43339) in south Tamil Nadu. Thereafter, it emerged into east Arabian Sea on 1 December as a low pressure system and weakened later.

From the information gathered from the affected people in the coastal areas, it was learnt that lull period lasted for a maximum of 45 minutes indicating prevalence of 'eye' which was, however, not seen in the satellite and radar images at that time.

WEATHER REALISED

The system produced comparatively very less rainfall activity. However, a few stations in the south-west and western sector of the storm received very heavy rainfall during the 24 hours periods of the order of 20 cm and above, the highest being 45 cm at Thozhudhur and 44 cm at Kilacheruvai in Cuddalore district.

DAMAGE

Two states namely Tamil Nadu and Pondicherry were mainly affected by this system.

Tamil Nadu

The loss is mainly due to crop damage, uprooting of big trees and partial damages to more than one thousand Kuchha houses and fourteen brick houses due to strong wind. 10 persons lost their lives due to wall/ building collapse/ electrocution. Of these 7 were in Cuddalore district , two in Thiruvallure district and one in Nagapattinam district. Cuddalore district bore the brunt of cyclone fury where more than 30,000 trees were uprooted, more than thousand electric poles and four transformers had been damaged. Estimated loss in Cuddalore district is about 20 crores as per press report. Roofs of 1000 houses were blown off, 14 brick houses were washed away and 300 houses were surrounded by sea water. Sugarcane in 100 acres, 30,000 Plantain trees, 50,000 plantain saplings also got destroyed.

Pondicherry

Damage to paddy crops, plantains and coconut plantation were the major loss. About 40,000 Kutcha houses along the coastal belt were partially damaged due to strong wind. Two persons lost their lives. Total loss is estimated to be about 50 crores as per press report.

VERY SEVERE CYCLONIC STORM OVER THE BAY OF BENGAL

23-28 DECEMBER

BOB 00 05 12 23 28

Sri Lanka experienced the landfall of a very severe cyclonic storm 9 years after the strike of earlier cyclone of November 1992. But unlike the previous cyclone, it did not strengthen after emerging in the Gulf of Mannar. It was still able to deliver most needed rains in the southern state of Tamil Nadu .

A well marked low pressure area formed over south-west bay of bengal within the pre-existing active northern hemispherical equatorial trough on 22 december. A belt of strong easterly winds was seen extending westwards over the bay of bengal. A cloud vortex seen in the satellite imagery at 230300 utc indicated formation of depression near lat. 8.0^0 n / long. 86.0^0 e about 500 km east-south-east of trincomalee (43418) on the east coast of sri lanka.

The system moved very slowly westwards and intensified into a deep depression at 240000 near lat. 8.0^0 n / long. 84.0^0 e about 300 km east of trincomalee. Moving almost in a north-westerly direction, the deep depression further intensified into a cyclonic storm at 250300 utc near lat. 8.5^0 n / long 83.0^0 e when a central dense overcast pattern (cdo) started developing around the low level circulation centre. As the massive convective burst developed further in the cdo the system intensified into a severe cyclonic storm at 251800 utc near lat. 8.5^0 n / long. 83.0^0 e. It moved westwards under the influence of upper tropospheric easterly flow south of the ridge at 200 hpa level which lay at about 15^0 n latitude over india and neighbourhood.

A broad banding ‘eye’ appeared at 260300 utc when the system acquired the intensity of very severe cyclonic storm. The system came under the range of cdr karaikal at

260600 utc when it reported spiral band with partial eyewall. At 261000 utc it reported open eye about 180^0, circular in shape. The system acquired the maximum intensity at 261200 utc corresponding to t-5.0 with maximum sustained wind speed of 90 kts when it was centred near lat. 8.5^0 n / long. 81.0^0 e. The 'eye' was just on the east coast of sri lanka near trincomalee. The system started interacting with land and the convective pattern weakened leading to weakening of the cyclone. It emerged in the gulf of mannar and unlike the november 1992 cyclone, it did not show any intensification as the fetch available was relatively small. A buoy at lat. 8.2^0 n / long. 78.6^0 e reported pressure of 1000.4 hpa at 2712000 utc.

Continuing its westward course, it weakend further and made second landfall near Tuticorin (43379) between 272100 and 272200 UTC as a cyclonic storm. It further weakend into a depression at 281200 UTC near Alapuzha (43352). Moving westward it emerged in the Arabian Sea on 29 December. The system weakend into a low pressure area over east central Arabian Sea. It subsequently got linked up with the trough in mid tropospheric westerlies on 28 December. This synoptic situation gave rise to extensive light showers in parts of western and central India.

This system produced an excellent rainfall distribution in the drought hit state of tamil nadu on 3 days and improved the performance of the north-east monsoon further in the south peninsula.

WEATHER REALIZED

In association with the system widespread rainfall occurred in South Tamil Nadu, Rayalaseema, Pondicherry and Kerala. In association with this system the 24 hour rainfall was of the order of 10 cm and above, the highest being 18 cm at Nagapattinam and 13 cm at Ramanathapuram and Thanjavur each, 12 cm at Tiruvaarur.

DAMAGE

[source : Govt. of Tamil Nadu]

Three districts of Tamil Nadu state were affected by the storm. In the Ramanathpuram district, 350 houses were reported damaged. The reported damages from the remaining two districts are as below:

Thirunelveli:

- Cattle heads lost - 2
- Houses damaged - 162 (fully16; partially 146)

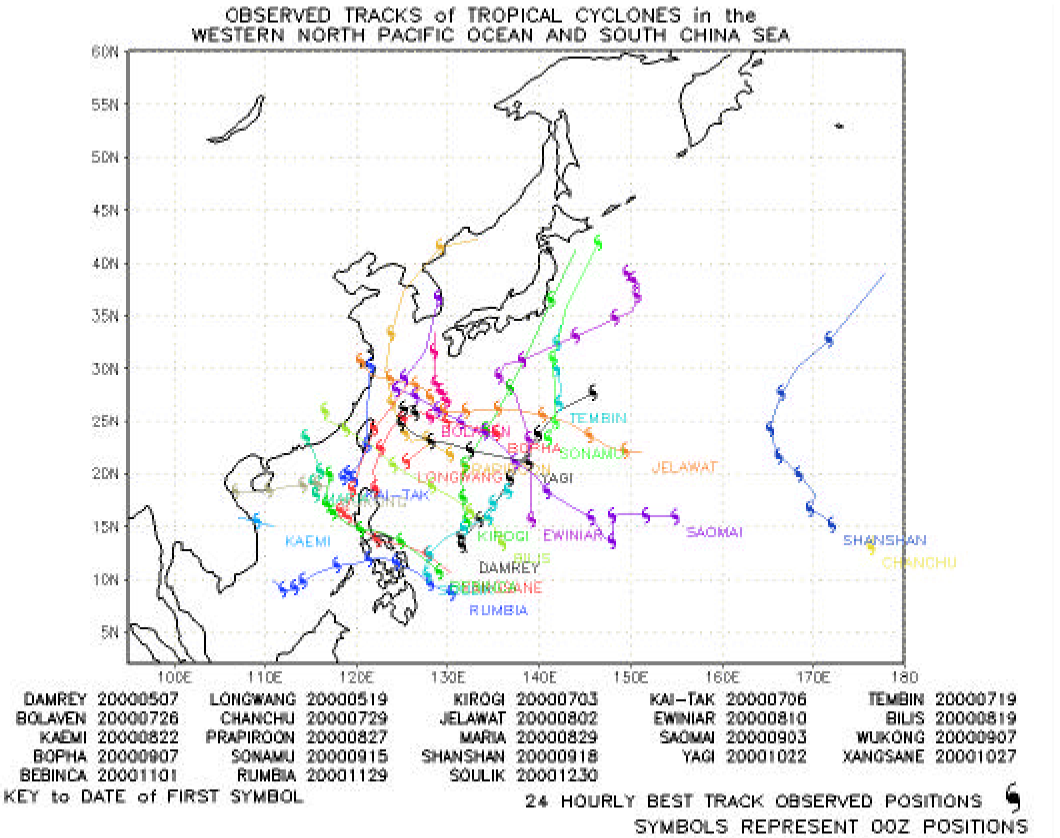
Tuticorin:

- Cattle heads lost- 3
- Houses damaged - 318 (fully 65; partially253)
- Fishing boats lost - 95
- Loss to crops: Paddy crops-281hectares
  - Betal - 80 hectares
  - Plantain- 650 hectares

RSMC Tokyo-Typhoon Center

Director: Mr Tatsuo Ueno


RSMC
Tokyo


OBSERVED TRACKS of TROPICAL CYCLONES in the
WESTERN NORTH PACIFIC OCEAN AND SOUTH CHINA SEA
60N
55N
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
100E
110E
120E
130E
140E
150E
160E
170E
180
TEMBIN
BOLAVEN
BOPHA
SONAMU
JELAWAT
LONGWANG
YAGI
KAI-TAK
KAEMI
KIROGI
EWINIAR
SAOMAI
BILIS
DAMREY
RUMBIA
SHANSHAN
CHANCHU
DAMREY 20000507
LONGWANG 20000519
KIROGI 20000703
KAI-TAK 20000706
TEMBIN 20000719
BOLAVEN 20000726
CHANCHU 20000729
JELAWAT 20000802
EWINIAR 20000810
BILIS 20000819
KAEMI 20000822
PRAPIROON 20000827
MARIA 20000829
SAOMAI 20000903
WUKONG 20000907
BOPHA 20000907
SONAMU 20000915
SHANSHAN 20000918
YAGI 20001022
XANGSANE 20001027
BEBINCA 20001101
RUMBIA 20001129
SOULIK 20001230
KEY to DATE of FIRST SYMBOL
24 HOURLY BEST TRACK OBSERVED POSITIONS
SYMBOLS REPRESENT 00Z POSITIONS

Classification of Cyclonic Disturbances

Tropical cyclone: Generic term for a non-frontal synoptic scale cyclone originating over tropical or sub-tropical waters with organized convection and definite cyclonic surface wind circulation. (The term is also used for a storm in the South-West Indian Ocean in which the maximum of the sustained wind speed* is estimated to be in the range of 64 to 90 knots and in the South Pacific and South-East Indian Ocean with the maximum of the sustained over 33 knots.)

Tropical depression: A tropical cyclone with the maximum sustained winds of 33 knots (17.1 m/s, 61 km/h) or less near the centre.

Tropical storm: A tropical cyclone with the maximum sustained winds of 34 knots (17.2 m/s, 62 km/h) to 47 knots (24.4 m/s, 88 km/h) near the centre.

Severe tropical storm: A tropical cyclone with the maximum sustained winds of 48 knots (24.5 m/s, 89 km/h) to 63 knots (32.6 m/s, 117 km/h) near the centre.

Typhoon: A tropical cyclone with the maximum sustained winds of 64 knots (32.7 m/s, 118 km/h) or more near the centre.

Cyclone Season

Tropical Cyclones in the western north Pacific Ocean occurs all-year round.

RSMC TOKYO-TYPHOON CENTER

SUMMARY

In 2000, 23 tropical cyclones of tropical storm (TS) intensity or higher were tracked in the area of responsibility of the RSMC Tokyo – Typhoon Center. The total number is smaller than the thirty-year-average of 27.8 for 1961-90. Thirteen cyclones out of them (57% of the total) reached typhoon (TY) intensity; the percentage is slightly larger than normal (54%). Four out of the remainder attained severe tropical storm (STS) intensity and six of the rest remained at TS intensity.

The tropical cyclone season of this year began in the beginning of May about one month and a half later than normal with the development of Damrey. After the second cyclone formed near the Philippines in mid-May, tropical cyclone activity in the basin was suppressed for more than one month. No tropical cyclone of TS intensity or higher was generated in June.

In July cyclogenesis became active and five storms formed in total within the month. Four of them took northward tracks along the western flank of the sub-tropical high. Among the four Kirogi, Tembin and Bolaven passed around the Japanese Archipelago. Bolaven hit the southern edge of the Korean Peninsula and Kai-tak skirted the eastern coast of the central China.

From August to September tropical cyclone activity was normal. Six and five storms were generated in August and September, respectively. Among them Jelawat, Bilis and Maria made landfall on China, Kaemi and Wukong on the Indo-China Peninsula, and Prapiroon and Saomai on the Korean Peninsula during the period. These storms caused a lot of damage to these regions. In particular Bilis, the most intense typhoon of this season, affected Taiwan seriously.

In late September cyclone activity became inactive again and no tropical cyclone of TS intensity or higher was tracked for almost one month until Yagi formed in late October. All the four tropical cyclones after Yagi became tropical storms east of the Philippines and three of them (Xangsane, Bebinca and Rumbia) made landfall on the Philippines in succession.

Other features of the tropical cyclone activity in 2000 were as follows:

- Tropical cyclones in 2000 tended to form in higher latitudes following a similar tendency in the last season. Nine storms (39%) out of the total of 23 formed in latitudes higher than 20°N in contrast with 24% in the normal year ;

- Movement of tropical cyclones was slower than normal particularly in waters of higher latitudes; and

- There were many tropical cyclones which moved northward through their lives, not taking normal westward tracks followed by northeastward ones after recurvature.

List of the Tropical Cyclones in 2000

Tropical Cyclone		Duration		Min Central Pressure (hPa)	Max Wind (kt)
TY	Damrey	07 May	12 May	930	90
TS	Longwang	19 May	20 May	990	45
TY	Kirogi	03 Jul	08 Jul	940	85
TY	Kai-tak	06 Jul	07 Jul	960	75
TS	Tembin	19 Jul	20 Jul	992	40
STS	Bolaven	26 Jul	31 Jul	980	50
TS	Chanchu	29 Jul	29 Jul	996	35
TY	Jelawat	01 Aug	10 Aug	940	85
TY	Ewiniar	10 Aug	18 Aug	975	65
TY	Bilis	19 Aug	23 Aug	920	110
TS	Kaemi	21 Aug	22 Aug	985	40
TY	Prapiroon	27 Aug	01 Sep	965	70
TS	Maria	28 Aug	01 Sep	985	40
TY	Saomai	02 Sep	16 Sep	925	95
TS	Bopha	07 Sep	11 Sep	988	45
TY	Wukong	06 Sep	10 Sep	955	75
STS	Sonamu	15 Sep	18 Sep	980	55
TY	Shanshan	18 Sep	24 Sep	925	95
TY	Yagi	22 Oct	27 Oct	965	70
TY	Xangsane	26 Oct	01 Nov	960	75
STS	Bebinca	01 Nov	07 Nov	980	60
STS	Rumbia	28 Nov	30 Nov	990	40
TY	Soulik	30 Dec	04 Jan	955	80

TYPHOON DAMREY
7-12 MAY

A tropical depression formed east-northeast of Palau Islands at 18UTC 4 May 2000. Moving northwestward, the depression attained TS intensity at 00UTC 7 May and was named Damrey, the first one from the new name list that became effective 1 January 2000 for tropical cyclones in the western North Pacific and the South China Sea. It then began to move northeastward east of the Philippines and developed into a typhoon on the following day. Accelerating gradually, Damrey reached peak intensity with estimated maximum sustained winds of 90 knots at 06UTC 9 May. It further continued to move northeastward for a couple of days with gradual weakening and crossed around Ogasawara-shoto (islands) south of Japan around 12UTC 11 May. Turning to the east, it downgraded to a tropical storm at 06UTC on the following day and became an extra-tropical cyclone at 12UTC of the day.

TROPICAL STORM LONGWANG
19-20 MAY

Longwang formed as a tropical depression in the South China Sea near the western coast of Luzon Island at 06UTC 17 May. It moved northeastward and became a tropical storm south of Japan at 00UTC 19 May. On the northeastward track, Longwang kept TS intensity until 06UTC 20 May, when it transformed into an extra-tropical cyclone south of Japan. The cyclone continued to move northeastward for further several days and went out to the east of the International Date Line.

TYPHOON KIROGI
3-8 JULY

After one-month rest of tropical cyclone activity in June, a tropical depression formed east of the Philippines at 06UTC 2 July. Moving northward, it attained TS intensity at 06UTC 3 July and developed rapidly into a typhoon southwest of Okinotorishima at 18UTC of the day. Kirogi then changed its movement to the north-northeast and reached its peak with estimated maximum sustained winds of 85 knots west of the island at 00UTC 5 July. On the north-northeastward track, it passed between small islands, south of Japan on the midnight of 8 July and approached the eastern coast of Japan. During the passage, a wind gust of 49.3 m/s was observed at Hachijo-jima (47678). Weakening to STS intensity, it moved along the eastern coast of Japan and turned to the east around 18UTC 9 July. Shortly after the turn it transformed into an extra-tropical cyclone.

TYPHOON KAI-TAK
6-7 JULY

Kai-tak was the first typhoon developed in the South China Sea in this season. It formed as a tropical depression west of Luzon Island at 12UTC 3 July and initially took a northward track. It then slowed down northwest of Luzon Island and quickly developed to a tropical storm at 18UTC 5 July, to a typhoon at 12UTC 6 July. Kai-tak reached peak intensity at 00UTC 7 July and maximum sustained winds of 75 knots were estimated. Right after reaching its peak, it began to move northeastward and made landfall on the eastern part of Taiwan around 00UTC 9 July. During the passage it turned to the north with weakening and crossed the eastern tips of central China on the morning of 10 June. Later Kai-tak transformed into an extra-tropical cyclone in the northern part of the Yellow Sea at 18UTC 10 July.

TROPICAL STORM TEMBIN
19-20 JULY

A tropical depression formed at 00UTC 17 July north of the Mariana Islands. Moving northwestward initially, then northward the depression became a tropical storm around Ogasawara-shoto at 00UTC 19 July. Keeping TS intensity, Tembin continued to move northward until it was downgraded into a tropical depression about 200 km southeast of Japan at 18UTC 21 July.

SEVERE TROPICAL STORM BOLAVEN
26-31 JULY

Bolaven formed as a tropical depression east of Luzon Island at 00UTC 24 July and moved north-northeastward. Turning to the east-northeast, it attained TS intensity around Okinawa at 18UTC 25 July. After passing south of Okinawa on the morning of 26 June, the storm made an anti-clockwise turn keeping TS intensity over waters east of Okinawa from 26 to 28 July. Decreasing its translation velocity, it developed into a severe tropical storm at 06UTC 29 July. As Bolaven moved northward further southwest of Japan, it weakened to a tropical depression at the southern tip of the Korean Peninsula at 00UTC 31 July, and transformed into an extra-tropical cyclone shortly.

TROPICAL STORM CHANCHU
29 JULY

Chanchu was a short-lived system, which formed as a tropical depression east of the Marshall Islands at 18UTC 27 July. The depression moved to the north-northwest and became a tropical storm east of the Islands at 18UTC 28 July. After moving northward with TS intensity for one day, it weakened to a tropical depression east of Wake Island at 18UTC 29 July.

TYPHOON JELAWAT

1-10 AUGUST

A tropical depression formed south of Marcus Island at 18UTC 31 July. Moving westward, the depression developed rapidly and became a tropical storm at 12UTC 1 August and a typhoon at 00UTC of the following day. On the west-northwestward track Jelawat reached peak intensity with estimated maximum sustained winds of 85 knots north of the Mariana Islands at 00UTC 3 August. It kept TY intensity for several days moving westward and passed near Minamidaito-jima (47945) around 06UTC 6 August. Jerawat then turned to the northwest and passed near Okinawa on the early morning of 8 August. A wind gust of 61.5 m/s was observed at Minamidaito-jima during the passage. As JELAWAT entered the East China Sea, it weakened gradually and was downgraded to a severe tropical storm near the central coast of China at 06UTC 10 August. Shortly from the downgrade it made landfall on the coast and further weakened to a tropical depression at 18UTC of the day.

TYPHOON EWINIAR
10-18 AUGUST

A tropical depression formed west of Guam Island at 00UTC 9 August. It moved westward initially, then northward and became a tropical storm over the same waters at 18UTC of the day. Accelerating to the north, the storm attained STS intensity southwest of Ogasawara-shoto at 06UTC 11 August. Ewiniar slowed down south of Japan and began moving to the east-northeast around 12UTC 12 August. The storm continued to move east-northeastward over the next three days keeping STS intensity until 18UTC 15 August when it intensified into a typhoon east of Japan. Maximum sustained winds of 65 knots were estimated at the time. As it turned to the north, it lost tropical characteristics gradually and became an extra-tropical cyclone at 12UTC 18 August.

TYPHOON BILIS
19 - 23 AUGUST

Bilis was the most intense tropical cyclone of this season, which was generated as a tropical depression northwest of Yap Island at 12UTC 18 August. It took a northwestward track in its almost whole life until making landfall on southern China. Developing gradually on the northwestward track east of the Philippines, Bilis attained TS intensity at 06UTC 19 August, TY intensity at 12UTC 20 August and reached its peak with estimated maximum sustained winds of 110 knots northeast of Luzon Island at 18UTC 21 August. With TY intensity Bilis made landfall on Taiwan around midnight of 23 August. After the landfall it weakened rapidly and landed on the southeast coast of China before the noon of the day. As it moved to inland of China, it further weakened to a tropical storm at 06UTC 23 August and to a tropical depression shortly.

TROPICAL STORM KAEMI
21-22 AUGUST

Kaemi was a very short-lived system, formed as a tropical depression in the South China Sea at 12UTC 19 August. Moving westward initially, then northwestward the depression reached TS intensity about 200 km east of Viet Nam at 12UTC 21 August. On the northwestward track, Kaemi made landfall on the central coast of Viet Nam around 06UTC 22 August. After the landfall, it weakened to a tropical depression at 12UTC 22 August.

TYPHOON PRAPIROON
27 AUGUST - 1 SEPTEMBER

A tropical depression, which formed northwest of Yap Island at 18UTC 24 August, moved westward initially and turned to the north. It became a tropical storm west of Okinotorishima at 18UTC 26 August turning to the northwest. After Prapiroon attained STS intensity at 18UTC 27 August on the northwestward track, it drifted to the west until 12UTC 28 August when it began to move northward. On the accelerating northward track, the storm passed around Okinawa on the evening of 29 August. A wind gust of 36.6 m/s was observed at Miyako-jima (47927). In the East China Sea the cyclone developed to a typhoon at 06UTC 30 August, reached peak intensity at 12UTC of the day and maximum sustained winds of 70 knots were estimated. After crossing the Yellow Sea, Prapiroon hit the northern part of the Korean Peninsula with STS intensity on the night of 31 August. It then weakened gradually and transformed into an extra-tropical cyclone at 12UTC 1 September.

TROPICAL STORM MARIA
28 AUGUST - 1 SEPTEMBER

A tropical depression formed southeast of Hong Kong at 06UTC 27 August. It took a southward track and became a tropical storm at 12UTC of the following day. Keeping TS intensity, Maria continued to move southward in the northern South China Sea for about two days. It then stopped southward movement about 500 km west of Luzon Island and remained almost stationary until 00UTC 30 August, when it began to make a clockwise turn. After the turn Maria moved northward and made landfall on the southern coast of China on the early morning of 1 September. Shortly after the landfall it weakened to a tropical depression.

TYPHOON SAOMAI
2 - 16 SEPTEMBER

SAOMAI was a long-lived tropical cyclone, which maintained TS intensity or higher almost two weeks. A tropical depression formed far east of the Mariana Islands at 18UTC 31 August and moved northward initially, then turned to the west. On the westward track, it developed into a tropical storm at 12UTC 2 September and a typhoon east of Saipan Island at 06UTC 4 September. It turned to the south and weakened into STS grade at 06UTC 5 September. At 06UTC 6 September it changed the track to the west and then to the northwest. On its steady northwestward track through the following several days, it kept STS intensity until 00UTC 9 September, when it re-developed to attain TY intensity. Saomai further developed and reached peak intensity with estimated maximum sustained winds of 95 knots southeast of Minamidaito-jima at 12UTC 10 September. It then passed the central portion of Okinawa Island just after 10UTC 12 September. A wind gust of 42.0 m/s was observed during the passage. In the East China Sea it changed the track northeastward, and then north-northeastward increasing its translation velocity. After weakening into STS intensity, Saomai made landfall on the southern coast of the Korean Peninsula around 20UTC 15 September. Moving north-northeastward, SAOMAI transformed into an extratropical cyclone at 06UTC 16 September northeast off the Korean Peninsula.

TROPICAL STORM BOPHA
7 - 11 SEPTEMBER

A tropical depression, which formed east of Luzon Island at 06UTC 4 September, moved east initially, then made a gradual anti-clockwise turn to the west-northwest on 6 September. It intensified into a tropical storm southeast of Minamidaito-jima at 18UTC 6 September. After passing just south of Okinawa Island on 08 September, Bopha made another anti-clockwise turn to the south on 9 September. Keeping TS intensity, it passed east off Taiwan from the night of 9 to the morning of 10 September and made landfall on Luzon Island around 23UTC 10 September. The storm weakened into a tropical depression on the northern coast of Luzon Island at 00UTC 11 September.

TYPHOON WUKONG
6 - 10 SEPTEMBER

Wukong formed as a tropical depression west of Luzon Island at 06UTC 4 September. It remained almost stationary until 12UTC 5 September and then made an anti-clockwise turn to the west in the South China Sea. During the turn the depression developed into a tropical storm at 00UTC 6 September. It further intensified to attain TY intensity at 18UTC 7 September and reached its peak with estimated maximum sustained winds of 75 knots at 06UTC 8 September. Weakening gradually, Wukong skirted around the southern coasts of Hainan Island on 9 September and made landfall on the northern part of Vietnam around 04UTC 10 September. After the landfall it weakened into a tropical depression in the northeastern part of Thailand at 12UTC of the day.

SEVERE TROPICAL STORM SONAMU

15 - 18 SEPTEMBER

A tropical depression, which formed southwest of Iwo-jima at 06UTC 14 September, moved northward and developed into a tropical storm south of the island at 03UTC 15 September. It turned to the north and passed just west of Ogasawara-shoto around 12UTC 16 September. A half day later Sonamu attained STS intensity southeast of

Japan and then made a slight turn to the north-northeast on 17 September. The storm transformed into an extratropical cyclone near the Chishima Islands at 06UTC 18 September.

TYPHOON SHANSHAN
18 - 24 SEPTEMBER

A tropical depression formed northeast of the Marshall Islands at 06UTC 17 September. Moving northwest, it developed into a tropical storm at 12UTC 18 September and one day later attained TY intensity over the same waters. Shanshan further intensified passing northeast of Wake Island and reached its peak with estimated maximum sustained winds of 95 knots north of the island at 12UTC 21 September. Turning to the northeast, Shanshan accelerated its translation velocity with gradual weakening on 22 and 23 September. The storm transformed into an extra-tropical cyclone northwest of Midway Island at 18UTC 24 September.

TYPHOON YAGI
22 - 27 OCTOBER

Almost one month later after Shanshan dissipated in late September, YAGI formed as a tropical depression north of the Mariana Islands at 00UTC 21 October. Moving west-northwest, it developed into a tropical storm east-northeast of Okino-torishima at 00UTC 22 October. The storm kept moving west-northwestward with gradual development and attained TY intensity south of Okinawa at 12UTC 24 October. After YAGI reached its peak with estimated maximum sustained winds of 70 knots, it changed the track to the northwest, then turned to the north and made a full turn over the waters around Okinawa from 26 to 28 October. YAGI weakened gradually during the turn and downgraded into a tropical depression over the same waters at 00UTC 27 October.

TYPHOON XANGSANE
26 OCTOBER - 1 NOVEMBER

A tropical depression formed southeast of Yap Island at 18UTC 24 October 2000. It gradually developed moving west-northwestward and became a tropical storm east of the Philippines at 06UTC 26 October. On the west-northwestward track, the storm attained STS intensity at 00UTC 27 October and made landfall on the east coast of the Philippines around 21UTC 27 October. It slightly weakened passing Luzon Island and entered the South China Sea on the early morning of 29 October. Xangsane then decelerated westward movement and almost remained stationary until 18UTC 29 October, when it started moving to the north-northeast. Shortly the storm re-intensified to attain TY intensity at 00UTC 30 October and reached its peak with estimated maximum sustained winds of 75 knots west of Luzon Island. Xangsane continued to move north-northeastward for the following two days keeping TY intensity and passed just east of Taiwan on the morning of 1 November. Entering the

East China Sea, it turned to the northeast and transformed into an extratropical cyclone at 12UTC 1 November.

SEVERE TROPICAL STORM BEBINCA
1 - 7 NOVEMBER

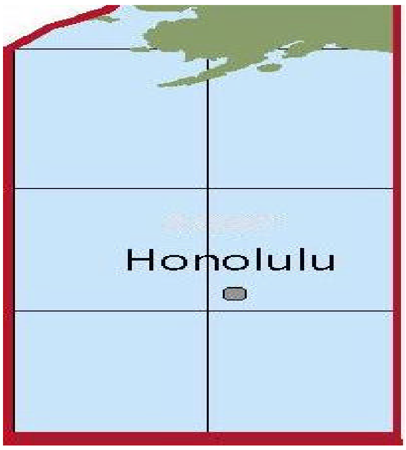
While Xangsane was located west of Luzon Island, Bebinca formed as a tropical depression north of Palau Island at 18UTC 30 October. It followed almost the same course that Xangsane took about six days before and developed into a tropical storm northeast of Mindanao Island at 00UTC 1 November. The storm further intensified into a severe tropical storm southeast of Luzon Island at 18UTC 1 November. It then started weakening around 18UTC 2 November, when it made landfall on the southern part of Luzon Island, and was downgraded into a tropical storm on the west coast of the Island at 00UTC 3 November. As Bebinca entered the South China Sea, it re-intensified to attain STS intensity again at 00UTC 4 November. It made a northward turn on 5 November and then a westward turn on 6 November with gradual weakening. The system weakened to a tropical depression southeast of Hong Kong at 00UTC 7 November.

TROPICAL STORM RUMBIA
28 - 30 NOVEMBER

A tropical depression formed west of Palau Island at 18UTC 27 November 2000. Moving west, it developed into a tropical storm over the same waters at 12UTC 28 November. Slightly turning to the west-northwest, Rumbia kept TS intensity until 18UTC 30 November, when it weakened into a tropical depression on southeastern Samar Island of the Philippines.

TYPHOON SOULIK
30 DECEMBER - 4 JANUARY

Soulik was generated in late December and lived beyond the year-end for the first time in the last 15 years. A tropical depression formed east of Mindanao Island at 18UTC 28 December. It moved northward initially and then made westward turn toward the Philippines on the following day. On the westward track Soulik became a tropical storm about 200km east of Layte Island at 00UTC 30 December. The storm changed its track to the northeast and attained STS intensity at 18UTC 31 December. Soulik moved east-northeastward keeping STS intensity until 00UTC 2 January 2001, when it turned to the north-northeast south of Okinotorishima. After slightly weakening on the day, it moved northeastward and began to develop rapidly on 3 January. The storm became a typhoon at 06UTC 3 January and reached its peak with estimated maximum sustained winds of 80 knots at 12UTC of the day. It however weakened quickly to a tropical depression over the same waters at 12UTC of the following day.

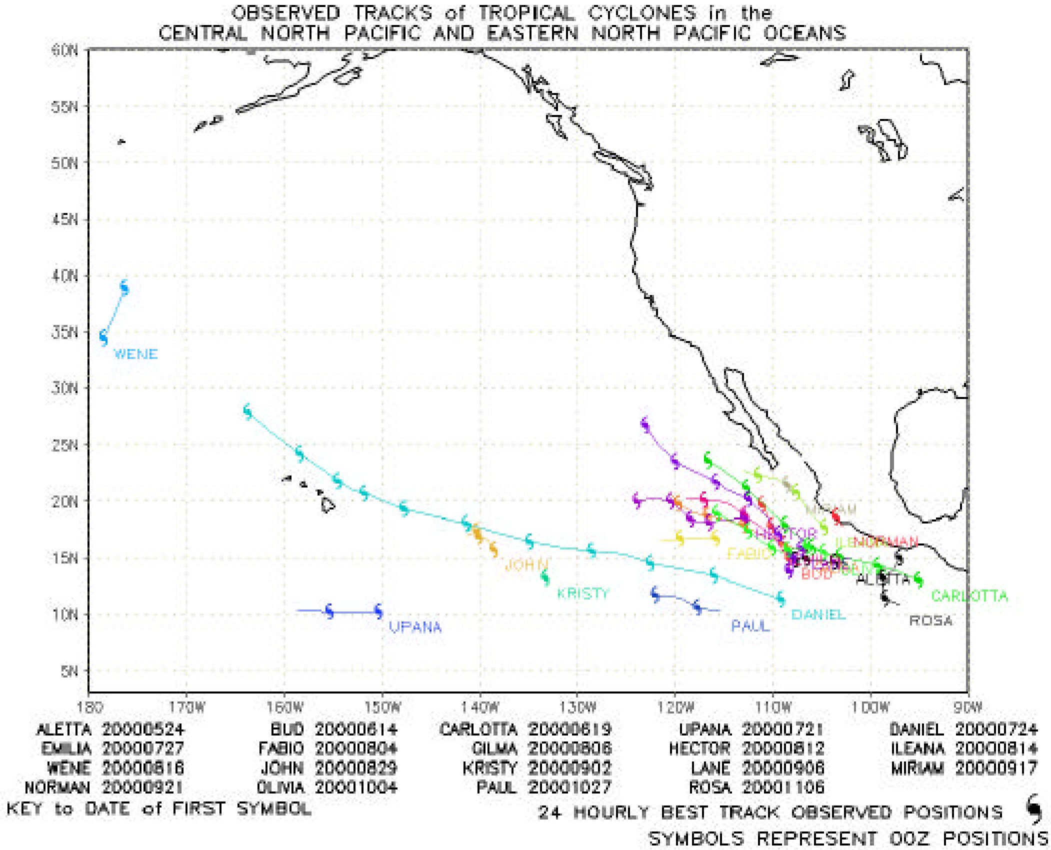


Central Pacific Hurricane Center - Honolulu*

Director: Mr James Weyman

RSMC Miami - Hurricane Center

Director: Mr Max Mayfield



*** renamed RSMC Honolulu - Hurricane Center (with effect from 1 July 2001)**

CENTRAL PACIFIC HURRICANE CENTER - HONOLULU

SUMMARY

Tropical cyclone activity in the Central North Pacific basin was near normal for 2000 with four systems forming within or moving into the region north of the equator between 140°W and 180°. The 38-year average for this basin is 4.5 tropical cyclones per year. The overall climate setting was one of weak La-Nina conditions where Central and Eastern Pacific equatorial sea surface temperature anomalies were between 0.0 and -1.0 degrees Celsius.

Central North Pacific tropical cyclone activity officially commenced on 20 July 2000 with the development of Tropical Depression 1-C which became Tropical Storm Upana during the latter hours of the same day. Upana was followed by Hurricane Daniel (28 July to 6 August 2000), the only hurricane of the year for the Central North Pacific. Daniel was also the greatest threat to the Hawaiian Islands. Fluctuating intensities and its projected path over the Hawaiian chain as a strong tropical storm caused considerable concern among residents. In the end, Daniel veered to the northwest and missed the Hawaiian Islands.

The 2000 season also saw an unusual occurrence of a tropical cyclone entering the basin from the *west*. Tropical Storm Wene initially formed as Tropical Depression 16-W on 15 August 2000 and crossed into the Central Pacific Hurricane Center s (CPHC) Area of Responsibility (AOR) late that same day.

Tropical Storm John closed out tropical cyclone activity in the Central North Pacific. John developed within the National Hurricane Center s (NHC) AOR near 15^{o}N 135^{o}W on 28 August 2000 and moved slowly west, crossing 140^{o}W on 30 August and dissipating on 1 September.

List of Tropical Cyclones in 2000

Tropical Cyclone		**Duration**		**Min Central Pressure (hPa)**	**Max Wind* (kt)**
TS	Upana	20 Jul	23 Jul		40
H	Daniel	29 Jul	05 Aug		80
TS	Wene	15 Aug	17 Aug		45
TS	John	30 Aug	01 Sep		60

* 1 minute wind

2000 Eastern Pacific Tropical Storm Damage Statistics

number	name	class*	dates**	direct deaths
3	Carlotta	H	18-25 Jun	18

* H: Hurricane wind speed 74 m.p.h. or higher.
** Dates begin 0000 UTC and include tropical depression stage (wind speed below 39 m.p.h.

TROPICAL STORM UPANA
20 - 23 JULY

HISTORY

Tropical Depression One-C (TD-1C) developed near 10.7^{o}N 147.1^{o}W on 20 July 2000 from a westward moving disturbance southeast of the Hawaiian Islands. Sea surface temperatures of around 28^{o}C in the formation region of the depression were near normal and more than warm enough to sustain tropical cyclone development. TD-1C intensified to tropical storm intensity on 1800 UTC 21 July and named Upana (*Urban* in English). Upana maintained a roughly westward track and reached peak intensity at 0600 UTC 21 July with maximum sustained winds of 40 knots. This level of intensity was maintained through 0000 UTC 22 July as the center passed well to the south of the Hawaiian Islands.

With no deep convection in its circulation, Upana was downgraded to a tropical depression on 1800 UTC 22 July carrying maximum sustained winds of 25 knots. Deep convective activity flared up during the later hours of 23 July and helped briefly raise the intensity of Upana to 30 knots, though the system remained poorly organized overall. Despite being in a low shear environment with sufficient sea surface warmth, Tropical Depression Upana dissipated near 9.5^{o}N 170.5^{o}W on 0600 UTC 24 July.

Due to the large distance away from land, no significant weather-related impacts were noted in the Hawaiian Islands.

SYNOPTIC SITUATION

LOWER LEVELS. Large-scale easterly winds of 15 to 20 knots were firmly entrenched in the lower levels of the troposphere within the region from 10^{o}N and 30^{o}N between 140^{o}W and 160^{o}W. Surface winds south of 10^{o}N were from the southeast at 10 to 15 knots based on scatterometer data. These surface conditions were normal for this time of year to include the position of the Intertropical Convergence Zone (ITCZ) near 10^{o}N.

MIDDLE AND UPPER LEVELS. During the formation stage of TD-1C, a ridge at 250 hPa was along 12^{o}N in the region between 140^{o}W and 160^{o}W. Deep easterly flow to the south of the ridge meant little vertical shear of the horizontal wind and a westward track for the storm system. By 22 July, a deepening upper level trough along an axis from 28^{o}N 144^{o}W to 11^{o}N 163^{o}W increased the vertical shear over Upana and helped weaken the system. As Upana moved westward, it once again entered a region of low vertical shear but could not effectively reorganize and intensify.

SATELLITE DATA

The incipient stages of TD-1C included several distinct bands of active convection with a relatively symmetric cloud pattern. Deep convection collapsed completely by 1230 UTC 22 July and left a fully exposed low level circulation center revealed by early morning (local time) visible sector images. However, by 2330 UTC 22 July thunderstorms rapidly redeveloped and began obscuring the low level circulation features. The reinvigoration of Upana was short-lived as deep convection became poorly organized about the system s center. After 0600 UTC 24 July, visible sector satellite images revealed easterly low level cloud movement across the entire system with no center detectable.

HURRICANE DANIEL
29 JULY - 5 AUGUST

HISTORY

Hurricane Daniel was the strongest tropical cyclone in the Central Pacific and provided the greatest threat to any populated landmass during the season for the year 2000. Daniel originated in the Eastern Pacific as Tropical Depression Six-E near 10.1^{o}N 102.3^{o}W at 0000 UTC 23 July. Further intensification prompted the National Hurricane Center to upgrade the cyclone to Tropical Storm Daniel at 1800 UTC 23 July. Daniel moved toward the west northwest and continued its rapid intensification, becoming a hurricane at 1800 UTC 24 July after only 24 hours as a tropical storm. Peak intensity was achieved on 25 July with 110 knots maximum sustained winds, followed by a slow weakening over the next several days.

Daniel crossed 140^{o}W near 18^{o}N late on 28 July as a weak hurricane with maximum sustained winds of 80 knots and only a small amount of deep convection. Although Daniel was expected to weaken to tropical storm intensity, its projected path near the Hawaiian Islands prompted the issuance of a Tropical Storm Watch for Maui County and the island of Hawaii on 2100 UTC 29 July, followed by a Tropical Storm Warning for both counties at 0900 UTC 30 July. A Tropical Storm Watch was also issued at the same time for the islands of Oahu and Kauai. Continued weakening of Daniel resulted in the expected downgrade to tropical storm status at 0300 UTC 30 July. However, with its projected track still over the island chain, the Tropical Storm Warning area was increased to also include the island of Oahu. To further complicate the situation, thunderstorm activity fluctuated considerably on 30 and 31 July with cycles of sheared convection exposing the low level circulation center followed by rapid thunderstorm development. These fluctuations added to the uncertainty of the forecast as the objective guidance packages proposed a wide range of scenarios.

Tropical Storm Daniel made its closest approach to land northeast of the Hawaiian Islands during the late hours of 31 July. It was during this time that the system rapidly intensified, shifted to the north of its previous track, and briefly formed an eye before rapidly collapsing again. Aerial reconnaissance data estimated maximum surface winds of 55 knots at 1940 UTC 31 July followed by 65 knots from 2117 to

2307 UTC 31 July. About seven hours later (0555 UTC 1 August), aircraft data indicated maximum flight level winds of just 32 knots (no surface estimate was available).

Over the next three days, Daniel maintained a track toward the northwest at 10 to 15 knots and slowly weakened, becoming a tropical depression at 1500 UTC 3 August. Tropical Depression Daniel hung on for two more days despite moving into cooler waters and was finally declared as *dissipated* near 36.7^{o}N 170.8^{o}W at 0900 UTC 5 August.

Impacts to the Hawaiian Islands from Daniel were mainly in the form of high surf where waves as high as 10 feet impacted the eastern side of the island of Hawai i. Heavy showers and thunderstorms associated with Daniel's trailing rain band affected the islands of Hawaii and Maui on August 1, though no significant flooding resulted.

SYNOPTIC SITUATION

LOWER LEVELS. A 1024 hPa subtropical high centered near 31^{o}N 141^{o}W and the associated subtropical ridge along 31^{o}N sustained a solid easterly low level current as Daniel entered the Central Pacific. By 31 July, an upper level trough began to induce a surface trough from 38^{o}N 141^{o}W to 25^{o}N 166^{o}W. This weakness in the subtropical ridge resulted in east southeasterly low level flow in the area near the Hawaiian Islands. This low level flow continued through 4 August and became the dominant factor in Daniel s steering current during its decay process.

Sea surface temperatures were around 25^{o}C in the area where Hurricane Daniel crossed into the Central Pacific. These temperatures were near normal and slightly cooler than what is considered necessary to sustain a tropical cyclone s warm core.

MIDDLE AND UPPER LEVELS. Hurricane Daniel was already on a weakening trend as it crossed into the Central Pacific due to the combination of cooler sea surface temperatures and the presence of southerly vertical shear from a weak upper level trough. As Daniel weakened to tropical storm strength, a stronger upper level trough moved over the Hawaiian Islands on 31 July with an axis running from a low center near 25^{o}N 157^{o}W to 18^{o}N 162^{o}W. This second upper level trough enhanced the outflow channel over the tropical storm and triggered a new burst of convective activity that briefly formed an eye just prior to 1 August. For the period from 1 August through 5 August, the upper level trough continued to support deep convection but also maintained enough vertical shear over Daniel to prevent significant intensification.

SATELLITE DATA

Hurricane Daniel lost its eye as it moved westward over 140^{o}W on 28 July through the previously mentioned vertical shear. A poorly defined eye reappeared and was noted in the 1730 and 2330 UTC 29 July fix, but overall organization continued to deteriorate. By 1130 UTC 30 July, the effects of vertical shear exposed the low level circulation center to the west northwest of the deep convection. A surge in thunderstorm activity covered up the center by 1730 UTC, only to be exposed once again early on 31 July. During Daniel s dramatic intensification near Hawai i late on 31 July, an eye became evident in visible sector images. Rapid scan images from GOES-10 clearly showed deep convection wrapping around the system center as the eye wall formed. Just 7 hours later, deep convection once again sheared toward the northeast and exposed a low level center. Deep convection remained sheared away from Daniel s center for the remainder of its life cycle.

TROPICAL STORM WENE
15-17 AUGUST 2000

HISTORY

This system originated near 33.1^{o}N 179.7^{o}E along the eastern periphery of a northward displaced monsoon trough and designated Tropical Depression Sixteen-W (TD-16W) by the Joint Typhoon Warning Center (JTWC) on 15 August. The depression moved toward the northeast and intensified to tropical storm strength, entering the Central Pacific during the late hours of 15 August. Since tropical storm intensity was attained in the Central Pacific, it was given the Hawaiian name of Wene (English translation: Wayne). Tropical Storm Wene shifted its movement slightly to a north northeastward direction and reached its peak intensity of 45 knots maximum sustained winds at 0900 UTC 16 August. With its movement toward the north, Wene subsequently began to weaken in cooler waters and merge with an extratropical system. The final advisory on Wene was issued at 0900 UTC 17 August as it rapidly made the transition to an extratropical system.

Tropical Storm Wene did not have any significant impacts to the Hawaiian Islands.

SYNOPTIC SITUATION

LOWER LEVELS. TD 16-W formed north of the subtropical ridge within an elongated west-east oriented surface pressure trough that appeared to be a long eastward extension of the Asian monsoon trough. Sea surface temperatures in the formation region of the depression were around 27^{o}C, or roughly 2^{o}C warmer than normal.

MIDDLE AND UPPER LEVELS. Genesis of TD-16W occurred beneath a diffluence region in the upper levels with an east to west subtropical ridge axis roughly along 27^{o}N and an upper level trough from 40^{o}N 173^{o}E to 30^{o}N 179^{o}W. While in the Central Pacific, Tropical Storm Wene remained primarily under the influence of this upper level trough that resulted in a northeastward-directed steering current.

SATELLITE DATA

After entering the Central Pacific, most of the thunderstorm activity and best-defined rain bands of Wene were in the system's northeastern quadrant. Evidence of vertical shear was apparent in the satellite images and served as the basis for Dvorak intensity classifications. Deep convective activity collapsed after 0000 UTC 17 August and the final Dvorak classification conducted at 0530 UTC of the same day.

TROPICAL STORM JOHN
30 AUGUST - 1 SEPTEMBER 2000

HISTORY

Tropical Depression Twelve-E (TD-12E) formed near 15.4^{o}N 138.0^{o}W on 28 August 2000 within a long monsoon trough extending westward from Central America. Rapid intensification occurred and TD-12E was upgraded to Tropical Storm John at 2100 UTC 28 August by the National Hurricane Center. John was rated at 55 knots maximum sustained winds on 0300 UTC 29 August while moving slowly toward the west northwest and crossed into the Central Pacific during the early hours of 30 August. Peak intensity of 60 knots maximum sustained winds was reached at 2100 UTC 30 August 2000. Over the ensuing hours, Tropical Storm John began to succumb to an unfavorable amount of vertical shear and lost almost all of its deep convection by 0900 UTC 31 August. Steady weakening continued until 2100 UTC 1 September when the CPHC declared John to be a dissipated system.

SYNOPTIC SITUATION

LOWER LEVELS. A 1035 hPa high pressure center near 45^{o}N 151^{o}W with a weaker 1018 hPa high pressure center near 27^{o}N 124^{o}W maintained solid easterly flow in the lower levels near Tropical Storm John. Erosion of the secondary high on 31 August and 1 September caused low level winds to turn to a more northeasterly direction. Sea surface temperatures were near 28^{o}C, more than adequate to sustain tropical cyclone activity.

MIDDLE AND UPPER LEVELS. Tropical Storm John crossed into the Central Pacific just south of a weak mid-level ridge. With this weather pattern, steering currents were very sluggish and John s progress was rated at 5 knots or less during its entire time west of 140^{o}W. An upper level trough along an axis from 30^{o}N 130^{o}W to 31^{o}N 160^{o}W to 17^{o}N 180^o produced southwesterly vertical shear that severely impacted the storm on 30 and 31 August and contributed substantially to its demise.

SATELLITE DATA

As Tropical Storm John crossed into the Central Pacific, satellite images showed its cloud pattern to be elongated to the northeast due to the effects of the aforementioned southwesterly shear. At about the same time, data from the DMSP SSM/I sensor indeed revealed strongest convective activity confined to the northeast quadrant of a well-defined circulation center. By 0900 UTC 31 August, Tropical Storm John lost all of its deep convection and daytime visible images showed only a well-defined swirl of low clouds.

VERIFICATION STATISTICS

This section contains track and intensity verification statistics for Tropical Storm Upana, Hurricane Daniel, Tropical Storm Wene, and Tropical Storm John. Track statistics include data from the official CPHC forecast plus 7 objective guidance packages. Intensity statistics include the official CPHC forecast and data from the Statistical Hurricane Intensity Prediction (SHIP) model.

The Medium Layer Beta Advection Model (BAMM) provided the best overall track guidance with the lowest or second-lowest errors through 72-hours (Table 1, below). Poorest performance was from the Climatology and Persistence (CLIPER) guidance. The official CPHC forecast was in the middle of the pack with a rank of 3rd or 4th (out of 8) for 12- through 48-hours and a rank of 7th for 72-hours.

Track error statistics for CPHC in 2000 showed a drop in performance from 1999. However, this point must be tempered by the fact that the Central Pacific tropical cyclones in 1999 had relatively straight, well-behaved paths toward the west.

For intensity forecasts, the official CPHC forecast beat the SHIP model at all time periods (Table 2, below). Intensity errors for CPHC also showed an improvement over 1999.

Table 1. Track forecast verification statistics for all Central Pacific tropical cyclones in 2000 at 12-, 24-, 36-, 48-, and 72-hours. The first number is the position error in nautical miles and the number in parentheses is the number of available forecasts. Please refer to the list of acronyms for definitions.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr
CPHC	49 (56)	79 (48)	131 (40)	173 (34)	257 (24)
CLIP	57 (55)	103 (47)	155 (38)	219 (32)	322 (23)
BAMD	55 (54)	97 (46)	137 (38)	178 (32)	219 (23)
BAMM	47 (54)	77 (46)	101 (38)	127 (32)	170 (23)
P91E	54 (54)	95 (46)	132 (38)	173 (32)	192 (22)
LBAR	58 (36)	92 (34)	115 (32)	190 (29)	167 (21)
GFDL	46 (48)	75 (37)	117 (33)	160 (29)	251 (21)
NGPS	77 (18)	113 (16)	148 (11)	165 (7)	211 (4)

Table 2. Intensity forecast verification statistics for all Central Pacific tropical cyclones in 2000 at 12-, 24-, 36-, 48-, and 72-hours. The first number is the intensity error in knots and the number in parentheses is the number of available forecasts. Please refer to the list of acronyms for definitions.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr
CPHC	5.0 (56)	7.0 (48)	8.9 (40)	10.3 (34)	10.8 (24)
SHIP	9.5 (32)	11.0 (28)	12.5 (28)	13.7 (22)	15.1 (22)

The following tables contain individual tropical cyclone verification statistics for Tropical Storm Upana (Tables 3 and 4), Hurricane Daniel (Tables 5 and 6), Tropical Storm Wene (Tables 7 and 8), and Tropical Storm John (Tables 9 and 10).

Table 3. Track forecast verification statistics for **Tropical Storm Upana** at 12-, 24-36-, 48-, and 72-hours. The first number is the position error in nautical miles and the

number in parentheses is the number of available forecasts. Please refer to the list of acronyms for definitions.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr
CPHC	80 (16)	121 (14)	174 (12)	184 (10)	189 (6)
CLIP	81 (15)	139 (13)	197 (11)	268 (9)	266 (5)
BAMD	75 (15)	129 (13)	197 (11)	270 (9)	405 (5)
BAMM	72 (15)	116 (13)	166 (11)	207 (9)	273 (5)
P91E	83 (15)	136 (13)	209 (11)	298 (9)	378 (5)
LBAR	88 (11)	141 (11)	168 (11)	364 (8)	121 (5)
GFDL	60 (15)	90 (11)	137 (10)	192 (8)	279 (4)
NGPS	107 (6)	157 (5)	234 (3)	243 (2)	240 (2)

Table 4. Intensity forecast verification statistics for **Tropical Storm Upana** at 12-, 24-, 36-, 48- and 72-hours. The first number is the intensity error in knots and the number in parentheses is the number of available forecasts. Please refer to the list of acronyms for definitions.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr
CPHC	4.4 (16)	6.4 (14)	9.2 (12)	14.5 (10)	21.7 (6)
SHIP	10.3 (11)	13.9 (9)	20.0 (9)	25.2 (5)	34.0 (5)

Table 5. Track forecast verification statistics for **Hurricane Daniel** at 12-, 24-, 36-, 48-, and 72-hours. The first number is the position error in nautical miles and the number in parentheses is the number of available forecasts. Please refer to the list of acronyms for definitions.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr
CPHC	31 (28)	72 (26)	120 (24)	174 (22)	279 (18)
CLIP	38 (28)	84 (25)	140 (23)	197 (21)	338 (18)
BAMD	51 (27)	92 (25)	124 (23)	146 (21)	167 (18)
BAMM	30 (27)	54 (25)	74 (23)	94 (21)	141 (18)
P91E	38 (27)	74 (25)	102 (23)	131 (21)	140 (18)
LBAR	44 (17)	71 (17)	100 (17)	127 (17)	170 (16)
GFDL	33 (23)	67 (20)	107 (19)	146 (19)	244 (17)
NGPS	56 (8)	97 (8)	128 (6)	139 (4)	183 (2)

Table 6. Intensity forecast verification statistics for **Hurricane Daniel** at 12-, 24-, 36-, 48-, and 72-hours. The first number is the intensity error in knots and the number in

parentheses is the number of available forecasts. Please refer to the list of acronyms for definitions.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr
CPHC	5.0 (28)	6.5 (26)	7.1 (24)	7.7 (22)	7.2 (18)
SHIP	8.7 (17)	9.8 (17)	9.1 (17)	10.3 (17)	9.5 (17)

Table 7. Track forecast verification statistics for **Tropical Storm Wene** at 12-, 24-, 36-, 48-, and 72-hours. Statistics beyond 24-hours are not available (N/A) due to the short duration of this storm. The first number is the position error in nautical miles and the number in parentheses is the number of available forecasts. Please refer to the list of acronyms for definitions.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr
CPHC	33 (4)	86 (2)	N/A	N/A	N/A
CLIP	43 (4)	152 (2)	N/A	N/A	N/A
BAMD	25 (4)	62 (2)	N/A	N/A	N/A
BAMM	37 (4)	81 (2)	N/A	N/A	N/A
P91E	37 (4)	113 (2)	N/A	N/A	N/A
LBAR	N/A	N/A	N/A	N/A	N/A
GFDL	43 (2)	N/A	N/A	N/A	N/A
NGPS	N/A	N/A	N/A	N/A	N/A

Table 8. Intensity forecast verification statistics for **Tropical Storm Wene** at 12-, 24-, 36-, 48-, and 72-hours. Statistics beyond 24-hours are not available (N/A) due to the short duration of this storm. SHIP data are also not available. The first number is the intensity error in knots and the number in parentheses is the number of available forecasts. Please refer to the list of acronyms for definitions.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr
CPHC	7.5 (4)	0.0 (2)	N/A	N/A	N/A
SHIP	N/A	N/A	N/A	N/A	N/A

Table 9. Track forecast verification statistics for **Tropical Storm John** at 12-, 24-, 36-, 48-, and 72-hours. Statistics beyond 48-hours are not available (N/A) due to the short duration of this storm in the Central Pacific. The first number is the position error in nautical miles and the number in parentheses is the number of available forecasts. Please refer to the list of acronyms for definitions.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr
CPHC	61 (8)	80 (6)	71 (4)	103 (2)	N/A

CLIP	66 (8)	92 (6)	124 (4)	231 (2)	N/A
BAMD	46 (8)	57 (6)	51 (4)	100 (2)	N/A
BAMM	62 (8)	86 (6)	78 (4)	122 (2)	N/A
P91E	63 (8)	85 (6)	87 (4)	45 (2)	N/A
LBAR	45 (8)	60 (6)	36 (4)	31 (2)	N/A
GFDL	66 (8)	88 (6)	101 (4)	149 (2)	N/A
NGPS	75 (4)	80 (3)	76 (2)	114 (1)	N/A

Table 10. Intensity forecast verification statistics for **Tropical Storm John** at 12-, 24-, 36-, 48-, and 72-hours. Statistics beyond 48-hours are not available (N/A) due to the short duration of this storm. SHIP data are also not available. The first number is the intensity error in knots and the number in parentheses is the number of available forecasts. Please refer to the list of acronyms below for definitions.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr
CPHC	5.0 (8)	12.5 (6)	18.8 (4)	17.5 (2)	N/A
SHIP	11.0 (4)	7.0 (2)	8.0 (2)	N/A	N/A

ACRONYMS

AOR	Area of Responsibility
BAMD	Deep Layer Beta Advection Model (mean layer averaged between 850 hPa and 200 hPa)
BAMM	Medium Layer Beta Advection Model (mean layer averaged between 850 hPa and 400 hPa)
CLIP	Climatology and Persistence
CPHC	Central Pacific Hurricane Center
GFDL	Geophysical Fluid Dynamics Laboratory Model
hPa	Hectopascal (pressure unit, where 1 hPa = 1 millibar)
JTWC	Joint Typhoon Warning Center
LBAR	Limited Area Sine Transform Barotropic Model
NGPS	NOGAPS (Navy Operational Global Atmospheric Prediction System) Vortex Tracking Routine
NHC	National Hurricane Center
P91E	Pacific Statistical Dynamic Model (adapted from NHC90 model for the Eastern Pacific
SHIP	Statistical Hurricane Intensity Prediction

UTC Universal Time Coordinated

2000 Eastern Pacific Hurricane Season Summary
RSMC Miami

The Eastern Pacific hurricane season of 2000 was two above the 1966-99 average of 15 tropical cyclones. There were 11 tropical storms and six hurricanes for a total of 17 named tropical cyclones. However, the six hurricanes is below the long-term average of nine. There were also two tropical depressions that did not reach tropical storm strength. Tropical Storms Emilia, John, and Kristy, appeared to be originated from disturbances in the intertropical convergence zone. All of the other tropical cyclones were at least partly initiated by tropical waves that moved westward from the Atlantic basin. A crew of 18 died at sea when a freighter was lost in Hurricane Carlotta. No other deaths are attributed to this years tropical cyclones.

Tropical Storms Norman and Rosa moved onshore along the coast of Mexico and spread rainfall inland. Tropical Storms Ileana and Miriam threatened Mexico and required the issuance of warnings, but neither affected land. Table 2 lists the named tropical cyclones and the unnamed subtropical storm, along with their dates, maximum sustained wind speed, minimum sea level pressure, and direct deaths.

Hurricane Aletta attained 105 m.p.h wind speeds while moving west-northwestward some two to three hundred statute miles south of Mexico. Aletta was tracked from May 22 to 28 and is the second strongest May hurricane in the eastern Pacific Ocean.

Tropical Storm Bud moved northwest to north-northwestward toward the Baja California peninsula from June 13th to 17th and then dissipated. Its winds reached 50 m.p.h. while passing near Socorro Island on the 14th.

Hurricane Carlotta was a category 4 hurricane (on the Saffir-Simpson hurricane scale) that had an offshore track parallel to the coast of Mexico from June 18th to 25th. Its maximum winds of 155 m.p.h. on the 21st make Carlotta the strongest June hurricane since Ava reached 160 m.p.h. in June 1973. The hurricane was responsible for 18 deaths when the Lithuanian freighter ***MV Linkuva*** was lost at sea after an engine failure. The ship was last heard from near the hurricane and about 250 miles south-southwest of Acapulco, Mexico, on the 20th.

Hurricane Daniel formed on July 23rd several hundred miles south of Acapulco, Mexico. It moved west-northwestward and rapidly strengthened to 125 m.p.h. Daniel gradually weakened on the 25th and then turned westward and re-intensified. It weakened again as it moved across 140° west longitude and into the central Pacific basin, but was still a strong tropical storm as it neared the Hawaiian islands. Tropical storm warnings were issued for Hawaii, Maui county, and Oahu when Daniel threatened on the 29th through 31st. However, it passed a short distance to the northeast of Hawaii on the 31st and the strong winds and rain remained off shore.

Tropical Storm Emilia formed on July 26th a few hundred miles south-southwest of Manzanillo, Mexico. It moved between west-northwestward and northwestward and strengthened to its peak of 65 m.p.h. on the 27th. Emilia then turned westward and weakened, dissipating by the 30th several hundred miles west-southwest of the southern tip of Baja California.

Tropical Storm Fabio formed on August 3rd about 625 miles southwest of the southern tip of Baja California. It moved westward and reached its peak of 50 m.p.h. on the 4th. It dissipated two days later while heading west-southwestward, far out at sea.

Hurricane Gilma was detected as a low-level circulation on August 4th about 350 miles south of Zihuatanejo, Mexico. Gilma began strengthening on the 6th and briefly became an 80-m.p.h. hurricane on the 8th. It moved generally west-northwestward until the 11th when it dissipated over open water.

Hurricane Hector's circulation formed on August 10th about 185 miles southwest of Manzanillo. Steered by a strong ridge to the north, Hector's track was westward until the 14th. It strengthened to 80 m.p.h. on the 14th when a "ragged eye" was seen on GOES satellite imagery. Hector also turned northwestward on the 14th and dissipated by the 16th over colder sea surface temperatures.

Tropical Storm Ileana formed as a depression about 115 miles south of Manzanillo on August 13th. Moving northwestward and parallel to the southwest coast of Mexico, it strengthened to 70 m.p.h. on the 15th. After turning west-northwestward, the center passed within 60 miles of the southern tip of Baja California later that day. Ileana dissipated on the 17th from a combination of vertical wind shear and cold ocean water. A tropical storm warning was issued for the southwest coast of Mexico from Lazaro Cardenas to Cabo Corrientes on the 14th. A hurricane warning was issued on the 15th for southern Baja California, but Ileana did not become a hurricane and the storm's strong winds remained offshore.

Tropical Storm John's track was generally slow and erratic toward the northwest, as well as over open water and far from land. It became a depression on August 28th almost 2000 miles from Baja California and near the boundary between the eastern and central Pacific basins. John became a tropical storm later on the 28th, and strengthened to 70 m.p.h. briefly on the 30th. The storm then gradually lost its convective cloud structure and John dissipated on September 1st, in the central Pacific basin and about 860 miles east-southeast of Hawaii.

Tropical Storm Kristy formed far out at sea about 1600 miles west-southwest of the southern tip of Baja on August 31st. Kristy moved very little, briefly acquired 40-m.p.h. winds on September 2nd, and dissipated the next day.

Hurricane Lane moved parallel to, and a few hundred miles offshore of, the southwest mainland coast of Mexico and the coast of Baja California from the 5th to the 14th of September. Lane moved in a small counter-clockwise loop from the 6th to the 8th, then strengthening, it passed directly over Socorro Island on the 9th with winds near 85 m.p.h. Lane strengthened to 100 m.p.h. on the 10th, accompanied by a large 50-60 mile diameter eye. Gradually turning northward and weakening over cold water, Lane dissipated on the 14th about 300 miles west of San Deigo, California.

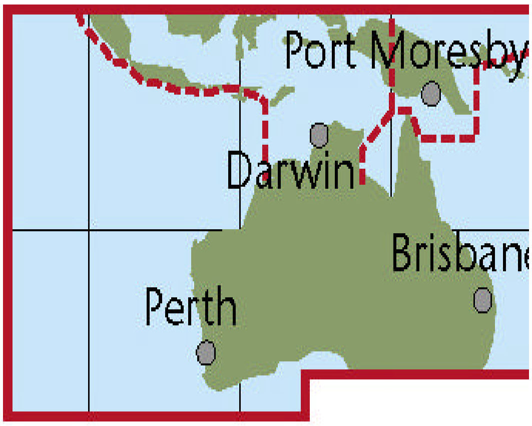
Tropical Storm Miriam occurred from September 15th to 17th while moving slowly northward along the northwest coast of Mexico and toward the Gulf of California. It was briefly a minimal tropical storm with winds to 40 m.p.h. on the 16t. Miriam dissipated on the 17th under southwesterly vertical wind shear just east of the southern Baja California peninsula. Tropical storm warnings were issued for a small portion of southern Baja California but tropical storm conditions did not affect land.

Tropical Storm Norman formed as a depression on early September 20th about 200 miles south-southeast of Manzanillo, Mexico. It drifted northward, briefly reached 50 m.p.h. wind speed and was weakening as its center moved on shore between Lazaro Cardenas and Colima late on the 20th. Norman moved along and just inland from the coast for a day as a wet depression. It moved back offshore and then inland again on the 22nd and dissipated near Mazatlan. Heavy rains fell over southwestern Mexico; the highest amount reported was 14 inches at Callejones, Colima. Tropical storm warnings were issued from Zihuantanejo to Manzanillo.

Tropical Storm Olivia formed about 195 miles south of the southwest coast of Mexico on October 3rd. The track was generally westward for four days and then northwestward for three more. Olivia reached its top wind speed of 65 mph on the 3rd and again on the 8th. This fluctuation in intensity is believed to be at least partially the result of increased vertical wind shear by nearby Hurricane Keith in the southern Gulf of Mexico. Dissipation occurred on the 10th about 600 miles west-southwest of the southern tip of Baja California.

Tropical Storm Paul moved generally westward over tropical waters beginning on October 25th. Paul reached its peak intensity of 45 m.p.h. on the 26th a little over 1000 miles south-southwest of Baja California. The storm underwent strong vertical shear during its existence and its low-level center was often exposed, and this contributed to the storm's dissipation on the 29th.

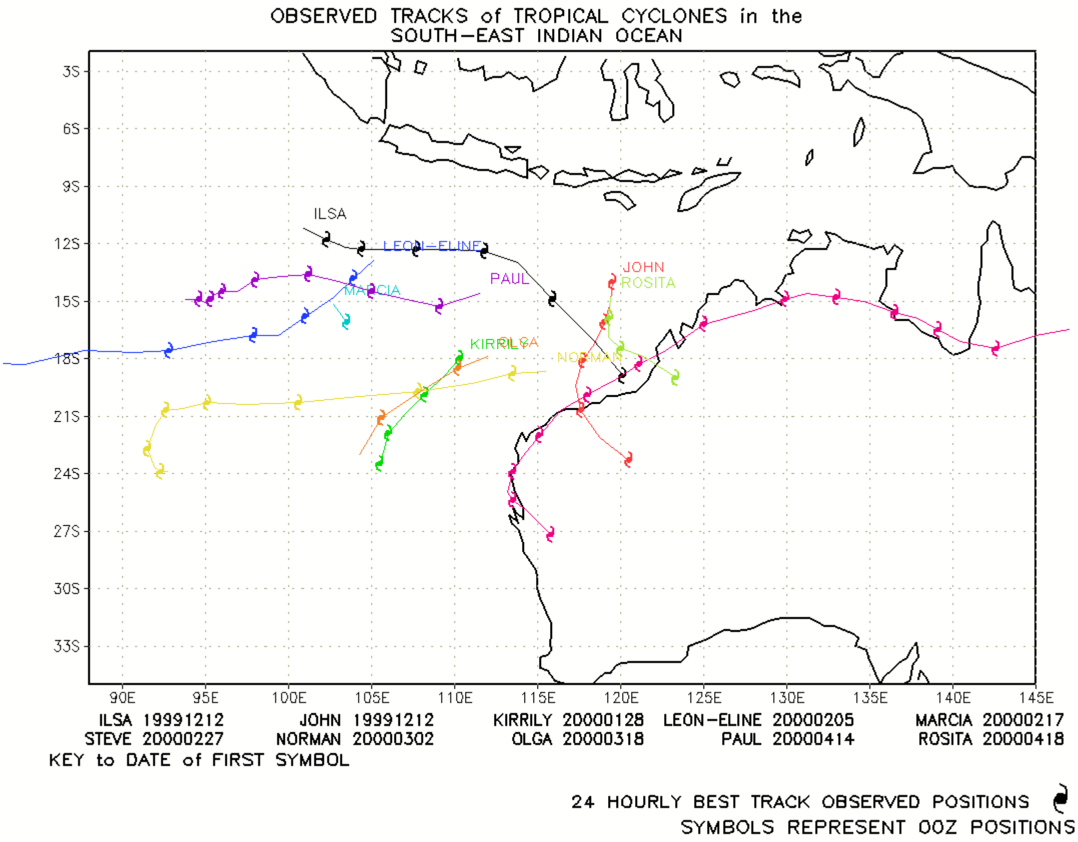
Tropical Storm Rosa became a depression on November 3rd about 200 miles south of the Pacific coast of El Salvador. It moved generally westward parallel to the coast and strengthened. Rosa turned northward to northeastward on the 6th and 7th a and reached its peak intensity of 65 m.p.h. on the 6th based on satellite wind speed estimates. A U.S. Air Force Reserve Hurricane Hunter aircraft flew into the storm on the 7th and reported a closed eyewall of 23-mile diameter. By this time, the winds had decreased to 55 to 60 m.p.h. The storm crossed the southern coast of Mexico on the 8th with 40-m.p.h. winds and was accompanied by locally heavy rain. Rosa, the final tropical cyclone of 2000, dissipated well inland on the 8th. Tropical storm warnings were issued along the south coast of Mexico from east of Acapulco to Tonala and a hurricane watch was issued from Acapulco to Salina Cruz.



TCWC - Perth

TCWC - Darwin

(TCWC - Brisbane)



Annual Tropical Cyclone Summary for 2000
Australian Region

The Australian Bureau of Meteorology is responsible for tropical cyclone monitoring in the area south of the equator between longitudes 90E-160E. The responsibility is shared by three Tropical Cyclone Warning Centres: Perth (Western Region - west of 125E), Darwin (Northern Region 125E-142E) and Brisbane (Eastern Region - east of 142E). In Australia, the generic term *tropical cyclone* is used for all tropical low pressure systems where the surrounding maximum 10-minute mean surface wind speed is gale force 17 m/s (34 kn) or more; a *severe tropical cyclone* has wind speeds of hurricane force 32 m/s (64 kn) or more. The tropical cyclone season in the southern hemisphere normally runs from November to April, so the annual summary encompass two separate seasons.

Eleven tropical cyclones were recorded in the Australian Region for the 2000 calendar year, close to the 22-year annual average of 11.5. The southeast Indian Ocean was the most active, where eight tropical cyclones developed, two above average. Five of these intensified into severe tropical cyclones, with four reaching wind speeds of 50 m/s (98 kn) or higher. Three tropical cyclones developed in the Coral Sea, one below average. Four tropical cyclones crossed the coast of the Australian mainland. Of these, *Rosita* in April and *Sam* in December were severe cyclones, both crossing the coast southwest of Broome[2] in Western Australia - two of the most intense tropical cyclones to cross that area in the last 100 years. *Steve* in February/March was notable for its long multi-basin track and made four water-to-land crossings during its lifetime.

The cyclone seasons at the beginning and end of 2000 were characterised by moderate phases of La Nina surrounding a mid-year decline in the Southern Oscillation Index[3]. Sea surface temperature anomalies tended to be warmer in the eastern Indian Ocean in the first few months of the year, while anomalies in the Coral Sea were weakly cool all year. Major active phases of the eastward propagating intra-seasonal (Madden-Julian) oscillation were evident in 200 hPa velocity potential time series in January, late February to early March, most of April, and in early December. Most tropical cyclones developed during these broad active phases.

List of the Tropical Cyclones in 2000

Tropical Cyclone	Date	Min Central Pressure (hPa)	Max Wind* (kt)

[2] Broome is located at 17.9S, 122.2E

[3] The Southern Oscillation Index (SOI) is calculated from the monthly or seasonal fluctuations in the air pressure difference between Tahiti and Darwin.

TC	Kirrily	24 Jan	31 Jan	975	58
STC	Leon/Eline	01 Feb	22 Feb	960	75
TC	Maria	14 Feb	18 Feb	994	35
TC	Steve	25 Feb	12 Mar	975	62
STC	Norman	28 Feb	08 Mar	932	98
TC	Olga	15 Mar	20 Mar	984	48
TC	Tessi	31 Mar	04 Apr	980	59
TC	Vaughan	29 Mar	07 Apr	977	58
STC	Paul	11 Apr	15 Apr	914	112
STC	Rosita	14 Apr	21 Apr	930	100
STC	Sam	28 Nov	08 Dec	923	105

* 10 minute wind

TROPICAL CYCLONE KIRRILY
27 - 31 January (Perth TCWC)

The monsoon trough in the Indian Ocean was quite active during the second half of the month, and by 24 January a low had separated from the main monsoon cloud mass to the east of the Cocos Islands. The low moved steadily towards the east southeast, but vertical wind shear hindered development until the environment became more favourable and intensification into a tropical cyclone occurred on 27 January. *Kirrily's* eastward movement ceased around this time as it came under the influence of a mid-level ridge and it recurved to the southwest, moving into an environment of increasing shear. The system weakened on 31 January, and the residual low-level circulation was steered to the northwest.

SEVERE TROPICAL CYCLONE LEON/ELINE
3 - 8 (8 - 22) February (Perth TCWC)

A monsoonal surge combined with an intensifying upper ridge promoted the development of a low south of Java on 1 February. Despite significant vertical wind shear it reached tropical cyclone strength on 3 February and steadily strengthened over the next 72 hours while moving towards the southwest, reaching peak intensity of 39 m/s (75 kn) on 5 February. From 7 February, *Leon* began to move on a more westerly track as the ridge to the south strengthened following the passage of a short wave trough, weakening as it encountered increasing wind shear. On 8 February, *Leon* crossed into La Reunion RSMC's area of responsibility, where it was renamed *Eline;* it continued on a west southwest course, crossing Madagascar then intensifying into a hurricane-force system prior to landfall on the coast of Mozambique on 22 February, exacerbating already serious flooding in that country.

TROPICAL CYCLONE MARIA
15-17 February (Perth TCWC)

Marcia formed from a low in the monsoon trough southeast of the Cocos Islands. It developed only slowly due to effects of moderate vertical wind shear, briefly attained minimal tropical cyclone status late on 15 February. *Marcia* weakened through the effects of vertical wind shear during 16 and 17 February, dissipating over water the next day. *Marcia* travelled on a slow easterly and then east-southeast track during its lifetime, under the influence of a northwest monsoon stream and a short wave trough to the southwest.

TROPICAL CYCLONE STEVE
27 February - 9 March (Brisbane /Darwin /Perth TCWCs)

By late February, monsoonal conditions extended across Australia and into the southwest Pacific, and a small circulation formed east of Willis Island on 25 February. The low moved west and deepened, and was named *Steve* on the morning of 27 February. *Steve* developed rapidly in close proximity to the Queensland coast, reaching peak intensity of 32 m/s (62 kn), before making landfall near Cairns and weakening as it tracked inland. The low crossed Cape York Peninsula as a rain depression then re-intensified to cyclone status, reaching near storm force in the southern Gulf of Carpentaria. *Steve* crossed the Northern Territory coast north of Port McArthur on 1 March and weakened. The residual depression travelled westward across northern Australia under the influence of a strong middle-level ridge, eventually moving offshore west of Broome in Western Australia and re-intensifying into a tropical cyclone on 5 March. *Steve* moved west-southwest parallel to the coast before moving inland near Mardie on 6 March. Early on 8 March, *Steve* again moved out to sea re-intensifying and reaching its most westward point before moving slowly around the mid-level ridge. *Steve's* final landfall was over Shark Bay on 9 March. The decaying cyclone then accelerated overland to the southeast and became extra-tropical, traversing southern Western Australia and moving into the Great Australian Bight on 12 March.

Steve had a significant impact over a large area of Australia. While crossing Cape York Peninsula it caused major flooding between Cairns and Mareeba, with a record flood level of 12.4 metres at Mareeba on 28 February. Ninety people were evacuated from the town and the railway bridge was washed away. The winds caused building damage and many trees and powerlines were brought down in the district; winds and floods also caused severe crop damage. Across the Northern Territory, strong squalls produced mainly minor damage, however widespread flooding from heavy rain was experienced in the Katherine, Daly and Victoria River regions. Several communities were evacuated and numerous roads and highways were cut. Over Western Australia, ex-*Steve* continued to produce heavy falls in the Kimberley with greater than 300 mm recorded in the Eighty Mile Beach area. Many communities remained isolated for up to two weeks. Several sites reported highest-on-record daily rainfall amounts including Mandora (281 mm on 6 March) and Mount Narryer (152 mm on 9 March). Carnarvon reported its highest March daily rainfall (100.6 mm on 9 March). The Gascoyne River recorded its highest flood level since 1961. Flooding also occurred along the southern coast of Western Australia near Esperance where a number of roads and bridges were washed away.

SEVERE TROPICAL STORM NORMAN
29 February - 8 March (Perth TCWC)

A depression developed in the active monsoon trough over northwest Australia late in February and moved offshore, reaching tropical cyclone status on the evening of 29 February. In a favourable upper environment, *Norman* rapidly intensified while travelling steadily west southwest, reaching its peak intensity of 50 m/s (98 kn) on 2 March, exhibiting a very symmetrical structure and a large eye. From 3 March, *Norman* began to weaken as it experienced increased vertical wind shear. On 6 March, *Norman* turned south then southeast, weakened into a tropical low on 8 March and dissipated two days later.

TROPICAL CYCLONE OLGA
16-19 March (Perth TCWC)

Surges in the westerlies to the north of the monsoon trough and in the easterlies to the south assisted a circulation to develop in waters off the northwest of Australia on 15 March. The low moved towards the southwest, intensifying only slowly, and reached tropical cyclone status late on 16 March, but *Olga* only just peaked at storm force during the next day as its intensification was inhibited by vertical wind shear. A series of mid-level troughs produced a more southerly motion and the cyclone eventually weakened over water on 19 March.

TROPICAL CYCLONE TESSI
2 - 3 April (Brisbane TCWC)

Tessi was first identified as a tropical low in the northern Coral Sea on 31 March. The low travelled towards the southwest and intensified to tropical cyclone strength early on 2 April. *Tessi* continued to track west-southwest, reaching its peak intensity of 30 m/s (59 kn) close to the Queensland coast. The cyclone crossed the coast about 75 kilometres to the northwest of Townsville early on 3 April and rapidly weakened overland. *Tessi* caused widespread wind damage to trees and powerlines and high seas destroyed boats and caused coastal erosion around the city. A significant landslide in a Townsville suburb destroyed two homes and required the evacuation of another 50 households. Townsville Airport recorded a maximum wind gust of 36 m/s (70 kn) and its highest April daily rainfall of 271.6 mm in the 24 hours to 9 am on 3 April.

TROPICAL CYCLONE VAUGHAN
3-6 April (Brisbane TCWC)

A monsoon low was identified near New Caledonia on 29 March and initially moved southwest before commencing a north and then northwest track. The low intensified rapidly due to favourable upper outflow and was named *Vaughan* on 3 April. The cyclone tracked westward across the Coral Sea towards north Queensland, reaching peak intensity of 30 m/s (58 kn) on 5 April before rapidly weakening, being downgraded to a tropical low the following day. The low was responsible for heavy rainfall along the north Queensland coast.

SEVERE TROPICAL CYCLONE PAUL
12 - 20 April (Perth TCWC)

Paul started as a low in the monsoon trough in the Timor Sea on 11 April. The low tracked westwards, being located north of the mid-level ridge axis, and in a favourable environment developed into a tropical cyclone on 12 April. *Paul* reached a peak intensity of 58 m/s (112 kn) on 15 April, making it the strongest Australian Region tropical cyclone in the year 2000. Between 14 and 18 April, *Paul* had a symmetric structure and a clear well defined eye with a diameter of 40 kilometres. On 17 April, *Paul* slowed as it moved into a break in the middle level ridge, and subsequently weakened as vertical wind shear increased, dissipating over water on 20 April.

SEVERE TROPICAL CYCLONE ROSITA
17 - 20 April (Perth TCWC)

As *Paul* moved westward, a second low formed offshore from Timor on 14 April and travelled slowly southwest then south under the influence of the mid-level ridge. It developed into a very small tropical cyclone named *Rosita* on 17 April, and intensified rapidly. The following day, *Rosita* commenced a southeastward track and crossed the coast about 40 kilometres south of Broome at its peak intensity of 51 m/s (100 kn). *Rosita* was one of the most severe tropical cyclones to cross the west Kimberley coast in the past 100 years. Major structural damage occurred at a tourist resort and pastoral station near Cape Villaret where the eye crossed the coast. In Broome the maximum wind gust recorded was 43 m/s (83 kn) causing extensive damage to trees and power lines. After crossing the coast, *Rosita* moved southeast over the Great Sandy desert causing damage at the remote community of Balgo Hills about 700 kilometres inland. *Rosita* eventually weakened below tropical cyclone strength late on 20 April as it approached the Northern Territory border.

SEVERE TROPICAL CYCLONE SAM
5 - 10 December (Perth TCWC)

During an active phase of the ISO over Australian longitudes late in November, a broad area of low pressure formed in the monsoon trough near Cape York. The weak disturbance moved westward across the southern Arafura Sea then slowly southwards through the western Timor Sea. The low deepened in association with a westerly wind burst in early December, and turned westward across the far north Kimberley region of Western Australia. The low attained tropical cyclone intensity after moving offshore into the Indian Ocean on 5 December. *Sam* initially moved on a westward track but turned to the south late on 6 December after interacting with an approaching short wave trough. *Sam* then intensified rapidly, reaching Australian Category 5 intensity early on 8 December, as it moved very slowly to the southwest offshore from the town of Broome. The cyclone commenced a southeast track and crossed the Western Australian coast close to its maximum intensity of 54 m/s (105 kn) during the evening of 8 December near the small community of Bidyadanga. Tropical cyclone structure appeared to be maintained for a day or so as *Sam* progressed inland into the Great Sandy Desert, after which the residual circulation persisted for another four days as it moved east across the Northern Territory.

Sam caused severe damage to buildings, power lines and vegetation at Bidyadanga and Anna Springs Station, but fortunately the resident population of several hundred people were evacuated prior to coastal crossing. *Sam*, its precursor low and residual rain depression caused heavy rain and flooding over a wide area of northern Australia. The peak rainfall reported in the 48 hours to 9 am 11 December was 520 mm at Shelamar, inland from the coastal crossing point.

RSMC LA REUNION TROPICAL CYCLONE CENTER

BEST TRACK DATA
STS ASTRIDE

MMDDHR	LAT	LONG	PPP	WND	STAGE
122306	8.2	75.5	1007	20	
122312	9.0	75.8	1005	20	
122318	9.7	75.5	1005	20	
122400	10.3	74.8	1005	20	
122406	11.1	74.3	1004	23	
122412	11.9	73.1	1004	23	
122418	12.1	72.1	1002	25	
122500	12.1	71.1	1000	25	
122506	12.2	70.0	1000	25	
122512	12.3	68.6	998	30	
122518	12.5	67.8	995	35	
122600	12.6	66.9	992	40	
122606	12.9	65.7	990	40	
122612	13.3	64.8	988	45	
122618	13.8	64.0	985	50	
122700	14.1	63.0	985	50	
122706	14.3	62.2	985	50	
122712	14.4	61.4	985	50	
122718	14.5	60.3	988	45	
122800	14.7	59.3	990	40	
122806	15.0	58.3	992	40	
122812	15.2	57.8	992	40	
122818	15.4	57.2	992	40	
122900	15.6	56.7	988	45	
122906	15.7	56.2	985	50	
122912	15.7	55.8	985	50	
122918	15.6	55.4	985	50	
123000	15.4	55.0	985	50	
123006	15.0	54.3	985	50	
123012	14.8	53.0	985	50	
123018	14.2	52.2	988	45	
123100	13.5	51.6	988	45	
123106	13.1	51.1	992	40	
123112	12.9	50.6	992	40	
123118	12.7	49.9	995	35	
010100	12.7	49.0	1000	25	
010106	12.8	47.9	1000	25	
010112	12.5	47.2	1000	25	

010118	12.5	46.7	998	30	
010200	12.8	45.9	996	33	
010206	13.1	45.0	995	35	
010212	13.5	44.0	995	35	
010218	13.8	42.6	995	35	
010300	13.7	41.4	996	33	
010306	13.6	40.3	998	30	
010312	13.2	39.5	1000	25	

BEST TRACK DATA
TC BABIOLA

MMDDHR	LAT	LONG	PPP	WND	STAGE
010306	11.9	82.6	1002	25	
010312	12.4	82.2	1002	25	
010318	12.5	81.8	1002	25	
010400	12.5	81.6	1002	25	
010406	12.4	81.8	1002	25	
010412	12.0	82.3	1002	25	
010418	11.4	82.9	1002	25	
010500	10.9	83.4	1002	25	
010506	10.9	84.1	1002	25	
010512	11.5	84.0	1002	30	
010518	11.9	83.2	1003	35	
010600	12.3	82.6	1003	35	
010606	12.7	82.0	1003	40	
010612	13.3	81.4	1003	40	
010618	13.8	80.4	1003	42	
010700	14.2	79.4	1003	45	
010706	14.7	78.3	1003	45	
010712	15.2	77.1	1003	50	
010718	15.5	75.8	1003	53	
010800	15.9	74.7	1003	55	
010806	16.5	73.3	1003	60	
010812	16.7	72.0	1004	65	
010818	17.1	71.1	1004	70	
010900	17.8	70.0	1004	73	
010906	18.4	68.8	1004	75	
010912	18.8	68.0	1004	80	
010918	19.6	67.6	1004	85	
011000	20.3	67.3	1004	85	
011006	21.0	67.1	1004	85	
011012	21.5	67.1	1004	80	
011018	22.2	67.2	1004	70	
011100	23.0	67.4	1003	58	
011106	23.7	67.7	1003	53	
011112	24.7	68.5	1003	50	
011118	25.4	68.8	1003	40	
011200	26.6	69.3	1003	35	
011206	27.7	70.1	1003	35	
011212	28.5	71.4	1003	35	
011218	29.3	72.7	1005	35	
011300	30.6	74.3	1005	35	
011306	31.8	74.7	1005	35	

011312	33.0	74.8	1005	40	
011318	34.1	74.6	1005	40	
011400	35.0	74.4	1005	40	
011406	36.1	74.9	1005	40	
011412	37.5	76.5	1005	40	

BEST TRACK DATA
ITC CONNIE

MMDDHR	LAT	LONG	PPP	WND	STAGE
012500	15.3	56.1	1003	20	
012506	15.3	55.7	1000	25	
012512	15.0	55.3	997	30	
012518	14.8	55.3	993	35	
012600	14.7	55.3	990	40	
012606	14.6	55.4	988	43	
012612	14.4	55.6	988	43	
012618	14.3	55.7	983	50	
012700	14.7	56.0	975	60	
012706	15.2	56.4	965	70	
012712	15.7	56.6	955	80	
012718	16.0	56.8	940	90	
012800	16.4	57.0	940	90	
012806	16.7	57.1	935	95	
012812	17.1	57.0	930	100	
012818	17.7	56.6	930	100	
012900	18.1	56.2	930	100	
012906	18.9	55.2	935	95	
012912	19.9	54.5	950	85	
012918	20.9	53.6	960	75	
013000	22.0	52.6	965	70	
013006	23.1	51.6	968	70	
013012	24.4	50.7	973	60	
013018	25.6	50.2	975	60	
013100	26.4	50.2	975	60	
013106	27.6	50.4	980	55	
013112	28.8	50.8	980	55	
013118	29.6	51.3	983	50	
020100	30.4	51.9	985	50	
020106	30.9	52.3	988	45	
020112	31.5	52.8	988	45	
020118	31.9	53.4	990	40	
020200	32.4	53.9	990	40	
020206	33.0	54.6	992	40	
020212	33.8	55.6	995	35	

BEST TRACK DATA
MTS DAMIENNE

MMDDHR	LAT	LONG	PPP	WND	STAGE

013018	10.4	73.6	1003	25	
013100	11.0	74.2	1002	25	
013106	11.6	74.9	1000	25	
013112	12.0	75.3	999	27	
013118	12.5	76.0	998	30	
020100	13.0	77.1	997	30	
020106	13.6	78.3	995	35	
020112	14.9	78.3	994	35	
020118	15.5	77.7	995	35	
020200	15.9	77.3	996	33	
020206	16.2	77.0	998	30	
020212	16.8	76.6	1000	25	
020218	17.3	75.4	1000	25	
020300	18.0	73.9	1000	25	
020306	18.3	72.9	1000	25	
020312	18.9	71.5	1000	25	
020318	19.2	69.9	1001	25	
020400	19.4	68.4	1002	25	
020406	19.3	67.4	1004	20	
020412	18.9	66.0	1005	20	
020418	18.6	64.5	1006	20	
020500	18.4	63.0	1007	20	
020506	18.3	61.7	1008	20	
020512	18.0	60.2	1008	20	
020518	17.5	58.6	1009	20	
020600	16.9	57.0	1009	20	
020606	16.2	55.8	1010	15	
020612	15.7	54.5	1010	15	
020618	15.5	53.1	1010	15	
020700	15.3	51.6	1010	15	

BEST TRACK DATA
ITC ELINE

MMDDHR	LAT	LONG	PPP	WND	STAGE
020706	17.3	96.9	975	60	
020712	17.3	95.8	980	55	
020718	17.3	94.5	983	50	
020800	17.3	93.3	987	45	
020806	17.2	92.1	990	40	
020812	17.0	90.4	992	38	
020818	17.2	89.2	995	35	
020900	17.6	87.7	990	40	
020906	18.1	85.7	988	43	
020912	18.3	84.1	988	43	
020918	18.3	82.4	988	43	
021000	18.2	80.6	990	40	
021006	17.9	79.3	990	40	
021012	17.7	78.1	990	40	
021018	17.8	76.7	992	38	
021100	17.7	74.9	992	38	
021106	17.6	73.6	995	35	
021112	17.4	72.2	995	35	
021118	16.9	70.9	992	38	

021200	16.5	69.6	990	40	
021206	16.2	68.2	990	40	
021212	16.2	67.0	990	40	
021218	16.1	65.5	988	43	
021300	15.9	64.0	988	43	
021306	15.8	63.1	988	43	
021312	16.1	62.1	988	43	
021318	16.5	61.5	983	50	
021400	17.0	60.8	975	60	
021406	17.3	59.8	975	60	
021412	17.6	58.8	975	60	
021418	18.0	57.9	978	55	
021500	18.4	57.0	978	55	
021506	18.8	56.1	980	55	
021512	18.9	55.5	978	55	
021518	19.5	54.8	975	60	
021600	20.0	54.0	973	60	
021606	20.5	52.8	970	65	
021612	20.4	51.9	970	65	
021618	20.2	51.5	965	70	
021700	19.9	51.0	965	70	
021706	19.9	50.2	960	75	
021712	19.8	49.3	953	80	
021718	19.5	48.5	940	90	
021800	18.8	47.6			
021806	19.1	46.3			
021812	19.3	45.1			
021818	19.4	44.4			
021900	19.8	43.5	999	30	
021906	20.5	42.5	997	30	
021912	21.1	41.9	995	35	
021918	21.7	41.1	992	40	
022000	22.0	40.1	988	45	
022006	22.1	39.4	983	50	
022012	22.3	38.2	978	55	
022018	22.0	37.7	975	60	
022100	21.8	37.4	975	60	
022106	21.4	37.0	975	60	
022112	21.2	36.5	970	65	
022118	21.1	36.1	955	80	
022200	20.8	35.3	935	95	
022206	20.6	34.7	930	100	
022212	20.2	33.8	960	75	
022218	19.8	33.0			
022300	19.5	31.7			
022306	19.2	30.5			
022312	19.3	29.8			
022318	19.5	29.2			
022400	19.7	28.6			
022406	19.8	28.1			
022412	20.0	27.3			
022418	20.1	26.7			
022500	20.2	25.9			
022506	20.2	25.0			
022512	20.3	24.2			
022518	20.3	23.6			
022600	20.3	22.9			
022606	20.3	22.2			

022612	20.4	21.7			
022618	20.4	21.2			
022700	20.5	20.7			
022706	20.6	20.3			
022712	20.7	19.9			
022718	20.9	19.5			
022800	21.2	19.1			
022806	21.4	18.8			
022812	21.8	18.7			
022818	22.3	18.8			
022900	22.8	18.9			
022906	23.3	18.9			
022912	23.8	18.7			

BEST TRACK DATA
STS FELICIA

MMDDHR	LAT	LONG	PPP	WND	STAGE
021818	13.5	75.8	1002	20	
021900	14.1	76.5	1002	20	
021906	14.4	76.9	1001	25	
021912	14.6	77.0	1000	25	
021918	14.8	77.1	1000	25	
022000	15.0	77.2	1000	25	
022006	15.2	77.1	999	25	
022012	15.7	76.2	999	25	
022018	16.2	75.0	997	30	
022100	16.7	73.9	997	30	
022106	17.4	73.0	996	30	
022112	17.8	71.5	993	35	
022118	18.7	70.8	990	40	
022200	19.8	69.7	987	45	
022206	20.8	68.4	983	50	
022212	21.9	67.6	980	55	
022218	23.3	67.3	975	60	
022300	24.5	66.6	975	60	
022306	25.6	66.1	975	60	
022312	27.0	65.9	978	55	
022318	28.2	65.2	983	50	
022400	29.7	64.4	990	40	
022406	30.4	63.9	993	35	
022412	31.1	63.5	995	30	
022418	31.6	63.4	996	30	
022500	31.9	63.6	997	30	
022506	32.1	63.9	999	25	
022512	31.4	64.4	1000	25	
022518	30.8	64.2	1003	20	
022600	30.2	63.8	1005	20	
022606	29.5	63.2	1008	20	
022612	28.8	62.5	1010	15	

BEST TRACK DATA
MTS GLORIA

MMDDHR	LAT	LONG	PPP	WND	STAGE
022712	13.3	61.5	1000	25	
022718	13.5	61.0	1000	25	
022800	13.6	60.1	1000	25	
022806	13.5	59.0	1000	25	
022812	13.3	57.9	999	25	
022818	13.1	57.0	999	25	
022900	13.0	56.4	997	30	
022906	12.7	55.5	997	30	
022912	12.3	54.1	997	30	
022918	12.3	52.5	997	30	
030100	12.5	51.9	994	35	
030106	12.9	51.3	990	40	
030112	13.6	50.7	987	45	
030118	14.2	50.1	985	50	
030200	14.6	49.5			
030206	15.3	49.1			
030212	16.1	48.5			
030218	16.8	47.5			
030300	17.7	46.2			
030306	17.9	45.7			
030312	18.1	45.2			
030318	18.3	44.7			
030400	18.5	44.2	1005		
030406	18.8	43.8	1006		
030412	19.4	43.6	1006		
030418	19.8	43.4	1007		
030500	20.0	43.2	1007		
030506	20.2	43.0	1007		
030512	20.4	42.8	1006		
030518	20.6	42.6	1006		
030600	20.7	42.3	1006		
030606	20.9	42.1	1006		
030612	21.0	41.9	1006		
030618	21.2	41.6	1006		
030700	21.2	41.1	1006		
030706	21.5	40.6	1007		
030712	22.0	40.0	1007		
030718	22.3	39.2	1006		
030800	22.4	38.2	1005	20	
030806	22.9	37.5	1004	20	
030812	23.8	36.9	1002	25	
030818	24.2	36.2	1000	25	
030900	24.0	35.5	1000	25	
030906	23.9	34.6			
030912	23.8	33.7			
030918	23.9	33.5			
031000	24.0	33.5			
031006	24.3	33.5			
031012	24.4	33.6			

BEST TRACK DATA
VITC HUDAH

MMDDHR	LAT	LONG	PPP	WND	STAGE
032400	15.5	95.3	1002	20	
032406	15.4	94.2	1000	25	
032412	15.3	92.9	999	25	
032418	15.2	91.7	997	30	
032500	15.1	90.3	994	35	
032506	15.3	89.3	990	40	
032512	15.3	88.4	980	53	
032518	15.2	87.5	978	55	
032600	15.1	86.5	978	55	
032606	14.9	85.3	978	55	
032612	14.7	84.4	976	57	
032618	14.7	83.7	974	60	
032700	14.6	82.6	970	65	
032706	14.5	81.6	965	70	
032712	14.6	80.7	965	70	
032718	14.7	79.5	965	70	
032800	14.9	78.2	960	75	
032806	15.2	77.1	960	75	
032812	15.4	76.1	960	75	
032818	15.8	75.1	960	75	
032900	16.1	73.5	955	80	
032906	16.3	72.6	950	83	
032912	16.6	71.3	950	83	
032918	16.8	70.1	950	83	
033000	16.9	68.7	955	80	
033006	16.8	67.7	960	75	
033012	17.0	66.6	965	70	
033018	17.1	65.4	965	70	
033100	17.1	64.4	960	75	
033106	17.0	63.0	945	85	
033112	17.0	61.7	935	95	
033118	17.1	60.6	928	100	
040100	17.0	59.4	915	110	
040106	16.8	58.1	910	115	
040112	16.6	56.9	910	115	
040118	16.5	55.6	910	115	
040200	16.1	54.1	905	120	
040206	15.6	52.9	905	120	
040212	15.4	51.4	905	120	
040218	15.0	50.5	910	115	
040300	14.8	49.1			
040306	14.9	47.4			
040312	14.7	46.0	996	30	
040318	14.7	45.2	997	30	
040400	14.9	44.4	994	35	
040406	15.2	43.5	990	40	
040412	15.6	42.6	983	50	
040418	16.1	41.8	978	55	
040500	16.3	41.0	975	60	
040506	16.6	40.2	975	60	
040512	16.9	39.7	975	60	
040518	17.2	39.4	970	65	
040600	17.7	39.0	965	70	
040606	18.0	38.8	965	70	
040612	18.5	38.6	965	70	
040618	18.8	38.6	960	75	

040700	18.8	38.3	955	80	
040706	18.7	38.3	947	85	
040712	18.6	38.1	947	85	
040718	18.1	38.6	947	85	
040800	17.8	38.5	955	80	
040806	17.2	38.3	970	65	
040812	16.7	38.3			
040818	16.1	38.3			
040900	15.6	38.3			

BEST TRACK DATA
MTS INNOCENTE

MMDDHR	LAT	LONG	PPP	WND	STAGE
041112	10.0	95.3	1002	20	
041118	10.1	94.8	1002	20	
041200	10.1	94.2	1002	20	
041206	10.4	92.7	1002	20	
041212	10.8	90.7	1002	20	
041218	11.1	89.5	1000	25	
041300	11.3	88.2	1000	25	
041306	11.7	86.8	998	30	
041312	11.5	85.7	998	30	
041318	11.3	85.1	998	30	
041400	11.1	84.9	998	30	
041406	11.0	84.7	1000	25	
041412	11.3	84.4	1000	25	
041418	12.2	84.1	1000	25	
041500	13.0	83.6	1000	25	
041506	13.8	82.5	1000	25	
041512	14.5	81.4	998	30	
041518	14.9	80.6	998	30	
041600	15.2	79.7	998	30	
041606	15.6	78.5	998	30	
041612	15.7	78.0	998	30	
041618	15.9	77.4	998	30	
041700	16.1	76.8	998	30	
041706	16.2	76.3	995	35	
041712	16.4	75.8	993	37	
041718	16.7	75.1	993	37	
041800	17.0	74.4	993	37	
041806	17.3	73.6	995	35	
041812	17.5	73.0	995	35	
041818	17.6	72.0	997	30	
041900	17.7	70.7	997	30	
041906	17.8	70.4	998	30	
041912	18.1	69.9	998	30	
041918	18.4	69.0	1000	25	
042000	18.4	68.0	1000	25	
042006	18.2	67.3	1000	25	
042012	17.9	66.6	1000	25	
042018	17.6	65.7	1002	20	
042100	17.3	65.2	1003	20	
042106	17.1	64.9	1004	20	
042112	17.0	64.7	1004	20	

042118	16.7	63.9	1005	20	
042200	16.6	63.5	1005	20	
042206	16.1	62.7	1006	20	
042212	15.5	62.0	1006	20	
042218	15.0	61.2	1007	20	
042300	14.4	60.1	1007	20	
042306	14.2	58.8	1008	20	
042312	14.5	58.4	1008	20	
042318	14.7	57.2	1010	15	
042400	14.8	55.9	1010	15	
042406	15.1	54.9	1011	15	
042412	16.3	53.7	1011	20	

LEGEND:

MTS - Moderate Tropical Storm
TS - Tropical Storm
STS - Severe Tropical Storm
TC - Tropical Cyclone
ITC - Intense Tropical Cyclone
VITC - Very Intense Tropical Cyclone

Wind Speed - knots

RSMC MIAMI - HURRICANE CENTER
BEST TRACK DATA
H ALBERTO

MMDDHR	LAT	LONG	PPP	WND	STAGE
080318	10.8	18.0	1007	25	TD
080400	11.5	20.1	1005	30	TD
080406	12.0	22.3	1004	35	TS
080412	12.3	23.8	1003	35	TS
080418	12.7	25.2	1002	40	TS
080500	13.2	26.7	1001	40	TS
080506	13.7	28.2	1000	45	TS
080512	14.1	29.8	999	45	TS
080518	14.5	31.4	994	55	TS
080600	14.5	33.2	987	65	H
080606	14.6	34.4	985	65	H
080612	14.7	35.4	983	70	H
080618	15.2	36.6	981	75	H
080700	15.7	38.1	979	75	H
080706	16.0	39.6	978	80	H
080712	16.2	41.0	977	80	H
080718	16.5	42.2	978	80	H
080800	16.7	43.6	979	75	H
080806	17.0	44.9	982	70	H
080812	17.7	45.7	985	70	H
080818	18.6	46.5	987	65	H
080900	19.6	47.2	989	60	TS
080906	20.6	48.5	992	60	TS
080912	21.9	49.9	994	55	TS
080918	23.4	51.3	991	60	TS
081000	24.8	52.6	988	65	H
081006	26.1	54.0	987	65	H
081012	27.5	55.3	986	65	H
081018	28.8	56.7	984	65	H
081100	29.9	57.7	982	70	H
081106	31.1	58.4	979	75	H
081112	32.2	58.6	976	80	H
081118	33.3	58.5	973	85	H
081200	34.3	58.0	970	90	H
081206	35.1	56.7	960	100	H
081212	35.9	55.3	950	110	H
081218	36.8	53.8	954	110	H
081300	37.4	52.0	958	105	H
081306	38.0	50.3	966	95	H
081312	38.4	48.3	973	85	H
081318	38.8	46.3	980	75	H
081400	39.0	44.2	987	65	H
081406	39.1	42.2	991	60	TS

081412	39.1	40.6	994	55	TS
081418	39.1	39.3	997	50	TS
081500	38.9	38.5	1000	45	TS
081506	38.3	38.5	1001	45	TS
081512	37.3	38.5	1002	45	TS
081518	36.6	38.9	1002	40	TS
081600	36.1	39.4	1003	40	TS
081606	35.4	40.2	1003	40	TS
081612	34.6	41.3	1003	40	TS
081618	33.9	42.4	1002	40	TS
081700	33.4	43.5	1001	45	TS
081706	33.0	44.2	1000	45	TS
081712	33.0	44.9	998	50	TS
081718	33.0	45.8	997	50	TS
081800	33.2	46.5	995	55	TS
081806	33.6	47.1	993	55	TS
081812	34.2	47.6	991	60	TS
081818	34.7	48.0	987	65	H
081900	34.9	48.1	979	75	H
081906	35.3	48.2	976	80	H
081912	35.6	48.2	973	85	H
081918	36.0	48.2	970	90	H
082000	36.4	48.1	970	90	H
082006	36.7	48.0	971	90	H
082012	37.1	47.9	972	85	H
082018	37.4	47.7	973	85	H
082100	37.9	47.5	974	85	H
082106	38.3	47.3	976	80	H
082112	38.9	47.2	977	80	H
082118	40.0	46.7	978	80	H
082200	41.2	45.9	979	75	H
082206	42.6	45.4	981	75	H
082212	44.0	44.0	983	70	H
082218	46.1	42.1	985	65	H
082300	48.3	39.5	987	65	H
082306	50.7	36.8	994	55	TS
082312	53.2	35.4	997	45	EXT
082318	57.0	34.0	997	45	EXT
082400	59.5	30.3	995	40	EXT
082406	62.0	25.5	992	35	EXT
082412	65.5	23.0	990	35	EXT
082418	68.0	20.0	992	30	EXT
082500	69.0	12.5	990	30	EXT
082506	70.7	4.9	994	30	EXT

BEST TRACK DATA
TS BERYL

MMDDHR	LAT	LONG	PPP	WND	STAGE
081318	22.5	94.5	1008	30	TD
081400	22.7	93.8	1008	30	TD
081406	23.1	94.6	1007	35	TS
081412	23.5	95.4	1009	40	TS
081418	23.9	96.3	1009	45	TS
081500	24.1	97.0	1007	45	TS
081506	24.5	97.7	1009	45	TS

081512	24.9	98.6	1010	30	TD
081518	25.2	99.8	1012	25	TD

BEST TRACK DATA
TS CHRIS

MMDDHR	LAT	LONG	PPP	WND	STAGE
081712	14.2	51.9	1009	25	TD
081718	14.7	52.8	1009	25	TD
081800	15.2	53.4	1009	25	TD
081806	15.6	54.1	1009	30	TD
081812	16.2	55.4	1008	35	TS
081818	16.8	56.5	1011	30	TD
081900	17.3	57.7	1012	25	TD
081906	17.8	59.0	1012	25	TD
081912	18.3	60.4	1013	20	DIS

BEST TRACK DATA
TS ERNESTO

MMDDHR	LAT	LONG	PPP	WND	STAGE
090112	14.8	45.2	1009	25	TD
090118	15.0	47.0	1009	30	TD
090200	15.6	48.3	1009	30	TD
090206	16.2	49.5	1008	35	TS
090212	16.9	50.8	1008	35	TS
090218	17.5	52.1	1008	35	TS
090300	18.2	53.6	1008	35	TS
090306	18.8	55.0	1008	35	TS
090312	19.4	56.6	1008	35	TS
090318	20.0	58.0	1009	30	TD

BEST TRACK DATA
H DEBBY

MMDDHR	LAT	LONG	PPP	WND	STAGE
081918	12.0	44.5	1010	30	TD
082000	12.6	45.3	1010	30	TD
082006	13.3	46.8	1009	35	TS
082012	14.0	48.8	1008	40	TS
082018	14.7	50.6	1007	45	TS
082100	15.1	52.1	1006	55	TS
082106	15.4	54.0	1005	65	H
082112	15.7	56.3	1004	75	H
082118	16.1	58.5	1004	75	H
082200	16.8	60.1	995	70	H
082206	17.5	61.7	993	65	H
082212	18.1	63.5	994	65	H

082218	18.8	65.4	995	65	H
082300	19.2	66.7	995	65	H
082306	19.5	68.1	995	65	H
082312	19.8	69.7	1005	60	TS
082318	20.0	71.5	1009	50	TS
082400	19.9	73.3	1010	40	TS
082406	19.6	75.1	1011	35	TS
082412	19.5	77.0	1011	30	TD

BEST TRACK DATA
H FLORENCE

MMDDHR	LAT	LONG	PPP	WND	STAGE
091018	30.9	70.9	1007	30	STD
091100	30.8	71.3	1007	30	STD
091106	30.7	71.8	1006	30	TD
091112	30.4	72.2	1002	45	TS
091118	30.1	72.6	998	65	H
091200	30.1	72.7	992	65	H
091206	30.2	72.8	993	60	TS
091212	30.3	73.1	991	60	TS
091218	30.6	73.3	987	65	H
091300	30.8	73.7	986	65	H
091306	30.7	74.0	986	65	H
091312	30.7	73.8	987	60	TS
091318	30.5	73.7	989	55	TS
091400	30.2	73.6	991	50	TS
091406	29.6	73.6	993	45	TS
091412	29.5	73.4	994	45	TS
091418	29.3	73.1	995	45	TS
091500	29.2	72.8	995	45	TS
091506	29.1	72.4	996	45	TS
091512	29.8	71.2	997	50	TS
091518	30.1	69.7	997	60	TS
091600	30.8	67.5	994	65	H
091606	32.6	66.1	988	65	H
091612	34.3	64.2	987	65	H
091618	36.1	61.8	985	70	H
091700	37.6	59.5	990	60	TS
091706	40.1	57.4	995	55	TS
091712	42.5	55.0	1000	50	TS
091718	45.5	53.0	1002	50	TS

BEST TRACK DATA
H GORDON

MMDDHR	LAT	LONG	PPP	WND	STAGE
091412	19.8	87.3	1008	25	
091418	20.4	87.4	1007	25	
091500	20.7	87.7	1007	25	
091506	21.0	88.0	1006	25	
091512	21.4	88.7	1004	25	
091518	21.6	87.8	1004	30	
091600	22.5	86.7	1000	40	TS
091606	22.9	86.6	997	50	
091612	23.5	86.3	992	55	

091618	24.3	85.9	983	60	
091700	25.2	85.4	985	65	H
091706	26.1	84.9	981	70	
091712	27.1	84.3	987	65	
091718	28.0	83.8	985	60	TS
091800	28.9	83.4	992	55	
091806	29.8	83.0	1000	40	
091812	31.0	82.3	1006	30	TD
091818	32.3	81.5	1011	25	EXT
091900	33.5	80.2	1011	25	
091906	35.0	79.0	1011	20	
091912	37.0	78.2	1010	20	
091918	38.5	76.0	1008	25	
092000	40.0	74.0	1007	25	
092006	41.5	72.0	1005	25	
092012	42.0	69.5	1005	30	
092018	42.5	97.2	1005	30	
092100	43.0	65.0	1004	30	
092106	43.5	63.0	1003	30	

BEST TRACK DATA
TS HELENE

MMDDHR	LAT	LONG	PPP	WND	STAGE
091512	14.9	52.2	1010	25	TD
091518	15.3	53.0	1010	25	TD
091600	15.6	53.6	1010	25	TD
091606	15.8	54.4	1010	25	TD
091612	16.1	55.9	1010	30	TD
091618	16.4	58.0	1010	30	TW
091700	16.6	59.9	1010	30	TW
091706	16.6	61.7	1010	30	TW
091712	16.4	63.6	1010	30	TW
091718	16.7	65.6	1010	30	TW
091800	17.0	67.1	1010	30	TW
091806	17.1	68.7	1010	30	TW
091812	17.2	70.6	1010	30	TW
091818	17.4	72.5	1010	30	TW
091900	17.6	74.4	1010	30	TW
091906	18.3	76.3	1010	30	TW
091912	18.9	78.3	1010	30	TW
091918	19.4	79.6	1010	30	TD
092000	19.9	81.0	1010	30	TD
092006	20.7	82.6	1010	25	TD
092012	21.8	84.3	1010	25	TD
092018	23.0	85.4	1010	25	TD
092100	23.9	86.1	1008	25	TD
092106	24.9	86.6	1007	35	TS
092112	26.1	87.0	1006	45	TS
092118	27.1	87.1	999	60	TS
092200	28.4	87.2	996	60	TS
092206	29.5	87.2	1001	50	TS
092212	30.5	86.6	1006	35	TS
092218	31.6	85.4	1010	25	TD
092300	32.9	83.5	1011	25	TD
092306	33.6	81.7	1012	25	TD

092312	34.4	80.0	1011	25	TD
092318	35.4	78.0	1010	35	TS
092400	36.4	76.1	1008	40	TS
092406	37.2	74.7	1005	45	TS
092412	38.0	72.5	1001	45	TS
092418	39.2	70.1	997	45	TS
092500	40.1	66.8	993	55	TS
092506	41.6	62.2	986	60	TS
092512	44.0	55.5	988	55	TS
092518	46.1	48.8	990	45	TS

BEST TRACK DATA
H ISAAC

MMDDHR	LAT	LONG	PPP	WND	STAGE
092112	11.5	23.0	1008	30	TD
092118	11.9	24.5	1008	30	TD
092200	12.3	25.9	1005	35	TS
092206	12.7	27.2	1001	40	TS
092212	13.1	28.7	1000	45	TS
092218	13.5	30.1	1000	45	TS
092300	13.7	31.2	997	50	TS
092306	13.9	32.3	994	55	TS
092312	14.3	33.2	984	70	H
092318	14.6	34.2	973	85	H
092400	14.9	35.0	960	105	H
092406	15.1	35.8	960	100	H
092412	15.5	36.8	960	100	H
092418	15.8	37.8	960	100	H
092500	16.3	38.6	965	95	H
092506	16.7	39.5	965	95	H
092512	17.2	40.4	970	90	H
092518	17.6	41.2	970	90	H
092600	17.9	42.0	970	90	H
092606	18.3	42.9	973	85	H
092612	18.6	43.9	980	75	H
092618	19.1	45.0	980	75	H
092700	19.6	46.0	977	80	H
092706	20.4	47.0	973	85	H
092712	21.0	48.1	970	90	H
092718	21.9	49.5	965	95	H
092800	22.8	50.6	960	100	H
092806	23.8	52.0	955	105	H
092812	25.0	52.9	950	110	H
092818	26.6	54.2	943	120	H
092900	28.0	55.1	948	115	H
092906	29.7	55.9	950	110	H
092912	31.2	56.2	955	105	H
092918	32.9	55.9	965	90	H
093000	34.4	55.2	970	85	H
093006	35.7	54.0	975	80	H
093012	37.0	51.8	979	75	H
093018	38.3	49.8	985	70	H
100100	39.7	47.9	987	65	H
100106	40.9	45.7	990	60	TS

100112	42.1	43.6	990	55	TS
100118	43.5	39.5	990	55	EXT
100200	44.5	36.5	982	55	EXT
100206	45.7	33.0	972	60	EXT
100212	47.0	29.0	975	60	EXT
100218	48.5	25.0	976	60	EXT
100300	49.5	20.5	976	60	EXT
100306	50.5	16.5	978	60	EXT
100312	52.0	12.0	982	55	EXT
100318	55.0	9.0	988	45	EXT
100400	58.0	6.0	989	45	EXT
100406	62.0	4.0	994	45	EXT

BEST TRACK DATA
H JOYCE

MMDDHR	LAT	LONG	PPP	WND	STAGE
092512	11.2	29.6	1009	25	TD
092518	11.4	30.7	1009	30	TD
092600	11.5	31.9	1008	35	TS
092606	11.6	33.0	1007	35	TS
092612	11.6	34.1	1005	35	TS
092618	11.7	35.3	1002	40	TS
092700	12.1	36.4	998	50	TS
092706	12.2	37.6	993	55	TS
092712	12.4	38.8	985	65	H
092718	12.5	40.1	978	70	H
092800	12.4	41.3	976	75	H
092806	12.2	42.5	975	80	H
092812	11.7	43.8	975	80	H
092818	11.3	45.0	976	75	H
092900	10.9	46.1	977	75	H
092906	10.7	47.2	980	70	H
092912	10.5	48.6	984	65	H
092918	10.5	50.1	988	60	TS
093000	10.4	51.7	992	55	TS
093006	10.3	53.3	996	50	TS
093012	10.3	54.9	1000	45	TS
093018	10.5	56.6	1003	40	TS
100100	10.7	58.0	1005	40	TS
100106	11.0	59.5	1006	35	TS
100112	11.3	60.9	1007	35	TS
100118	11.7	62.3	1008	30	TD
100200	11.9	63.5	1009	30	TD
100206	11.9	64.9	1009	25	TD

BEST TRACK DATA
H KEITH

MMDDHR	LAT	LONG	PPP	WND	STAGE
092818	16.1	82.9	1005	25	TD
092900	16.2	83.3	1004	25	TD
092906	16.6	83.6	1003	30	TD
092912	16.9	84.0	1002	30	TD

092918	17.4	84.8	1000	40	TS
093000	17.7	85.4	993	45	TS
093006	17.9	86.0	987	55	TS
093012	17.9	86.4	982	65	H
093018	17.9	86.7	977	75	H
100100	17.9	86.9	955	100	H
100106	17.9	87.2	941	120	H
100112	17.9	87.4	944	115	H
100118	17.9	87.7	950	110	H
100200	17.8	87.9	959	100	H
100206	17.6	87.8	974	80	H
100212	17.7	87.8	980	70	H
100218	17.7	87.9	987	65	H
100300	17.9	88.0	989	60	TS
100306	18.0	88.4	990	45	TS
100312	18.3	88.8	995	30	TD
100318	18.6	89.5	998	30	TD
100400	19.0	90.4	1000	25	TD
100406	19.5	91.4	1000	30	TD
100412	19.9	92.5	999	35	TS
100418	20.3	93.5	996	40	TS
100500	20.7	94.8	988	60	TS
100506	21.2	96.1	987	65	H
100512	21.8	97.0	983	75	H
100518	22.6	97.9	980	80	H
100600	23.2	99.0	988	45	TS
100606	23.5	100.0	1002	30	TD
100612	23.8	101.0	1007	20	TD

BEST TRACK DATA
TS LESLIE

MMDDHR	LAT	LONG	PPP	WND	STAGE
100412	29.0	81.4	1012	30	STD
100418	29.5	80.8	1012	30	STD
100500	29.7	79.9	1010	30	STD
100506	29.8	78.6	1010	30	STD
100512	29.9	77.3	1009	35	TS
100518	30.2	75.9	1009	35	TS
100600	30.3	74.3	1010	35	TS
100606	30.6	73.1	1006	40	TS
100612	30.9	72.4	1007	40	TS
100618	31.3	71.8	1007	40	TS
100700	32.1	70.7	1006	40	TS
100706	33.1	69.6	1006	40	TS
100712	35.4	68.3	1006	40	TS
100718	37.4	66.7	1005	40	EXT
100800	40.0	64.0	1004	40	EXT
100806	43.0	60.0	1003	40	EXT
100812	46.0	57.0	1003	40	EXT
100818	49.0	54.0	1005	35	EXT
100900	51.0	50.0	1007	35	EXT
100906	53.0	46.0	1006	35	EXT
100912	55.0	41.0	1005	35	EXT
100918	56.0	36.0	1003	35	EXT

101000	56.0	30.0	999	40	EXT
101006	55.0	24.0	987	50	EXT
101012	54.0	17.0	980	55	EXT
101018	53.0	10.0	973	60	EXT

BEST TRACK DATA
H MICHAEL

MMDDHR	LAT	LONG	PPP	WND	STAGE
101512	30.0	71.2	1007	30	STD
101518	30.0	71.5	1006	30	STD
101600	29.9	71.8	1005	35	STS
101606	29.9	71.9	1005	35	STS
101612	29.7	71.7	1005	35	STS
101618	29.8	71.4	1004	35	STS
101700	29.9	71.1	1003	35	TS
101706	29.8	71.0	1000	45	TS
101712	29.8	70.9	995	55	TS
101718	30.1	70.9	988	65	H
101800	30.4	70.9	988	65	H
101806	30.8	70.8	986	65	H
101812	31.5	70.4	984	65	H
101818	32.6	69.5	979	70	H
101900	34.2	97.8	983	75	H
101906	36.3	65.5	986	65	H
101912	39.8	61.6	979	75	H
101918	44.0	58.5	965	85	H
102000	48.0	56.5	966	75	EXT
102006	50.0	56.0	966	70	EXT
102012	51.0	53.5	968	65	EXT
102018	52.0	50.5	970	60	EXT

BEST TRACK DATA
TS NADINE

MMDDHR	LAT	LONG	PPP	WND	STAGE
101912	26.2	59.9	1009	25	TD
101918	27.5	59.4	1008	30	TD
102000	28.7	58.8	1008	30	TD
102006	29.7	58.0	1005	30	TD
102012	30.4	57.2	1003	35	TS
102018	31.4	56.3	1000	40	TS
102100	32.4	55.2	999	50	TS
102106	33.3	53.5	1000	50	TS
102112	34.1	52.3	1000	50	TS
102118	34.8	51.3	1000	45	TS
102200	35.7	50.5	1004	40	EXT
102206	37.0	49.0	1005	40	EXT
102212	39.0	47.0	1005	35	EXT

BEST TRACK DATA
UNNAMED SUBTROPICAL STORM

MMDDHR	LAT	LONG	PPP	WND	STAGE
102500	21.5	69.5	1009	30	EXT L
102506	22.5	70.0	1007	35	EXT G
102512	23.5	70.9	1006	35	EXT G
102518	24.5	71.7	1005	35	STS
102600	25.7	71.7	1004	35	STS
102606	26.6	71.7	1003	35	STS
102612	27.4	71.8	1002	40	STS
102618	28.3	72.1	1000	45	STS
102700	29.2	72.5	997	50	STS
102706	30.0	72.6	997	50	STS
102712	30.9	72.5	997	50	STS
102718	32.6	71.6	996	50	STS
102800	34.2	70.7	994	50	STS
102806	35.7	69.9	992	50	STS
102812	36.5	68.1	990	50	STS
102818	38.0	65.5	984	55	STS
102900	40.5	62.6	978	55	STS
102906	44.0	60.0	980	50	EXT
102912	46.0	59.5	992	45	EXT

LEGEND:

EXT - Extratropical
EXT L - Extratropical Low
EXT G - Extratropical Gale
TD - Tropical Depression
STD - Subtropical Depression
TS - Tropical Storm
STS - Subtropical Storm
H - Hurricane

Wind Speed - knots

RSMC NADI - TROPICAL CYCLONE CENTRE

BEST TRACK DATA
STC IRIS

MMDDHR	LAT	LONG	PPP	WND	STAGE
010612	15.0	164.0	1000	25	TD
010618	15.3	164.2	998	30	TD
010700	15.5	164.3	996	35	TC
010706	16.0	164.5	992	40	TC
010712	16.3	164.9	986	50	TC
010718	16.3	165.3	981	55	TC
010800	16.4	165.6	972	70	STC
010806	16.6	166.5	964	80	STC
010812	16.7	167.5	978	60	TC
010818	17.0	168.3	986	50	TC
010900	17.2	169.3	982	55	TC
010906	17.5	170.5	984	50	TC
010912	17.7	172.1	985	50	TC
010918	18.7	174.0	988	45	TC
011000	18.9	176.1	994	35	TC
011006	19.4	177.7	998	30	TD
011012	19.9	179.0	1000	25	TD

BEST TRACK DATA
TC JO

MMDDHR	LAT	LONG	PPP	WND	STAGE
012300	14.5	171.7	1000	25	TD
012306	14.7	172.1	999	25	TD
012312	16.2	172.7	998	30	TD
012318	17.3	172.6	997	30	TD
012400	17.9	173.1	995	35	TC
012406	18.5	173.4	990	40	TC
012412	19.1	173.7	987	45	TC
012418	19.6	174.2	985	50	TC
012500	20.2	174.7	980	55	TC
012506	21.0	174.9	978	60	TC
012512	21.9	175.1	975	60	TC
012518	22.6	176.0	974	60	TC
012600	23.2	176.8	972	65	TC
012606	24.0	177.9	974	60	TC
012612	25.1	179.0	975	60	TC
012618	26.3	-179.8	982	55	TC
012700	27.4	-178.8	987	45	TC
012706	28.5	-176.4	990	40	TC
012712	30.0	-174.5	995	35	TC

BEST TRACK DATA
STC KIM

MMDDHR	LAT	LONG	PPP	WND	STAGE
022312	23.0	-132.8	1005	20	TD
022318	23.2	-133.4	1003	20	TD
022400	23.1	-134.1	1000	25	TD
022406	23.2	-134.4	999	25	TD
022412	23.3	-135.1	997	30	TD
022418	23.2	-135.6	994	35	TC
022500	23.2	-136.0	985	50	TC
022506	23.3	-136.4	975	60	TC
022512	23.5	-137.0	965	70	STC
022518	24.0	-137.5	960	75	STC
022600	24.4	-138.4	955	80	STC
022606	24.9	-139.3	940	90	STC
022612	25.7	-139.9	935	90	STC
022618	26.5	-140.9	940	90	STC
022700	27.2	-141.7	945	85	STC
022706	28.0	-142.6	955	80	STC
022712	29.0	-144.0	965	70	STC
022718	29.4	-144.7	975	60	TC

BEST TRACK DATA
TC LEO

MMDDHR	LAT	LONG	PPP	WND	STAGE
030400	18.0	-150.0	1009	15	TD
030406	18.5	-151.0	1009	15	TD
030412	19.1	-152.0	1009	15	TD
030418	19.8	-153.0	1006	20	TD
030500	20.2	-154.0	1002	20	TD
030506	20.5	-155.0	1000	25	TD
030512	21.0	-156.5	1000	25	TD
030518	22.0	-158.5	1000	25	TD
030600	23.0	-160.5	999	25	TD
030606	24.2	-162.2	997	30	TD
030612	24.7	-163.4	995	35	TC
030618	25.6	-164.6	990	40	TC
030700	27.4	-165.8	985	50	TC
030706	29.5	-166.0	985	50	TC

BEST TRACK DATA
STC MONA

MMDDHR	LAT	LONG	PPP	WND	STAGE

030612	15.1	-171.3	1005	20	TD
030618	15.6	-171.5	1004	20	TD
030700	16.2	-172.0	1002	20	TD
030706	16.7	-172.7	1002	20	TD
030712	17.6	-173.2	1002	20	TD
030718	18.2	-174.0	1000	25	TD
030800	18.8	174.5	1000	25	TD
030806	19.4	-175.1	999	25	TD
030812	20.0	-175.5	997	30	TD
030818	20.4	-175.8	987	45	TC
030900	20.8	-176.0	980	55	TC
030906	21.3	-176.0	975	60	TC
030912	21.9	-175.7	970	65	TC
030918	22.6	-175.4	965	70	STC
031000	23.4	-174.9	965	70	STC
031006	24.3	-173.3	960	75	STC
031012	25.6	-172.2	960	75	STC
031018	26.7	-172.1	965	75	STC
031100	27.6	-172.3	975	60	TC
031106	28.6	-172.1	985	50	TC
031112	29.5	-171.8	995	35	TC

BEST TRACK DATA
TC NIEL

MMDDHR	LAT	LONG	PPP	WND	STAGE
041300	17.0	-178.0	1004	20	TD
041306	17.3	-178.8	1002	20	TD
041312	17.5	-179.2	1002	20	TD
041318	17.8	-179.6	1000	25	TD
041400	18.0	-179.9	1000	25	TD
041406	18.4	179.7	1000	25	TD
041412	18.7	179.4	999	25	TD
041418	18.9	178.9	999	25	TD
041500	19.3	178.5	998	30	TD
041506	19.7	178.2	998	30	TD
041512	20.0	178.4	997	30	TD
041518	20.2	178.8	992	40	TC
041600	21.8	178.9	992	40	TC
041606	22.2	179.0	995	35	TC
041612	22.7	179.4	997	30	TD
041618	23.1	180.0	997	30	TD
041700	23.2	-178.6	998	30	TD
041706	23.6	-177.6	998	30	TD
041712	24.3	-177.1	999	25	TD
041718	25.0	-176.8	999	25	TD

TCWC - WELLINGTON

BEST TRACK DATA
TC NEIL

MMDDHR	LAT	LONG	PPP	WND	STAGE
041718	25.0	176.8	999	30	TD
041800	26.2	175.9	996	35	TC
041806	27.0	175.0	996	35	TC
041812	27.5	174.4	996	35	TC
041818	28.2	173.9	997	35	TC
041900	29.0	173.6	997	35	TC
041906	29.7	173.3	999	35	TC
041912	30.0	172.5	1001	30	TD
041819	30.5	172.0	1003	30	TD
042000	31.1	171.6	1006	25	TD
042006	32.0	171.5	1010	25	TD

BEST TRACK DATA
STC MONA

MMDDHR	LAT	LONG	PPP	WND	STAGE
031012	25.6	172.2	960	75	STC
031018	26.7	172.1	965	70	STC
031100	27.6	172.3	975	60	TC
031106	28.6	172.1	980	55	TC
031112	29.5	171.8	985	50	TC
031118	31.1	171.8	990	40	TC
031200	33.1	171.4	990	40	TC
031206	34.7	171.2	990	40	TC
031212	37.0	171.0	990	40	TC
031218	39.8	169.5	990	40	TC
031300	41.4	166.4	990	40	TC
031306	43.1	160.1	995	30	TD
031312	45.6	153.2	988	30	TD
031318	48.0	147.4	987	30	TD
031400	51.0	142.5	985	30	TD

BEST TRACK DATA
TC LEO

MMDDHR	LAT	LONG	PPP	WND	STAGE
030612	24.7	163.4	995	35	TC
030618	25.6	164.6	990	40	TC
030700	27.4	165.8	985	50	TC
030706	29.5	166.0	985	50	TC

030712	31.1	166.5	985	50	TC
030718	33.3	166.7	985	50	TC
030800	36.0	166.4	992	45	TC
030806	39.5	164.8	992	40	TC
030812	42.0	161.9	996	40	TC
030818	44.3	158.8	997	40	TC
030900	46.5	156.5	984	40	TC
030906	49.0	152.5	981	40	TC
030912	51.0	147.0	979	40	TC
030918	53.0	139.0	978	40	TC
031000	55.0	134.0	974	40	TC

BEST TRACK DATA
STC KIM

MMDDHR	LAT	LONG	PPP	WND	STAGE
022606	24.9	139.3	940	90	STC
022612	25.7	139.9	935	90	STC
022618	26.5	140.9	940	90	STC
022700	27.2	141.7	945	85	STC
022706	28.0	142.6	955	80	STC
022712	29.0	144.0	965	70	STC
022718	29.4	144.7	975	60	TC
022800	30.2	148.4	980	55	TC
022806	30.0	147.6	983	50	TC
022812	31.6	149.0	985	50	TC
022818	32.5	149.3	985	50	TC
022900	33.3	149.7	987	45	TC
022906	34.1	150.6	990	40	TC
022912	34.8	151.5	994	40	TC
022918	35.5	152.3	994	40	TC
030100	36.3	152.7	996	40	TC
030106	37.0	153.0	1000	40	TC
030112	37.6	153.3	1002	40	TC
030118	38.2	153.6	1004	40	TC
030200	39.9	148.9	1008	35	TC
030206	41.0	144.0	1008	35	TC
030212	43.0	141.0	1010	35	TC
030218	45.4	137.2	1010	35	TC
030300	47.5	132.5	1013	25	TD

BEST TRACK DATA
TC JO

MMDDHR	LAT	LONG	PPP	WND	STAGE
012612	25.1	179.0	975	60	TC
012618	26.3	179.8	975	60	TC
012700	27.4	178.8	975	60	TC
012706	28.5	176.4	980	55	TC
012712	30.0	174.5	984	55	TC
012718	29.9	170.7	984	55	TC
012800	31.8	165.6	984	55	TC

012806	33.5	161.9	985	55	TC
012812	34.9	158.1	984	55	TC
012818	37.5	154.5	978	55	TC
012900	40.9	153.8	979	55	TC
012906	42.6	153.8	981	45	TC
012912	43.7	153.7	983	45	TC
012918	44.5	153.6	974	45	TC
013000	44.0	153.4	989	40	TC
013006	45.3	153.3	988	40	TC
013012	45.6	152.9	988	40	TC
013018	45.8	152.1	990	40	TC
013100	45.9	150.7	991	35	TC
013106	46.0	149.0	993	35	TC
013112	46.0	147.0	997	30	TD
013118	46.0	145.0	998	25	TD
020100	45.6	143.0	999	25	TD
020106	45.0	141.0	998	25	TD
020112	44.5	139.0	999	25	TD
020118	43.0	137.3	1001	25	TD
020200	43.5	136.0	1002	25	TD
020206	43.3	135.6	1003	25	TD
020212	43.0	135.0	1004	25	TD
020217	43.0	135.0	1004	25	TD

RSMC TROPICAL CYCLONES - NEW DELHI

BEST TRACK DATA
CYCLONIC STORM (27-30 MARCH 2000)

MMDDHR	LAT	LONG	PPP	WND	STAGE
032712	7.5	90.0	1004	25	D
032718	8.5	89.0	1006	25	D
032800	9.5	89.0	1004	25	D
032806	10.0	88.5	1006	25	D
032812	12.0	88.0	1004	25	D
032818	12.0	88.0	1004	25	D
032900	12.5	88.0	1004	25	D
032903	13.0	88.0	1002	30	DD
032906	13.5	88.0	1002	30	DD
032912	14.0	88.5	998	35	CS
032915	14.5	89.0	1000	35	CS
032918	15.0	89.5	1000	35	CS
032921	15.0	89.5	1000	45	CS
033000	15.0	89.5	998	45	CS
033003	15.5	90.0	998	45	CS
033006	15.5	90.0	1000	35	CS
033009	15.0	90.0	1000	30	DD
033012	16.0	90.5	1002	25	D

BEST TRACK DATA
DEPRESSION (23-24 AUGUST 2000)

MMDDHR	LAT	LONG	PPP	WND	STAGE
082303	16.5	83.5	994	25	D
082306	16.5	83.0	996	25	D
082312	16.5	82.5	994	25	D
082318	17.5	82.0	996	25	D
082400	18.0	79.5	996	25	D

BEST TRACK DATA
CYCLONIC STORM (15-19 OCTOBER 2000)

MMDDHR	LAT	LONG	PPP	WND	STAGE
101500	14.5	88.5	1004	25	D
101503	14.5	88.5	1004	25	D
101506	14.5	88.0	1002	25	D
101512	14.5	87.0	1000	25	D
101518	14.5	86.5	1002	30	DD
101600	14.5	86.3	1000	30	DD
101603	14.5	86.0	1000	30	DD

101606	14.5	85.5	1000	30	DD
101612	14.5	85.0	998	30	DD
101618	14.0	85.0	1000	30	DD
101700	14.0	84.5	998	35	CS
101703	14.0	84.5	998	35	CS
101706	14.0	84.5	996	35	CS
101709	14.0	84.0	996	35	CS
101712	14.0	84.0	998	35	CS
101715	14.0	84.0	998	35	CS
101718	14.0	84.0	998	35	CS
101721	14.0	84.0	998	35	CS
101800	14.5	83.5	998	35	CS
101803	14.0	83.5	1000	30	DD
101806	14.0	83.5	1000	30	DD
101812	14.0	83.0	998	30	DD
101818	14.5	82.5	1000	25	D
101903	14.5	82.0	1004	25	D
101906	14.5	82.0	1004	25	D

BEST TRACK DATA
CYCLONIC STORM (25-28 OCTOBER 2000)

MMDDHR	LAT	LONG	PPP	WND	STAGE
102509	13.5	93.0	1002	25	D
102512	14.0	92.5	1002	25	D
102518	14.5	92.0	1002	25	D
102600	15.0	91.5	1002	25	D
102603	15.5	90.5	1004	25	D
102606	16.5	90.5	1002	25	D
102612	16.5	89.5	1002	25	D
102618	17.0	89.0	1004	25	D
102700	17.5	88.5	1002	25	D
102703	18.0	88.5	1002	30	DD
102706	18.5	88.5	1002	30	DD
102712	19.0	88.5	1000	30	DD
102718	20.5	88.5	998	35	CS
102721	21.0	88.5	998	35	CS
102800	21.5	89.0	998	35	CS
102803	22.5	89.0		30	DD
102806	23.0	89.5		30	DD
102812	23.5	90.5		25	D
102818	24.0	93.0		25	D
102900	24.0	94.0		25	D

BEST TRACK DATA
VERY SEVERE CYCLONIC STORM (26-30 NOVEMBER 2000)

MMDDHR	LAT	LONG	PPP	WND	STAGE
112603	8.5	91.5	1004	25	D
112606	9.5	90.5	1004	25	D
112609	9.5	91.0	1004	25	D
112612	10.0	89.5	1004	25	D
112615	10.0	90.0	1004	30	DD

112618	10.0	90.0	1002	30	DD
112700	10.5	88.0	1002	30	DD
112703	11.0	87.5	1004	30	DD
112706	11.0	87.0	1002	30	DD
112709	11.0	86.5	998	35	CS
112712	11.0	86.0	998	45	CS
112715	11.0	85.5	998	45	CS
112718	11.0	85.0	998	45	CS
112721	11.0	84.5	998	45	CS
112800	11.5	84.0	992	55	SCS
112803	11.5	83.5	992	55	SCS
112806	11.5	83.0	986	65	VSCS
112809	11.5	82.5	986	65	VSCS
112812	11.5	82.0	978	77	VSCS
112815	11.5	81.8	968	90	VSCS
112818	11.5	81.5	958	102	VSCS
112821	11.5	81.2	958	102	VSCS
112900	11.5	81.0	968	90	VSCS
112903	11.5	80.5	966	90	VSCS
112906	11.5	80.5	976	77	VSCS
112909	11.5	80.0	976	77	VSCS
112912	11.5	80.0	998	55	SCS
112918	11.0	78.5	998	45	CS
113003	11.5	78.0	1002	30	DD
113006	11.5	77.0	1004	25	D

BEST TRACK DATA
VERY SEVERE CYCLONIC STORM (23-28 DECEMBER 2000)

MMDDHR	LAT	LONG	PPP	WND	STAGE
122303	8.0	86.0	1006	25	D
122306	8.0	86.0	1006	25	D
122312	8.0	85.0	1006	25	D
122318	8.0	84.5	1006	25	D
122400	8.0	84.0	1004	30	DD
122403	8.5	84.0	1004	30	DD
122406	8.5	84.0	1004	30	DD
122412	8.5	83.5	1004	30	DD
122418	8.5	83.5	1004	30	DD
122500	8.5	83.0	1004	30	DD
122503	8.5	83.0	1004	35	CS
122506	8.5	83.0	1000	45	CS
122512	8.5	83.0	994	55	CS
122518	8.5	83.0	990	65	SCS
122600	8.5	82.5	990	65	SCS
122603	8.5	82.5	990	65	VSCS
122606	8.5	82.0	982	77	VSCS
122609	8.5	81.5	982	77	VSCS
122612	8.5	81.0	970	90	VSCS
122615	8.5	81.0	970	90	VSCS
122618	8.5	81.0	982	77	VSCS
122621	8.5	81.0	982	77	VSCS
122700	8.5	81.0	984	77	VSCS
122703	8.5	80.0	986	77	VSCS
122706	8.5	79.5	986	77	VSCS

122709	8.5	79.0	988	77	VSCS
122712	8.5	78.5	990	65	SCS
122715	8.5	78.5	996	55	SCS
122718	8.5	78.5	998	55	SCS
122721	8.5	78.0	1002	55	CS
122800	8.5	77.5	1004	35	CS
122803	8.5	77.5	1004	35	CS
122806	8.5	77.0	1004	30	DD
122812	9.0	76.5	1006	25	D
122900	9.0	75.5	1002		L

RSMC TOKYO - TYPHOON CENTER

BEST TRACK DATA
TY DAMREY

MMDDHR	LAT	LONG	PPP	WND	STAGE
050418	8.8	137.5	1004		
050500	9.7	136.0	1004		
050506	9.9	135.0	1004		
050512	10.2	134.4	1004		
050518	10.7	133.7	1002		
050600	11.1	133.0	1000		
050606	11.8	132.2	1000		
050612	12.5	132.2	1000		
050618	13.0	131.8	996		
050700	13.2	131.6	992	45	TD
050706	13.5	131.2	985	55	TS
050712	13.5	131.1	980	55	TS
050718	13.7	131.4	975	60	TS
050800	14.0	131.5	970	65	STS
050806	14.3	132.0	965	70	TY
050812	14.5	132.4	960	75	TY
050818	15.1	133.0	955	75	TY
050900	15.6	133.5	945	80	TY
050906	16.4	134.4	935	**90**	TY
050912	17.3	135.3	**930**	**90**	TY
050918	18.7	136.0	**930**	**90**	TY
051000	19.5	136.8	935	85	TY
051006	20.8	137.8	945	80	TY
051012	22.2	138.8	955	75	TY
051018	23.0	139.5	960	75	TY
051100	23.7	139.9	965	70	TY
051103	24.5	140.5	970	65	STS
051106	25.3	141.0	970	65	STS
051109	25.5	141.3	970	65	STS
051112	26.0	142.0	975	60	TS
051115	26.5	142.6	975	55	TS
051118	27.0	143.5	980	55	TS
051121	27.4	144.5	980	55	TS
051200	27.7	145.9	985	50	TS
051206	28.3	147.9	994	35	TS
051212	28.4	149.5	996		
051218	28.3	150.8	996		
051300	28.1	151.8	996		
051306	27.9	153.4	996		
051312	27.7	154.7	1000		
051318	27.4	155.4	1004		
051400	27.2	156.0	1004		
051406	27.5	157.5	1004		
051412	28.1	158.4	1004		
051418	29.0	159.1	1004		
051500	30.1	159.7	1004		
051506	30.6	160.5	1004		

051512	31.2	161.3	1004		
051518	31.7	162.5	1004		
051600	32.3	163.7	1004		
051606	32.7	165.2	1004		
051612	33.0	167.3	1004		
051618	33.2	169.7	1008		

BEST TRACK DATA
TS LONGWANG

MMDDHR	LAT	LONG	PPP	WND	STAGE
051706	16.1	118.8	1002		
051712	16.0	119.6	1002		
051718	15.9	120.0	1002		
051800	16.2	121.1	1002		
051806	18.0	122.5	1000		
051812	19.2	123.6	1000		
051818	20.4	124.1	1000		
051900	21.1	125.5	998	35	TS
051906	22.3	126.8	994	40	TS
051912	23.3	128.6	994	40	TS
051915	24.1	129.7	992	40	TS
051918	24.7	130.8	990	45	TS
051921	25.4	132.8	992	40	TS
052000	26.4	135.0	994	40	TS
052006	28.2	139.0	996		
052012	30.3	142.0	1000		
052018	31.3	144.8	1000		
052100	33.5	146.8	1000		
052106	34.7	149.8	1000		
052112	35.8	153.6	1000		
052118	37.1	156.2	1000		
052200	38.8	160.3	1000		
052206	39.8	163.4	996		
052212	40.6	167.0	994		
052218	41.0	170.6	992		
052300	41.9	172.1	992		
052306	42.1	174.1	992		
052312	42.2	176.7	992		
052318	42.3	178.4	990		
052400	42.3	179.9	992		
052406	43.0	182.5	992		

BEST TRACK DATA
TY KIROGI

MMDDHR	LAT	LONG	PPP	WND	STAGE
070206	12.8	133.2	1002		
070212	13.3	133.0	1000		
070218	14.2	132.5	996		
070300	15.5	132.1	994		
070306	16.2	131.8	990	40	TS
070312	16.7	131.7	985	50	STS

070318	17.1	131.7	970	65	TY
070400	17.7	131.7	960	70	TY
070406	18.3	131.6	950	80	TY
070412	19.2	131.5	945	80	TY
070418	19.9	131.4	945	80	TY
070500	20.8	131.9	**940**	**85**	TY
070506	21.7	132.4	**940**	**85**	TY
070512	22.5	133.0	**940**	**85**	TY
070518	23.4	133.6	945	80	TY
070600	24.2	134.2	950	80	TY
070606	24.9	134.6	955	75	TY
070612	25.8	135.3	955	75	TY
070618	26.9	136.0	955	75	TY
070700	28.2	136.8	955	75	TY
070706	29.9	137.7	955	**75**	TY
070709	30.8	138.2	955	75	TY
070712	31.8	138.9	955	75	TY
070715	33.0	139.4	955	75	TY
070718	34.2	139.9	955	75	TY
070721	35.4	140.9	960	70	TY
070800	36.5	141.3	970	60	STS
070803	38.0	142.0	975	55	STS
070806	39.2	142.7	975	55	STS
070809	40.4	143.4	980	50	STS
070812	41.2	143.9	985	50	STS
070815	41.8	144.3	985	50	STS
070818	41.9	144.7	985	50	STS
070821	42.1	145.7	986		
070900	42.3	146.9	988		
070906	42.9	149.5	992		
070912	43.0	153.4	994		
070918	43.0	157.1	996		
071000	43.0	161.5	996		
071006	43.5	165.2	998		

BEST TRACK DATA
TY KAI-TAK

MMDDHR	LAT	LONG	PPP	WND	STAGE
070312	15.9	119.1	1000		
070318	16.4	119.5	996		
070400	17.0	119.8	996		
070406	17.8	120.1	994		
070412	18.6	120.3	996		
070418	18.9	120.3	994		
070500	19.0	120.2	994		
070506	19.1	120.1	994		
070512	19.2	120.0	994		
070518	19.3	120.0	992	40	TS
070600	19.4	119.8	985	50	STS
070606	19.5	119.6	975	60	STS
070612	19.6	119.0	970	65	TY
070618	19.6	118.6	965	70	TY
070700	19.6	118.6	960	75	TY
070706	19.7	118.7	960	75	TY

070712	19.8	118.8	960	75	TY
070718	19.9	119.0	960	75	TY
070800	20.0	119.2	965	70	TY
070806	20.3	119.6	970	65	TY
070812	20.8	120.2	980	55	STS
070818	21.5	120.8	980	55	STS
070900	22.7	121.2	985	50	STS
070903	23.6	121.3	985	50	STS
070906	24.4	121.4	985	50	STS
070909	25.4	121.3	990	45	TS
070912	26.3	121.2	990	45	TS
070918	28.0	121.5	990	40	TS
071000	30.3	121.6	992	40	TS
071006	32.2	122.1	994	35	TS
071012	34.3	122.6	994	35	TS
071018	36.9	122.9	994		
071100	38.4	123.2	994		
071106	40.0	123.9	996		
071112	41.2	125.4	996		
071118	42.0	127.9	996		
071200	42.8	130.9	996		

BEST TRACK DATA
TS TEMBIN

MMDDHR	LAT	LONG	PPP	WND	STAGE
071700	19.8	145.0	1006		
071706	20.8	144.5	1004		
071712	21.6	144.0	1004		
071718	22.2	143.4	1004		
071800	22.7	142.9	1004		
071806	23.5	142.2	1002		
071812	24.2	141.9	1000		
071818	25.1	141.7	1000		
071900	26.7	142.2	998	35	TS
071903	27.3	142.3	998	35	TS
071906	27.7	142.4	996	35	TS
071909	28.1	142.3	996	35	TS
071912	28.4	142.3	996	35	TS
071918	29.4	142.1	992	40	TS
072000	30.0	141.9	992	40	TS
072006	30.7	141.7	992	40	TS
072012	31.4	141.7	992	40	TS
072018	31.9	141.9	992	40	TS
072100	32.4	142.0	994	**35**	TS
072106	33.1	142.1	994	35	TS
072112	34.1	142.3	994	35	TS
072118	34.9	142.5	994		
072200	25.9	143.0	996		
072206	37.2	144.2	996		
072212	38.7	146.0	996		
072218	40.2	147.6	998		
072300	42.0	148.4	1000		
072306	43.0	151.9	1000		

BEST TRACK DATA
STS BOLAVEN

MMDDHR	LAT	LONG	PPP	WND	STAGE
072400	17.9	123.9	1000		
072406	18.8	124.2	1000		
072412	20.3	124.4	1000		
072418	21.8	124.8	998		
072500	23.0	125.2	998		
072506	24.0	125.8	996		
072512	24.7	126.4	994		
072518	25.0	126.9	992	35	TS
072600	25.4	128.1	990	40	TS
072603	25.7	128.6	990	40	TS
072606	25.8	129.0	985	40	TS
072609	26.0	129.4	985	40	TS
072612	26.2	129.7	985	45	TS
072615	26.6	129.9	985	45	TS
072618	26.8	129.9	985	45	TS
072621	26.9	129.9	985	45	TS
072700	27.0	129.9	985	45	TS
072703	27.2	129.9	985	45	TS
072706	27.3	129.8	985	45	TS
072709	27.4	129.7	985	45	TS
072712	27.4	129.6	985	45	TS
072715	27.4	129.5	985	45	TS
072718	27.5	129.4	985	45	TS
072721	27.6	129.3	985	45	TS
072800	27.8	129.3	985	45	TS
072803	28.0	129.2	985	45	TS
072806	28.1	129.1	985	45	TS
072809	28.2	129.1	985	45	TS
072812	28.2	129.0	985	45	TS
072815	28.2	128.9	985	45	TS
072818	28.3	128.8	985	45	TS
072821	28.4	128.7	985	45	TS
072900	28.6	128.7	985	45	TS
072903	28.8	128.7	985	45	TS
072906	29.1	128.7	980	50	STS
072909	29.5	128.7	980	50	STS
072912	29.9	128.6	985	45	TS
072915	30.3	128.6	985	45	TS
072918	30.7	128.5	985	45	TS
072921	31.1	128.5	985	45	TS
073000	31.6	128.5	985	45	TS
073003	32.1	128.5	985	40	TS
073006	32.6	128.5	985	40	TS
073009	33.0	128.6	985	40	TS
073012	33.4	128.6	985	40	TS
073015	33.8	128.7	990	40	TS
073018	34.4	128.9	988	40	TS
073021	35.2	129.2	990	35	TS
073100	35.9	129.7	992		

073106	37.7	131.0	994		
073112	40.8	132.7	996		
073118	42.2	133.9	998		
080100	43.5	135.1	1000		
080106	44.7	137.3	1004		
080112	45.9	139.7	1006		
080118	47.3	141.8	1006		
080200	47.9	144.2	1010		

BEST TRACK DATA
TS CHANCHU

MMDDHR	LAT	LONG	PPP	WND	STAGE
072718	8.8	178.1	1004		
072800	9.7	177.5	1004		
072806	10.5	177.0	1004		
072812	11.2	176.8	1004		
072818	12.1	176.5	998	35	TS
072900	13.0	176.4	996	35	TS
072906	13.6	176.3	998	35	TS
072912	14.1	176.6	1000	35	TS
072918	14.7	177.1	1002		
073000	15.5	177.8	1004		
073006	16.6	178.6	1008		

BEST TRACK DATA
TY JELAWAT

MMDDHR	LAT	LONG	PPP	WND	STAGE
073118	22.0	154.4	1008		
080100	22.0	153.0	1004		
080106	22.0	152.0	1000		
080112	22.0	151.2	996	35	TS
080118	22.0	150.2	985	45	TS
080200	22.1	149.4	970	65	TY
080206	22.3	148.6	960	75	TY
080212	22.3	147.7	955	75	TY
080218	23.1	146.6	945	80	TY
080300	23.6	145.5	940	85	TY
080306	24.4	144.4	940	85	TY
080312	24.9	143.0	940	85	TY
080315	25.1	142.2	940	85	TY
080318	25.2	141.6	945	85	TY
080321	25.5	141.0	945	85	TY
080400	25.6	140.4	950	80	TY
080406	26.1	139.1	950	80	TY
080412	26.1	137.7	950	80	TY
080418	26.1	136.4	950	80	TY
080500	26.2	135.5	950	80	TY
080506	26.2	134.5	950	80	TY
080512	26.1	133.5	955	80	TY
080515	26.1	133.1	955	80	TY
080518	26.0	132.7	955	80	TY

080521	26.0	132.3	955	80	TY
080600	26.0	132.0	960	80	TY
080603	26.0	131.6	960	80	TY
080606	26.0	131.1	960	80	TY
080609	26.0	130.8	960	80	TY
080615	25.9	130.2	960	80	TY
080618	25.9	129.9	960	80	TY
080621	25.9	129.7	960	80	TY
080700	26.0	129.6	960	80	TY
080703	26.0	129.4	960	80	TY
080706	26.2	129.2	960	80	TY
080709	26.3	129.0	960	80	TY
080712	26.5	128.8	965	75	TY
080715	26.6	128.5	965	75	TY
080718	26.8	128.4	965	75	TY
080721	27.0	128.2	965	75	TY
080800	27.3	128.1	965	75	TY
080803	27.6	127.9	965	75	TY
080806	27.8	127.7	965	75	TY
080809	28.0	127.6	965	75	TY
080812	28.0	127.4	965	75	TY
080818	28.2	127.0	965	70	TY
080900	28.5	126.5	965	70	TY
080906	28.8	125.8	965	70	TY
080912	28.8	125.0	970	70	TY
080918	28.8	124.3	970	70	TY
081000	29.1	123.7	970	65	TY
081006	29.1	122.8	980	50	STS
081012	29.3	121.8	985	40	TS
081018	29.8	121.0	994		
081100	30.7	120.5	998		
081106	30.7	119.4	998		
081112	30.4	118.1	1000		
081118	30.2	117.3	1000		
081200	30.7	116.6	1002		
081206	30.8	115.9	1002		
081212	30.6	115.3	1002		

BEST TRACK DATA
TY EWINIAR

MMDDHR	LAT	LONG	PPP	WND	STAGE
080900	14.3	142.5	1002		
080906	14.1	141.6	998		
080912	14.2	140.1	996		
080918	14.9	139.5	994	35	TS
081000	15.6	139.2	992	40	TS
081006	17.0	139.1	992	40	TS
081012	18.3	139.0	992	40	TS
081018	19.9	138.9	992	40	TS
081100	23.2	138.9	990	45	TS
081106	25.5	138.0	985	50	STS
081112	27.6	137.4	980	55	STS
081118	29.1	136.3	980	55	STS
081200	29.3	135.6	980	55	STS

081206	29.3	135.9	985	50	STS
081209	29.8	136.2	985	50	STS
081212	30.4	136.2	985	50	STS
081215	30.6	136.5	985	50	STS
081218	30.6	136.7	985	50	STS
081221	30.7	137.3	985	50	STS
081300	30.8	138.2	985	50	STS
081303	31.1	138.7	985	50	STS
081306	31.5	139.3	985	50	STS
081309	31.8	140.2	985	50	STS
081312	31.9	141.0	985	50	STS
081315	32.2	141.8	985	50	STS
081318	32.5	142.5	985	50	STS
081400	33.1	144.0	985	50	STS
081406	33.8	145.6	985	50	STS
081412	34.2	147.0	985	50	STS
081418	34.7	147.7	980	55	STS
081500	34.8	148.3	980	55	STS
081506	35.0	149.4	975	60	STS
081512	35.4	150.2	975	60	STS
081518	36.1	150.8	975	65	TY
081600	36.9	150.7	975	65	TY
081606	37.3	150.7	975	65	TY
081612	38.0	150.9	980	60	STS
081618	38.3	150.7	980	55	STS
081700	38.4	150.3	985	50	STS
081706	38.6	149.9	985	50	STS
081712	38.5	149.7	990	45	TS
081718	38.5	150.0	992	45	TS
081800	39.0	149.6	994	45	TS
081806	39.2	149.7	994	45	TS
081812	39.4	149.5	994		
081818	39.5	149.1	994		
081900	39.4	148.5	996		
081906	39.2	149.1	996		
081912	39.3	150.0	998		
081918	39.6	150.7	1000		
082000	40.2	151.1	1000		
082006	40.6	151.2	1002		
082012	40.8	151.2	1004		
082018	40.8	150.7	1004		
082100	40.2	149.8	1008		
082106	40.1	149.9	1008		

BEST TRACK DATA
TY BILIS

MMDDHR	LAT	LONG	PPP	WND	STAGE
081812	11.5	137.0	1004		
081818	12.5	136.6	1002		
081900	13.4	136.0	1000		
081906	14.6	135.6	996	35	TS
081912	15.4	134.8	992	45	TS
081918	16.1	133.5	985	50	STS
082000	16.4	132.5	980	50	STS

082006	16.7	131.8	975	55	STS
082012	17.5	130.8	960	70	TY
082018	18.2	129.6	945	80	TY
082100	18.8	128.3	935	90	TY
082106	19.4	127.1	930	90	TY
082112	19.7	126.1	920	100	TY
082118	20.3	125.1	920	110	TY
082200	20.8	124.1	920	110	TY
082206	21.5	123.0	920	110	TY
082212	22.5	122.0	920	110	TY
082215	23.1	121.3	930	100	TY
082218	23.6	120.0	950	90	TY
082221	23.9	119.4	960	80	TY
082300	24.2	118.9	970	65	TY
082306	25.2	117.9	985	45	TS
082312	25.2	116.5	994		
082318	25.4	116.5	996		
082400	26.0	116.6	998		
082406	27.2	116.5	998		
082412	28.4	116.5	998		
082418	29.1	116.7	1000		
082500	30.2	117.0	1000		
082506	31.6	118.3	1000		
082512	32.0	119.8	1000		
082518	33.3	120.9	1000		
082600	33.8	121.9	1000		
082606	34.4	122.9	1002		
082612	35.4	123.9	1004		
082618	36.1	124.8	1004		
082700	37.2	125.4	1004		
082706	38.0	126.2	1006		

BEST TRACK DATA
TS KAEMI

MMDDHR	LAT	LONG	PPP	WND	STAGE
081912	13.4	113.7	1000		
081918	13.4	114.5	998		
082000	13.5	114.0	996		
082006	13.1	113.0	996		
082012	13.5	112.8	996		
082018	13.6	112.7	996		
082100	14.3	112.6	994		
082106	14.9	111.7	992		
082112	15.0	111.0	985	40	TS
082118	15.2	110.1	985	40	TS
082200	15.5	109.2	985	40	TS
082206	16.1	108.4	985	35	TS
082212	15.8	107.1	992		
082218	16.0	106.4	994		
082300	16.3	105.8	996		
082306	16.5	105.4	998		
082312	16.3	104.9	998		
082318	16.4	104.1	1000		

BEST TRACK DATA
TY PRAPIROON

MMDDHR	LAT	LONG	PPP	WND	STAGE
082418	12.4	136.0	1002		
082500	12.6	134.1	1002		
082506	13.0	132.3	1002		
082512	13.2	131.4	1002		
082518	13.5	131.7	1000		
082600	15.4	131.9	998		
082606	16.7	131.7	996		
082612	19.0	131.7	996		
082618	20.4	131.5	992	35	TS
082700	21.8	130.3	992	40	TS
082706	22.5	128.9	990	40	TS
082712	22.5	128.9	990	40	TS
082718	22.6	128.9	985	50	STS
082800	23.3	127.8	985	50	STS
082803	23.3	126.9	985	50	STS
082806	22.8	126.2	985	50	STS
082809	22.8	126.1	980	55	STS
082812	23.0	126.0	980	55	STS
082815	23.2	125.8	980	55	STS
082818	23.6	125.5	980	55	STS
082821	23.7	125.5	975	60	STS
082900	23.8	125.4	975	60	STS
082903	24.0	125.2	975	60	STS
082906	24.3	125.0	975	55	STS
082909	24.7	124.7	975	55	STS
082912	25.0	124.6	975	55	STS
082915	25.5	124.3	975	55	STS
082918	25.9	123.9	975	55	STS
083000	26.8	123.9	970	60	STS
083006	28.7	123.4	970	65	TY
083012	29.8	123.2	965	70	TY
083018	31.4	123.3	965	70	TY
083100	33.3	123.8	965	70	TY
083106	35.4	124.1	965	70	TY
083112	37.3	125.1	975	60	TY
083118	39.2	126.7	980	55	STS
090100	41.5	129.2	985	50	STS
090106	42.2	131.1	990	45	TS
090112	42.2	133.2	990		
090118	42.1	135.0	992		
090200	42.1	137.4	992		
090206	42.1	139.2	990		
090212	41.5	140.2	992		
090218	40.3	141.4	994		
090300	39.6	144.5	996		
090306	39.7	146.8	996		
090312	41.2	149.8	996		
090318	41.9	152.6	996		
090400	42.7	153.7	1000		

090406	42.8	153.9	1000		

BEST TRACK DATA
TS MARIA

MMDDHR	LAT	LONG	PPP	WND	STAGE
082706	21.6	115.0	1000		
082712	21.3	115.2	1000		
082718	21.2	115.5	1000		
082800	21.2	115.9	1000		
082806	20.8	115.7	998		
082812	20.2	115.2	996	35	TS
082818	19.6	115.0	992	35	TS
082900	19.1	115.3	992	35	TS
082906	18.6	115.6	992	35	TS
082912	18.2	115.7	990	35	TS
082918	18.1	115.8	990	35	TS
083000	18.0	115.6	990	35	TS
083006	18.2	115.1	990	35	TS
083012	19.0	115.9	990	35	TS
083018	19.4	116.0	990	35	TS
083100	20.2	116.1	985	40	TS
083106	21.0	115.6	985	40	TS
083112	21.8	115.4	985	40	TS
083118	22.4	115.3	985	40	TS
090100	23.4	114.5	990	35	TS
090106	24.6	114.4	990		
090112	25.4	114.6	996		
090118	26.7	114.2	998		
090200	27.5	113.7	1000		
090206	28.7	113.4	1002		
090212	29.5	112.5	1002		
090218	29.8	111.7	1004		

BEST TRACK DATA
TY SAOMAI

MMDDHR	LAT	LONG	PPP	WND	STAGE
083118	13.5	156.9	1008		
090100	14.2	157.0	1008		
090106	14.8	157.0	1006		
090112	15.5	157.1	1008		
090118	15.9	157.2	1004		
090200	16.1	157.4	1004		
090206	16.3	157.1	1004		
090212	16.1	156.3	1000	35	TS
090218	16.0	155.5	996	40	TS
090300	15.9	154.9	992	40	TS
090306	15.9	154.2	990	45	TS
090312	15.9	153.4	985	50	STS
090318	15.9	152.6	980	55	STS
090400	16.0	151.7	980	60	STS
090406	16.1	150.7	975	65	TY

090412	16.2	149.9	975	65	TY
090418	16.1	149.0	975	65	TY
090500	16.0	148.0	975	65	TY
090506	15.9	148.0	980	55	STS
090512	15.0	148.0	985	50	STS
090518	14.2	148.0	985	50	STS
090600	13.6	148.0	985	50	STS
090606	13.6	147.4	985	50	STS
090612	13.9	147.1	985	50	STS
090618	14.2	146.9	985	50	STS
090700	15.8	145.7	985	50	STS
090706	16.4	144.7	985	50	STS
090712	16.9	143.5	985	50	STS
090718	17.5	142.0	985	50	STS
090800	18.3	140.9	980	55	STS
090806	19.1	140.4	980	55	STS
090812	19.7	139.7	980	55	STS
090818	20.4	138.4	975	60	STS
090900	21.1	137.4	965	70	TY
090906	21.7	136.8	955	75	TY
090912	22.5	136.1	945	80	TY
090918	23.3	135.2	935	90	TY
091000	23.9	134.1	930	90	TY
091003	24.2	133.5	930	90	TY
091006	24.3	133.0	930	90	TY
091009	24.2	132.5	930	90	TY
091012	24.3	132.4	925	95	TY
091015	24.4	132.2	925	95	TY
091018	24.4	132.0	925	95	TY
091021	24.6	131.8	925	95	TY
091100	24.9	131.5	925	95	TY
091103	25.2	131.1	930	90	TY
091106	25.4	130.8	930	90	TY
091109	25.5	130.5	930	90	TY
091112	25.5	130.4	935	90	TY
091115	25.7	129.8	935	90	TY
091118	25.8	129.5	940	85	TY
091121	25.9	129.2	940	85	TY
091200	26.1	128.9	940	85	TY
091203	26.2	128.5	945	80	TY
091206	26.3	128.2	945	75	TY
091209	26.5	128.1	945	75	TY
091210	26.5	128.0	945	75	TY
091212	26.7	127.8	945	75	TY
091215	26.8	127.4	950	75	TY
091218	27.0	127.0	950	75	TY
091221	27.2	126.7	950	75	TY
091300	27.4	126.5	950	75	TY
091303	27.6	126.2	955	70	TY
091306	27.8	125.9	960	70	TY
091309	27.9	125.5	960	70	TY
091312	27.9	125.2	955	70	TY
091318	27.9	124.6	955	70	TY
091400	28.0	124.4	955	70	TY
091406	28.2	124.2	955	70	TY
091412	28.4	124.2	960	70	TY
091418	28.6	124.4	960	70	TY
091500	29.1	125.3	965	65	TY

091503	29.6	125.8	965	65	TY
091506	30.1	126.3	965	65	TY
091509	30.8	127.0	965	65	TY
091512	31.6	127.6	970	60	STS
091515	32.8	127.9	970	60	STS
091518	34.0	128.1	970	60	STS
091521	35.2	128.4	970	55	STS
091600	36.7	129.0	980	50	STS
091606	39.5	129.5	982		
091612	40.1	130.5	986		
091618	42.0	131.4	988		
091700	42.7	131.6	990		
091706	44.7	133.0	990		
091712	46.5	135.1	992		
091718	47.0	136.2	994		
091800	47.5	137.2	996		
091806	47.5	138.7	998		
091812	47.6	140.7	1004		
091818	47.5	141.6	1008		
091900	47.4	142.2	1012		

BEST TRACK DATA
TS BOPHA

MMDDHR	LAT	LONG	PPP	WND	STAGE
090406	18.0	125.8	1000		
090412	18.1	127.0	1000		
090418	18.1	128.1	1000		
090500	18.3	129.1	1000		
090506	18.9	130.8	998		
090512	19.4	133.0	998		
090518	20.5	135.0	998		
090600	21.2	135.8	998		
090606	22.1	136.4	996		
090612	22.9	136.4	996		
090618	23.4	136.2	994	35	TS
090700	23.8	135.4	994	40	TS
090706	24.3	133.4	992	40	TS
090712	24.5	132.0	990	45	TS
090715	24.6	131.6	990	45	TS
090718	24.7	131.2	990	45	TS
090721	24.8	130.6	990	45	TS
090800	25.0	129.9	990	45	TS
090803	25.3	129.4	990	45	TS
090806	25.6	128.6	990	45	TS
090809	25.8	127.7	990	45	TS
090812	25.9	127.0	994	40	TS
090815	25.8	126.5	994	40	TS
090818	25.7	125.9	994	40	TS
090821	25.5	125.4	994	40	TS
090900	25.3	125.1	994	40	TS
090903	25.0	124.7	994	40	TS
090906	24.8	124.4	992	40	TS
090909	24.6	124.1	990	45	TS
090912	24.3	123.8	988	45	TS

090915	23.9	123.5	992	45	TS
090918	23.5	123.2	988	45	TS
091000	22.4	122.7	990	45	TS
091006	21.4	122.2	990	45	TS
091012	20.3	121.9	990	45	TS
091018	19.2	121.9	990	45	TS
091100	18.6	122.1	994		
091106	18.0	122.2	994		
091112	17.3	122.1	998		

BEST TRACK DATA
TY WUKONG

MMDDHR	LAT	LONG	PPP	WND	STAGE
090406	16.6	117.2	1000		
090412	16.7	116.6	1000		
090418	16.6	116.4	1000		
090500	16.4	116.6	1000		
090506	16.5	116.8	998		
090512	16.9	117.2	996		
090518	17.3	117.5	994		
090600	17.9	117.6	992	35	TS
090606	18.4	117.4	990	40	TS
090612	18.7	117.0	985	50	STS
090618	18.9	116.3	985	50	STS
090700	19.0	115.8	980	55	STS
090706	19.0	115.5	980	55	STS
090712	19.0	115.2	975	60	STS
090718	19.0	114.7	970	65	TY
090800	18.9	114.2	960	70	TY
090806	18.8	113.4	955	75	TY
090812	18.8	112.5	955	75	TY
090818	18.6	111.6	960	70	TY
090900	18.4	110.5	960	70	TY
090906	18.1	109.7	970	60	STS
090912	18.3	108.8	975	55	STS
090918	18.5	107.8	980	50	STS
091000	18.3	106.8	985	50	STS
091006	17.9	105.6	990	45	TS
091012	17.9	104.0	996		
091018	17.9	102.5	1000		

BEST TRACK DATA
STS SONAMU

MMDDHR	LAT	LONG	PPP	WND	STAGE
091406	21.9	139.5	998		
091412	22.1	140.0	1000		
091418	22.7	140.7	1000		
091500	23.3	141.0	1000		
091503	23.4	141.0	996	35	TS
091506	23.6	141.0	994	40	TS
091512	23.9	141.2	992	45	TS

091515	24.0	141.3	992	45	TS
091518	24.2	141.5	990	45	TS
091521	24.4	141.8	990	45	TS
091600	24.9	141.8	990	45	TS
091603	25.5	141.8	990	45	TS
091606	26.0	141.7	990	45	TS
091609	26.6	141.7	990	45	TS
091612	27.3	141.6	990	45	TS
091615	28.3	141.6	990	45	TS
091618	29.2	141.6	990	45	TS
091621	30.1	141.5	990	45	TS
091700	30.9	141.5	985	50	STS
091703	32.1	141.8	980	55	STS
091706	33.3	142.1	980	55	STS
091709	34.6	142.6	980	55	STS
091712	35.9	143.0	980	55	STS
091718	38.8	144.3	980	55	STS
091800	41.9	146.5	985	50	STS
091806	44.7	149.0	988		
091812	47.1	153.6	990		
091818	48.9	157.5	996		
091900	50.5	163.6	994		
091906	52.5	169.7	992		
091912	54.5	174.8	988		
091918	55.4	176.5	986		
092000	56.1	178.5	984		
092006	56.4	179.0	984		
092012	57.0	180.5	986		

BEST TRACK DATA
TY SHANSHAN

MMDDHR	LAT	LONG	PPP	WND	STAGE
091706	14.2	173.6	1004		
071712	14.5	173.1	1004		
091718	14.8	172.6	1004		
091800	15.1	172.1	1004		
091806	15.5	171.8	1002		
091812	16.0	171.0	998	35	TS
091818	16.2	170.0	990	45	TS
091900	16.6	169.7	985	50	STS
091906	17.3	169.7	980	55	STS
091912	18.0	170.3	970	65	TY
091918	19.3	169.8	960	75	TY
092000	19.9	168.5	950	80	TY
092006	20.3	168.1	945	85	TY
092012	20.9	167.2	940	85	TY
092018	21.2	166.6	935	90	TY
092100	21.6	166.2	935	90	TY
092106	22.3	166.0	930	95	TY
092112	22.9	165.6	925	95	TY
092118	23.6	165.4	925	95	TY
092200	24.2	165.3	925	95	TY
092206	24.9	165.3	925	95	TY
092212	25.5	165.6	935	90	TY

092218	26.6	166.2	940	85	TY
092300	27.7	166.5	945	85	TY
092306	28.7	167.0	950	80	TY
092312	30.1	168.3	955	75	TY
092318	31.1	169.6	960	70	TY
092400	32.7	171.8	960	70	TY
092406	35.8	174.6	960	70	TY
092412	38.9	177.8	955	70	TY
092418	42.8	177.9	956		
092500	43.3	175.6	956		
092506	43.3	177.8	960		
092512	44.4	180.0	964		
092518	45.9	181.7	964		

BEST TRACK DATA
TY YAGI

MMDDHR	LAT	LONG	PPP	WND	STAGE
102100	20.1	145.9	1008		
102106	20.4	143.8	1006		
102112	20.5	141.7	1004		
102118	20.6	140.2	1002		
102200	21.0	138.9	1000	35	TS
102206	21.1	137.6	998	35	TS
102212	21.6	135.7	996	40	TS
102218	21.9	134.0	992	40	TS
102300	22.2	132.5	990	45	TS
102306	22.3	131.2	990	45	TS
102312	22.8	130.2	985	50	STS
102318	22.8	129.2	985	50	STS
102400	23.0	128.2	980	55	STS
102406	23.4	127.2	975	60	STS
102409	23.5	126.7	975	60	STS
102412	23.7	126.3	970	65	TY
102415	23.9	125.9	970	65	TY
102418	24.1	125.5	965	70	TY
1024121	24.4	125.2	965	70	TY
102500	24.7	124.9	965	70	TY
102503	24.9	124.6	965	70	TY
102506	25.2	124.5	970	65	TY
102509	25.4	124.5	970	65	TY
102512	25.6	124.5	975	60	STS
102515	25.8	124.4	975	60	STS
102518	25.9	124.3	980	55	STS
102521	26.1	124.8	980	55	STS
102600	26.2	125.2	985	50	STS
102603	26.5	125.6	985	50	STS
102606	26.6	126.0	985	50	STS
102609	26.5	126.5	985	50	STS
102612	26.5	126.5	990	45	TS
102615	26.4	126.5	992	45	TS
102618	26.2	126.4	998	40	TS
102621	26.0	126.5	1000	35	TS
102700	25.8	126.5	1004		
102706	25.4	126.1	1008		

102712	25.2	125.6	1012		
102718	25.0	124.9	1012		
102800	24.9	124.0	1012		
102806	25.2	123.3	1010		

BEST TRACK DATA
TY XANGSANE

MMDDHR	LAT	LONG	PPP	WND	STAGE
102418	8.3	139.3	1008		
102500	8.4	138.1	1008		
102506	9.1	136.9	1004		
102512	9.1	135.4	1004		
102518	9.2	133.9	1004		
102600	10.0	133.3	1004		
102606	10.3	131.4	998	35	TS
102612	10.6	130.3	996	40	TS
102618	11.0	128.8	992	45	TS
102700	12.3	127.8	985	50	STS
102706	12.6	126.1	980	55	STS
102712	13.3	125.0	975	60	STS
102718	13.6	123.6	975	60	STS
102800	13.7	122.3	980	55	STS
102806	14.2	121.3	985	50	STS
102812	14.8	120.5	990	45	TS
102818	15.6	119.8	990	45	TS
102900	15.9	119.1	990	45	TS
102906	15.9	118.2	985	50	STS
102912	15.9	118.1	980	55	STS
102918	16.0	118.1	975	60	STS
103000	16.5	118.3	965	70	TY
103006	16.7	118.8	960	75	TY
103012	17.2	119.2	960	75	TY
103018	18.0	119.5	960	75	TY
103100	18.5	119.6	960	75	TY
103106	19.7	120.2	960	75	TY
103112	20.9	120.5	960	75	TY
103118	22.4	121.2	965	70	TY
110100	24.3	122.0	975	60	STS
110103	25.2	122.3	985	50	STS
110106	26.2	123.0	985	50	STS
110109	27.3	124.0	985	50	STS
110112	28.6	125.7	992		
110118	31.1	128.9	1000		
110200	32.7	131.8	1006		
110206	33.4	134.9	1006		

BEST TRACK DATA
STS BEBINCA

MMDDHR	LAT	LONG	PPP	WND	STAGE
103018	8.3	135.1	1004		

103100	8.9	133.4	1004		
103106	9.1	132.0	1002		
103112	9.6	130.9	1002		
103118	10.1	130.0	1000		
110100	10.7	129.1	998	35	TS
110106	11.3	128.2	996	35	TS
110112	12.0	127.2	994	45	TS
110118	12.8	126.2	990	50	STS
110200	13.6	124.9	985	55	STS
110206	14.2	123.5	985	55	STS
110212	14.5	122.5	985	55	STS
110218	14.6	121.5	990	50	STS
110300	14.7	120.5	998	35	TS
110306	15.0	119.5	996	40	TS
110312	15.4	118.8	994	45	TS
110318	15.8	118.2	992	45	TS
110400	16.3	117.5	990	50	STS
110406	16.6	117.2	985	55	STS
110412	16.7	117.1	985	55	STS
110418	16.9	116.9	985	55	STS
110500	17.1	116.8	985	55	STS
110506	17.7	116.8	985	55	STS
110512	18.5	116.8	980	60	STS
110518	19.3	117.1	980	60	STS
110600	19.9	117.1	985	55	STS
110606	20.1	116.9	990	50	STS
110612	20.1	116.8	996	40	TS
110618	20.2	116.5	1000	35	TS
110700	20.4	115.8	1006		
110706	20.7	114.8	1006		
110712	20.8	114.3	1006		
110718	21.0	113.4	1008		

BEST TRACK DATA
STS RUMBIA

MMDDHR	LAT	LONG	PPP	WND	STAGE
112718	8.3	132.5	1000		
112800	8.5	131.8	1000		
112806	8.5	131.4	998		
112812	8.5	131.2	996	35	TS
112818	8.5	130.8	990	40	TS
112900	8.7	130.4	992	40	TS
112906	8.7	130.2	992	40	TS
112912	8.9	129.5	992	40	TS
112918	9.2	128.9	992	40	TS
113000	9.6	128.1	994	40	TS
113006	10.1	127.4	990	40	TS
113012	10.6	126.7	994	40	TS
113018	11.2	125.6	998		
120100	11.6	124.4	1000		
120106	11.9	123.7	1000		
120112	12.0	123.0	1002		
120118	12.0	122.2	1002		
120200	11.9	121.4	1004		

BEST TRACK DATA
TY SOULIK

MMDDHR	LAT	LONG	PPP	WND	STAGE
122818	7.8	130.2	1002		
122900	8.7	130.3	1002		
122906	9.3	129.9	1000		
122912	10.0	129.5	1000		
122918	10.4	128.5	998		
123000	10.4	127.8	994	35	TS
123006	10.7	127.1	992	40	TS
123012	11.0	127.4	990	45	TS
123018	11.7	127.8	990	45	TS
123100	12.4	128.0	990	45	TS
123106	13.1	128.5	990	45	TS
123112	13.8	129.6	990	45	TS
123118	14.4	130.7	985	50	STS
010100	14.8	131.8	985	50	STS
010106	15.2	132.4	985	50	STS
010112	15.5	133.2	985	50	STS
010118	15.6	133.9	985	50	STS
010200	15.8	134.5	985	50	STS
010206	16.3	134.6	990	45	TS
010212	16.7	134.7	990	45	TS
010218	17.0	134.8	985	50	STS
010300	17.2	135.0	980	55	STS
010306	17.5	135.5	965	70	TY
010312	17.9	135.9	955	80	TY
010318	18.2	136.2	955	80	TY
010400	18.3	136.6	960	70	TY
010406	18.5	136.9	975	60	STS
010412	18.3	137.2	990	45	TS
010418	18.0	137.6	1000		

CENTRAL PACIFIC HURRICANE CENTER - HONOLULU

BEST TRACK DATA
TS UPANA

MMDDHR	LAT	LONG	PPP	WND	STAGE
072000	10.8	144.6		30	TD
072006	10.7	146.2		30	TD
072012	10.6	147.7		30	TD
072018	10.3	149.0		35	TS
072100	10.2	150.3		35	TS
072106	10.2	151.4		40	TS
072112	10.2	152.6		40	TS
072118	10.1	153.9		40	TS
072200	10.2	155.3		40	TS
072206	10.3	156.8		35	TS
072212	10.4	158.6		35	TS
072218	10.7	160.5		25	TD
072300	10.9	162.5		25	TD
072306	10.9	164.4		25	TD
072312	10.8	166.1		30	TD
072318	10.6	167.6		30	TD
072400	10.1	169.2		30	TD
072406	9.5	170.5		20	TD

BEST TRACK DATA
H DANIEL

MMDDHR	LAT	LONG	PPP	WND	STAGE
072900	18.0	141.3		80	H
072906	18.4	142.9		65	H
072912	18.7	144.6		65	H
072918	18.9	146.3		65	H
073000	19.3	147.7		60	TS
073006	19.8	148.9		55	TS
073012	20.1	150.0		55	TS
073018	20.5	151.0		50	TS
073100	20.7	151.8		55	TS
073106	20.8	152.5		50	TS
073112	21.0	153.1		45	TS
073118	21.3	153.8		60	TS
080100	21.8	154.5		60	TS
080106	22.3	155.2		50	TS
080112	22.9	156.1		45	TS
080118	23.6	157.2		45	TS
080200	24.2	158.4		40	TS
080206	25.0	159.6		45	TS
080212	25.8	160.9		45	TS
080218	26.9	162.3		45	TS
080300	27.9	163.7		40	TS
080306	28.8	165.2		35	TS
080312	29.8	166.5		30	TD
080318	30.5	167.6		30	TD

080400	31.4	168.6		30	TD
080406	32.2	169.3		30	TD
080412	33.0	169.9		25	TD
080418	33.9	170.3		25	TD
080500	35.0	170.5		25	TD
080506	36.1	170.7		25	TD

BEST TRACK DATA
TS WENE

MMDDHR	LAT	LONG	PPP	WND	STAGE
081600	34.4	178.5		45	TS
081606	35.3	177.9		45	TS
081612	36.4	177.4		40	TS
081618	37.6	176.9		40	TS
081700	39.0	176.4		40	TS
081706	40.2	176.0		35	TS

BEST TRACK DATA
TS JOHN

MMDDHR	LAT	LONG	PPP	WND	STAGE
083006	17.1	140.4		55	TS
083012	17.2	140.5		55	TS
083018	17.3	140.4		60	TS
083100	17.4	140.3		55	TS
083106	17.2	140.6		45	TS
083112	17.0	141.2		35	TS
083118	17.1	141.7		35	TS
090100	17.3	141.9		30	TD
090106	17.4	141.9		30	TD
090112	17.5	141.9		25	TD