E G O W S 6

European Working Group on Operational Meteorological Workstations 6th Meeting

Vienna , 19 - 22 June 1995

Central Institute of Meteorology and Geodynamics

Hohe Warte 38
A-1190 Vienna

Foreword :

I like to remember the old greek word

σύνοπτος
(synoptos)

which means
" clear , distinct , clearly arranged , easily understandable ".

Thus the only way to get

Information at your fingertip

ist to produce

GRAPHICS

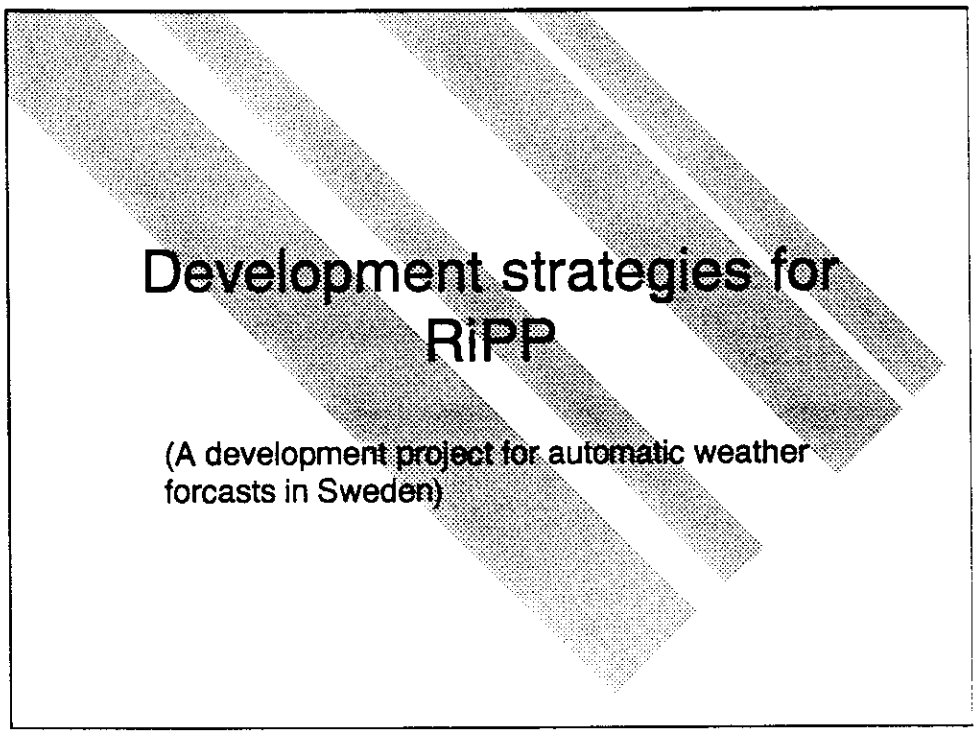
(This small sentence instaed of a long mostly unread foreword.)

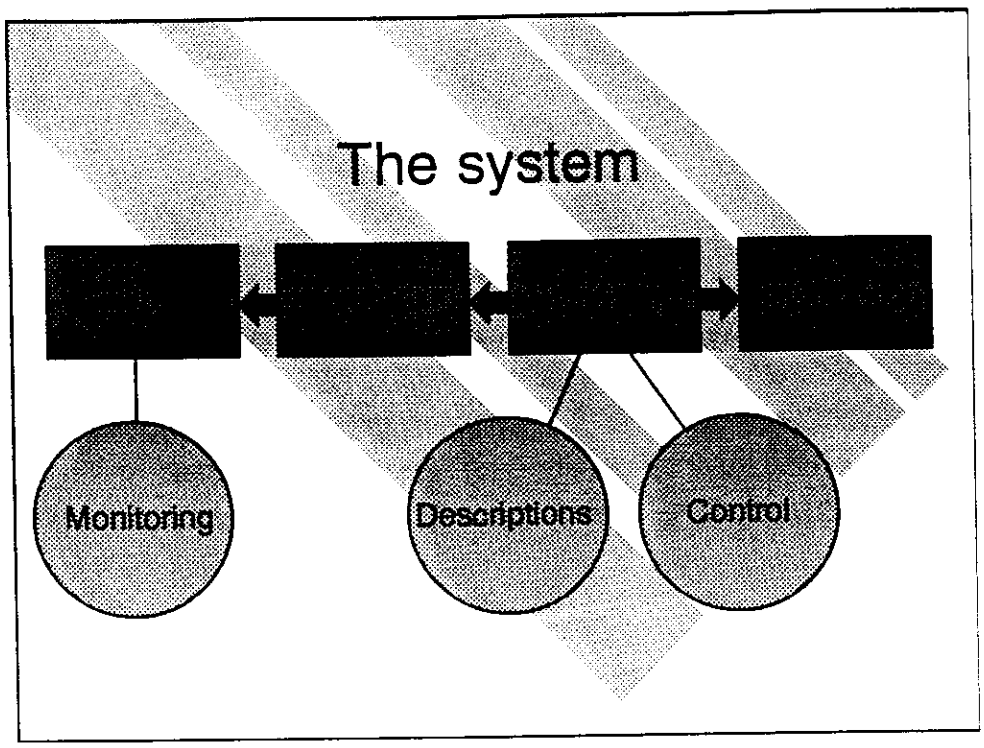
Gunter Wihl

Contents :

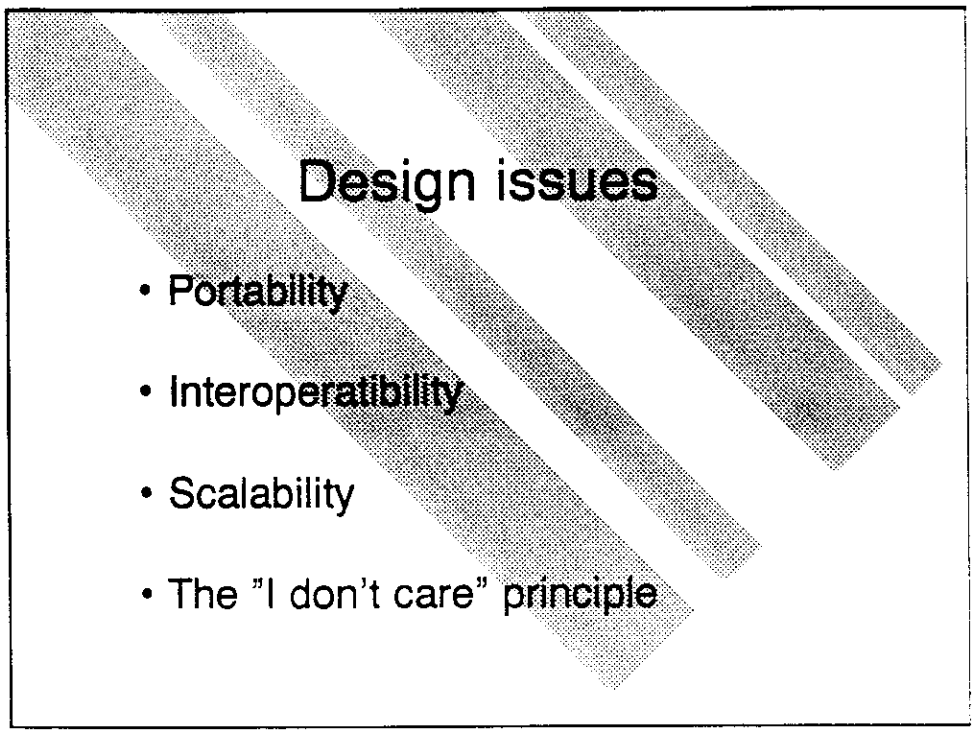
Session : General Developement

Hakan C A R L S S O N

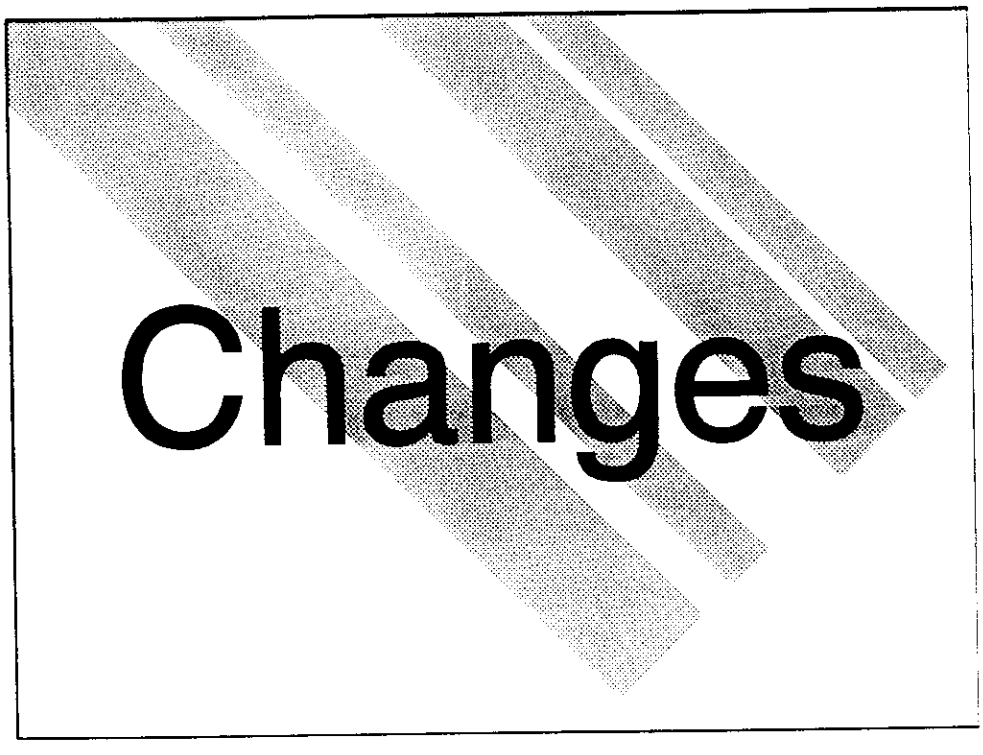

Development strategies for RiPP
(A development project for automatic weather forcasts in Sweden)



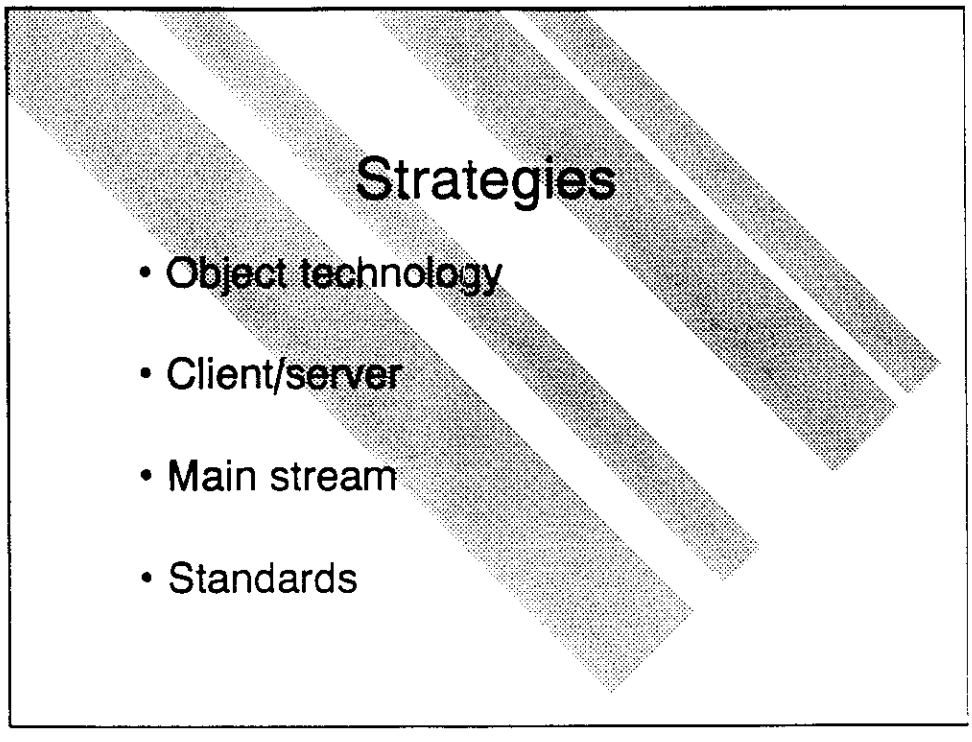
- DB = Database of some kind.
- Preparation = Selection and analyzing of data from the database.
- Assembling = Assembling product layers.
- Distribution = Distribution of some kind.
- Monitoring = Selection of model and posibility to change some values in the database.
- Descriptions = Product descriptions that controls the assembling.
- Control = Quality control.



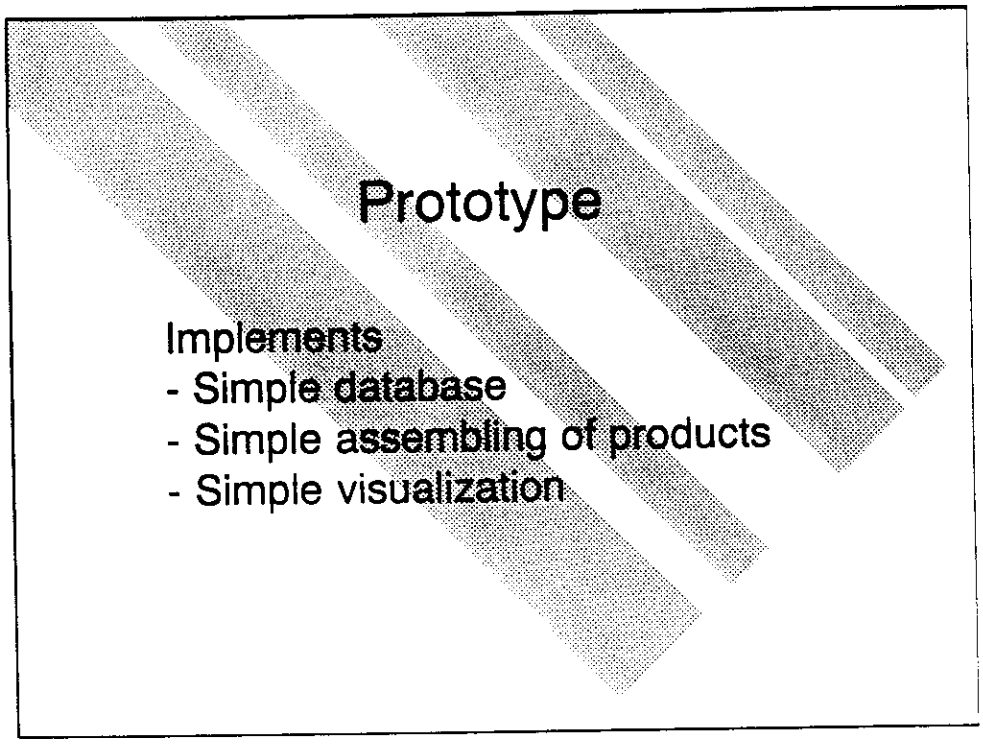
- Portability - Reduce the number of times you have to recode an application
- Interoperatibility = There will alwaysbe a need for different platforms.
- Scalability = Possible to build large systems from small systems. Possible to add computing power when needed.
- I don't care =Language, operating system and hardware independent.



- The rate of change is accelerating.



- Object technology = To simulate the real world.
- Client server = Separating computing power and "stupid" interfaces.
- Main stream = Bye software rather than building it. Focus on our strength.
- Standards = Not locked into any particular vendors product.


Prototype
Implements
- Simple database
- Simple assembling of products
- Simple visualization

Session : General Developement

Angela S M I T H

The HORACE Workstation System

- EGOWS
- Vienna, 19 - 22 June 1995

- Angela Smith
- Operational Workstation Systems
- Meteorological Office, Bracknell, U.K.

The functions of the CFO

- Analysis and prognosis
- Forecast guidance
- Public Met. Service provision
- NWP model global intervention
- Civil Aviation services
- METROUTE shipping services
- National and International commercial forecast services

The Core Responsibilities of the Operational Forecaster

- To produce quality forecast products, in a format to suite each customer, to a strict time schedule
- To gain a full understanding of the current weather situation

The Main Aims of the HORACE Project

- To create a user-friendly, robust, flexible and upgradeable forecast-office computer graphics system.
- Based on the projected data volumes and user requirements.
- Quality and timeliness of the output products and displays are of paramount importance.

The HORACE system will ...

- Display every type of global weather observation or forecast.
- Provide tools to help the forecaster to understand the current weather situation and to make decisions about the future evolution of the situation.
- Provide facilities to help create value-added forecast products.
- Provide the methods to disseminate the output products in different formats.

The Perceived Benefits of HORACE

- Less labour-intensive than the old system. Improved working practices.
- Increased productivity. Potential forecast-office staff savings.
- New and improved applications.
- Better informed forecasters with the potential for higher quality forecasts.
- Increased consistency between products created by different forecasters.
- Upgradeable hardware and software.
- Can readily cope with increased data volumes.
- Centralised software support and development.
- Systems can be supplied to other sites should the need arise.

Applications Development

- **Languages:** C, FORTRAN, X, GKS.
- **Design:** Systems analysis and design aided by use of the CASE tool Software-through-Pictures.
- **Standards:** Defined at start of project to help ensure robust, maintainable code. Quality assurance enforced. Rigorous error-trapping and associated user help panels.
- **User Interface:** Windows system with pop-up menus, conforming to OSF-MOTIF requirements, developed with the aid of X-Designer.
- **Applications:** Ported from legacy systems if they conformed to required standards; otherwise developed from new.

Implementation Issues

- Availability of forecast office resources for user testing during development.
- Assessing the correct level of user training for each new type of application.
- Judging whether ongoing familiarisation is required before operational implementation.
- Availability of backup facilities.

Hardware for the CFO

- A client-server architecture running HP-UX systems software.
- Three Hewlett Packard 9000/897 file servers.
- Up to 20 HP 735/720 twin monitor combination of workstations.
- Each workstation has at least 48Mb RAM and a CRX24-bit graphics card.
- Three HP DesignJet plotters for hardcopy charts up to A0.

Communications for CFO

- Direct ethernet links to the COSMOS mainframe and to the TROPICS telecommunications message-switching system.
- FDDI network joining each workstation pair to the file-servers.
- File-level security provided by standard UNIX facilities.
- Access is controlled through operating system and communications controls.

Database

- Sited on the file-server holding global -
- Observational data from the GTS, warnings, messages etc.
- Satellite and rainfall radar imagery
- NWP GRIB data from UKMO Unified Model at all resolutions
- NWP GRIB from local wave, storm-surge and pollution models
- NWP GRIB from other international centres

Graphical User Interface

- Designed to be intuitive, requiring little user training
- All new applications have a MOTIF interface
- Applications ported from other system more likely to have GKS interface. They will be converted to MOTIF at a later stage.

Applications facilities

- With flexibility to choose displays and data from any area of the globe.
- Configurability of default options to personal choice.
- Provide features to plot, contour, multi-overlay, zoom, roam, animate etc.
- Share information and products between forecasters.
- Plot hardcopy charts of observed data. Overlay with NWP if required.
- Disseminate products internally and externally.
- Calculation of forecaster aids e.g. night minima
- Word-processing for text generation and dissemination.

Applications displays

- Observed data in alphanumeric and graphical formats
- NWP data as contoured fields or grid-point representations
- Sliced/coloured imagery.
- Observed and forecast tephigrams.
- Hodograms.
- Textual products, warnings, messages.

Error Messages

- Be specific and precise
- Be constructive
- Use a positive tone
- Choose user-centred phrasing
- Keep visual format and placement constant

Development Facilities

- HP File-server
- A variety of HP workstations and x-terminals - total 16
- A DesignJet plotter
- A demonstration workstation within the CFO
- A target system for HQSTC
- Target systems for each site are being sought

Communication with the User

- Before development begins
- During development
- During implementation
- After implementation

Plans for the Future I

- Emphasis on providing tools, techniques and facilities to streamline tasks.
- Attention-getters
- Merging of textual and graphical products
- On-screen analysis of irregularly space data
- Display of specialised ensemble products
- Integration of the UKMO intervention system
- Integration of the semi-automatic production of SigWx charts
- Provision of special features for the Storm-Tides Warning Service

Plans for the Future II

- 3-D Visualisation
- Graphical editing in 2-D. Later 3-D?
- Flexible X-Section displays
- Internet access once security requirements satisfied
- Forecast validation facilities
- Further aids to decision making?
- The paperless office..... ?

Operational considerations

- Dependability. Quality and timeliness.
- Provision of systems support
- Availability of backup facilities
- User confidence
- User training and familiarisation
- Response times
- Training

Open Systems - a realistic aim?

- Vendor Independence
  - Hardware and Software
- Portability
  - Applications can transfer platform to platform and be scaled across a variety of platform sizes
  - System can be expanded without impacting applications
- Interoperability
  - Applications communicate with one another and operate among others follwing the same standards.
- Useability
  - Applications have the same 'look and feel' across different platforms.

Other HORACE sites

- RAF HQSTC operational
  - Sub-set of TROPICS message-switching system
  - Two HP file-servers and 6 workstation s
  - Provides limited backup to Bracknell
- Royal Navy operational
  - two sites, more to follow over the next year
- Full development system at Bracknell
- Several other possibilities in prospect

Session : General Developement

Luc G E R A R D

General Operational Developments at Belgian Royal Meteorological Institute

Luc Gerard, IRM-KMI, Belgium, June 1995

The system presented below was developed at minimum costs, aiming at a best use of the available resources. We wanted to avoid redundancy in the system as well as in the work to set it up, so we decided to use a set of shared specialized libraries, with a good separation of the tasks for a rational use.

The basic values we wished to promote are the following:

- An effective use of our limited hardware resources
- Avoid spilling development efforts and money throug a wide use of existing (free) available code
- Reliability: essential for the operational users
- Flexibility: to allow the users to get anything they fancy without needing extra development work.
- Extendability, easy update procedures

We began our developments around ECMWF's *MAGICS* library; progressively adding several new funcionnalities while keeping in mind *MAGICS'*prime philosophy. As the ECMWF continued its own developments, we happened to diverge in our choices; but we are still able to integrate in our system the major novelties arising in ECMWF's *MAGICS* package.

1. Whole system structure

The following charts show the system structure, first as a flow of control signals, secondly with respect to the data flow.

a) The data are kept in rather simple databases, as far as we have only one office. We are thinking of using a more elaborate Database Management System in a near future. We separated the following data types:

- *ASCII* database, containing alphanumerical messages from the WMO Global Telecommunication System. The data are classified by type and time in different files allowing to access quickly the needed information in a straightforward way.
- Binary database, containing
  - ⇒ *BUFR* messages encoded and packed locally from the ascii database,
  - ⇒ *GRIB* fields we get from the ECMWF (different NWP products), and
  - ⇒ binary fields we compute locally from the precedent fields.
- Satellite pictures database containing preprocessed satellite pictures (often reprojected into polar stereographic) in the *xwd* format, sometimes in the *PIF* format. Other Pictures like the radar and safir images are also available as *xwd* files.
- Graphic files database, which contains drawings that you can still annotate, combine with other graphics or plot through the graphical post-processors.

b) The libraries include:

- Vendors libraries: *GKS, X11, fortran, c...*
- Binary coding and decoding libraries: *BUFR* and *GRIB*, taken from the ECMWF.
- Binary file i/o library (locally developed for a quicker access to the data).
- Satellite / *xwd* file access library (locally developed).
- Alphanumerical messages decoding (locally developed).
- Enhanced Magics, which is described below.

Automatically scheduled scripts care for data acquisition and preprocessing and for the generation of several routine drawings.

c) The Operational front panel includes

- An ASCII-file viewer, allowing to scan through clear text messages or any other meteorological message, in source as well as in decoded form.
- The Main Operational *MAGICS*-based application (*MAGICS* provides also the GUI)

- The Graphical Edition post-processor (*VIEWS*):

  This *GKS*-based program lets you superimpose parts of drawings, annotate them with text as well as meteorological symbols (fronts, wheather symbols, lines, arrows, areas,...). You can also superimpose drawings on a satellite picture on the screen.

- The Plot post-processor (*MAGPLOT*) allows to generate postscript files from graphical files, and to arrange the layout of the different drawing layers on the output page. It is possible to plot a rectangular area inside the drawing rather than the whole drawing. *VIEWS* lets you delimit this area easily with the mouse, before calling the Plot program.

- The Control Panel permits to control the execution of the automatic scripts, and to order some extra paper products (plots, listings).

2. Enhanced Magics: current status

a) Review of the earlier additions to Standard *MAGICS*

- Enhanced *BUFR* and *GRIB* data acquisition.
- Drawing structuring: layers with distinct names that can be handled separately.
- Interactivity: simple Magics calls to control the user interface:

  PZOOM (to produce an automatic interactive phase, allowing to zoom, pan, change layers visibility, see information linked the drawing or about stations, select some observations...)

  PSAVE (to select layers, save them and plot them)

  PASK ('Prompt string',variable,)* (to modify or accept the value of a variable)

  PASKM ('Magics_parameter_name',)* (to modify the value of a parameter)

  PMSG ('Message') (to send an informative message)

  PMENU ('Menu_items_list.',ichoice,)* (to produce a menu and return the users' choice)

  this interface handles automatically the fact that you are working from a tty or a graphical workstation.
- Observations analysis in order to draw isolines, smoothing procedures, tephigram and hodograph drawing.
- Coastline structuring allowing to draw more elaborate backgrounds;
- A series of other additional parameters, allowing a better control of the shading colours, the observation symbols plotting, etc.
- Extended use of specification files, for a maximum flexibility.

b) Last updates

- Better user interface, based on *Motif* and by-passing *GKS*.
- You can now select some observations to rule them out from a subsequent analysis, or on the contrary, add some fictitious observations at places the data are scarce (for instance if you can see a storm over the ocean on the satellite pictures, while the analysis of the available observations does not reveal it).
- Choose upper air stations on a map in order to draw tephigrams;
- Associate textual information to the drawings, that you can reviewduring the interactive phases (*PZOOM*). You can also obtain the stations names and the value of their main parameters by clicking at them on the screen.
- *METARs* are drawn as virtual *SYNOPs*.
- Satellite pictures:

  The satellite data acquisition of *MAGICS* has been adapted for:

  - The use of partial pictures (not containing the whole Meteosat disk)
  - the loading of already projected polar-stereographic images: this speeds up the picture acquisition, the projection occuring in a preprocessing phase.

3. The operational application

Following MAGICS'philosophy, you only have to write your own main program calling the different MAGICS routines and setting MAGICS parameters suitable for your application. You can then save your drawings and use the power of the Graphical Editor *VIEWS* and the Plot postprocessor *MAGPLOT* to obtain fine representations. For the Operational work, we developed a very complete main program, using a large Specification File, and allowing to draw all the routine products as well as some less usual ones. Some extra menu items let you visualize very quickly the contents of *GRIB* or *BUFR*-files without having to write a dedicated program. The use of specification files ensures a maximum flexibility.

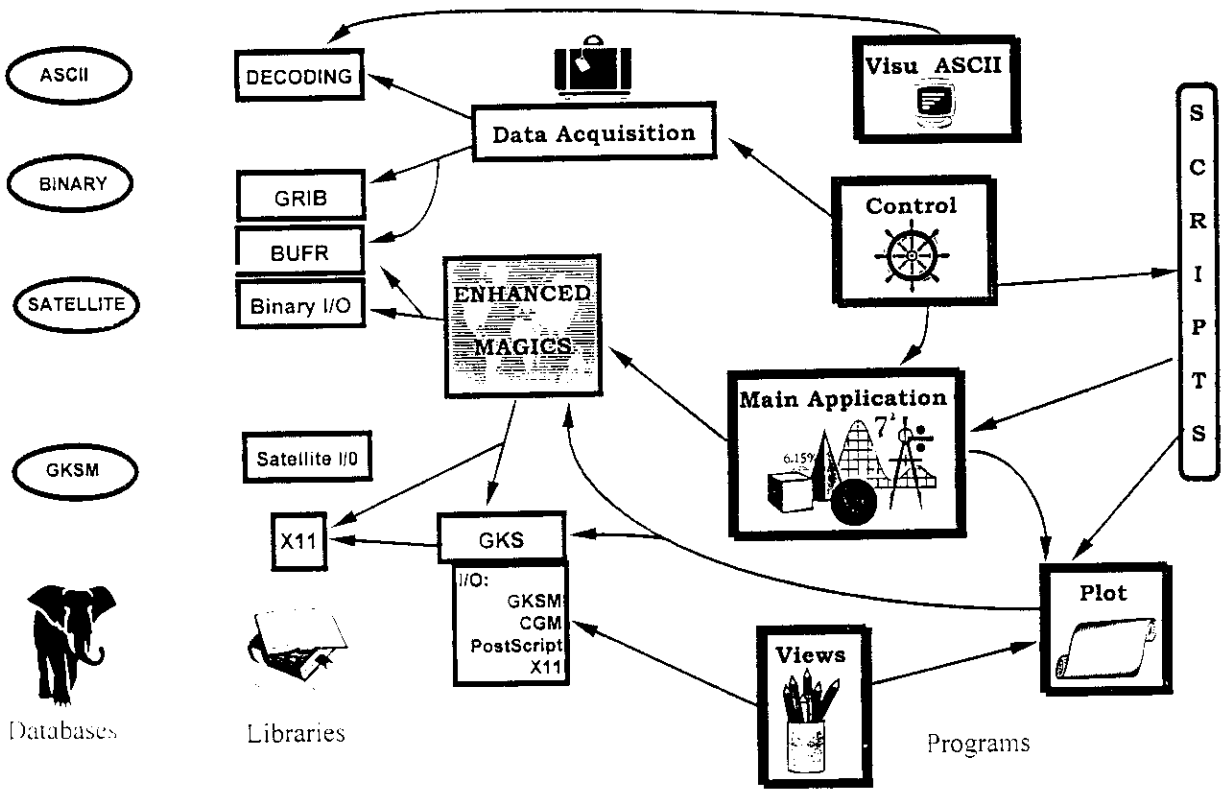
4. Conclusions

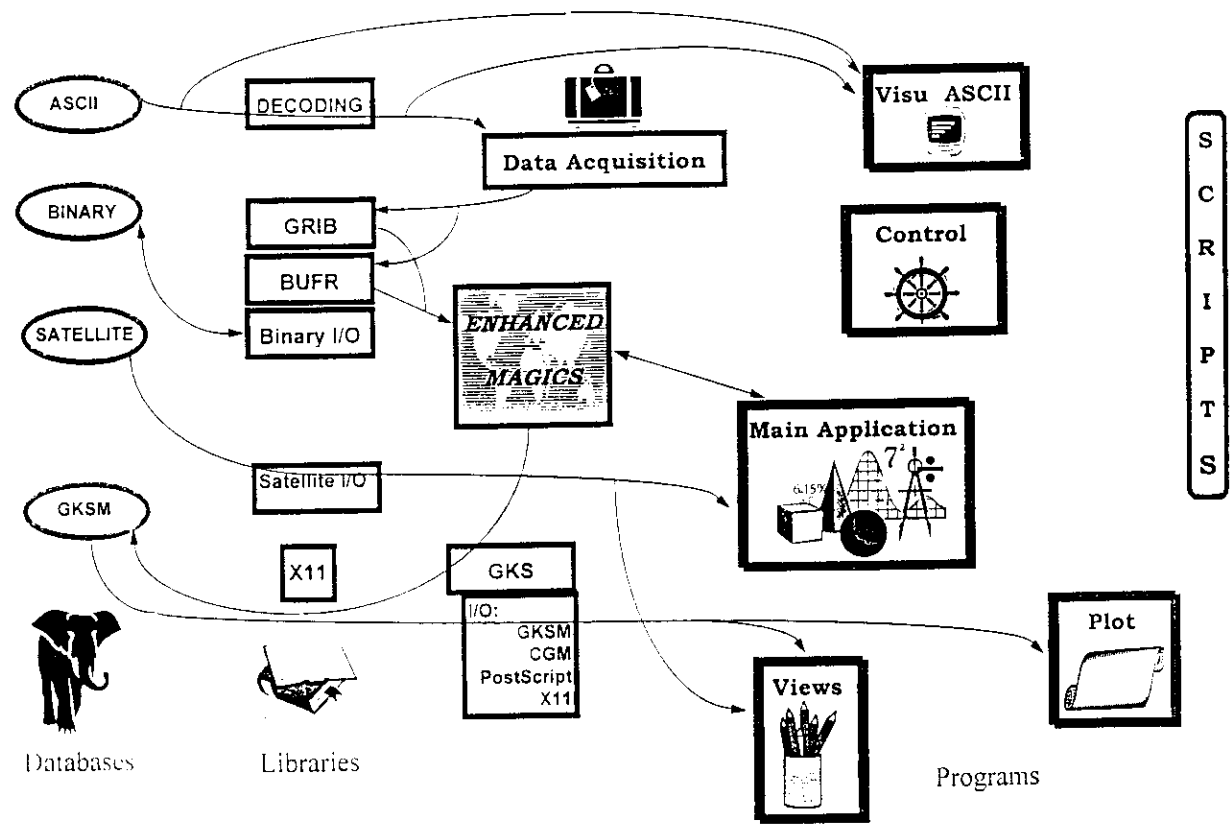
The handling of satellite pictures has pushed *GKS-GRAL* to its extreme limits, so we have to switch to a more performant *GKS* in the following months.

Moreover we plan a wider use of satellite-related pictures, for instance pictures produced by a cloud classifier. Those pictures (and those of Polar-orbiting Satellites) cover generally a limited area, so it seemed advantageous to prepare the acquisition of portions of satellite picture by *MAGICS*.

The radar and lightning detection pictures are still to be integrated in *MAGICS*, and some combinations with satellite or other pictures could be interesting.

Those further improvements could take place within the frame of Nowcasting projects.


ASCII
BINARY
SATELLITE
GKSM
Databases
DECODING
Data Acquisition
GRIB
BUFR
Binary I/O
ENHANCED MAGICS
Satellite I/O
X11
GKS
I/O:
GKSM
CGM
PostScript
X11
Libraries
Visu ASCII
Control
Main Application
Views
Plot
Programs
SCRIPTS


ASCII
BINARY
SATELLITE
GKSM
Databases
DECODING
Data Acquisition
GRIB
BUFR
Binary I/O
ENHANCED MAGICS
Satellite I/O
X11
GKS
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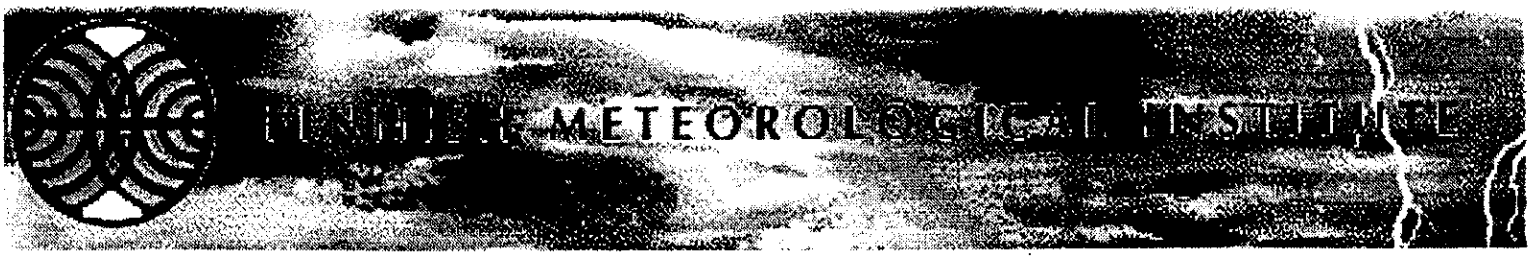
GKSM
CGM
PostScript
X11
Libraries
Visu ASCII
Control
Main Application
Views
Plot
Programs
SCRIPTS

EGOWS 6
Vienna , 19-22 June 1995

Session : Generall Developement

Lars W I N B E R G



The VMS Workstation

- 87->
- Digital 3100 19"
- 31 totally :
  - 18 operational in-house
  - 5 other (in-house, follow-up, demo)
  - 8 outhouse (demo, monitoring, education)

- GUI (DIGITAL sw)

- file based data management

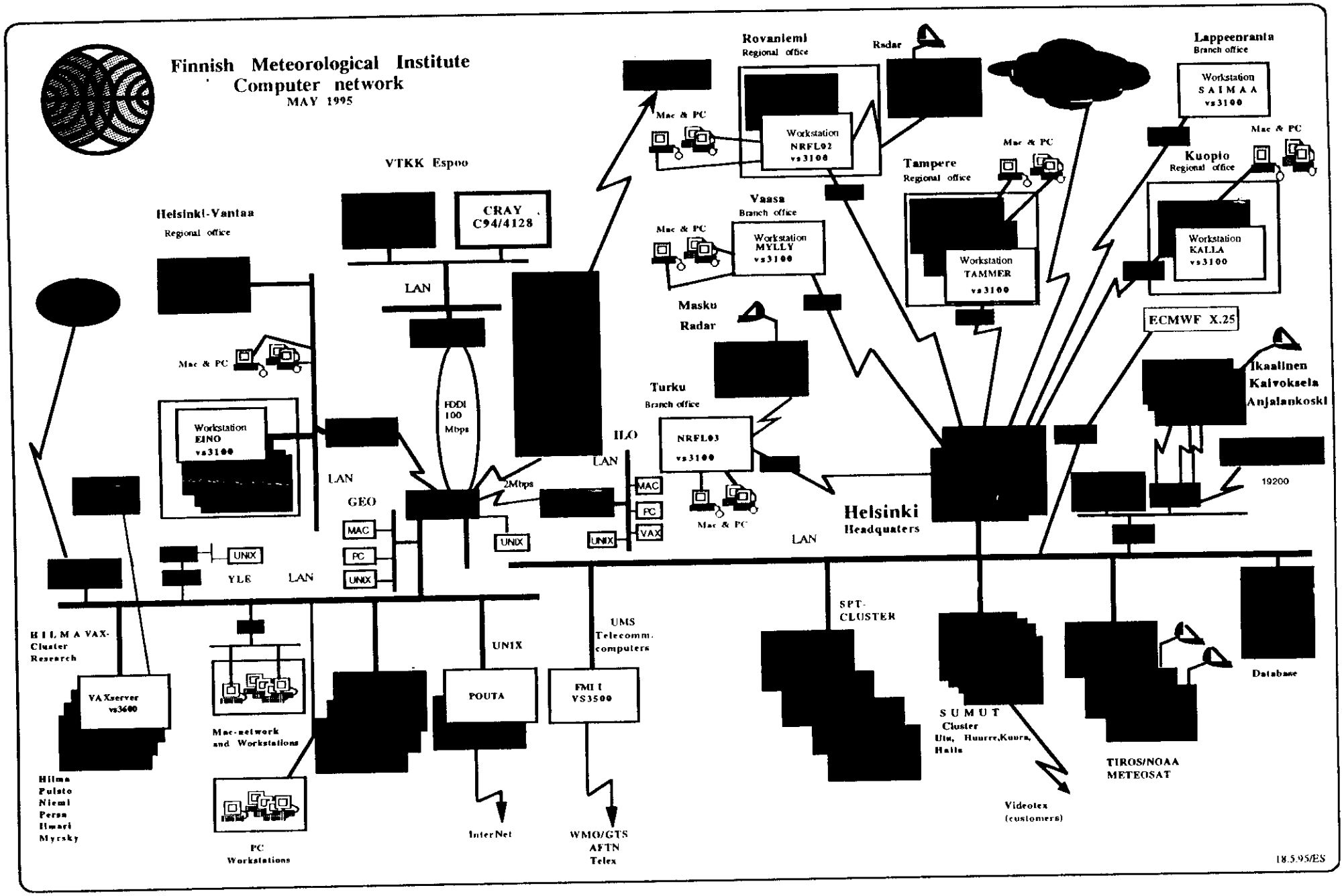
- regional linespeeds 64 000 bps

- development currently on a very low priority level

- new features during last two years:
  - lightnings added
    - superimposed on radar images
    - 4 age classes in different colors
  - composite radar images over Scandinavia (NORDRAD)
  - successive radar images superimposed -> movement
  - NH area for NWP

- data
  - SYNOPs (+domestic AWS)
  -TEMPs
  - Meteosat IR
  - Radar images (incl. NORDRAD)
  - NWP products (DMO, processed)
  - Lightnings

- functions
  - superimposing of obs, images, NWP
  - 3D trajectories, positioning
  - editing capabilities (line, area drawing)
  - emagrams, 1 day gram...


Finnish Meteorological Institute
Computer network
MAY 1995
VTKK Espoo
CRAY C94/4128
LAN
Helsinki-Vantaa
Regional office
Mac & PC
Workstation EINO vs3100
UNIX
YLE
LAN
FDDI 100 Mbps
GEO
MAC
PC
UNIX
2Mbps
ILO
LAN
MAC
PC
VAX
UNIX
Rovaniemi
Regional office
Radar
Mac & PC
Workstation NRFL02 vs3100
Vaasa
Branch office
Mac & PC
Workstation MYLLY vs3100
Masku
Radar
Turku
Branch office
NRFL03 vs3100
Mac & PC
Tampere
Regional office
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Workstation KALLA vs3100
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Ikaalinen
Kalvoksela
Anjalankoski
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Headquaters
LAN
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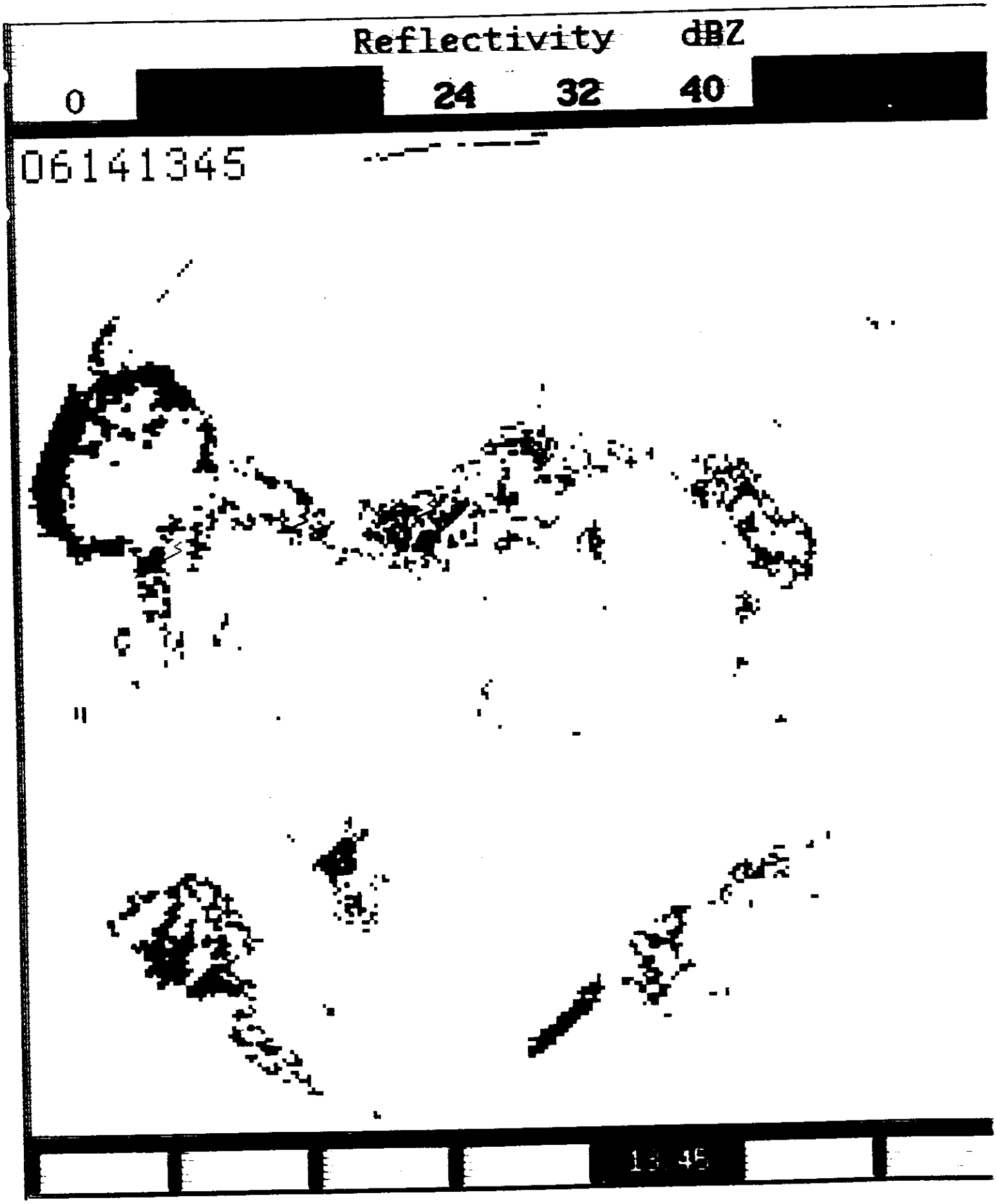
VAXserver vs3600
Hilma
Pulsto
Niemi
Persa
Ilmari
Myrsky
Mac-network and Workstations
PC Workstations
POUTA
UNIX
InterNet
UMS Telecomm. computers
FMI I VS3500
WMO/GTS
AFTN
Telex
SPT-CLUSTER
SUMUT Cluster
Ilu, Huurre,Kuura, Halla
Videotex (customers)
TIROS/NOAA
METEOSAT
Database
18.5.95/ES


Reflectivity dBZ
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24
32
40
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Dedicated visualisation systems

- METEOSAT
  - VCS pdus
- NOAA
  - to be renewed 95/96
  - postprocessed precipitation and cloud type analysis
- Radar systems
  - IRIS from SIGMET
  - 3 Doppler, 4th coming
  - 2 conventional
- Customer Windows station
  - telephone connection + modem + PC + FMI's display program
  - test use started
  - GIF and JPEG pictures (satellite, radar, temperature)
  - GUI built with Borland's OWL
  - cost per connected time
- Skyway
  - TV antenna + decoder + PC + FMI's display program
  - make use of the extra stripes in the TV picture
  - a few products for a large audience
  - fixed cost per month, more expensive
- Press products
  - MACs with Adobe Illustrator
  - telefax or modem dissemination
- TV cloud animations
- Internet

  http://www.fmi.fi

The WETO (Weather tools) project

Cross-division project started in Jan 1995
15 half or full time people

1. Object

- automated forecast production
- centralised database management
- elimination of duplicated work
- faster development cycles

2. Final system

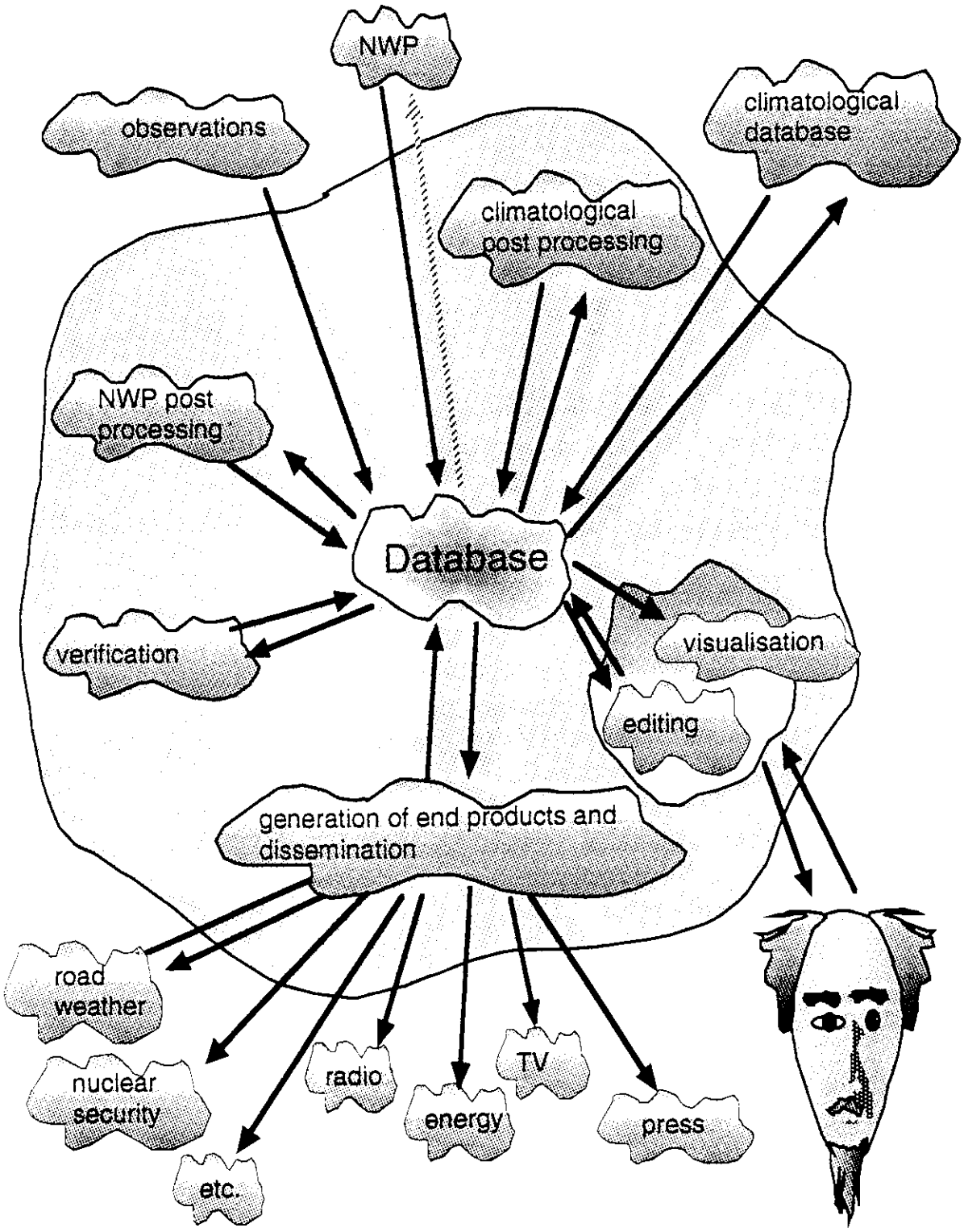
- an automated volume forecast producing system controlled by a central logical (distributed) database
  - with all info needed for the forecasts
  - linking all subsystems:
    - meteorologist's interfacing
    - end product generation
    - postprocessing
    - verification

3. Implementation

- TCP/IP
- ORACLE 7
- NEONS
- Client/Server as applicable
- C++

4. Started subprojects

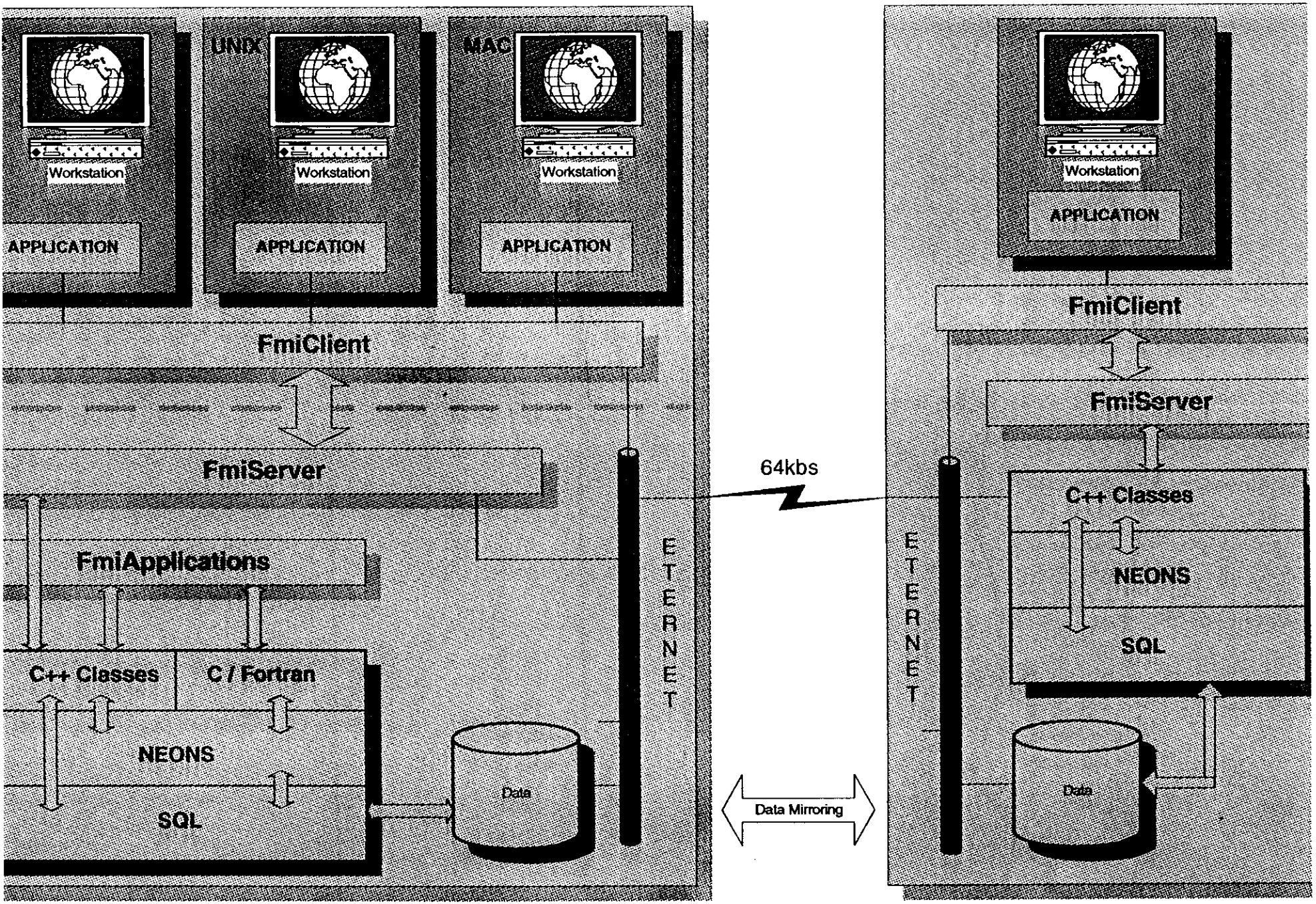
- automated sea weather (speech on phone service)
  - forecasts
  - observations
  - MTV (same classes)
- automated TAFs
- Meteograms


NWP
observations
climatological database
climatological post processing
NWP post processing
Database
verification
visualisation
editing
generation of end products and dissemination
road weather
nuclear security
radio
TV
energy
press
etc.

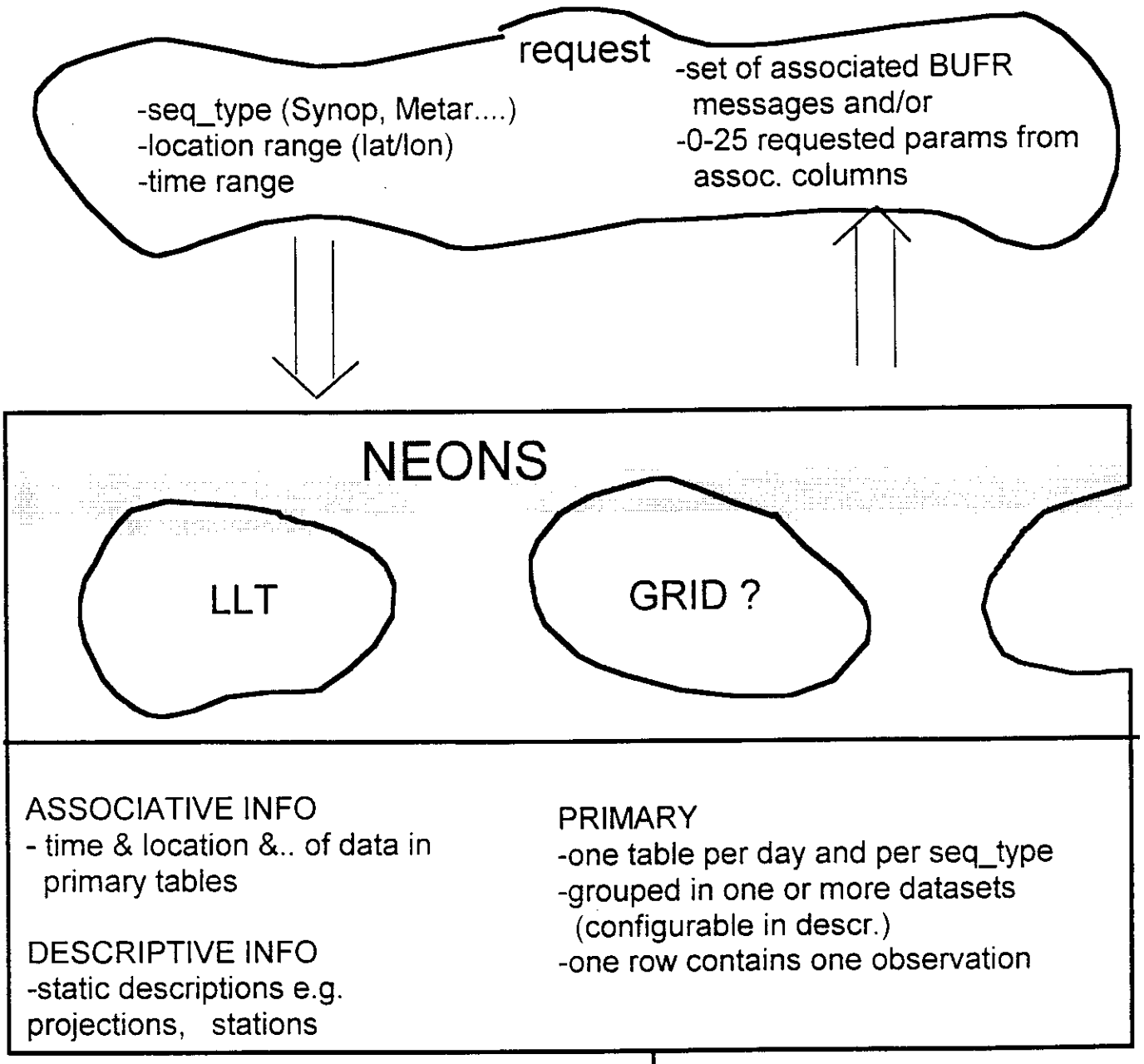
METEOROLOCICAL INFORMATION SYSTEM

FMI- Central Office

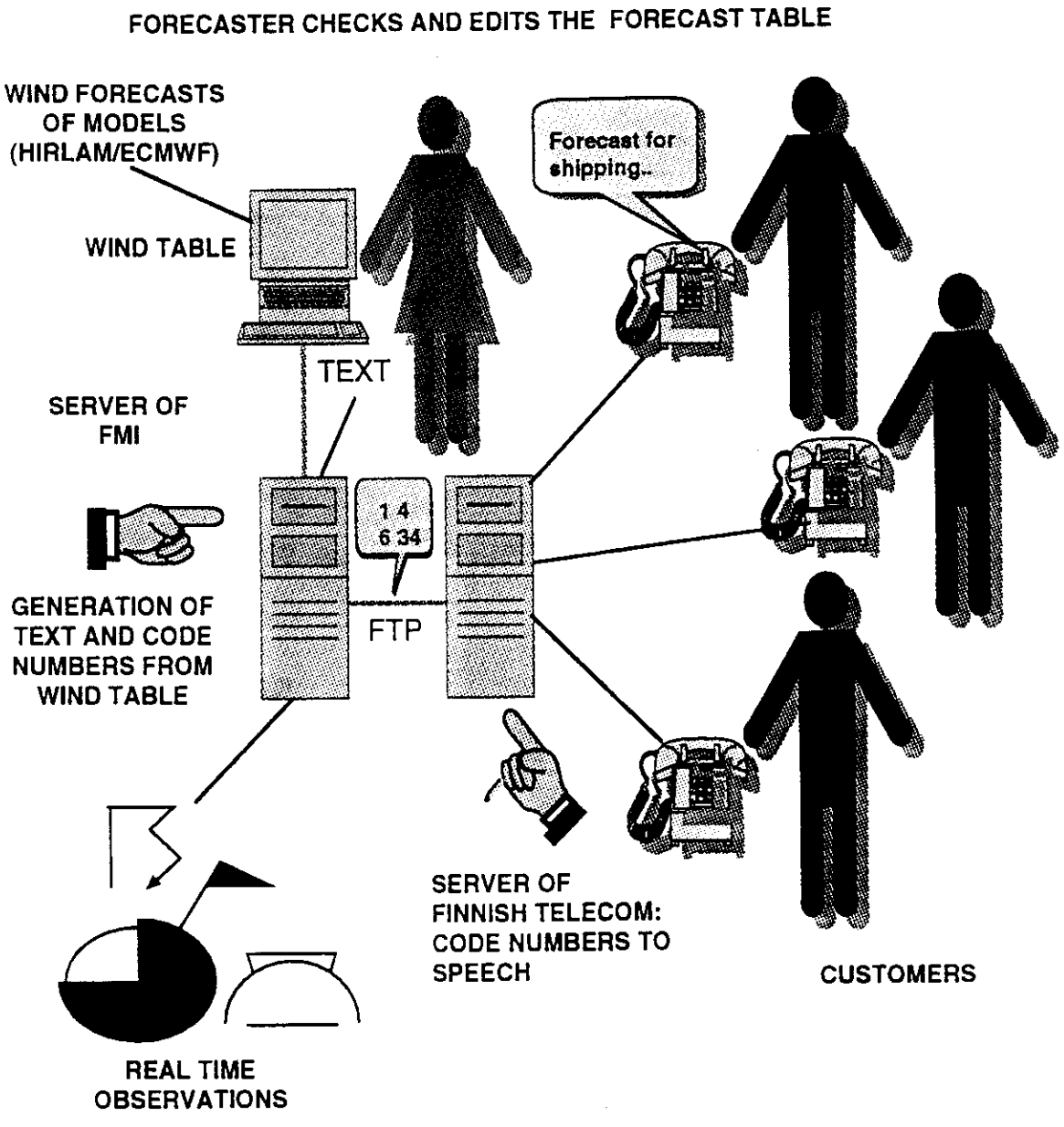
Regional Offices

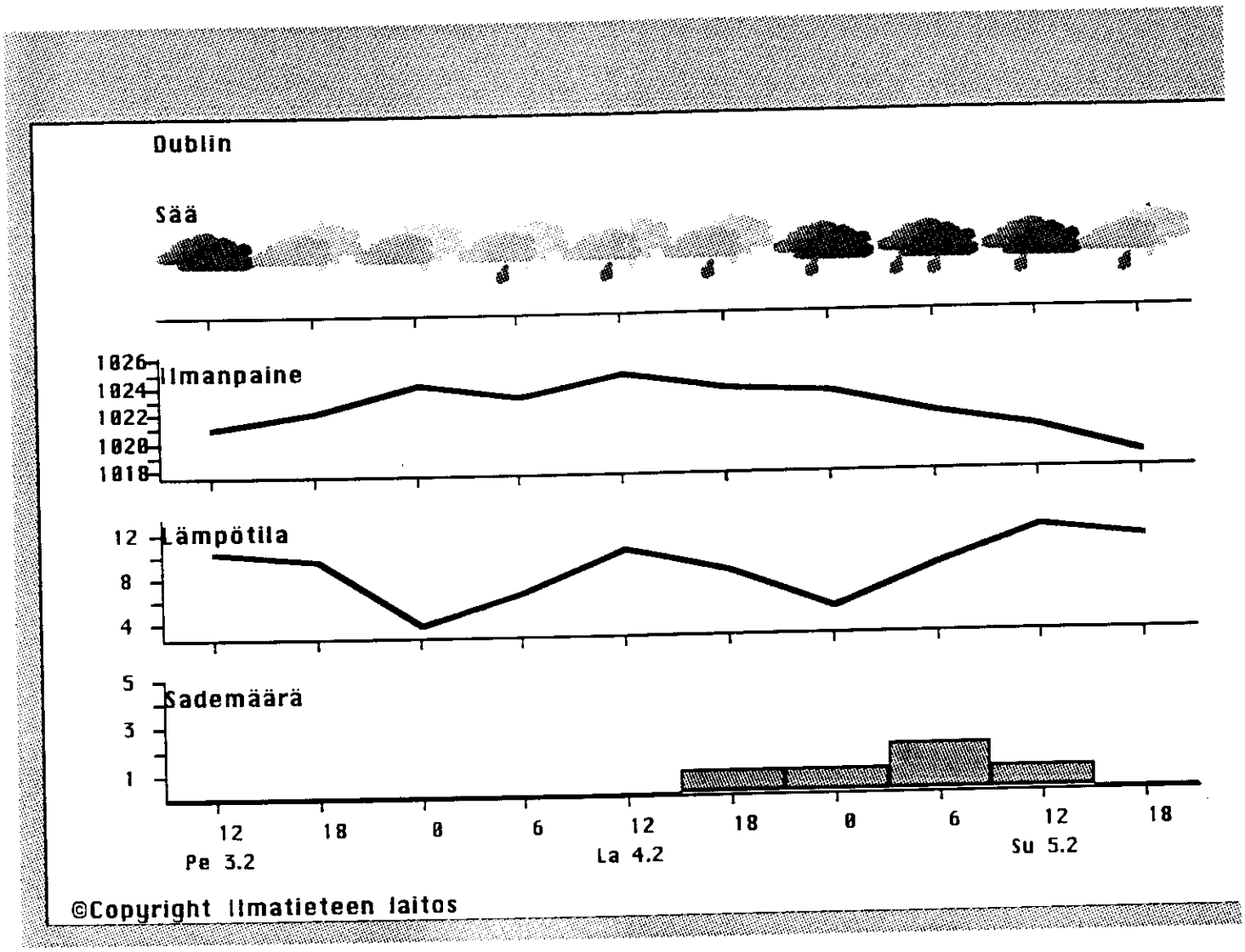


NEONS implementation



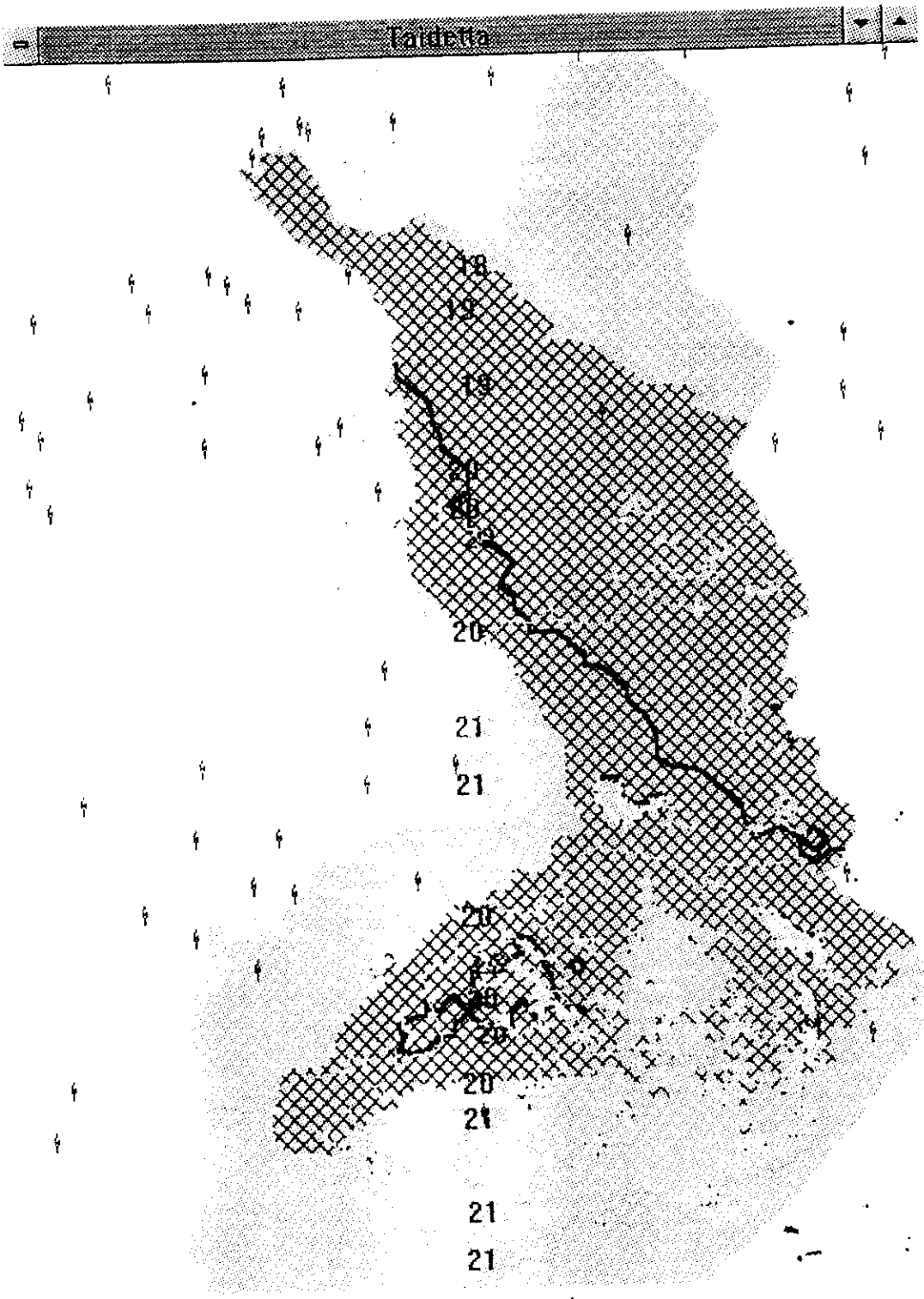
NEW TELEPHONE SERVICE FOR SAILORS





C++ progress

- not as fast as anticipated
  - staff resources busy
  - OOP market unsettled
- still aiming at multi platform applications
- development concentrated on lower, platform independent layers (database, base classes)
- development platforms:
  - PC (NT 3.5):
    - Borland C++ v. 4.5
    - soon Microsoft Visual C++ for comparisons
  - MAC:
    - Symantec
  - SGI UNIX:
    - CaseVision
- own class libraries developed for
  - containers (lists, etc.)
  - database interface
  - time manipulating
  - strings
  - map projections
  - scales etc.
  - insufficient
  - shortcomings
- pilot applications
  - meteogram (Mac, XVT)
  - sea weather (no GUI)
  - contour maps (OWL)
- final solution ?
  - base classes
  - user interface
    - own next generation
    - XVT
    - MFC
    - some other stable vendor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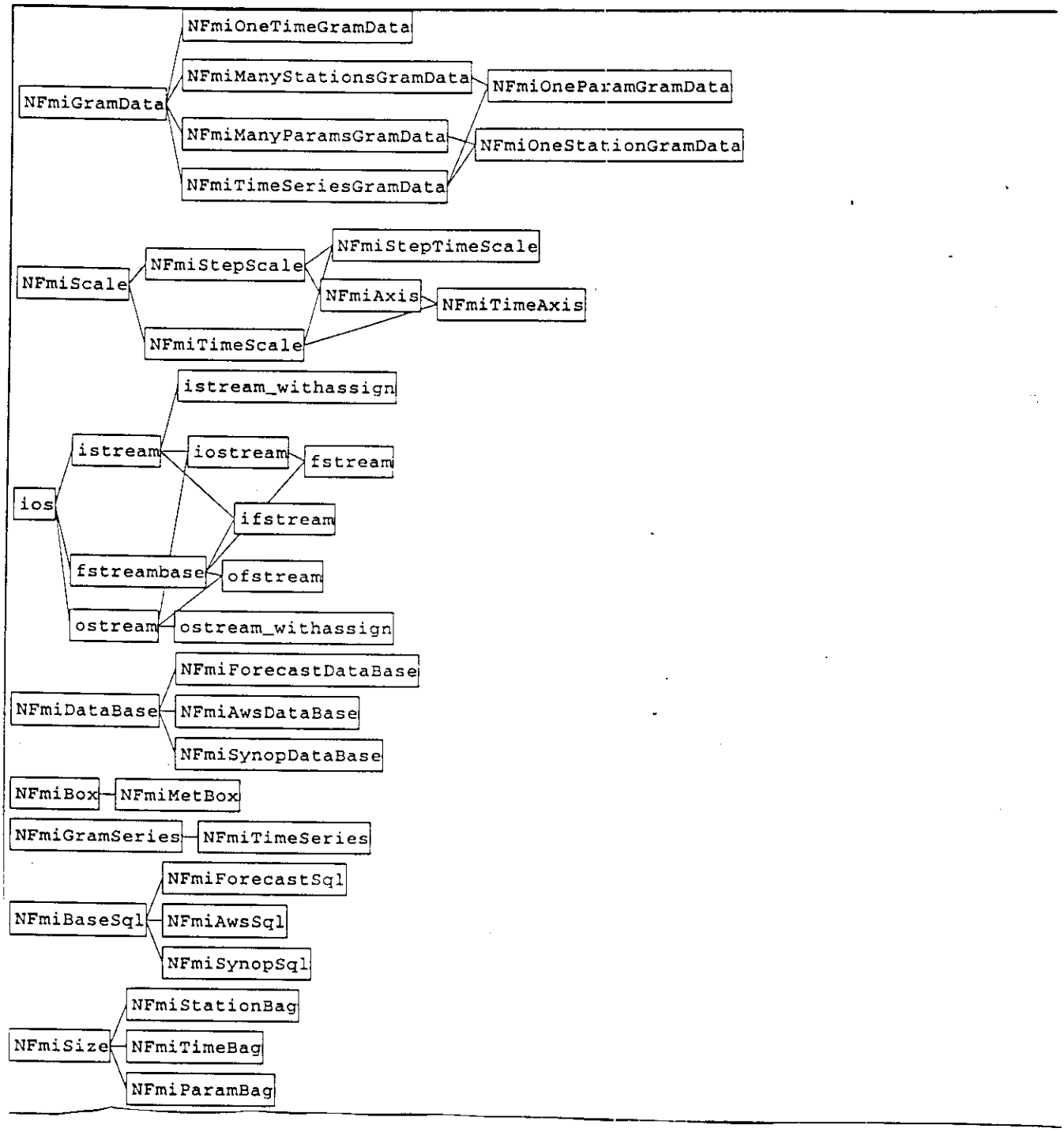
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NFmiManyStationsGramData
NFmiGramData
NFmiOneParamGramData
NFmiManyParamsGramData
NFmiOneStationGramData
NFmiTimeSeriesGramData
NFmiStepTimeScale
NFmiScale
NFmiStepScale
NFmiAxis
NFmiTimeAxis
NFmiTimeScale
istream_withassign
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iostream
fstream
ios
ifstream
fstreambase
ofstream
ostream
ostream_withassign
NFmiForecastDataBase
NFmiDataBase
NFmiAwsDataBase
NFmiSynopDataBase
NFmiBox
NFmiMetBox
NFmiGramSeries
NFmiTimeSeries
NFmiForecastSql
NFmiBaseSql
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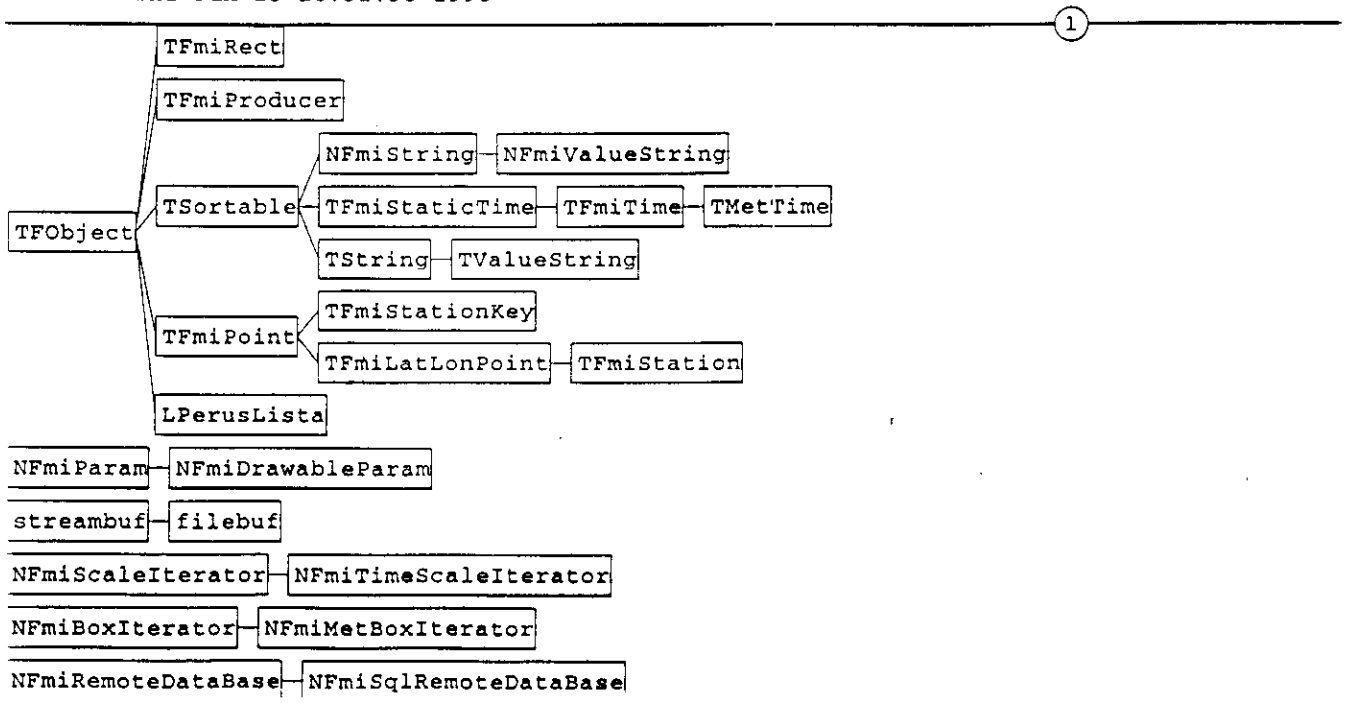
NFmiSynopSql
NFmiStationBag
NFmiSize
NFmiTimeBag
NFmiParamBag


TFmiRect
TFmiProducer
NFmiString
NFmiValueString
TSortable
TFmiStaticTime
TFmiTime
TMetTime
TFObject
TString
TValueString
TFmiStationKey
TFmiPoint
TFmiLatLonPoint
TFmiStation
LPerusLista
NFmiParam
NFmiDrawableParam
streambuf
filebuf
NFmiScaleIterator
NFmiTimeScaleIterator
NFmiBoxIterator
NFmiMetBoxIterator
NFmiRemoteDataBase
NFmiSqlRemoteDataBase

EGOWS 6
Vienna , 19-22 June 1995

Session : General Developement

Silvio C A U

EGOWS '95

1. INTRODUCTION

This presentation starts showing how a meteorological workstation works, then the features of a future workstation for Italian Air Force Meteorological Service will be drawn.
The path of our speech will enlight the main features of a meteorological workstation.
At this time, a workstation can be described speaking of:

- hardware configuration;
- link to the Data Computing Centre of National Meteorological Centre;
- access mode to data bank;
- presentation and handling mode of informations;
- strenghts and weaknesses of actual configuration.

A future workstation will be described in terms of:

- function and environment;
- hardware configuration;
- basic software;
- applications software.

2. ACTUAL SITUATION

a. Hardware configuration.

The core of an actual workstation is, basically, an IBM, or type IBM, PC with a microprocessor 386 or 486. There are also the following peripherals:

- a color video unit with a SVGA card;
- a pins or laser print writer;
- a 3270 emulation card with a coaxial wire or a PCSA adapter.

Sometimes a 3192 IBM Graphic terminal, instead of a PC, is linked to a remote cluster unit 3174.

b. Link to the Data Computing Centre of National Meteorological Centre.

All the remote users have a link with the Data Computing Centre mainframe according one of the following modes:

- monouser, i.e. using a modem connected to an IBM 3270 emulation card with a PSCA adapter in remote workstation;

- multiuser, i.e. using a modem connected to a 3174 remote unit with an output to a coaxial wire.

All the remote workstations have a set link apart with a sincronous transmittive protocol. Two IBM 3275 control transmission unit, with a NCP module, manage the linkage with remote users.

c. Access mode to data bank.

The actual structure of Data Bank is splitted into two main areas:

- a partition for data in an alphanumeric format;
- an other partition for data in a graphic format.

The area retaining data in an alphanumeric format is made of 28 files with a VSAM architecture filled up using programmes developed in a CICS environment.
Data access is obtained making a login to the CICS environment of the IBM 3090 (that is our mainframe), that manage an inquiry system based on a software developed by personnel of Air Force using assembler language.
Even though this set of files isn't a real Data Base, a user, skilled in aeronautical meteorology, can take advantage of data in alpanumeric format in a proficient a complete way.

The partition for data in a graphic format can be splitted into three sub-areas:

- an area containing graphic files in a PIF format, memorized in a MVS data set partitioned and made by time driven jobs in a TSO environment in IBM 3090.
  All the software required to realize these graphic files, named SIGAMO, is written in APL language and uses graphic routines GDDM;
- another area containing satellite images in a binary format worked out by National Centre. All these files are stocked in MVS data sets partitioned and are made by modules translating METEOSAT and TIROS images;
- a last area containing graphic files in a BGL format, memorized in sequence data sets. These files are made by a graphic BGL routine.

The access to graphic partition of data bank needs a login to TSO environment in IBM 3090 using softwares produced to manage and display data transferred to workstations.

d. Presentation and handling mode of informations.

There are several options to make an inquiry:

- search of a meteorological message for header type;
- request of headers general directory of available meteorological messages and subsequent seize of one or more of these to display;
- search of last messages available using station code;
- search, using station code, of the chronological summary of METARs and SYNOPs concerning last 24/48 hours;
- search of route informations;
- search of the most recent informations about wind, visibility and thunderstorms on a selected geographic area.

Data presentation in a graphic format, isn't univocal, in fact:

- files managed by SIGAMO software, can be displayed:
  - using an interactive procedure, on an IBM 3192G graphic terminal. The user, helped by a menu driven procedure, builds in real time maps enjoying of mainframe resources.;
  - using a "Transfer File" procedure, on a PC. The user brings garphic files in a PIF format from mainframe to his own workstation. Command procedures and suitable EXE files, manage transferring, displaying and memorizing images;
- BGL files and satellite images display is a two steps sequence:
  - fisrt step: transmition from mainframe to remote PC;
  - second step: interpretation, display and memorization of files.

  Both steps are managed by PRESAGIO software.

e. Strenghts and weaknesses of actual configuration.

The actual system, based on a general purpose mainframe, proved affordable due to the rarity of failures. The most part of these was repared in less than 24 hours.
As far as weaknwsses, we can say:

- the IBM 3090 is working at the limit of its power;
- at this time, computing power is becoming isnsufficient;
- the number of communication links, manageable by our system, is poor in rapport with the number of users;
- there's a difficult management due to the use of different operational systems;
- software developed in CICS environment and developed in TSO environment shows a format incompatibility;

- the mainframe architecture offers limited autonomous computing power of data available in central data bank, to a remote user;
- a direct connection to climatological archive is impossible to a remote user;
- a remote user has to wait for data retrival even more than 10 seconds;
- inquiry procedures are rigid and narrow.

3. FUTURE SITUATION.

a. Function and environment.

A future meteorological remote workstation will enjoy a new informatic philosophy. We will pass from a general purpose mainframe configuration, with a connected PC or terminal, to a client/server configuration where a remote workstation will be a client iserted in a national Wide Area Network to access the computing centre via a BACK END facility to the following areas:

- ON-LINE METEOROLOGICAL DATA BANK;
- CLIMATOLOGICAL ARCHIVE;
- GENERAL SERVICES AREA;

All operational data/products will be avilable in DATA BANK enjoying a dedicated computer. The workstation modem will be linked to BACK END facility in computing centre. This facility will manage all links beetween computing centre and users.
We forecast two kind of major failures that we have to put a stop assuring an operational continuity even though with a downgraded performance:

- the DATA BANK computer is out of work. A workstation will be able to access directly data of the following areas:
  - FRONT END to retrieve meteorological messages;
  - NUMERIC PROCESSING AREA to retrieve analisys and forecast models;
  - METEOROLOGICAL OPERATIONAL AREA to retrieve products issued by National Centre forecasters.

These areas, in routine conditions, give data filling in DATA BANK;

- the back end facility is out of work. The local area network unit, routinely managing Centre computers and local links, will take upon itself all BACK END functions too.

The link beetween computing centre and a remote user will be 19200 bit/sec, at least.
In every functioning condition these will be the scheme of an inquiry procedure:

- a user send a request to computing centre. Firstly the user identity is verified, comparing his ID with all the others stocked in a users data bank. If this identification is positive, his request goes by, else it's stopped;
- then the request will be compared with the list of those allowed for that user. If it's allowed there will be a validation;
- requested data will be retrieved from DATA BANK or CLIMATOLOGICAL ARCHIVE, depending from request kind, and are assembled in a right format for the message in output;
- all the messages in output will be a feedback for archives;
- following a pre-programmed schedule, DATA BANK feed CLIMATOLOGICAL ARCHIVE.

The remote workstation, that is a client of central server, will be a server in a remote Local Area Network devoted to distribute meteorological informations with a 9600 bit/sec. transmittion speed.
The power of these new workstations will assure:

- a LOCAL DATA BANK;
- an AUTOMATIC PRODUCTION of graphic local products and subsequent stocking in LOCAL DATA BANK;
- a 2D and/or 3D DISPLAYING of Centre and local products in less than 1 sec..

b. Hardware configuration.

The hardware configuration of a workstation, leaving aside a mono or multi processor configuration, will let to display locally available data in less than 1 sec..
The mass memory will be adequate to manage 1 Gbyte at least, and it will have a back-up system.
Data display will be assured by:

- a high resolution color video display unit (256 colors at least, 1024x768 pixels) with a 16' monitor;
- a thermal printer for A3 and A4 sheet formats, with possibility of hardcopies. Color managing will be assured for PostScript, Encapsulated PostScript and Bitmap formats.

All the following periferals will be possible to connect to a workstation:

- scanner;
- telefax;
- CD-ROM reader;
- SDUS (Secondary Data Unit Satellite);

- mufax;

This goal will be reached using on the shelf hardware, if possible in use in other Meteorological Services. So we'll have a tested technology with machines that will be available in a short period of time.

c. Basic software.

The new basic software will give a transparent access to archive data, in a fully compatible way with all developed/managed applications of computing centre.
Operating system will be a multitasking and multiuser UNIX like.
Developing and managing programmes will be possible using FORTRAN 77 and FORTRAN 90 ANSI standard, C and C^{++} with libraries of graphic, maths interactive products.
A support for office automation will be provided as far as files management, texts editing, a spreadsheet, a database, graphs handling, e-mail and maximum compression without downgrading data.
As far as graphics, converting format will be possible, using on the shelf product, by editing tools to change shape, type,dimension, font, etc.
the support to data visualization will be based on one or more graphic packages and S-GKS presence will be mandatory.
Telecommunications will be multiprotocol with a high speed access, and particularly there will be X.25, TCP/IP, SNA, Decnet.

d. Applications software.

Applications software will allow meteorologist to access, to handle, to display data by a flexible, modular, expandible and open system.
A system with all these features will allow to design very easily and in a transparent way new applications, also in subsequent steps to upgrade system.

Work environment will be WINDOWS like with icons and/or menus (metaphors) that a user will be able to build or modify. Metaphors will be displayed in a work space where these will be handled both by mouse and by keyboard.
Icons and menus will belong to different classes to manage:

- data retrival;
- data display;
- windows management.

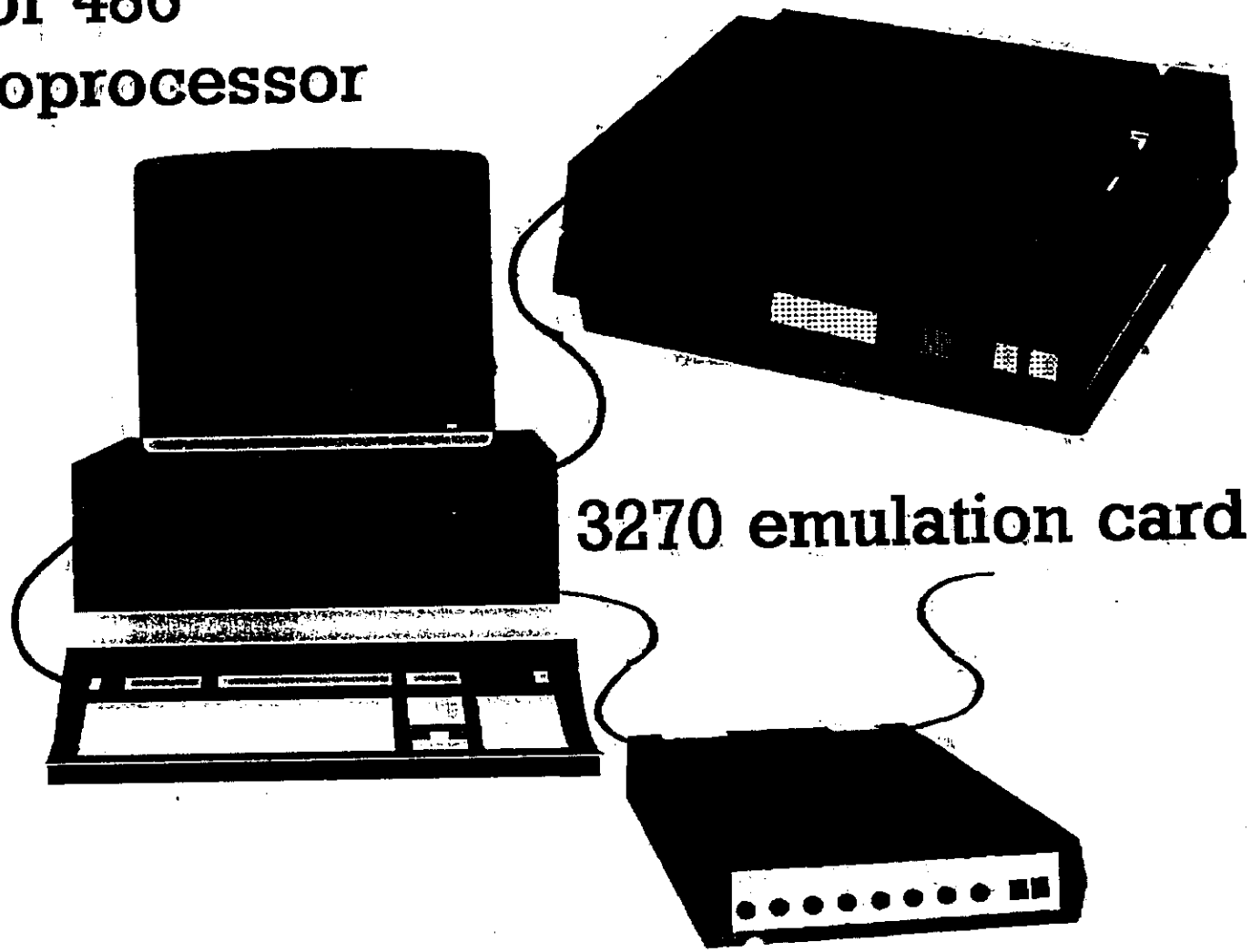
In addition to above-named programming languages, a macro language will be available, with the same power of those.
This macro language will allow a user to handle variables, loops, procedures, real numbers, strings, formats, windows.

ACTUAL WS → FUTURE WS

HW configuration	- function & environment
link fm/to NWC	- HW configuration
access to data bank	- basic SW
presentation & handling	- applications SW
strenghts & weaknesses	

IBM or type IBM PC

386 or 486
microprocessor



3270 emulation card

computing
centre

Windows management will allow a user:

- to choose how many windows to open simultaneously;
- to enlarge a window up to the its maximum available size;
- to use a "panic button" to put windows in order again if he looses control.

One will be able to define dates, sets of meteorological fields, images and observations, to handle by operators and functions, using macro language.
Applying filters on and handling observations, fields and images will be possible too.
All these tools will be put right using either macro or any other available programming language.

An editor, with a set apart window, will make easier macros writing. All so built and/or modified macros will be stored in user or accessible from system libraries, and their executor will translate and perform macros instruction lines.
When one will desire to execute macros with optional specified parameters, without activating any user graphic interface, a batch mode will be possible.

System modularity provide for a set of programmes (modules) able to communicate each other by sending questions and receiving answers.
A CENTRAL MODULE will exclusively manage all these questions and answers and it will record transactions and it will manage question sequences so, none of these will be lost in case of system overflow.
If an activate module doesn't receive any question during a scheduled time slot, it will be automatically disabled and, only when a question will reach it there will be a new activation; so an optimum memory resources exploitation will be allowed.

User interface will be assured by a dedicated module that will manage metaphors and their logical flow of requests and data between modules.

A module, devoted to displaying, will manage fields plotting in windows, aside from their operational format.
This module will be able:

- to handle mathematical and statistic tools to process data from local and/or remote archive;
- to retrieve and plot data from files coming from archives or data borning from mathematical processing, according to data kind and geographic area.
  Changing geografic projection and data format will be possible.

Geographic tools will allow to display or not national or sub-national borders and the availability of several projection type.

Graphic object like fronts and weather symbols will be available for user to post-elaborate displayed data.
Other options, managed by visualization module, will be:

- animation controlling colors and speed;
- overlap and/or comparison of more fields and images inluded radar and satellite products;
- passing from 2D to 3D and vice versa with a chance to zoom on spatial details and cut objects according to selected plans and views, selecting point or an area on the screen using mouse and/or keyboard.

All work files defining metaphors will be stored in an ad hoc temporary directory. Disconnecting system will remove all temporary files.
All files defining icons will be organized in sub-directories according to homogeneity criteria.
A dedicated module will manage memory space occupied by these files and it will verify correlations between metaphors.

3. CONCLUSIONS.

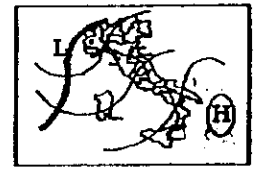
The new system, based on client/server architecture, will give the remote user wide autonomous processing power and a huge local memory capability.
The new configuration will allow a decreasing of computing centre personnel devoted to develop applications software, because remote users will be able to develop their own sized products.

DATA BANK

ALPHANUMERIC

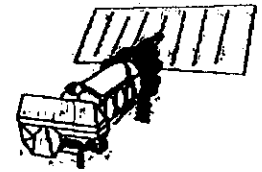
28 files
VSAM architecture
CICS environment

GRAPHIC



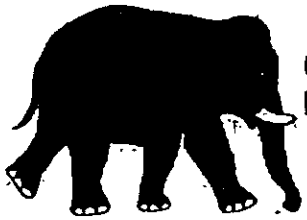
.PIF format
MVS partition
TSO

SIGAMO
APL language
GDDM routines



binary format
MVS data set

BGL format
sequence data sets



STRENGHT

AFFORDABILITY

WEAKNESS

LIMIT OF:
- resources;
- computing power;
- communication links;

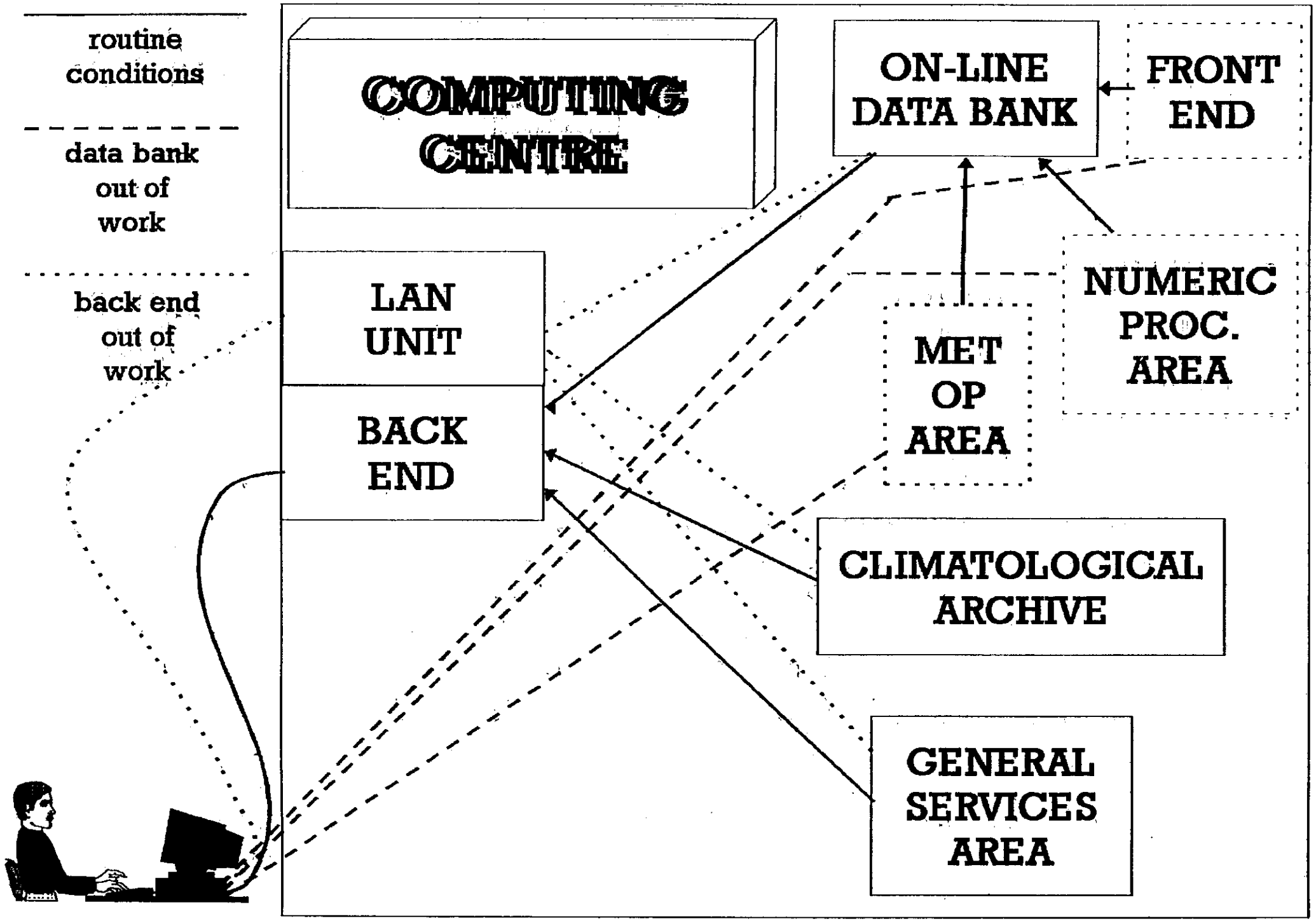
DIFFERENT OP. SIST.

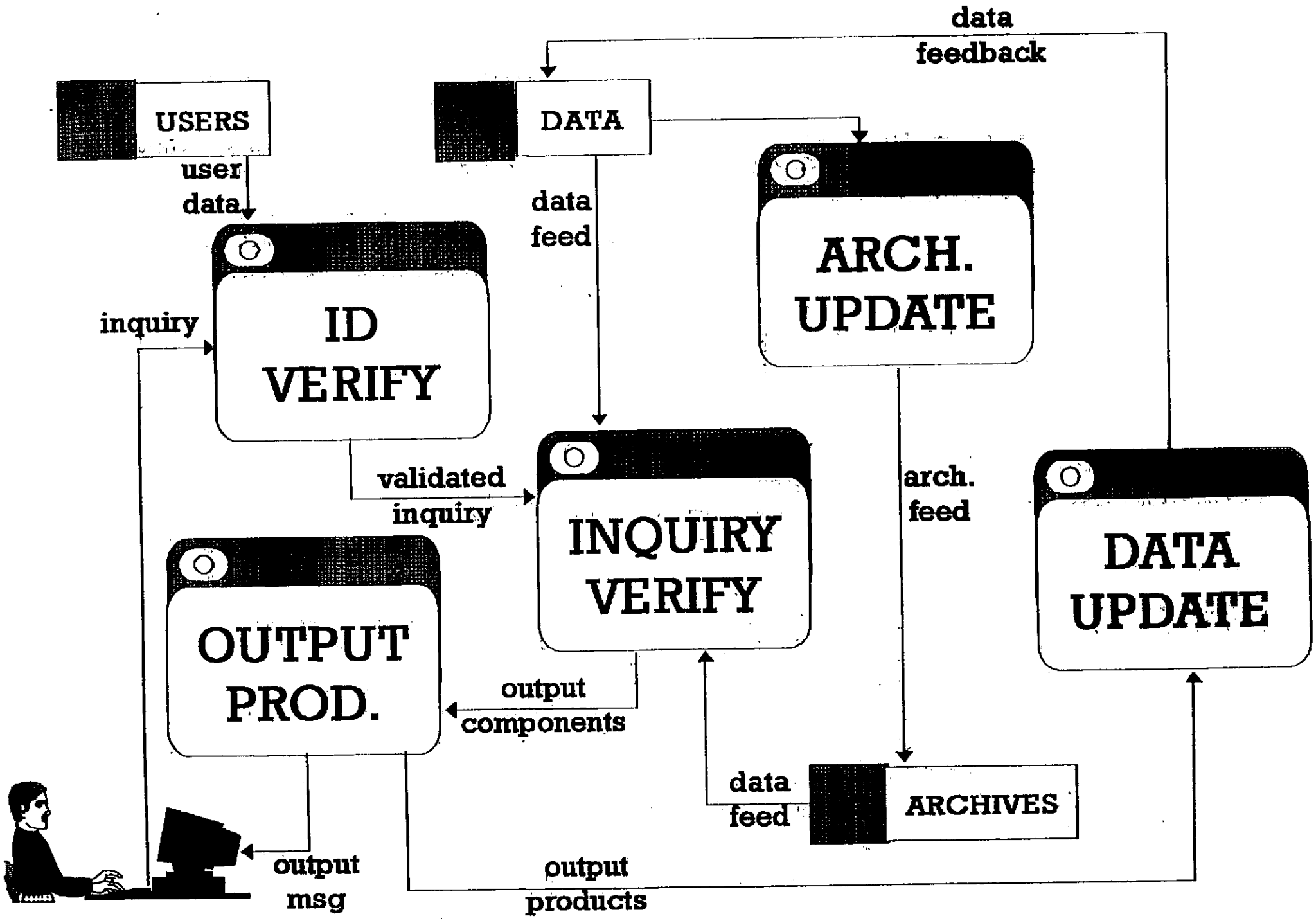
FORMAT INCOMPATIBILITY

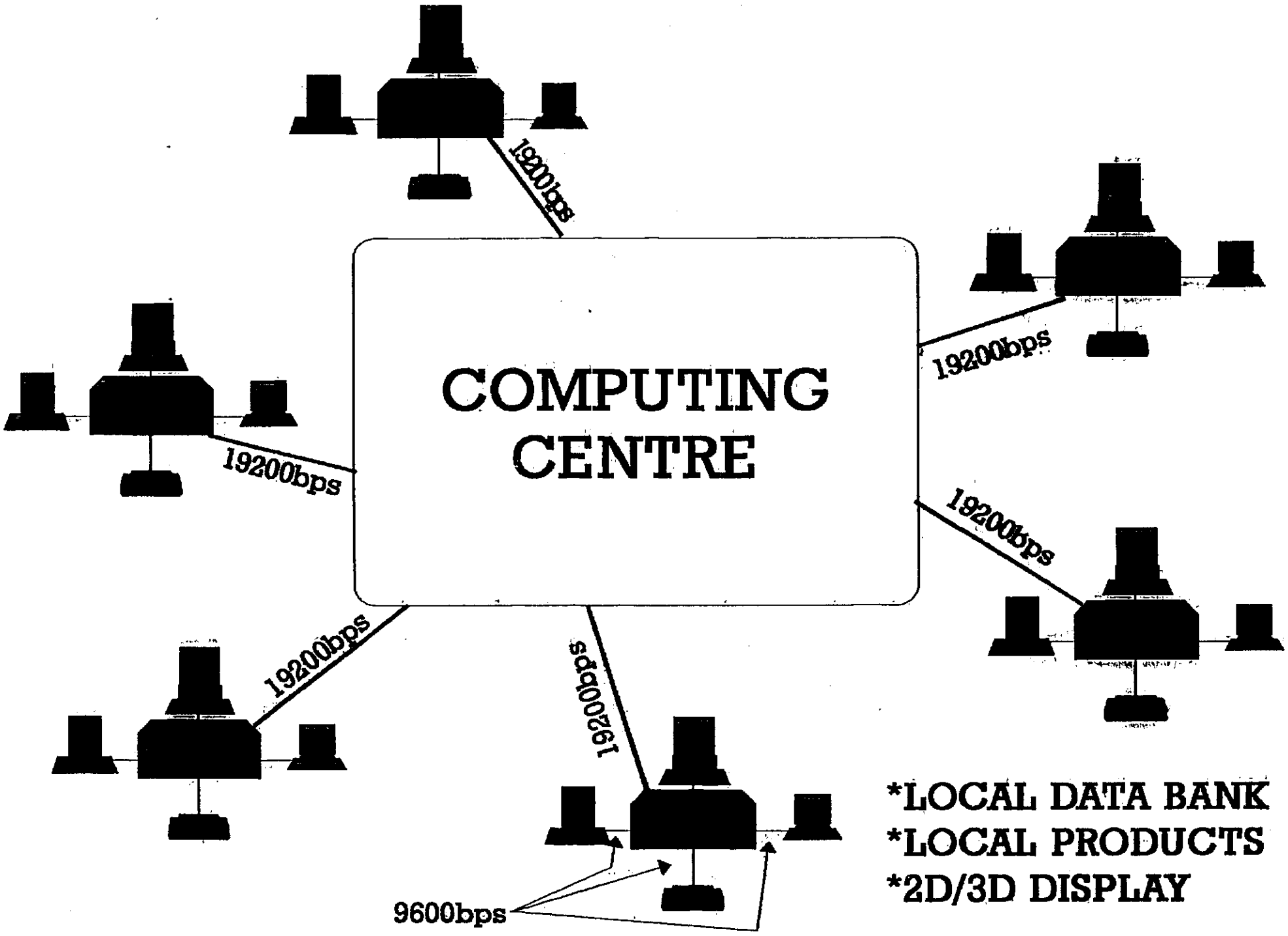
REMOTE LIMITED
COMPUTING POWER

NO REMOTE CONNECTION
TO CLIMAT. ARCHIVE

INQUIRY:
- long waitings;
- rigid procedures;


routine conditions
data bank out of work
back end out of work
COMPUTING CENTRE
ON-LINE DATA BANK
FRONT END
LAN UNIT
BACK END
MET OP AREA
NUMERIC PROC. AREA
CLIMATOLOGICAL ARCHIVE
GENERAL SERVICES AREA


data
feedback
USERS
DATA
user
data
data
feed
ARCH.
UPDATE
inquiry
ID
VERIFY
validated
inquiry
INQUIRY
VERIFY
arch.
feed
DATA
UPDATE
OUTPUT
PROD.
output
components
data
feed
ARCHIVES
output
msg
output
products


19200bps
19200bps
19200bps
19200bps
19200bps
19200bps
9600bps
COMPUTING CENTRE
*LOCAL DATA BANK
*LOCAL PRODUCTS
*2D/3D DISPLAY

HARDWARE CONFIGURATION

*MONO/MULTI PROCESSOR
*DISPLAY TIME <1sec.
*MASS MEMORY 1Gbyte MIN.
*BACK UP FACILITY

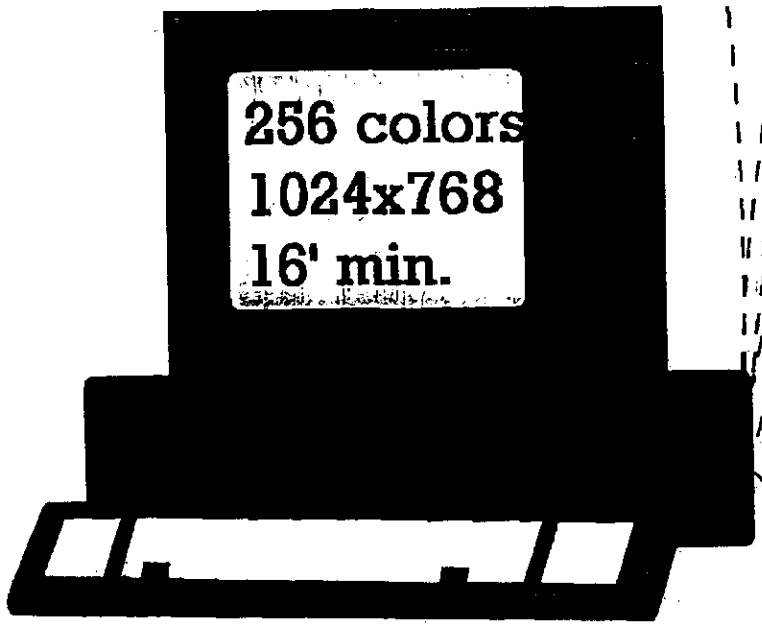
SCANNER

TELEFAX

CD-ROM

SDUS

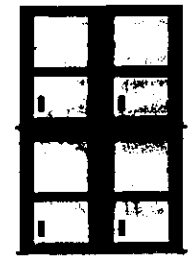
MUFAX



*THERMAL
*A3 & A4 SHEET FORMATS
*HARDCOPIES
*POSTSCRIPT, EPS, BMP

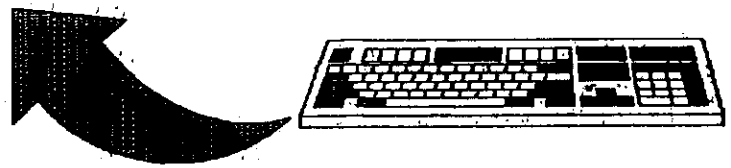
APPLICATIONS SOFTWARE

WINDOWS ENVIRONMENT



ICONS
MENUS =METAPHORS

-data retrival
-data display
-windows management



MACRO LANGUAGE & EDITOR

BASIC SOFTWARE

FORTRAN 77
FORTRAN 90
C
C++

+

LIBRARIES

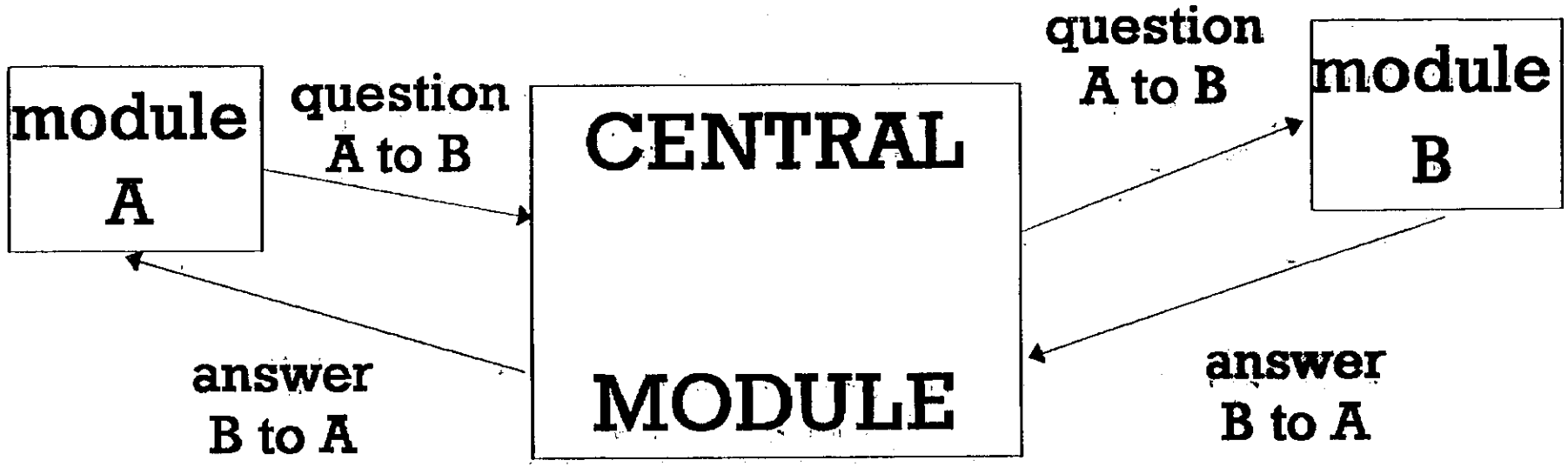
GRAPHIC
MATH
INTERACTIVE PRODUCTS

OFFICE AUTOMATION

GRAPHIC PACKAGES (mandatory S-GKS)

TLC
MULTIPROTOCOL

MODULARITY



MANAGEMENT sequences of transactions

RECORDING

DISACTIVATION/ACTIVATION modules

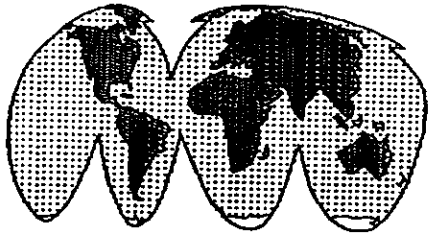
MODULARITY

USER INTERFACE MODULE

HANDLING OF MATH AND STATISTIC TOOLS

RETRIEVING AND PLOTTING DATA

GEOGRAPHIC TOOLS



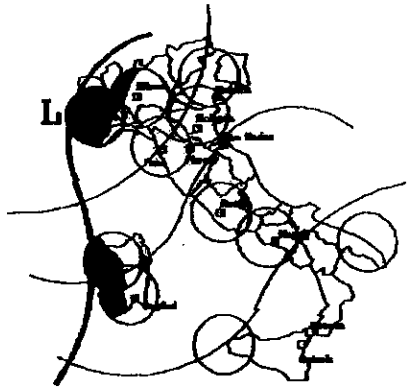
MODULARITY

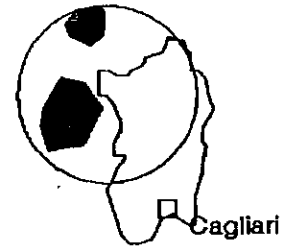
ANIMATION

VISUALIZATION

MODULE

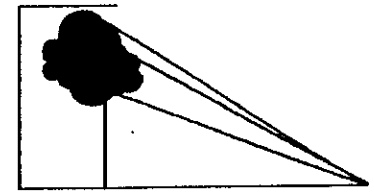
IMAGES OVERLAP





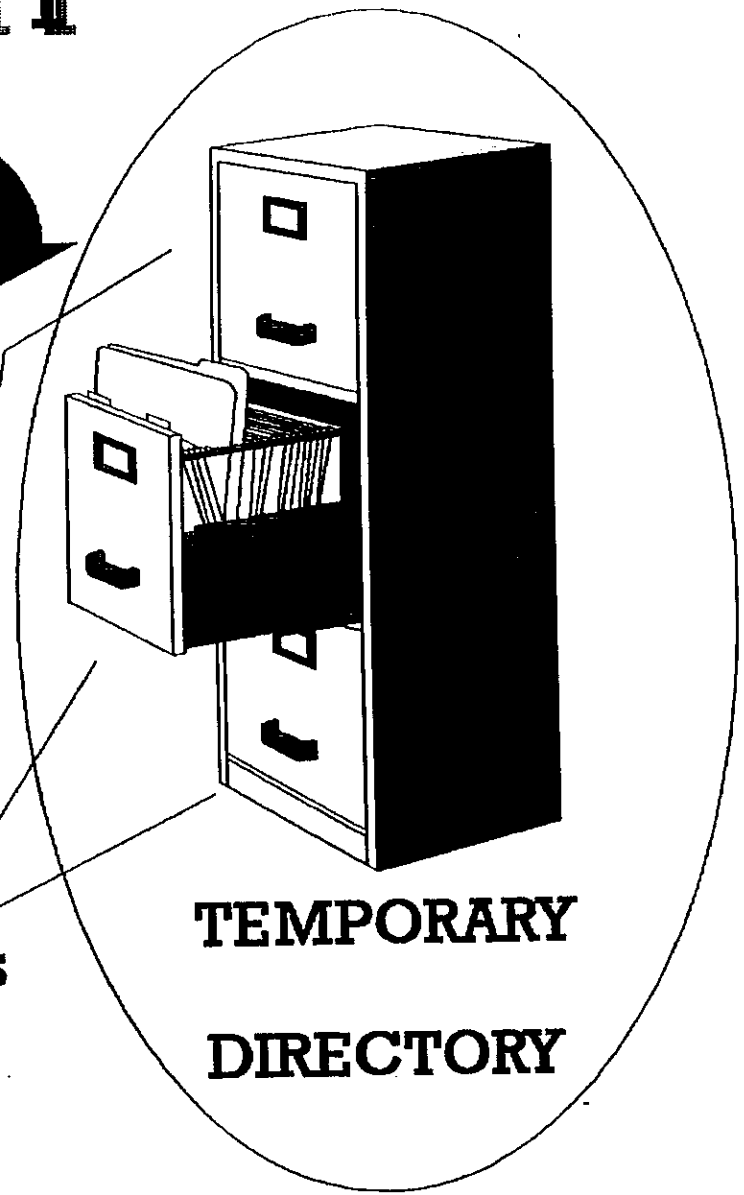
2D to 3D

and vice versa



MODULARITY

FILES
DEFINING
METAPHORS



TEMPORARY

DIRECTORY

SUB-DIRECTORIES

DEDICATED

MODULE

*SPACE MANAGEMENT
*CORRELATIONS VERIFICATION

CONCLUSIONS

END USER

+ processing power
+ memory capability

CLIENT/SERVER ARCHITECTURE

- personnel

COMPUTING CENTRE

EGOWS 6
Vienna , 19-22 June 1995

Session : General Developement

Jacob B R O C K

Graphical applications development

at the Danish Meteorological Institute

A report prepared for the sixth EGOWS meeting

Jacob Brock

As usual there has been a lot of things to look into for the development group in the past year. There is the never-ending story of migrating to the next release of the operating system, there has been a big chapter in the - hopefully soon - ending story of migrating from Open Windows to Motif, project administration has had to be taken more seriously with the growing number of people in the group, and there has been the usual bug-fixing and improvements to existing programs. But a certain amount of time has been available for new projects.

The development group

The graphics applications development group by now has 12 members, a little more than last year. But being that number of people means that management has had to be formalized in some areas. The "good old days" of 4-5 people with everyone having a fairly good idea of what the others were doing are gone.

We were - and partially still are - faced with at least three problems:

1. Group management. How do we schedule and assign priorities to all the projects across the members of the group? How do we keep track of milestones and deadlines?
2. Project management. Setting up a framework and timetable for non-trivial projects.
3. Status reporting. How do we keep the management informed about the state of affairs in such a way that they can act accordingly?

Group management seems to be the hardest part. Some tools have been tested, the latest being Microsoft Project. Generally they work all right in what we term static planning; a number of welldefined projects with given resources and/or deadlines. But static planning only accounts for about half of what we are doing. The other half is what we term dynamic planning; New projects with tight deadlines popping in the door in the appearance of a manager, starting off something like "How soon can you ...". Such projects are the death to the planning tools we have tested so far. But they are an inevitable (and challenging) part of life if you want to keep up with the ever moving marketplace.

In a common effort, the members of the group have come up with a framework for project management. This framework contains a number of steps from an informal project description through full functionality specification, program design, implementation, testing, documentation and release to feedback from operational users. The aim of project management is of course to do it as right as possible the first time around and getting realistic estimates for deadlines as early as possible.

Status reporting is essential in the lack of an efficient planning and reporting tool. But it can be a very time consuming task. We are still testing different ways to do it.

As for the future, the development group will be introduced to object oriented programming. An educational session on C++ programming is being scheduled for this fall. We do not see C++ as the only programming language from then on, but it has definitely got a number of advantages compared to C, and it is expected to be the choice for graphical user interfaces in new projects.

Porting to Motif continued

All new development is of course done in Motif. But as Motif and OpenLook applications

coexist relatively well, we are not in any hurry to port existing OpenLook applications. We still hope it can be done along with normal revision of the programs. Usually a major revision results in a redesign anyway.

For interface building, we continue to use XDesigner and are pleased with it. By now we have 3 licenses, which seems to be sufficient. We were pleased to hear that SUN is going to use XDesigner as their choice of GUI builder for Motif.

Automatic sea area forecasts

The sea area forecast system has an automatic part, which based solely on NWP products produces a first guess for the sea area forecasts on a digital format. These forecasts contain information on wind speed and direction only. They are then modified by the forecaster, using a graphical user interface. The forecaster can change the wind information by modifying wind symbols on the screen and add information on weather conditions and visibility by choosing from a number of predefined phrases. The result of the modification is still on a digital format.

The sea area forecast system has by now been operational for nearly a year. So far, the output has mainly been used for telephone forecasts, where you dial a forecast for a given area, and the forecast is then automatically phrased from the digital format codes produced by the system. So far the forecasts can be phrased in Danish, German, English and Faeroese.

The forecaster feedback on the system has been mixed. Some like it, some "have learned to live with it", and a few definitely do not like it. The complaints have been that the system is too detailed on wind direction in weak wind conditions, and that weather condition and visibility information have been too coarse in the forecasts when the system has put it down in writing. An evaluation of the experiences is taking place involving representatives from management, the forecasters and the development group.

Forecasts for print and broadcast have so far been written manually, but a number of modifications, proposed by the evaluation group, are being done to enable the system to produce all written forecasts. These modifications will include phrases for icing as well as more phrases for weather conditions and visibility. The phrases can still only be selected from a number of predefined phrases, and there will be no first guess made by the system. The goal is to make all 24 hour forecasts digital, and have the system put them in writing.

A bit on verification: For gale warnings, the automatic system does not detect a satisfactory part of the gales yet. In this case the meteorologist can add value to the product. As goes for individual values of wind speed and direction, the automatic system is slightly better.

Project Digital Chart of the World

As it was demonstrated last year in Copenhagen by the Department of Defense Geophysics from Germany, the Digital Chart of the World (DCW), produced by the United States Defense Mapping Agency, contains very detailed maps of the entire world. The maps are far better than the versions of the CIA-map, used by for instance NCAR-graphics and Magics, but the amount of data is huge, and there is no software for extracting selected areas and features for use in workstation applications.

But as we continue to create more and more detailed NWPs, and as we sell forecasts for very localized areas, there is a growing need for high resolution maps, partly for use on screen but particularly for printing. The introduction of high resolution colour printers at comprehensible pricing is putting emphasis on this need.

The development group has initiated a project, which will come up with a program for map generation. The specifications for the program is nearly completed, and the project has been approved for implementation already. The program is an interactive interface to the DCW database. The area of interest is selected and drawn onto the screen. Map features, projection

and resolution can be selected and will be visualized. The first version of the application will include the features Political/Ocean boundaries (country/state borders, land/water/ice borders), Drainage (rivers and lakes) and Hypsography (land elevation). These features will be available as vectors (contour plot) and polygons (filled area plot).

Once you are satisfied with the map, it can be saved in a file in one of several formats. These formats include PostScript, a binary format for use in X, and an ASCII based format. The maps generated in this way are intended to be used in all of our applications and products. Vector maps of the Political/Ocean features, generated by a test version of the program, has already been included in a couple of applications.

Project TAF

The production of TAFs (Aerodrome Forecasts) as it is traditionally done by now, requires a lot of manpower. Hence it is a prime target for staff cuts if the job can be done in any other way.

As a part of longrange planning, a number of projects regarding TAFs have been initiated. One is TAF monitoring. The program has been implemented and is running in test at the moment. Most of the Danish TAFs are sent to the monitoring program, which compares the contents with current observations (METARs/SPECIs). The monitor is an interactive application. Airfields being monitored, are shown as green dots on a map as long as everything is OK. If any discrepancy is detected, the dot turns red and a warning is displayed. By clicking on the red dot a window will pop up and display the issued TAF and the METAR/SPECI which caused the warning. It is the decision of the meteorologist whether he wants to issue an amendment or not. The monitor can only compare TAFs and METARs according to a set of rules and has no means to check the validity of the contents of incoming METARs.

The nordic countries have a working group on TAF automatisation, called NORTAF. This group has set up a number of recommendations, and each country is doing it's own TAF automation project. At the DMI this project is at a very preliminary stage.

NORTAF has a subgroup which has recently come up with a standard for verifying TAFs. The verification procedure is based on work by Neil Gordon of New Zealand, and will give statistics on the quality of the TAFs issued. This project is in the phase of functionality specification.

Project DIATEL

A new PC based information service, called Diatel, has been introduced in Denmark this spring. If you have a PC with Windows and a modem, you can buy a program, called Diatel Assistant, with which you can connect to one of several Diatel servers. The server gives you access to a certain amount of information for free. The rest is based on a pay-as-you-choose concept, in which case you also have to obtain a username and password, giving your name and address to Diatel for billing purposes.

The Diatel servers act only as access controllers, accountants and information mediators. The actual information is accessed directly at the suppliers' information servers.

Information is obtainable in two ways. The first is On-line, where you keep an online connection to the Diatel server, click away in the menus and get (almost exclusively) text pages displayed on your screen. The DMI supplies a number of written forecasts in this way. Another feature of the online service is that you can download special (PC) programs from the information suppliers to your PC. The development group has developed Windows programs for the display of composite radar and reprojected MeteoSat images, which can be downloaded to your PC.

The other way to obtain data is by downloading. With the information suppliers program,

you make up an order for a certain amount of information. The order is sent to the information supplier by the Diatel Assistant, which in turn downloads the requested information to your PC. Then you may close your connection and have a look at the downloaded information.The DMI sells composite radar images and reprojected MeteoSat images in this way.

Magics to be used for plotting NWPs

The presentation of NWPs is based completely on precomputed PostScript files. Once our model has passed a requested time step or we have received data from, say the ECMWF, post-processing of the GRIB data is initiated. This postprocessing produces a number of PostScript plots for preselected areas, time steps and parameters. The processing is done by NCAR Graphics software, which in turn uses a standard GKS to produce the PostScript.

Until this spring, we produced ready-to-display/print files centrally and distributed them to the operational workstations. By now, we are moving into a concept where fields are plotted in separate files without any "decorations" like legends, text and land contours. These field plots, which are incomplete PostScript files, are distributed and combined into proper plots at the local workstation. This approach has taken away nearly one third of the network load regarding NWPs.

But we are not quite happy with the version of NCAR that we are running, which is rather old. We have tried to install a new version, but ran into serious problems. Not because of NCAR as such, but it turned out that in order to get the functionality we wanted, changes had been made to the source code of the old NCAR graphics software. The search for these changes ended up in a binary executable file - and no source file!

Instead we have decided to try out Magics. 1) because it is developed and maintained "within the family", so we expect it to be around for quite some time, and 2) it is possible to put MetView on top of it once workstation and network power allows online calculations. Then it can be used for the production of non-standard plots during special weather conditions.

Work is being done on implementing Magics, based on the S-GKS by Xelion as used by the ECMWF, on an SGI Challenger. Magics and S-GKS have been installed and compiled, but for some yet unknown reason, the main product right at the moment is mainly core dumps.

We intend to stick to the concept described above, in which we generate PostScript plots of separate fields centrally and distribute them. At the workstations, they can be combined as you please, and at a later stage, it might be possible to request non-standard fields. The request will be sent to the central site, the field produced and returned for display.

Self-briefing at Copenhagen Airport

Few years ago the pilot briefing at Copenhagen Airport had 75.000 customers a year. But a redesign of the airport has moved the meteorologists away from the Scandinavian Airlines Systems crewlounge, and pilots are not given as much time for preparing a flight as earlier so the number of customers has dropped to less than one third. Also, the Weather service in general has been told to cut staff, and as one of the effects, it is impossible to continue a special briefer duty for briefing pilots at the airport. The night and afternoon duties have already been removed, and the morning duty will go later this year.

A PC is replacing the briefer. The PC is just a terminal into our workstation system. The pilot can type in his destination, and a list of selected TAFs and METARs for airports and alternate airports as well as a table of the wind conditions along the route will be printed on an attached printer. Copies of significant weather charts and other meteorological information can be picked from a supply "off the shelf".

Although the special briefer duty is being removed, pilots can still get a person-to-person briefing around the clock if he wants to by the duty meteorologist.

Other projects

The lightning detection program has been developed further and is being sold to companies distributing electricity. They use it for tracking thunderstorms and closing down power supply lines which are prone to lightning strikes before they are hit. This project has meant a good deal of extra work and a number of headaches as the power supply companies are using a DIGITAL platform.

Ship routing applications are being refurbished. Partly because we have had to implement a local database (based on Ingres) containing the necessary information. Previously we depended on a connection to Ingres in the Database Department, but their equipment is guaranteed operational during normal working hours only, which is not enough for our needs. Another reason for the revision is to get better optimization for the routes proposed by the applications.

Applications for detecting fog and classifying clouds on satellite images are being implemented and tested. Both applications are based on NOAA images. Fog detection is done using channel 3 and 4 in a method used by the UK Met office, amongst others. It is a rather simple method, but it can only be used with night images. The cloud classification is based on a method by Karlsson and Liljas from the SMHI of Sweden. It is a box classification scheme using all three og five available channels from the satellite. In the daytime, a 7-dimensional space is used (derivatives of the channels) for classification and at nighttime a 4-dimensional space. Some problems occur around sunrise and sunset. The method is mainly based on channel 4, and will classify clouds into three major altitude levels (like HIRLAM does), subdividing each major level into a few categories. For the high altitude level, a probability of precipitation is assigned to each sublevel.

Our presentation programs for observations and NWPs have been exported to Iceland and are being used operationally by the Icelandic Meteorological Institute.

There has been a number of small projects involving the production of different kinds of specialised weather predictions for private companies. These products are produced automatically and sent at regular intervals. The products include temperature predictions for suppliers of natural gas, wind predictions for construction companies and power suppliers (windmills) and wave predictions for domestic waters for seacarriers.

Just starting is a project on getting a clean interface to GRIB data for the entire Institute. At the moment you have to have good knowledge of the file system structure, naming conventions of files and numbering of fields to get anything. The intention of the project (which mainly runs outside the development group) is to hide the grim details behind a consistent and uniform interface: You ask for the data you want and leave it to the interface to locate and internally name it. Our contribution to the project is a pure C interface, including de- and encoding of GRIB fields.

A project for extrapolating radar images has been launched. In the first version the advection of the extrapolation will be based on 700 hPa winds as predicted by our HIRLAM model. Also we will try to interface the extrapolation with model data from HIRLAM to fill in missing data in upwind areas. Prototyping will show what can be done and how it is to be done.

Hardware

The operational workstation platform for the presentation of all graphics products for the meteorologists is still purely SUN. Nearly the complete product line of lowend SUNs can be found among the operational machines, though we are starting to upgrade the oldest machines.

The latest inventory of SUNs in use at the Weather Service counted 63 machines:

	SLC	IPC	IPX	SS2	Classic	LX	SS5	10/20	10/30	10/41	Total
Operational		11	7	4	10	5	2	1	4	1	45
Development	1	4	4		8					1	18

All (except the SLC which is monochrome) are 8 bit machines, most of them in colour.

A general upgrading/replacement of particularly the lowest end of the operational presentation machines is scheduled to start off at the beginning of next year.

As we see it at the moment, the workstation of our choice will have 24 bit colour and a minimum of 64 Mbyte RAM and 500 Mb system disk. 24 bit true colour as we have a number of different applications, each using at least 128 colours, and the set of colours usually being disjoint with the choice made by other applications. 500 Mbyte disk because animation can munch up any amount of RAM and swap.

Apart from the workstations, we have a number of printers. All printer output is based on PostScript. There is a dozen or so penplotters for plotting observations. For the replacement of the pen plotters, we are testing an A0 colour printer. It is an HP Design Jet, based on inkjet technology, and we are quite pleased with it. Although the printer is expensive, materials for it are priced reasonably, and the price per unit printed is much lower than many of the previous colour printers we have seen.

The A0 printer has gone into operations, printing Temps and synops, and once the Digital Chart of the World project is ready, we expect to be able to print our own maps instead of using preprinted (and expensive!) charts as we do today on the pen plotters.

This fall, we are planning to test a Pentium based PC for running our presentation applications. The gap between highend PCs and lowend workstations is narrowing if it is still there at all. And there is no doubt that in order to target the general public, it is necessary to make information available through PCs. Previous attempts to sell our products have often been stopped by the reluctance of companies, which were not familiar to workstations, to have to invest in a thing like that, just to be able to access our information. In the test, we will be running the PC with SVGA graphics and Solaris 2.4.

Software

Programming languages: C, Fortran77, csh, sh, C++.

In programming we mainly use C, and exclusively in building graphics applications. C++ is being "tested"; a few members of the development group know C++ and use it a little, but for support reasons, there will be no general go-ahead for C++ until everyone has been introduced to it later this year. Almost all access to model output (that is, GRIB) is done through a Fortran-based set of libraries. Plotting of NWP is done using a Fortran program, and a few other programs are Fortran-based as well.

Development tools: XDesigner (by IXI) for building Motif based graphical user interfaces, and Purify (by Pure Software) for tracking down memory leaks. Lint and rigorous compiler options are used to make our code as clean as possible.

Standard software: GKS, olwm, mwm. GKS for plotting NWPs. At the moment, we only use the GKS for producing PostScript. OpenLook window manager (olwm) is used on operational workstations. Motif window manager (mwm) used by some developers, and is being tested for operational use.

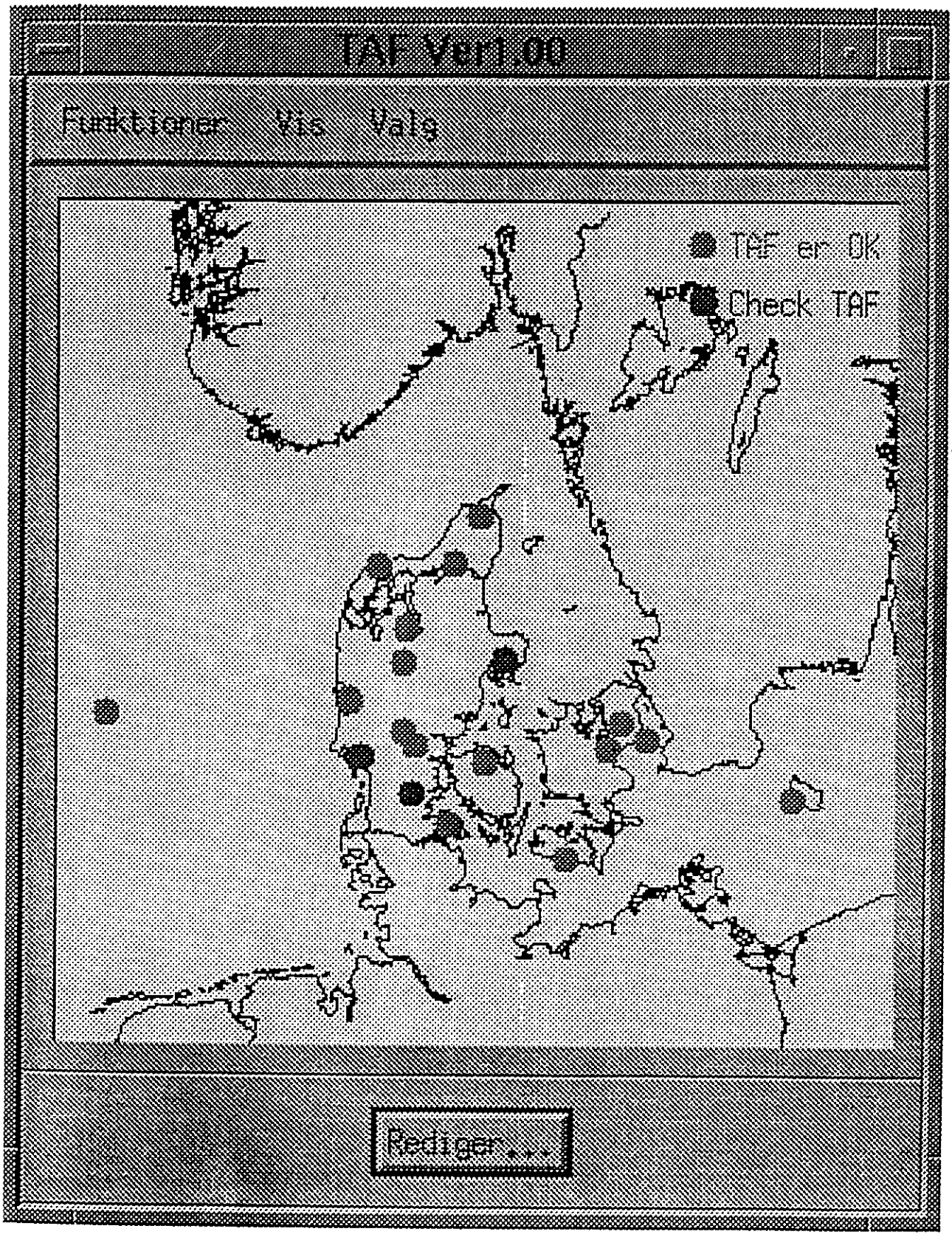
Experiences on Solaris

The majority of the operational workstations have been installed with Solaris 2.3. In this version of the OS, Display PostScript is available, which we welcomed as GhostScript, used so far, was very hard to control as goes for colour. Generally our experiences with Solaris 2.3 are good, as long as you do not use the S5 protocol for exchanging print information between machines. And we still find it incredible that you have to patch the OS as much as is the case.

Solaris 2.4 is running on a few of our machines. As you may recall, we use the print spool system to distribute data to the operational workstations. But is has turned out that if we use a Solaris 2.4 host for redistribution (that is, receiving data on one printqueue and retransmitting it to other hosts on one or more different queues), we get into trouble if more than a few files are distributed per day. The symptom is that the redistributor becomes irreversibly slower and finally becomes unreachable from the net and very slow to access from the console. With our normal use, which means processing appr. 5000 incoming files per day, the machine becomes inoperational within 24 to 36 hours. Rebooting will clear away the problems.

So far, we have not had the time to investigate properly on what is happening, but we can't find any obvious cause like a daemon growing in size or a process munching away CPU time. Eventually, we might just wait for Solaris 2.5, announced for this fall, and hope that SMCC has decided on which spool system to go for in the future.

As goes for ordinary printing on Solaris 2.4, we have not experienced any problems related to the SunOS.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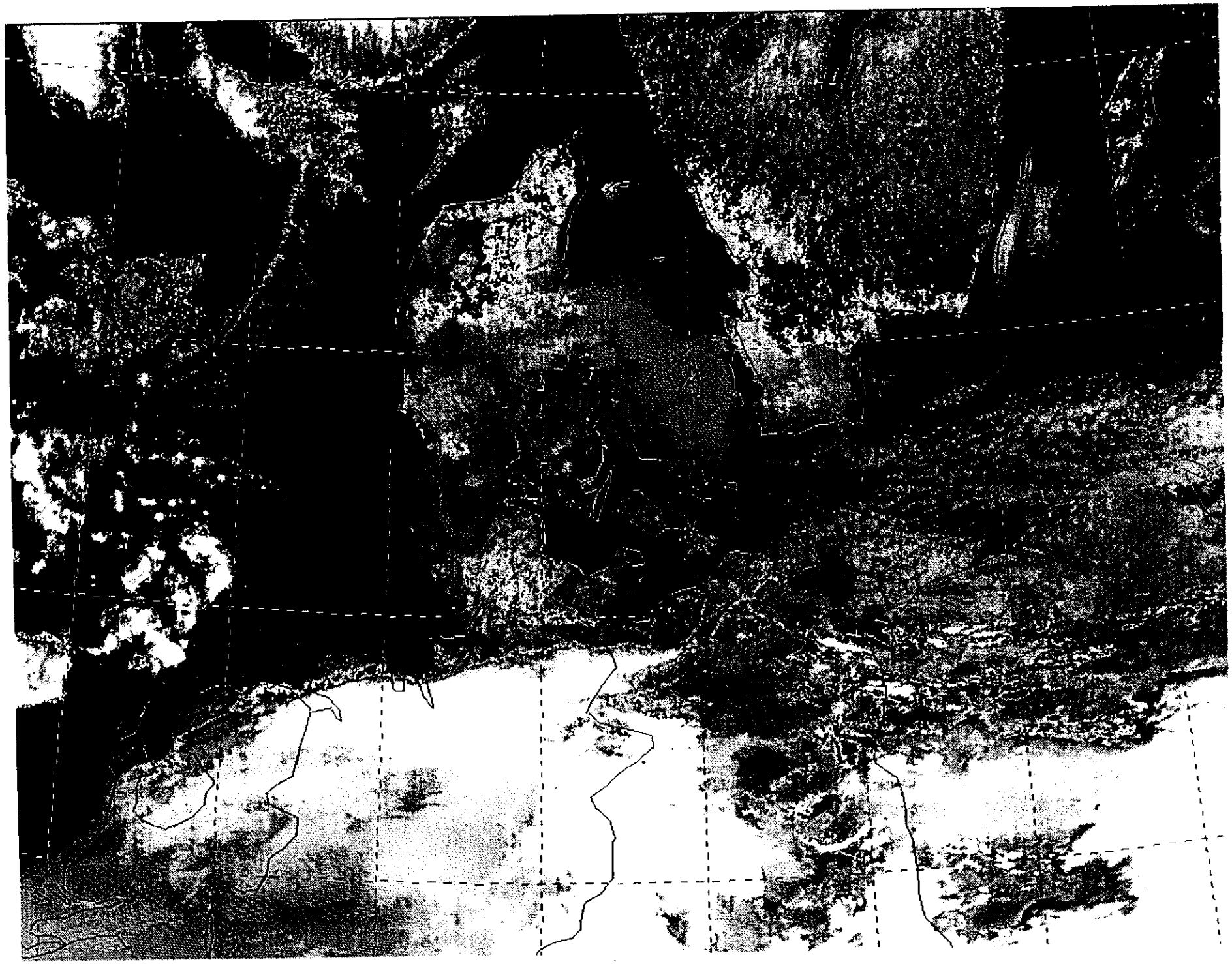

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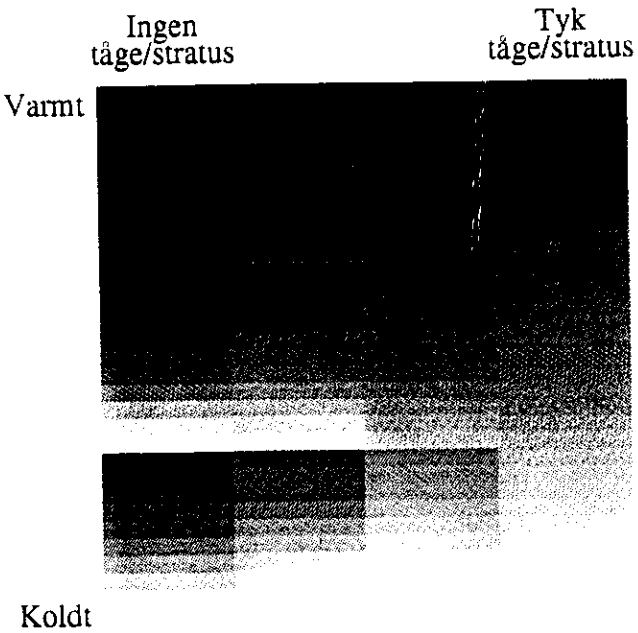

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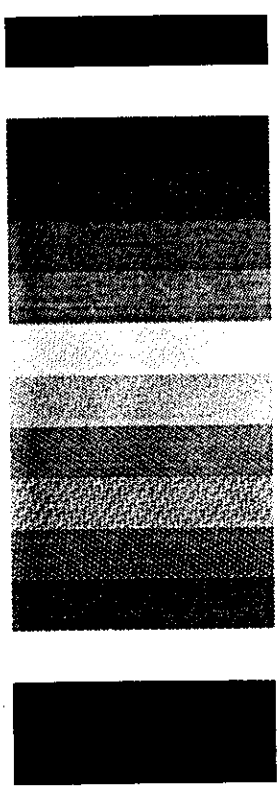

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Mellemhøje skyer - højest
Mellemhøje skyer - lavere
Mellemhøje skyer - lavest
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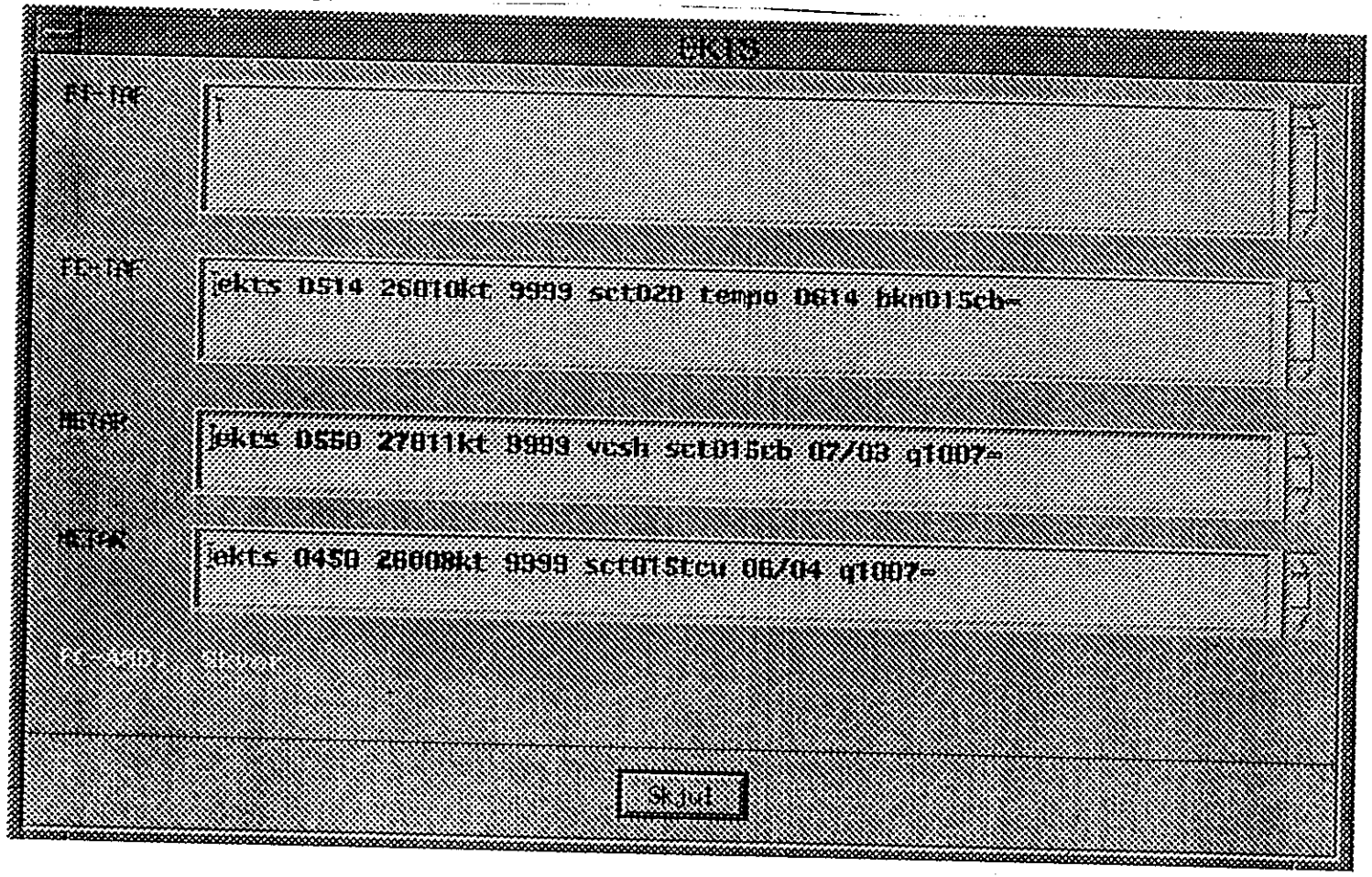
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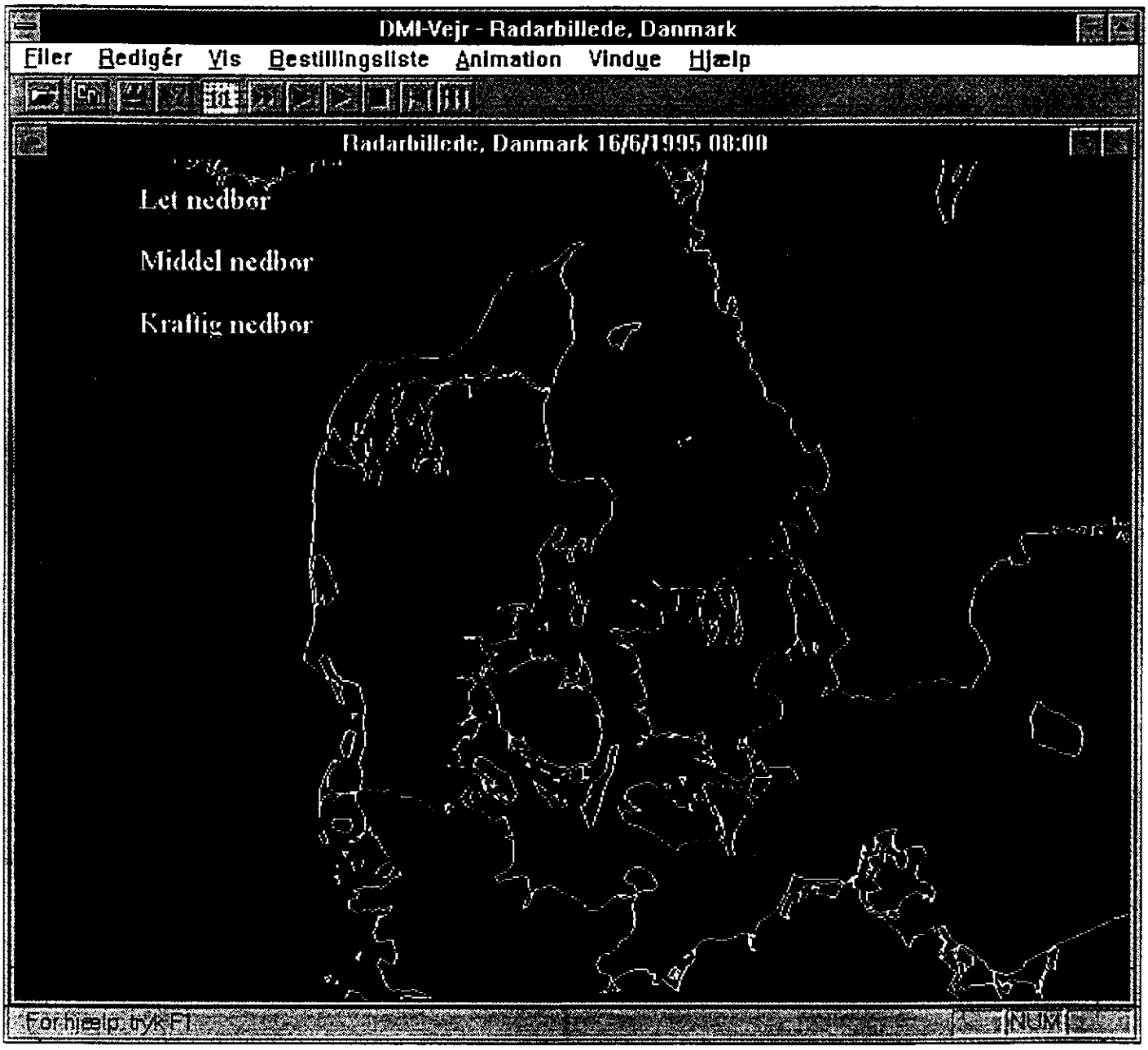
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EGOWS 6
Vienna , 19-22 June 1995

Session : General Developement

James H A M I L T O N

Irish Meteorological Service: Report to EGOWS-6 [1995] Meeting

(J.Hamilton, Meteorological Service, Glasnevin Hill, Dublin 9, Ireland)

Introduction

This is my third EGOWS meeting. In previous years I have given a fairly detailed account of the software and hardware configuration at the Irish Meteorological Service [Hamilton, 1993 and Hamilton, 1994]. Consequently, in this report, I will just summarise this data and concentrate on new developments and plans for the future.

Overview of the Hardware

We have quite a mix of hardware but at present we are moving more and more towards unix platforms. We have a number of dedicated servers and the current configuration consists of :

--A VAX cluster consisting of a MicroVax 3100 and two VAX 4200 used for telecommunications

--A MIPS RS-4000 Millenium used for decoding observations and NWP products and for the graphical display of such products. [An older, and less powerful, MIPS RS-3000 Magnum operates in 'stand-by' mode and is used as a backup in the case of a breakdown].

--A DEC-System 5000/200 server and 10 DEC-station 5000/120 workstations running INGRES [a commercial data-base package] used by the Climatological Division.

--Two networked Apple Macintosh computers used for desk-top publishing.

--Various networked PC's [running MS-Windows] used for word-processing etc.

--A VAX-server 3300 and three VAX-station 3100 workstations used for displaying the output of the Ericsson doppler radar at Dublin Airport.

--A Silicon Graphics Challenge-L server [with two 150Mhz processors] which is used for running the HirLam NWP model. The HirLam model has been running daily since January 1994 [in test mode] and the system became operational in Nov 1994.

--Six Silicon Graphics Indy R4000 workstations used by the Research,

Computer and Forecasting Division. Their primary use is to display output from numerical models. Four of the Indy workstations were purchased in late 1993 [for use by the Research and Computer Divisions]; the other two were purchased in Sept 1994 [for use by the Forecast Divisions].

The purchase of the two extra SGI workstations, for use by the Forecasting Divisions, is the main hardware change since last year. They were bought, primarily, to display Hirlam output. One has been installed in the main forecasting centre in Dublin [i.e. CAFO or the Central Analysis and Forecasting Office] whilst the second is destined for the CAO [i.e. Central Aviation Office] in Shannon Airport. Shannon Airport is about 200Km from Dublin.

The graphics workstation in CAFO is used to display output from the Hirlam model. However, it can also be used to display data from the ECMWF, UKMO and DWD models. Figure 1 summarises the computer system.

Overview of the Software

There are a number of computer graphics packages in use in the service -- some are commercial systems and some were developed in-house. Generally speaking, the various packages are not well integrated and it is hoped to have a much more integrated system in the future. The following is a summary of the various packages [for further details see Hamilton, 1993 and Hamilton, 1994]:

--We have two digitised radar stations in Ireland located at Dublin and Shannon Airports. Both radars are linked into the COST radar network and various composite plots are available on PC displays in the forecast offices. The Dublin Airport radar was supplied by Ericsson and the system includes VAX-station workstations in the forecast offices with numerous display options. We are currently in the process of replacing the Shannon radar, and, with the trend towards unix, we expect to replace the Ericsson software and hope to move to a software solution which will integrate the Dublin and Shannon radars.

--There are a number of self-contained satellite display systems which use secondary data. We are investigating the option of obtaining a PDUS system, to receive primary data.

--The in-house developed batch graphics systems include a package to display observations and/or NWP products in hardcopy form on pre-printed sheets using on-line Hewlett-Packard Draftmaster plotters. In addition, plots can be produced using Canon laser printers. We are gradually moving to PostScript printers because of their better facilities [such as the ability to shade areas] and because PostScript software is more portable.

--Plots, which will eventually be produced as hardcopy, are stored as random access binary files containing vectors. Each file may contain one or more plots [e.g. a file could contain a number of plots of geopotential at various standard levels]. Packages exist to display such plot-files on any of the available output devices which include the Hewlett-Packard pen-plotters, the Canon laser printers, the Hewlett-Packard PostScript printers, the DEC-REGIS

Irish Meteorological Service

Computer and LAN Configuration

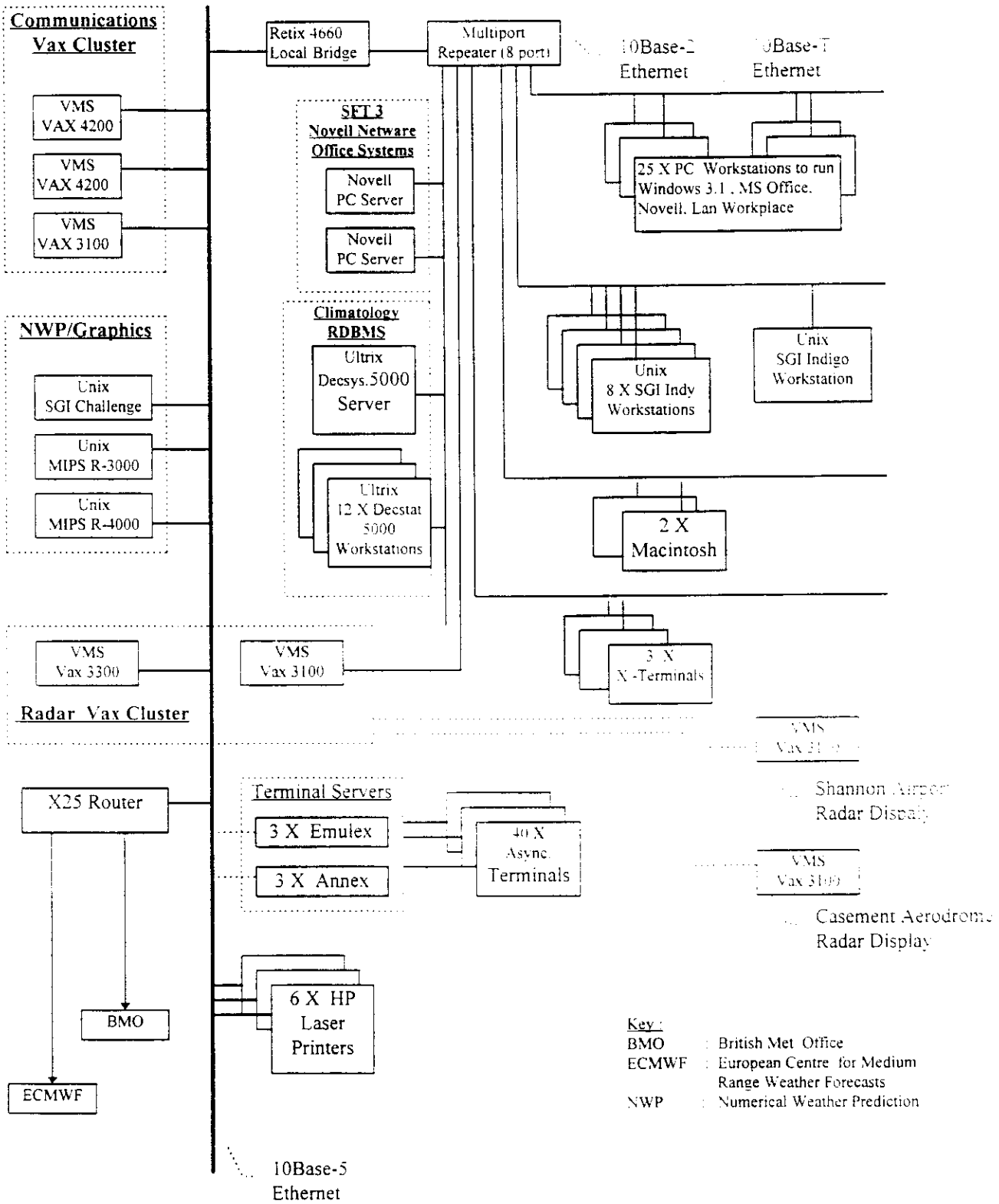


Figure 1: The computer configuration at the Irish Meteorological Service [June-1995].

terminals [VT-340's] and various X-windows workstations.

--Since 1984 the forecasters have had access to an on-line interactive graphics system [called CHARTS] which allows the display of NWP products on a colour graphics terminal [a DEC VT-340]. CHARTS uses a command language which has been designed to be as easy to use as possible. Full details are given in Hamilton [1984].

--The CHARTS command-line program has recently been supplemented by an x-windows system called xcharts. It uses many x-windows features [such as menus, icons etc.] but it still backwards compatible with the old system via a command line interface. In particular, it uses 'obey' files based on the [old] CHARTS command language. Such files allow the forecasters to write their own scripts.

--The climatological section produces a monthly climatological newsletter using an Apple Macintosh and the Quark Xpress desk-top publishing system. Many of the plots, including shaded climatological maps of mean monthly temperature, mean monthly sunshine and total monthly rainfall, are produced using our own graphics packages.

--We have implemented the ECMWF MAGICS package and it is used regularly for special projects. We have two implementations: the first, on a MicroVax, uses our own [minimal] version of GKS; the second, on an SGI workstation, uses Xelion GKS.

The Irish graphics system [including a contouring package, a package for displaying background maps, various packages for plotting observations and the CHARTS program] was originally developed on a DEC-2050. The various components have been ported to the VAX's and the various unix workstations/servers. All the software [with the exception of the X interface] is written in standard Fortran-77. The system has its own drivers for HP-GL [Hewlett Packard Graphics Language], PostScript and X-windows/Motif. The X applications were written directly in C.

Use of X-windows / Motif

A number of applications have been developed using X/Motif. In the present paper, we will discuss three of them. Thus, the following are the main X-windows graphics applications used by the Research and Forecasting sections :

--plotxw: This is a package which can display a plot-file [produced using the 'batch' plotting system] on an X-terminal. The package includes a zoom option and a hardcopy option. It is in daily operational use in the main forecasting office [viz. CAFO].

--xgrbplt: This program is used for plotting NWP GRIB-code output from the HirLam model. This package is mainly used by the Research Division. It includes various options including the ability to plot difference charts and to superimpose observations.

--xcharts: This package is an X-windows/Motif replacement for the

command-driven CHARTS program. It has been designed to retain as much compatibility as possible between the old and the new systems. It is still under development but has been operational since November 1994. It has been designed to display NWP output from a variety of models but it can also display observations.

All these systems are written in a combination of C and Fortran-77. The main routine, which handles the Motif widgets and the various call-backs, is written in C; this then calls various Fortran packages [such as the contouring package]; and finally the Fortran packages call low level C routines [such as XDrawLines and XFillPolygon] to produce the actual output. The C code was written directly rather than using a 4GL tool [such as X-Designer].

We discuss these various packages in the following sections.

plotxw: Display plot-files using X-windows

Plots destined for the Hewlett-Packard plotters [or the various laser printers] are stored as random access binary files containing vectors. Each file may contain one or more plots. plotxw can display such plot-files. The user gives the command:

```
plotxw plotfile.plt
```

where 'plotfile.plt' is the name of such a file. If the file contains just one plot then the plot is displayed and the user is presented with a menu, along the top of the chart, with the following options:

```
File, Bgnd, Zoom, UnZm, Hard, Help
```

The 'File' button calls up a menu which includes the 'quit' option; The 'Bgnd' button allows the user to display the plot on a map corresponding to one of the pre-printed backgrounds used with the Hewlett-Packard plotters; the 'Zoom' button allows the user to select a rectangular zoom area by defining its two opposite corners using the mouse; the 'UnZm' button cancels the zoom and displays the whole chart; the 'Hard' button produces a hardcopy [of the area on the screen, which may be a zoom area]; and finally the 'Help' button produces some help text. The user can cascade zooms but the 'UnZm' option will always return to the entire plot [not the previous zoom level]. When specifying a zoom the cursor appears as cross-hairs. The system preserves the aspect ratio of the plot during the zoom.

If the plot-file contains a number of plots then the menu contains additional entries and looks like this:

```
File, List, Bgnd, Next, Prev, Zoom, UnZm, Hard, Help
```

The 'List' button allows the user to list details of the plot-file entries [including the size of each plot] and then select a plot from the list; The 'Next' button moves to the next entry in the list; the 'Prev' button moves to the previous entry. If the user selects a zoom it remains in place as the user moves back and forth between plots within the plot-file. The program starts with a blank screen -- the user must select the first plot for display.

xgrbplt: Display GRIB-files

This package is used to display GRIB output files form the HirLam model. It is mainly used by the Research Division. A HirLam GRIB file typically contains all the output data for a given time level i.e. it usually has a number of surface fields [such as msl-pressure, rainfall etc.] and a number of multi-level fields [e.g. temperature, geopotential, wind components etc.]. The user runs the package by giving the command:

```
xgrbplt fc9506150024pp
```

where 'fc9506150024pp' is the HirLam 24-hour forecast [from 15-June-1995] after post-processing onto pressure levels. [The system can also plot model level files].

The program starts by reading the GRIB file and determining the grid geometry. Then it draws a polar-stereographic map which just covers the grid. The user is then presented with a menu:

```
File, Optn, List, Prev, Next, Zoom, UnZm, Hard, Help
```

The 'File' menu button includes the 'quit' option; the 'Optn' button [discussed later] is used to select various options; the 'List' option allows the user to select a field for plotting; the 'Next' and 'Prev' buttons move to the next and previous plot in the list, respectively; the 'Zoom' button is used to specify a zoom using the mouse; the 'UnZm' button cancels the zoom; the 'Hard' button produces a hardcopy and the 'Help' button produces some help text.

The 'List' button produces a list of options such as the following:

```
 6 100  200 Geopotential on Isobaric surface
 6 100  300 Geopotential on Isobaric surface
 6 100  500 Geopotential on Isobaric surface
 1 103    0 Pressure on Specified altitude
33 105   10 Wind on Specified height level
11 105    2 Temperature on Specified height level
61 105    0 Total precipitation on Specified height level
62 105 0 Large scale precipitation on Specified height level
63 105 0 Convective precipitation on Specified height level
71 105 0 Total cloud cover on Specified height level
66 105 0 Snow depth on Specified height level
 ...
```

Note that this list is produced automatically by reading the file. The three numbers at the start of each line are the WMO parameter code, the WMO height code and the height value. Hence, the first entry specifies the 200mb geopotential, the fourth entry is the msl pressure etc. The package combines the u- and v- wind components [i.e. parameters 33 and 34] to produce a plot of WMO wind arrows.

The package allows the user to resize the window. When the window is resized the plot is redrawn i.e. re-contoured and a new background map generated. This is to allow for changes in resolution due to the resizing: the labels on the plot remain at constant size in terms of pixels.

The zoom option uses a cursor which follows the latitude/longitude lines i.e. the cursor appears as a circle intersected by a straight line on a polar-stereographic map. Basically, the user specifies two points on the chart, and the zoom area is defined by the range of latitude and longitude defined by the points. A plot area is then calculated which includes the area requested by the user; the plot is realligned with the central meridian of the plot vertical. The package draws a label at the top of the plot produced by the zoom.

The user can plot difference charts with xgrbplt. The command is similar but two GRIB-files must be specified. They must be on the same area but need not contain the same number of fields or have the fields in the same order. The 'List' button will show just the fields common to both files.

The final way of using xgrbplt is to plot observations. An observation file [in a special format used as input to the Norwegian objective analysis system which we are using as part of HirLam] is specified on the command line. The result is that observations are displayed on the plots of geopotential and msl-pressure. The package uses a 'de-clutterring' algorithm to select the observations for display. The number of observations displayed varies with the size of the plot on the screen and the zoom level.

A typical plot can consist of a geographical background, a contour plot and a plot of observations. The 'Optn' button allows the user various choices via sub-menus. Thus the following sub-menus are available :

Field/Observations/Map
Tabulate
Contour
Wind/Isotachs
Observations
Shading of Maps
Coastline Resolution

The above sub-menus allow various options including the tabulation of data values, control over the contour spacing, various methods of plotting observations and a choice of coastline resolution.

xcharts: An X-windows version of CHARTS

The main development in graphics at the Irish Meteorological Service since the last EGOWS meeting is the development and implementation into operational use of the xcharts program.

Until recently, CHARTS [Hamilton, 1984] was the main forecaster interface to NWP output. This is a command driven interactive system which allows the display of charts on a DEC VT-340 terminal. It uses a command language which has been designed to be as easy to use as possible. Commands can be abbreviated; there is an on-line HELP system, a hardcopy option, a script option [viz. the so-called 'obey' files], and ambigious or incorrect commands produce meaningful error messages. The system remembers the parameters entered with previous commands and these become the defaults for subsequent commands -- this

reduces typing to a minimum.

Using CHARTS the forecaster can access output from the [old] Irish Meteorological Service [IMS] model as well as the models of ECMWF and the UKMO. Available output includes plots of wave data. The forecaster can also request plots of upper-air ascents as tephigrams.

The forecasters are very familiar with the old system and so the new system was designed to be as compatible as possible with the old. The new system is called xcharts.

The user interface in xcharts combines a command line with menu buttons. This allows for continuity between the old and new systems; it also allows the use of the current set of script [i.e. 'obey' files]. Ideally, all features should be available with either the command interface or the menu interface but, in practice, some of the more obscure features are only available through the command line. However, in practice, the users almost always use the menu buttons.

The menu interface contains the following buttons:

```
File, Plot, Optn, Modl, Parm, Levl, Time, Misc ...
                ... Prev, Next, Zoom, UnZm, Hard, Help
```

which we will now explain in turn.

The 'File' button produces a menu with the options 'Reset' [which resets parameters to their default values], 'Exit' [which exits the system] and 'Obey' [which allows the user to select and run an 'obey' file i.e. a scripts file with a chart definition].

The 'Plot' command is the main menu and the following is a simplified version :

Hirlam		Pressure		Surface		Analysis	
ECMWF		Geopotential		1000mb		12hour	
UKMO		Temperature		925mb		24hour	
DWD		Windarrows		850mb		36hour	
		DewPoint		700mb		48hour	
		...		...		...	
Plot	Pl Q=1	Pl Q=2	Overplot		Ov Q=1	Ov Q=2	
	Pl Q=3	Pl Q=4			Ov Q=3	Ov Q=4	

The procedure is to specify a model, parameter, level in the atmosphere and length of forecast. Then clicking on the 'plot' button will produce a new plot; clicking on the 'overplot' button will superimpose the chart on the previous plot. The 'Pl Q=1', 'Pl Q=2', 'Pl Q=3' and 'Pl Q=4' options divide the plot into quarters and allow for the plotting of multiple charts. The systems remembers previous values [which are highlighted] and it is unnecessary to specify any value which has not changed. Difference charts and thickness charts are specified by means of sub-menus [not shown].

The 'Optn' menu allows the user to specify various options, such as the colour of the plot, which are of secondary importance.

The 'Modl', 'Parm', 'Levl', 'Time' and 'Misc' buttons are 'short-cut' buttons which are designed to reduce the amount of typing required. Thus, the 'Modl' button is used to change the model [e.g. from Hirlam

to ECMWF] and plot immediately. So, for example, if a 24-hour Hirlam forecast of surface pressure is displayed and the user clicks on the 'ECMWF' option in the 'Modl' menu then an ECMWF chart will be displayed, without the need to click on anything else.

The 'Prev' and 'Next' buttons are used to retard or advance the time of the chart or charts. The 'Prev' button has the options '-6hours', '-12hours', '-18hours' and '-24hours'. If the plot consists of a number of superimposed charts or, if the screen is divided into quarters, the 'Prev' and 'Next' buttons will retard/advance all the charts.

The 'Zoom' button implements a zoom where the zoom cursor is defined as a latitude/longitude intersection i.e. as a circle of latitude and a straight line of longitude. The new area is defined by the lower-left and upper-right corners in latitude/longitude. If the screen is divided into quarters then the zoom is defined within the lower-left hand chart and it is applied to all four charts. All charts are recontoured after the zoom; if observations are being displayed a 'de-clutter' algorithm is applied.

The 'UnZm' button cancels a zoom [i.e. it displays the entire chart]; the 'Hard' button produces a hardcopy and the 'Help' button displays a help menu with some simplified help on various options.

Design Considerations in xcharts

The program is based on the earlier command driven CHARTS program. Consequently, it still allows users to use a command line. In fact, clicking buttons actually generates command strings which are sent to the original CHARTS command interpreter.

The 'obey' file option has been retained and users can write scripts to display charts. The following file will display a set of Hirlam forecasts [with the screen divided into quarters] :

```
Underplot Q=1 HIRLAM sfc press 6Hour
Underplot Q=2 12Hour
Underplot Q=3 18Hour
Underplot Q=4 24Hour
Display
```

The 'Underplot' command stores a chart for later plotting. The four underplot commands define the 6-hour, 12-hour, 18-hour and 24-hour Hirlam forecasts of surface pressure in the four quarters of the screen. The 'Display' command then displays the plot.

The user can use the main 'Plot' menu [or the command line] to select non-existent products [e.g. HirLam 3-day forecasts are not available]. In such a case the system prints a warning message.

At present xcharts is running in the main forecast office [viz. CAFO] in Dublin but it has not yet been installed in the main aviation office [i.e. the CAO at Shannon Airport]. This is because we are waiting to upgrade the communications lines to Shannon.

The raw field data, used by xcharts in CAFO, is stored as a set of

GRIB fields on a server machine. The data disks are nfs mounted on the workstation. Tests with routers and/or bridges and with 64-kilobit/128-kilobit lines have shown that this approach is too slow for Shannon. In this case we intend to broadcast the GRIB products as soon as they are available [either from a run of Hirlam or from one of the sets of model output we receive over the GTS]. The GRIB fields will be stored locally on the workstation in Shannon and this will make the response time much faster. It will also make the system more resilient to line outages, server breakdowns etc.

The entire xcharts system is written in a mixture of C and Fortran. It does not use any third party graphics libraries [apart from Motif and Xlib] and it was written without the aid of a 4GL design tool. Figures 2, 3 and 4 show some screen dumps from xcharts.

Future Plans

We hope to continue the development of xcharts and include many more derived products such as vorticity, potential temperature, height of CB-tops etc. Also, we hope to investigate the possibility of letting the forecaster draw fronts on the chart using the mouse.

Conclusions

Since the last EGOWS meeting a workstation has been installed in the main forecasting office and it is being used to display NWP output using the xcharts program.

The new system remains backwards compatible with the old command-driven CHARTS program and the latter is still in use at Shannon Airport and at two other sites.

The plotxw and xgrbplt programs, used by the Research division, have been enhanced.

References

Hamilton, J.E.M., [1984]: 'The Design of an Interactive Graphics System for the Display of Meteorological Fields', Software Practice and Experience, Vol. 14, No. 6, p. 587-600 (June 1984).

Hamilton, J.E.M., [1993]: 'The Computer Graphics System used at the Irish Meteorological Service', European Group on Operational Meteorological Workstations [EGOWS], Deutscher Wetterdienst, Offenbach, June 1993.

Hamilton, J.E.M., [1994] 'Irish Meteorological Service: Report to EGOWS-5 Meeting ', European Group on Operational Meteorological Workstations [EGOWS], Danish Meteorological Institute, copenhagen, June 1994.

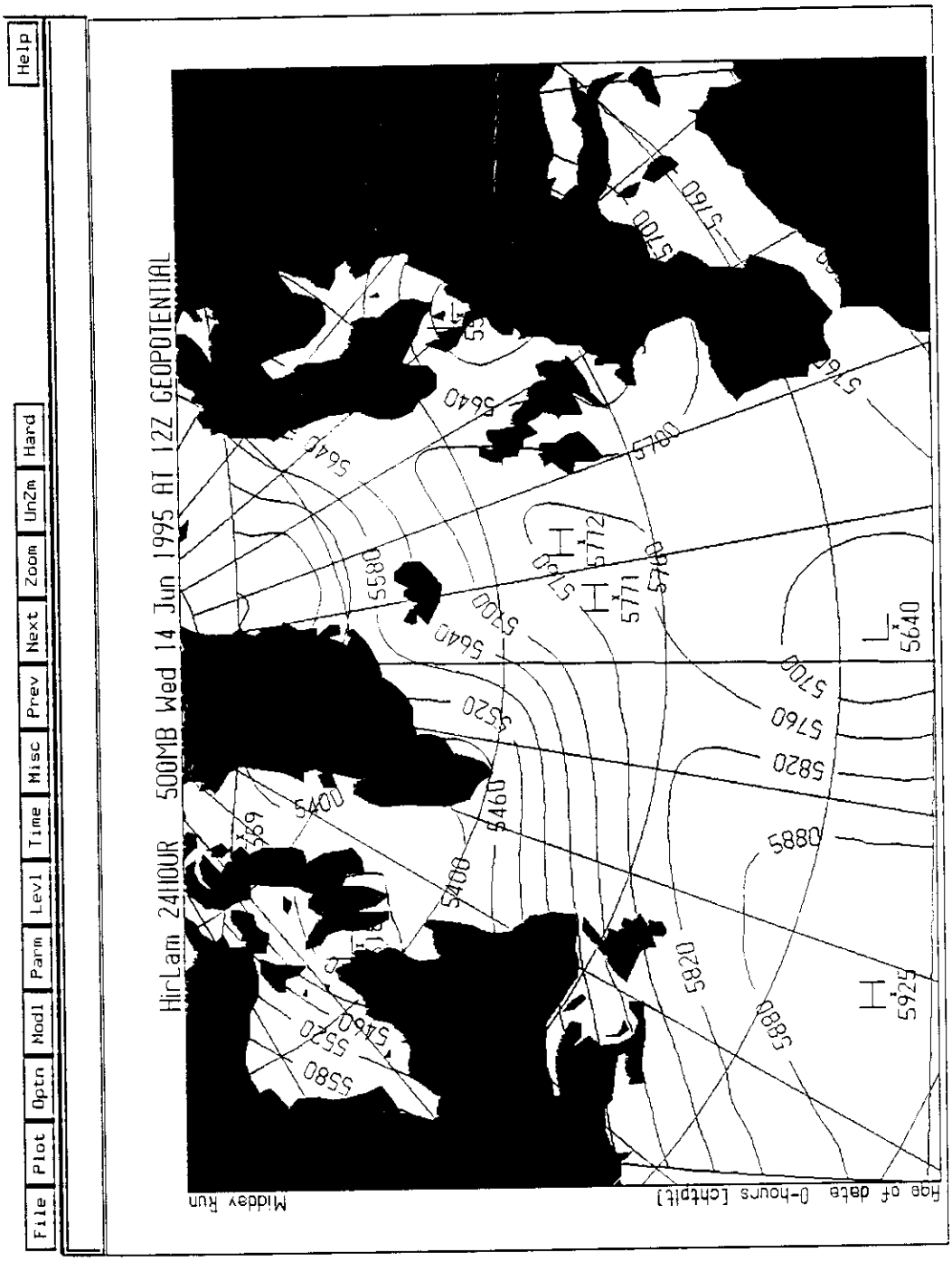


Figure 2: A screen dump of the xcharts program showing a typical plot and the main menu bar. Note the command-line option under the menu bar.

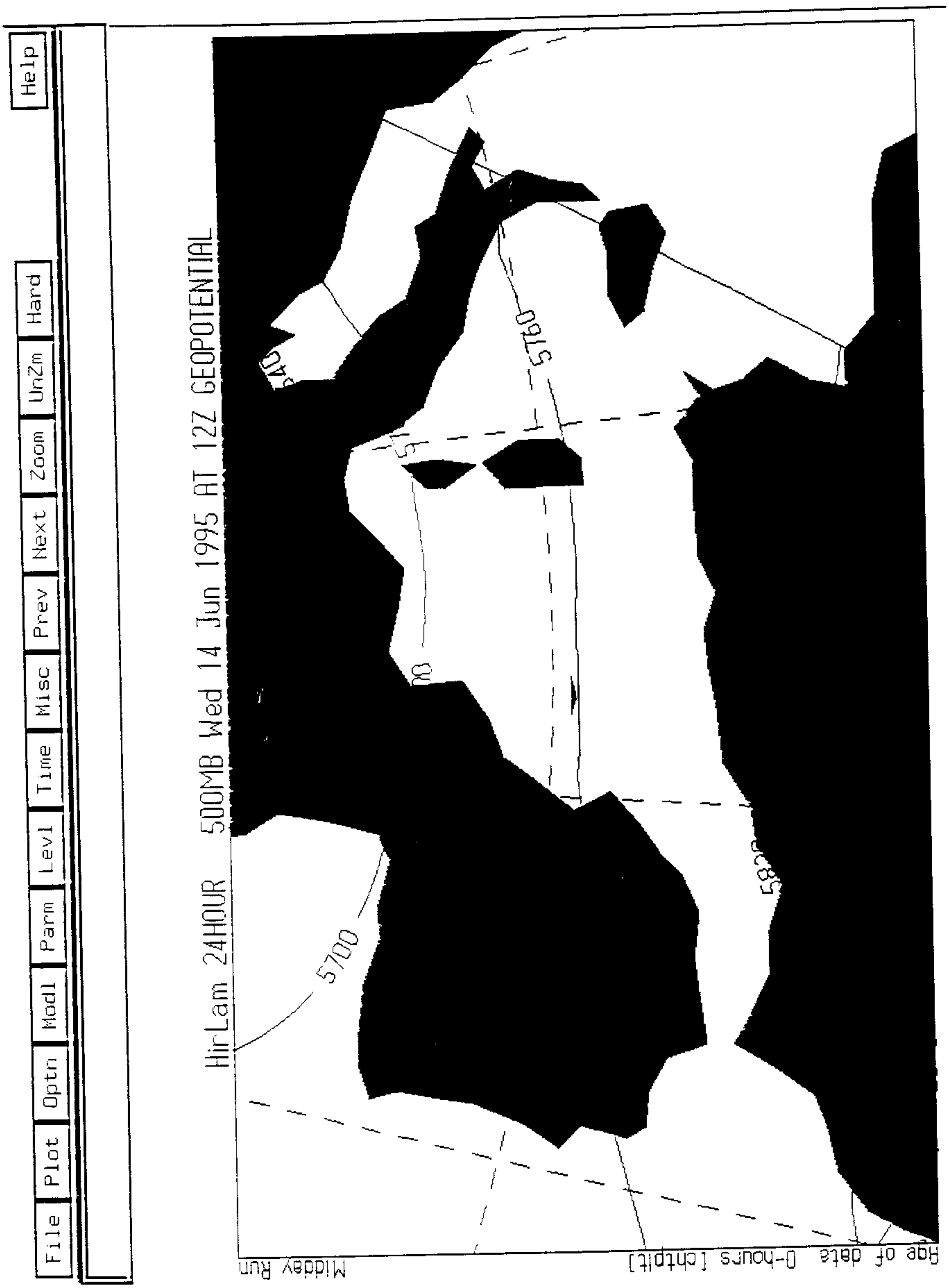


Figure 3: A chart produced from Figure 2 using the 'Zoom' option; note how the chart has been realigned so that the central meridian passes through the Mediterranean.

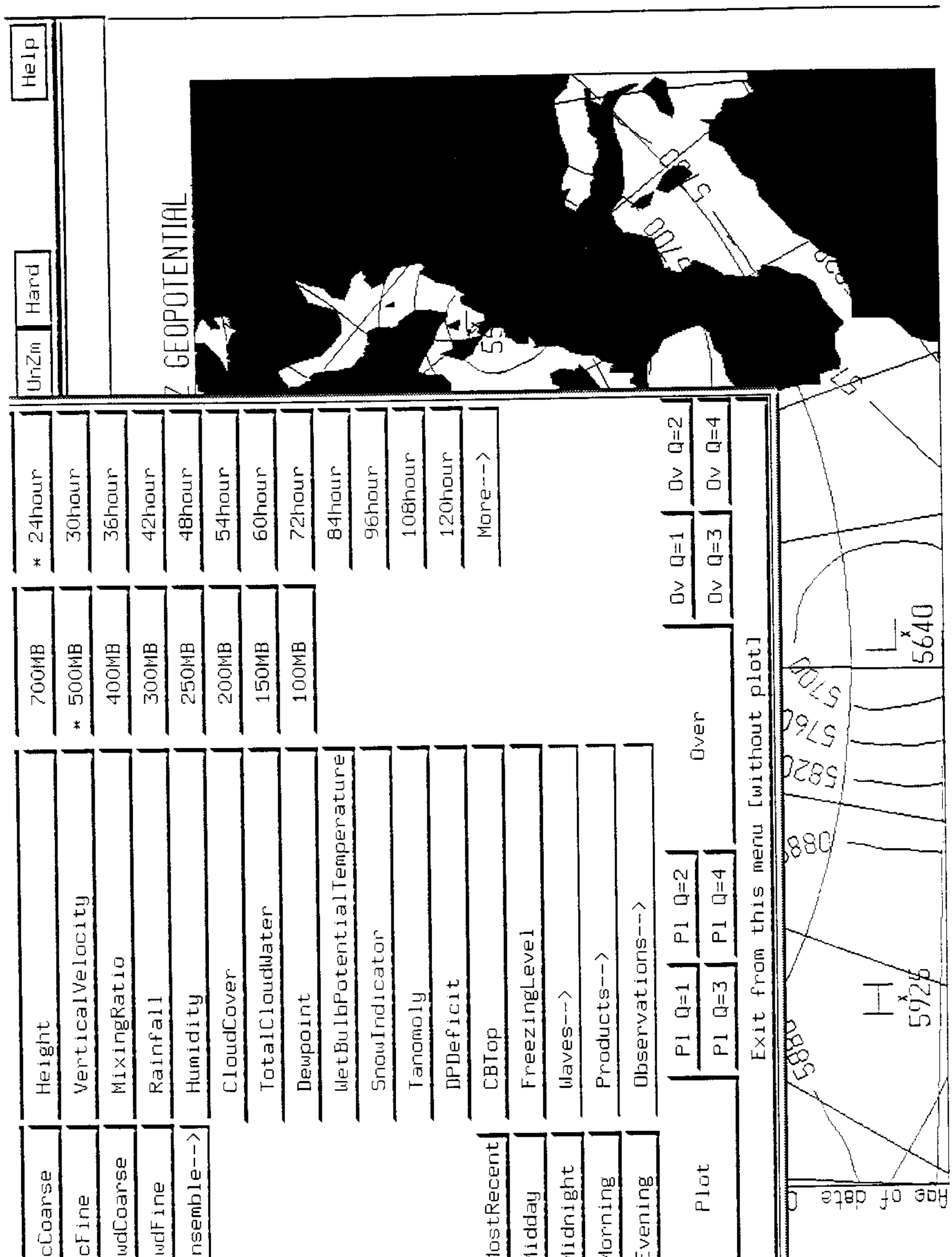


Figure 4: A screen dump showing a typical chart and the main plot menu. [Note that part of the menu has been clipped by the screen dump program.]

Developments in Computer Graphics

at the

Irish Meteorological Service

(J.Hamilton - Irish Meteorological Service)

*

HARDWARE CONFIGURATION

Hardware Configuration

VAX Cluster : Telecommunications

MIPS RS-4000 Millenium : Decoding and Graphics

MIPS RS-3000 Magnum : Backup to RS-4000

DEC-System/5000 and DEC-Station/5000 : Climatology

Silicon Graphics Challenge-L : Operational NWP

Apple Machintosh : Desk Top Publishing

Various MS-DOS PCs : Word Processing etc.

VAX-server-3300 and Vax-station-3100 : Radar

Recent Hardware Equipment

SGI Indy Workstations : Graphics

Hewlett-Packard PostScript Printers

*

Irish Meteorological Service

Computer and LAN Configuration

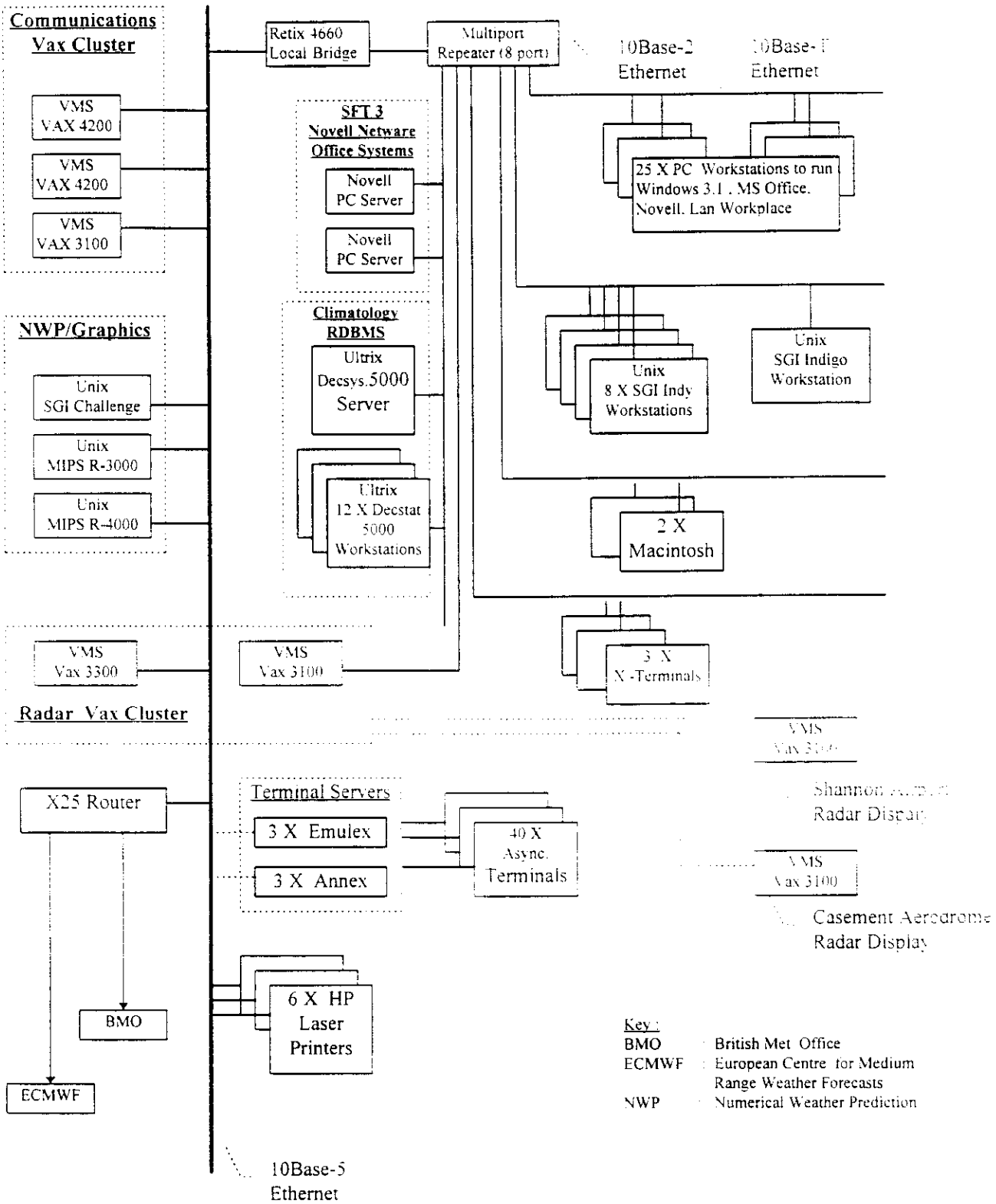


Figure 1: The computer configuration at the Irish Meteorological Service [June-1995].

SOFTWARE OVERVIEW - I

Digitised Radar

- Radars at Shannon Airport and Dublin Airport
- PC Display : COST radar network
- VAX Workstation : Ericsson software
- New radar for Shannon Airport

Satellite Display Systems

- Secondary Data
- Investigating options for PDUS data

Plotting of Observations

- Hewlett-Packard Pen-Plotters
- Canon / Hewlett-Packard Laser Printers

Graphics Hardware

- Drivers for Various Devices : Plot-Files
- H-P Pen Plotters
- PostScript Laser Printers
- Canon Laser Printers
- DEC-REGIS VT-340 Terminals
- X-windows Workstations

SOFTWARE OVERVIEW - II

Interactive System for NWP : CHARTS

- Used by Forecaster
- Display of NWP Products
- Command Driven Interface
- Charts generated as needed
- All possible charts allowed

Other Applications

- Analysis and Plotting of Climatological Fields
- Monthly Weather Bulletin : Climatology
- ECMWF MAGICS on VAX and SGI-Indy
- Work on HirLam MetGraf

*

CHARTS : An Interactive Graphics System

Application

Used by Forecasters

Display of NWP Products

Hardware

Graphics VDU [VT-340]

Hardcopy Unit [Canon Laser Printer]

Runs on MIPS-Millenium / MIPS-Magnum

Software

Command Processor

Interactive Interrogation System

Sample Commands Used with CHARTS

COMMAND>PLOT 3DAY SURFACE PRESSURE ECMWF

COMMAND>PLOT 500HPA-1000HPA 24HOUR GEOPOTENTIAL

Migration to X-Windows

Hardware : SGI Indy Workstations

System uses Motif / X-windows

Fortran-77 / C

Code is written directly [no 4GL]

Three systems developed / being developed

plotxw : plotfile pre-viewer

xgrbplt : HirLam GRIB-code output

xcharts : display NWP [replacement for CHARTS]

Application : plotxw, Display plotfiles

Implementation

X-windows / Motif

Main program in C ...

... calls Fortran packages ...

... call graphics in C [XDrawLines]

Features

plotfiles are random access vector files

select plot block

Zoom [Cross-hair cursor]

Hardcopy

User Interface

File, List, Bgnd, Prev, Next, Zoom, UnZm, Hard ...

Application : xgrbplt, Display HirLam files

HirLam GRIB output

One file per time-level

File contains multiple products

Use of xgrbplt

xgrbplt fc9506150024

User Interface

File, List, Optn, Prev, Next, Zoom, UnZm, Hard ...

Design of xgrbplt

Area calculated from field geometry

'LIst' menu generated automatically

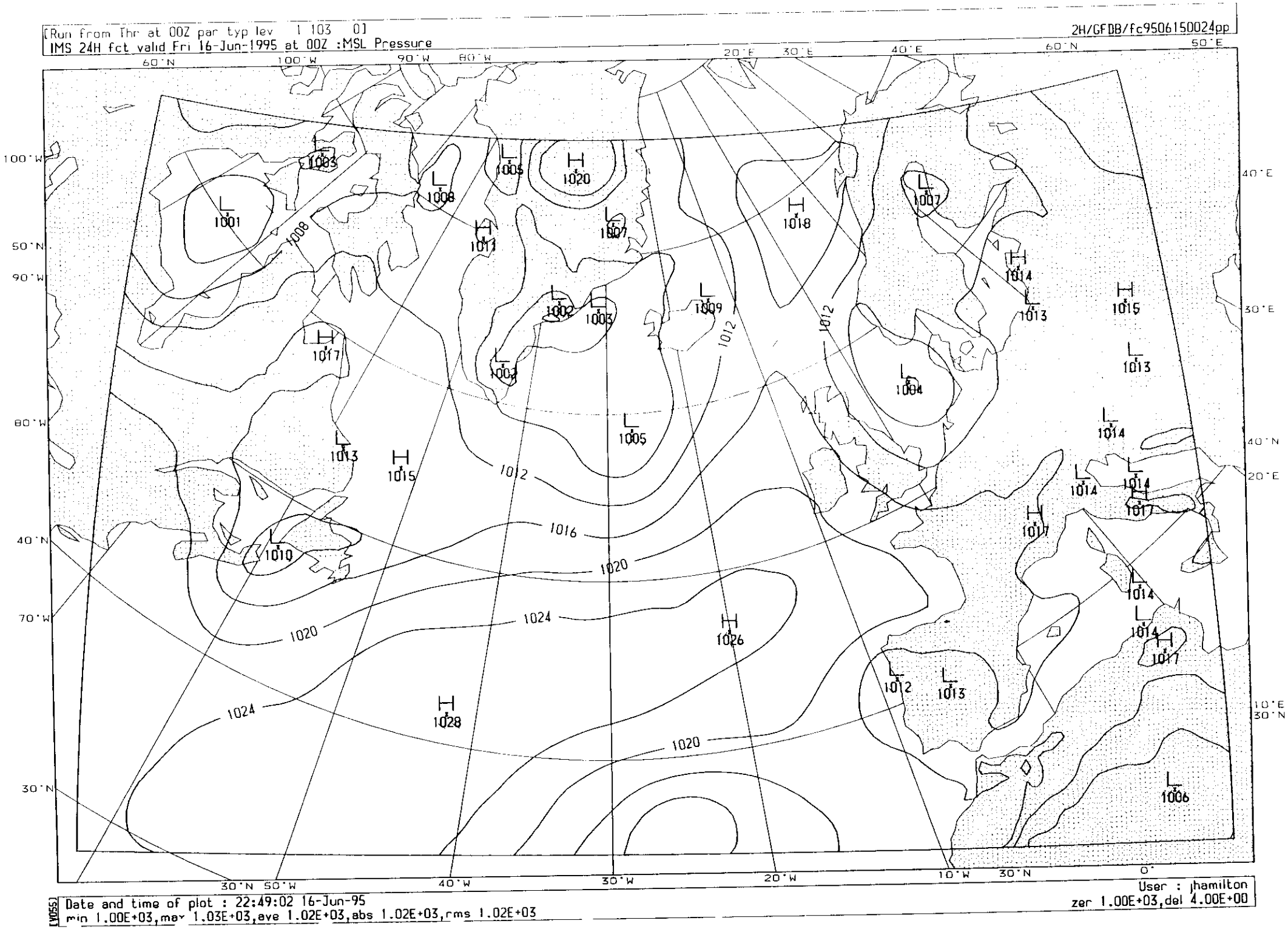
'Zoom' option based on latitude/longitude

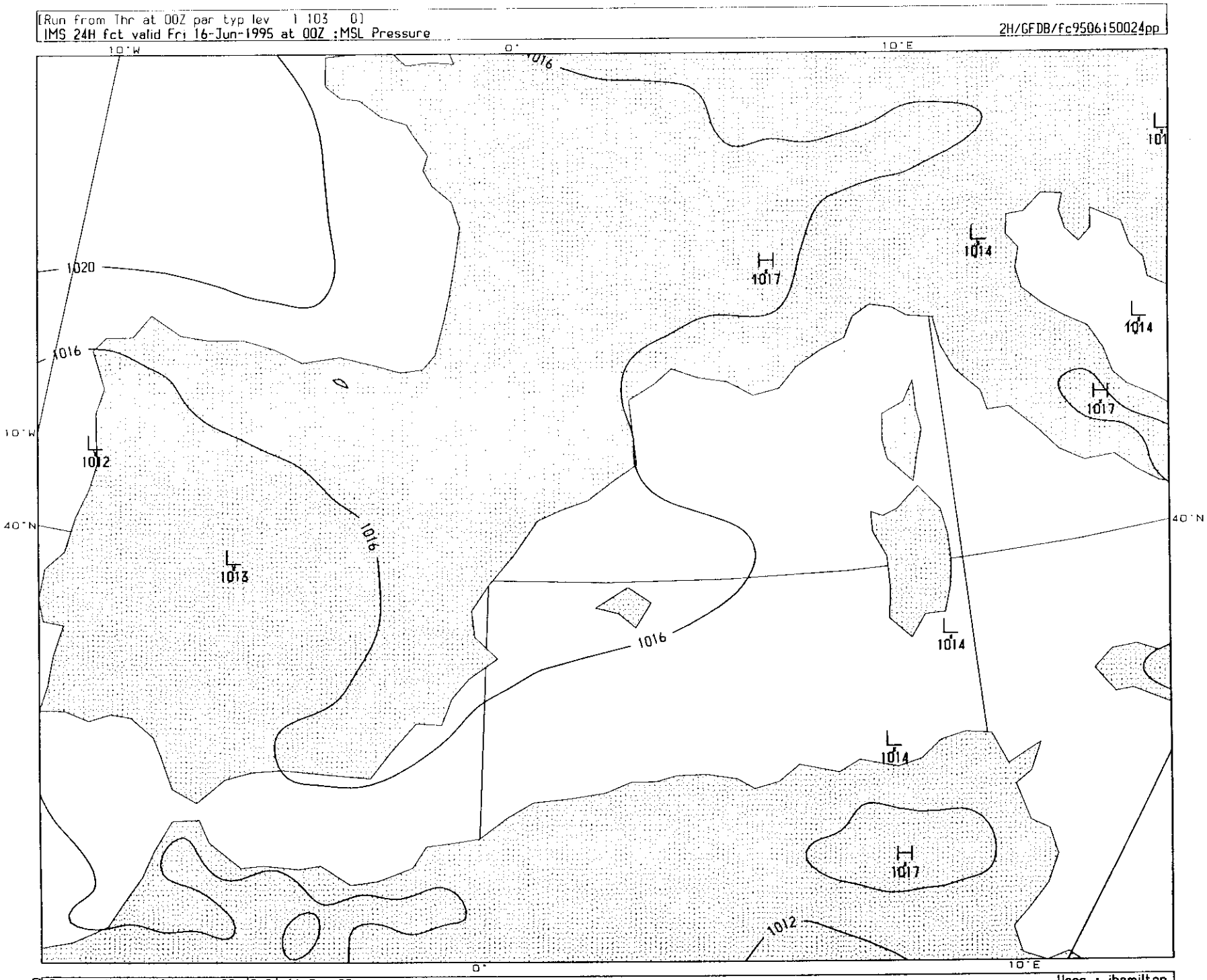
Other features

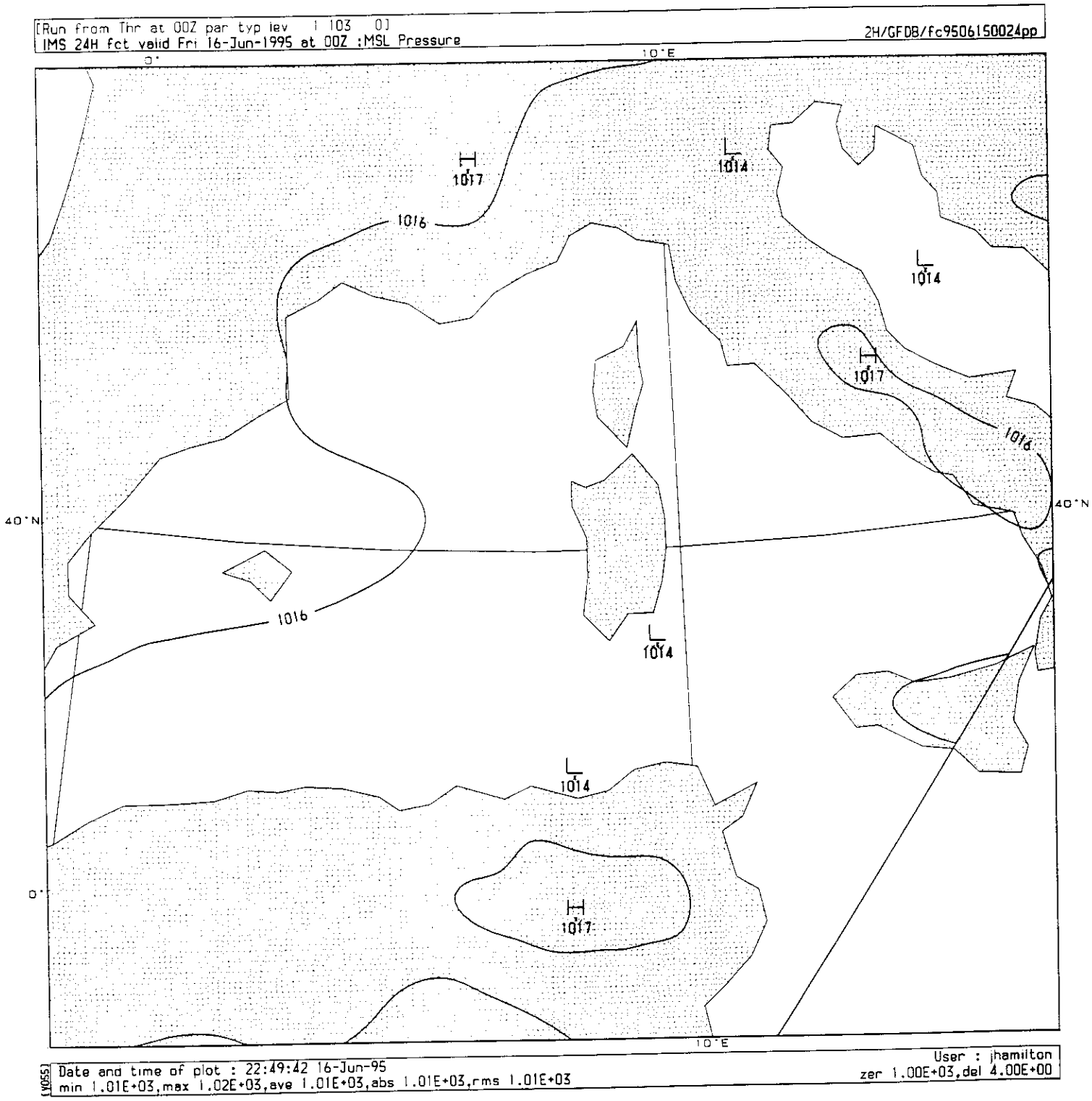
Difference charts

Observations [de-clutterring]

*


[Run from Thr at 00Z par typ lev 1 103 0]
IMS 24H fct valid Fri 16-Jun-1995 at 00Z :MSL Pressure
2H/GFDB/fc9506150024pp
60°N
100°W
90°W
80°W
20°E
30°E
40°E
60°N
50°E
100°W
50°N
90°W
80°W
70°W
40°N
30°N
40°E
30°E
40°N
20°E
10°E
30°N
30°N 50°W
40°W
30°W
20°W
10°W
30°N
0°
1001
1003
1008
1005
1020
1007
1018
1011
1007
1014
1013
1015
1002
1003
1009
1012
1017
1002
1004
1013
1005
1014
1013
1015
1012
1014
1014
1017
1016
1017
1010
1020
1014
1024
1014
1020
1026
1017
1012
1013
1028
1020
1006
User : jhamilton
zer 1.00E+03,del 4.00E+00
Date and time of plot : 22:49:02 16-Jun-95
min 1.00E+03,max 1.03E+03,ave 1.02E+03,abs 1.02E+03,rms 1.02E+03
VOSS


[Run from Thr at 00Z par typ lev 1 103 0]
IMS 24H fct valid Fri 16-Jun-1995 at 00Z :MSL Pressure
2H/GFDB/fc9506150024pp
10°W
0°
10°E
40°N
1020
1016
1012
1017
1014
1013
Date and time of plot : 22:48:24 16-Jun-95
min 1.01E+03,max 1.02E+03,ave 1.02E+03,abs 1.02E+03,rms 1.02E+03
User : jhamilton
zer 1.00E+03,del 4.00E+00


[Run from Thr at 00Z par typ lev 1 103 0]
IMS 24H fct valid Fri 16-Jun-1995 at 00Z :MSL Pressure
2H/GFDB/fc9506150024pp
0°
10°E
1017
1014
1016
1014
1017
1016
40°N
40°N
1016
1014
1014
0°
1017
10°E
Date and time of plot : 22:49:42 16-Jun-95
min 1.01E+03,max 1.02E+03,ave 1.01E+03,abs 1.01E+03,rms 1.01E+03
User : jhamilton
zer 1.00E+03,del 4.00E+00

Application : xcharts, X version of CHARTS

Workstations for Forecasters

Display NWP output / Display observations

Compatible with CHARTS

Use of script [obey] files

Command line and menu buttons

Design of user interface

Multiple Mouse Clicks for Selection ...

... e.g. Parm=geo, Levl=500mb, Modl=HirLam, Plot

Default Parameters and Memory of Selection

Options Available

NWP Output from Hirlam, ECMWF, UKMO and DWD

Observations

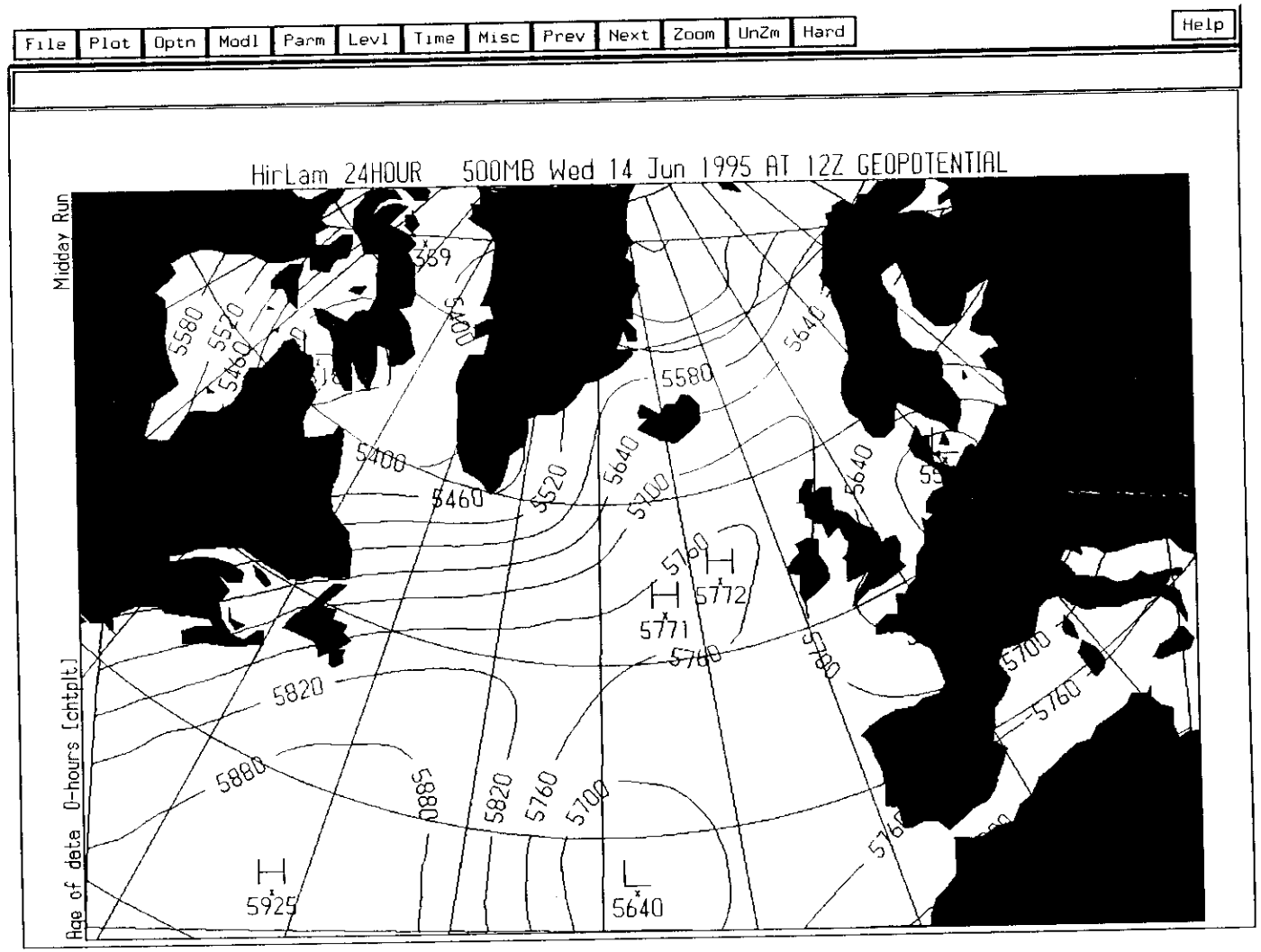
Latitude/Longitude Zoom option [Recontour]

Plans for the Future

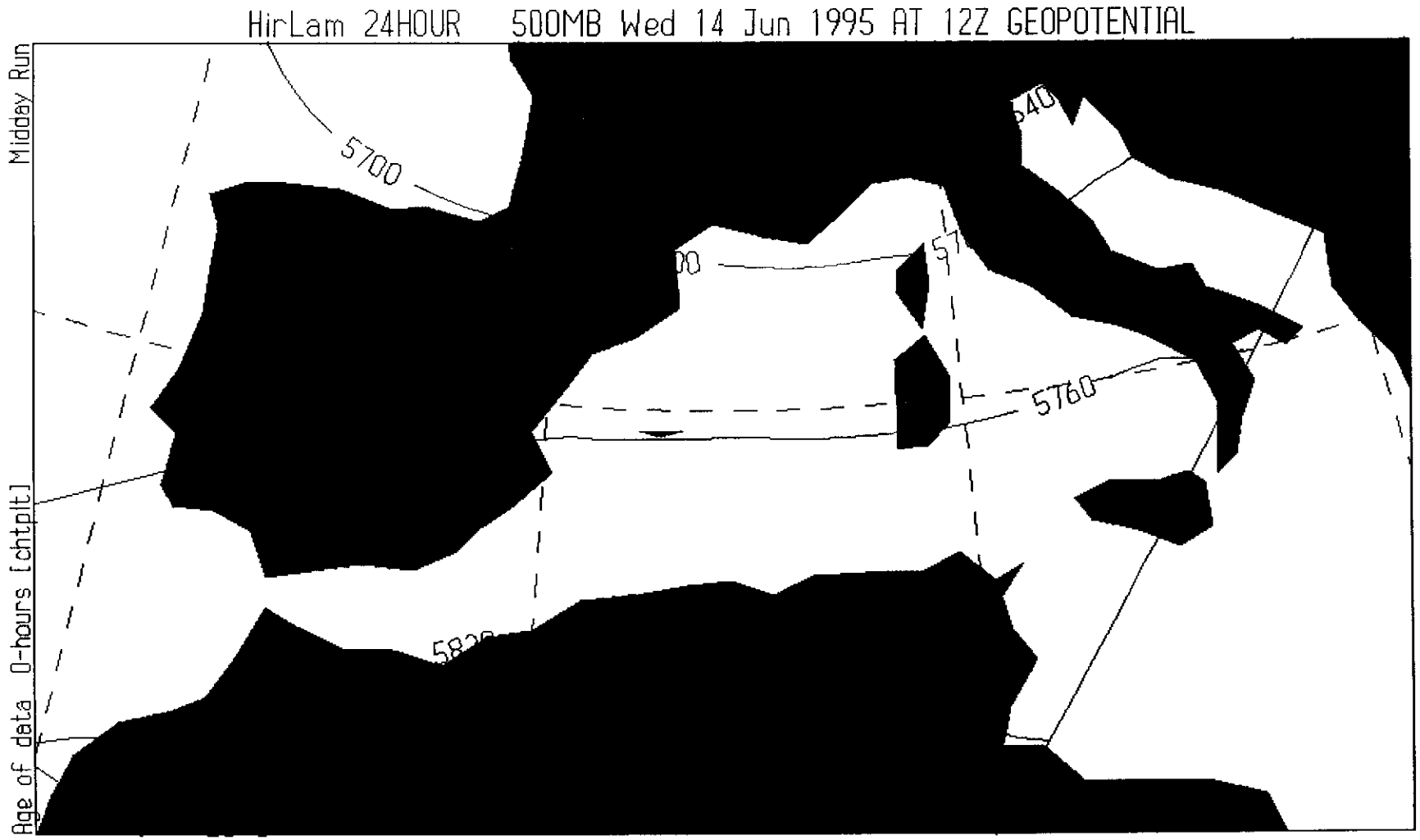
Install system in Shannon [remote site]

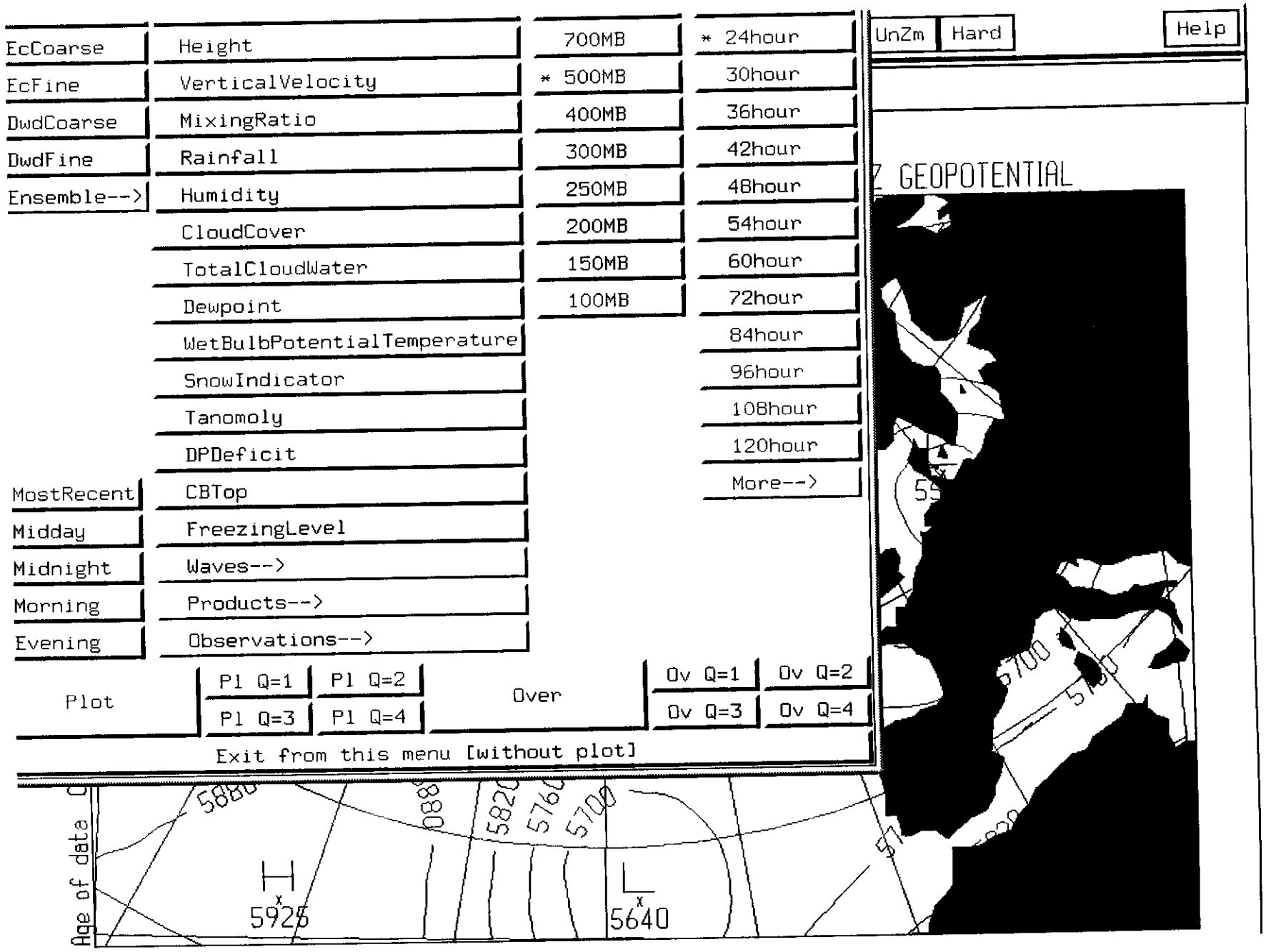
Replace nfs with Broadcast of Products

More derived products [e.g. Cb-tops]


File
Plot
Optn
Modl
Parm
Levl
Time
Misc
Prev
Next
Zoom
UnZm
Hard
Help
HirLam 24HOUR 500MB Wed 14 Jun 1995 AT 12Z GEOPOTENTIAL
Midday Run
Age of data 0-hours [chtplt]
5580
5520
5460
5400
5640
5700
5760
5820
5880
5772
5771
5925
5640

File | Plot | Optn | Modl | Parm | Levl | Time | Misc | Prev | Next | Zoom | UnZm | Hard | Help




EcCoarse
EcFine
DwdCoarse
DwdFine
Ensemble-->
Height
VerticalVelocity
MixingRatio
Rainfall
Humidity
CloudCover
TotalCloudWater
Dewpoint
WetBulbPotentialTemperature
SnowIndicator
Tanomoly
DPDeficit
CBTop
FreezingLevel
Waves-->
Products-->
Observations-->
MostRecent
Midday
Midnight
Morning
Evening
700MB
* 500MB
400MB
300MB
250MB
200MB
150MB
100MB
* 24hour
30hour
36hour
42hour
48hour
54hour
60hour
72hour
84hour
96hour
108hour
120hour
More-->
UnZm
Hard
Help
Z GEOPOTENTIAL
Plot
Pl Q=1
Pl Q=2
Pl Q=3
Pl Q=4
Over
Ov Q=1
Ov Q=2
Ov Q=3
Ov Q=4
Exit from this menu [without plot]
Age of data
5880
5820
5760
5700
5925
5640

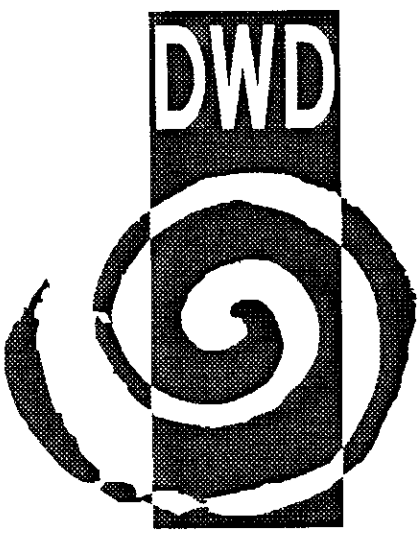
EGOWS 6
Vienna , 19-22 June 1995

Session : General Developement

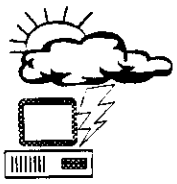
Michael P O G O D A

MAP

The Meteorological Application and Presentation system

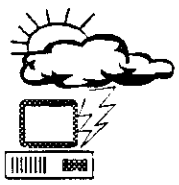


Michael Pogoda
Deutscher Wetterdienst
pogoda@w3-map.wa-potsdam.dwd.d400.de



Outline

- MAP 2.0
- MAP 2.1
- MAP 2.2
- Warnings
- MAP 2.3
- Problems and Workarounds
- Further plans
- Installation



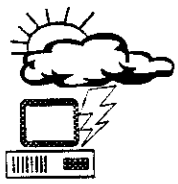
MAP 2.0 - October 1994

- GUI based on OSF/Motif

- Overlay of different data in maps:
  - surface and upper air observations (SYNOP, SHIP, METAR, SWIS, TEMP)
  - forecasts (DMO-EM, TEMP-EM)
  - grided data (FM47)
  - forecasts as metafiles (isolines IGS)

- time series (graphical, alphanumerical)

- temp evaluation



MAP 2.0

- display of meteogramms based on metafiles

- display and overlay of cross sections based on metafiles

- integration of the SWIS-Project

- "CIA-database" for geographical maps

MAP 2.1 - December 1994

- warnings (SYNOP, METAR, SPECI)

- new data type
  DMO - DM

- interface to the printer infra-structure

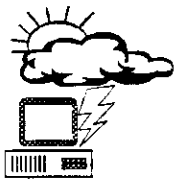
MAP 2.2 - April 1995

- warnings available on all hosts

- new data type
  AFREG (midrange forecast)

- interactive TEMP-zoom

- optimization of GUI



Warnings

- testing of all data for selected weather situations reaching of special levels

- user control of levels

- warning is done by sound

- event, location and time are displayed user can set filters

- near and far area with different levels of control

MAP 2.3 - summer 1995

- new data types
  ligthning data (LPATS)
  wind warning data

- 4 diagramms of TEMP

- isolines based on observation data
  calculated online

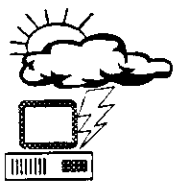
Problems and Workarounds

- OSF/Motif and GKS (eventhandling)
  events are filtered
  (source of GKS X11 driver is known)

- GKS and images
  using of X11 images without GKS
  (source of GKS X11 ...

- GKS and animation
  animation with X11 images created
  from GKS window

- shared colors between GKS and X11



Further plans

- satellite and RADAR images

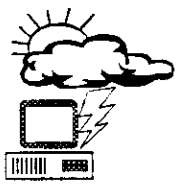
- local calculation of isolines based on GRIB, replacing metafiles

- new data type AUTOTAF

- nowcasting procedures

- storage of interesting weather situations

- use of "Digital Chart of the World" better geographical maps



Installation

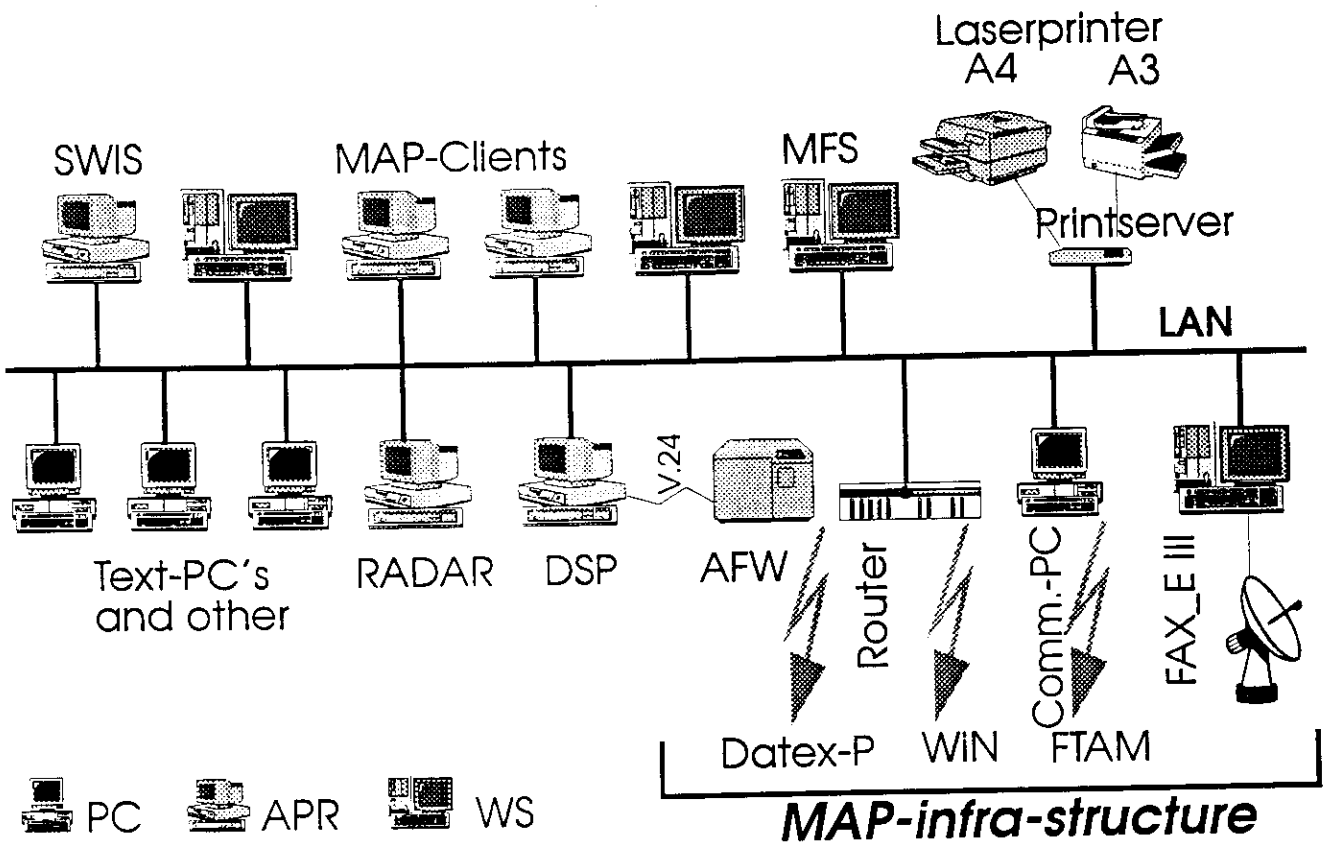
- 1995: 23 offices with
  34 24-bit workstations (WS)
  39 8-bit workstations (APR)

- reorganisation of DWD brings concentration

- 1998/99: 11 offices

- individual equipment for every office based on individual tasks

MAP at a Regional Centre



Installations up to 1995

Installations up to 1998/99

EGOWS 6
Vienna , 19-22 June 1995

Session : General Developement

Kees L E M C K E

KNMI Meteorological WorkStation

(MWS)

KNMI Meteorological Briefing WorkStation

(BWS)

Kees Lemcke

Project Manager MWS

CONTENTS 6th EGOWS presentation

1.1 HARDWARE

- Client-Server solution:
  - data ingest servers
  - display systems

- Hardware :
  - DIGITAL AXP systems:
    * 1-headed for ingest
    * 3-headed for MWS display
    * 1-headed for BWS display
  - all systems can do data ingest if required.

1.2 DATA_INGEST

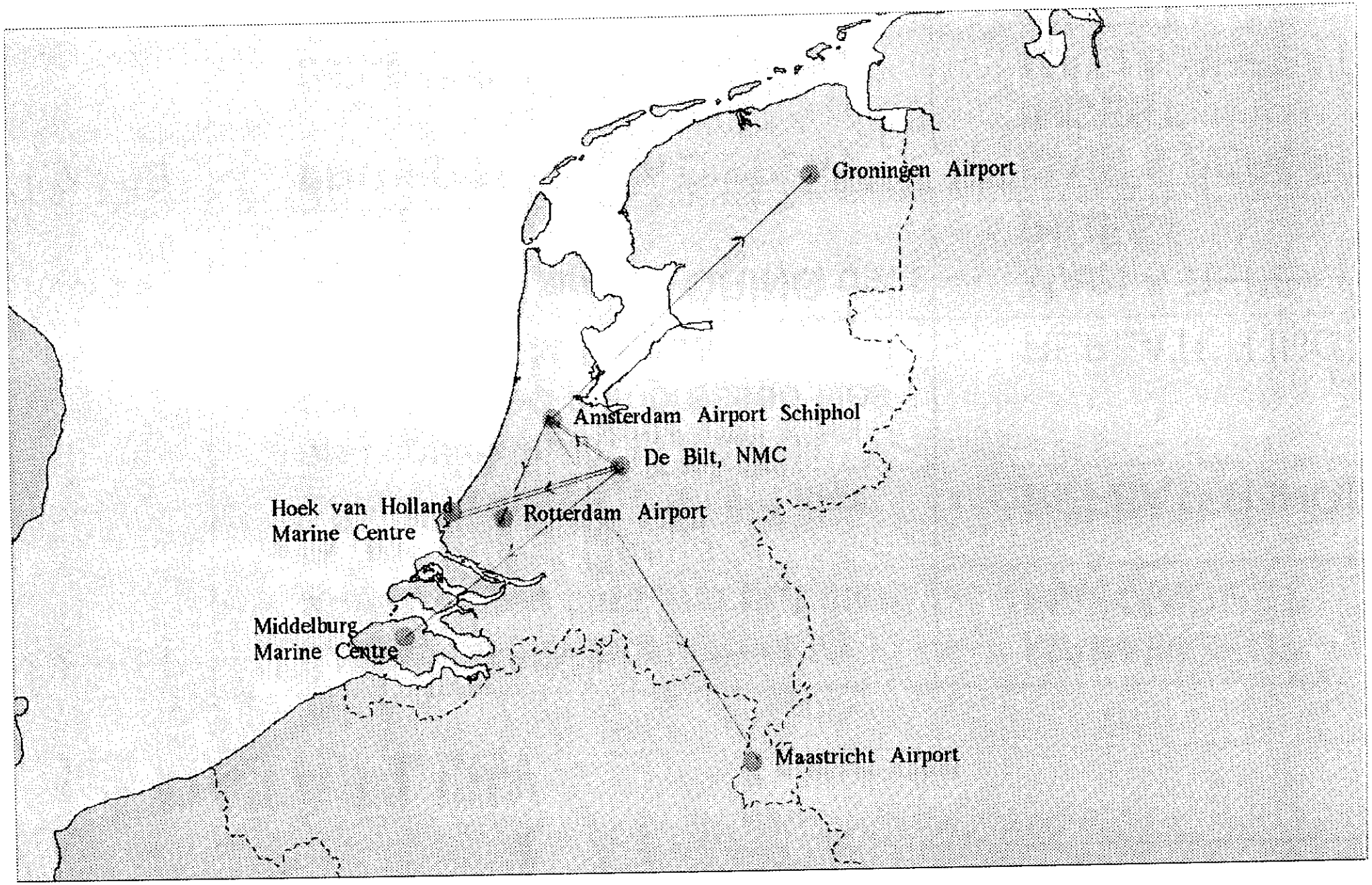
- DATA TYPES :
  - A observations (GTS, WMO char. code)
  - B digital facsimile (GTS, T4-code)
  - C satellite data (PIF format vendor)
  - D radar data (converted to PIF)
  - E model fields (GRIB)
  - F model time series (KNMI-format)

A-D **sent** by data source to main ingest server
E-F **grabbed** by main ingest server

- PROCESSES:
  - 2 grabbers
  - 6 copiers
  - 6 ingests
  - 6 dbases

1.3 DATA FLOW

COPIER	- **copies** files to local directory - **compresses** files and **put** them in **DATACOM-Queue** - **uncompresses** received files and copies them to local dir - **put received** compressed files in **DATACOM-Queue**	- MAIN INGEST - MAIN INGEST - REPEATER INGEST - REPEATER INGEST
INGEST	- **DECODING** and **STORING** data	- MAIN & REPEATER INGEST
DBASE	- **PROVIDES** data to DISPLAY - **DELETES** data after N-hours	- MAIN & REPEATER INGEST - MAIN & REPEATER INGEST


Groningen Airport
Amsterdam Airport Schiphol
De Bilt, NMC
Hoek van Holland
Marine Centre
Rotterdam Airport
Middelburg
Marine Centre
Maastricht Airport

1.4 DISPLAY FUNCTION MWS

- choice of several projections (configurable)
- choice of data types
- animation
- overlay
- draw
- send
- print (sreen dump)
- macros

What is **NEW since 5th EGOWS** ?

- software **ported** to **DIGITAL Alpha**
- **16 MWS-displays installed**
- First 2 phases accepted and in maintenance
  Phase 3 will be accepted at 14 July 1995.

- extension **MACRO-functions**
- **redesign** profiles, incl. selection from map
- configurable **initial zoomfactor & offset** satellite and radar
- **auto/non-auto refresh** within draw
- **legends** for drawings (screen coordinates)
- overlays,folders,draw **subdirectory structure**
- contour line **type, thickness & highlight** added
- **macro** can be **actived** in **listen-mode**by **external command**
- some **fine-tuning**

1.5 DISPLAY FUNCTION BWS (METSEL)

BWS : **B**riefing **W**ork**S**tation
METSEL: **MET**eorological **SEL**f briefing

- Workstation for **AVIATION** purposes

- Current situation : briefing by
  - forecasters
  - fax
  - alpha num. display

Schiphol International Airport : 24 hours / day
small airports limited hours

The crew gets also a set of **hardcopies**.

Problems:

- due large extension construction program at Schiphol, to meet Mainport requirements :

  large distance between:
  - * **crew centre**
  - * **gates**
  - * **meteo briefing desk**

- hardcopy set **to broad in scope**

Solution :

- **DEDICATED SELF BRIEFING** by the crew at required locations : **BWS**

- **BWS** is a dedicated display system connected to the same data-ingest servers as the **MWS.**

- maps / briefing text will be prepared at MWS and made available to BWS.

Current Briefing:

- explanation manual analysed weather map
- radar display at briefing desk
- satellite display at briefing desk
- significant weather map
- alphanumeric system
  (actuals,forecasts for take off, en route and destination alternative aerodromes,SIGMETS)

takes 2-5 minutes

BWS-AUTO briefing:

- enter ICAO or IATA destination code
- enter VFR (**V**isual **F**light **R**ules)
  or IFR (**I**nstrument **F**light **R**ules)
- enter flight level
- click **PRINT** button

==> hardcopies of relevant data (inclusive briefing text) 2 minutes later available.

90% of briefings is expected to be in auto-mode

BWS-MANUAL briefing:

possible selection both on screen and as hardcopy:

- surface maps (DIFAX and MWS-drawings)
- upper air maps (DIFAX)
- significant weather maps (DIFAX and MWS-drawing)
- satellite
- radar (NL)
- alphanumeric data
- briefing text

New role briefing officer:

- production surface analyses on MWS (every 3 hours)
- consultation beyond contents of BWS by telephone

2. Operational use of MWS

- fully operational at marine centre Hook of Holland
- partly operational at other locations

Problems

- **port to DEC ALPHA** more complex than expected
- reorganisation KNMI (AGENCY, more commercial) requires a lot of forecasters capacity
- the old work method was not structured
- large size paper maps :
  the **scale of the phenomena** is **"burned in"** in the forecastsers mind

Some Recommendations

- **set a date for MWS operations**
  In the mind of the forecaster, the current method works fine; so, where is the need to change

- **identify deficiences that effect operations**
  if products that are used routinely (paper) are missing on the workstation, forecasters will tend to avoid the MWS

- **continue MWS education**

- **continue meteorological education**

- **define new communicationroles and methods between forecasters**

3. Plans for the near future

- automatic update satellite & radar loops
- distance measurement curved lines
- print menu with printer & format selection
- automatic date/time legends and drawing-names
- post data as "tiles" : a number of different products at the same time at the screen
- possibility to display data from files with "meta graphic language"
  (LAT,LON,textstring,textcolor,textheight, textalignment etc
  LAT,LON,symbol etc, LAT,LON,lines/areas etc)
- lightning
- development more macros
- development new work methods

4. Conclusion

- all workstations installed at required locations
- follow up requirements in preparation
- change to new workmethods takes a lot of time
- opertional introduction BWS started

EGOWS 6
Vienna , 19-22 June 1995

Session : Meteorological Applications

Göran A X E L S S O N

SMHI

RiPP

A development project for automatic weather forecasts in Sweden

Numerical weather predictions have been the basic tool for forecasters during many years. Their quality is at present so good, that the forecasters can not in general compete with them. This has made it possible to assemble customer products automatically from direct model outputs. The role of the forecaster will therefore change. Important tasks in the future will in monitoring and consultation.

To develop this new efficient service, a project has been started at SMHI. The project is called RiPP, which is an acronym for: Rationalization in the Production Process. RiPP will not only comprise of weather forecasts, but also hydrological and oceanographical products.

In this pamphlet we will concentrate on the production of weather forecasts. On the next pages we have tried to illustrate the process with a simplified figure.

Database for basic information

A central component of the system is a database, which includes all basic information; observations, analyses and forecast fields from different numerical models. To improve the quality of certain parameters we make use of statistical interpretations. The intention is that there will not be any major human influence on this database. We will however monitor our own HIRLAM model and sometimes the forecasters will have to choose a different model.

Forecast database

Sometime in the future all products will be generated from the database for basic information. However, we know that today, at least warnings sometimes require manual modification of the numerical forecasts. For that reason a database for forecast products will be created, where data are taken from the database for basic information. Some key parameters are chosen, such as wind, temperature and different forms of precipitation. In order to change these parameters the forecaster will use an interactive graphical tool.

Database for special products

Aviation services, marine and hydrological production may require special parameters. These data are collected in special databases, which also will contain data from the earlier mentioned databases.

The automatic process

We have now introduced different kinds of databases, in which it will be possible to change certain parameters manually. The

intention is that the final assembly of all forecast products will be made more or less automatically. To assist in this generators for texts and graphics will be used. Tables and synthetic sound can also be made.

Consultation

Since routine tasks, such as preparing maps and typing the text of public and marine forecasts are automated, the forecasters have more time to focus on the analysis and interpretation of weather data. More time can also be devoted to those customers of ours, who need special attention.

Most products will require quality control. Certain texts will be almost impossible to generate automatically, hence they must be prepared by the forecaster.

Alarm

Already today, it is hard to handle all information a weather service receives and all the forecasts which are delivered. The latter will also hopefully increase. Some kind of quality control with an alarm function is therefore necessary. Rapid wind increases, unexpected weather and forecast values, which differ too much from reality, should trigger the alarm.

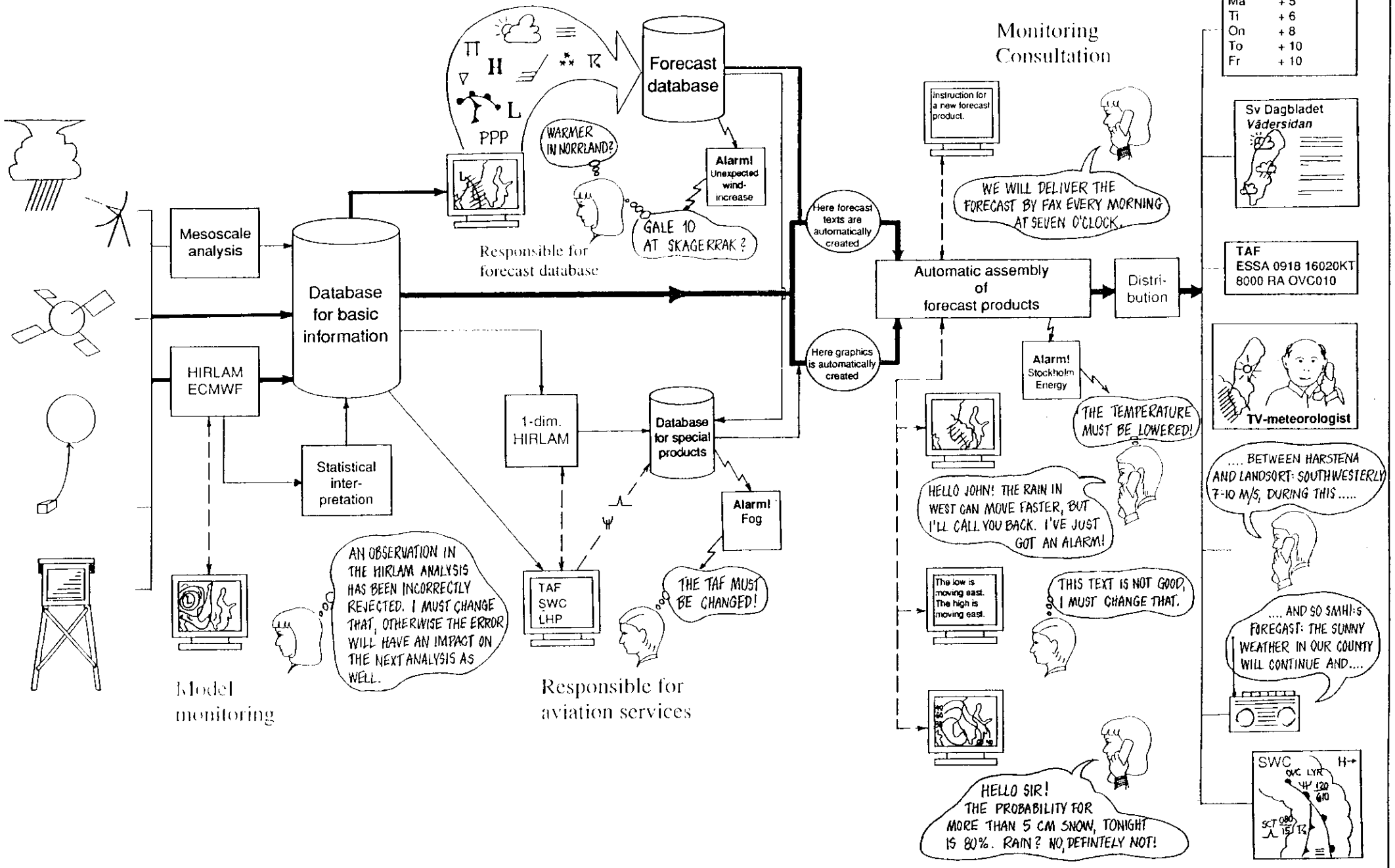
The project plan

The new production system, has been designed by meteorologists and technicians at SMHI. The project plan is divided into five steps. In the first three steps the tools of the forecaster will be improved using existing technique at SMHI. In the next two steps new technique will be implemented. The project will, according to the plan, be finished during summer 1997.

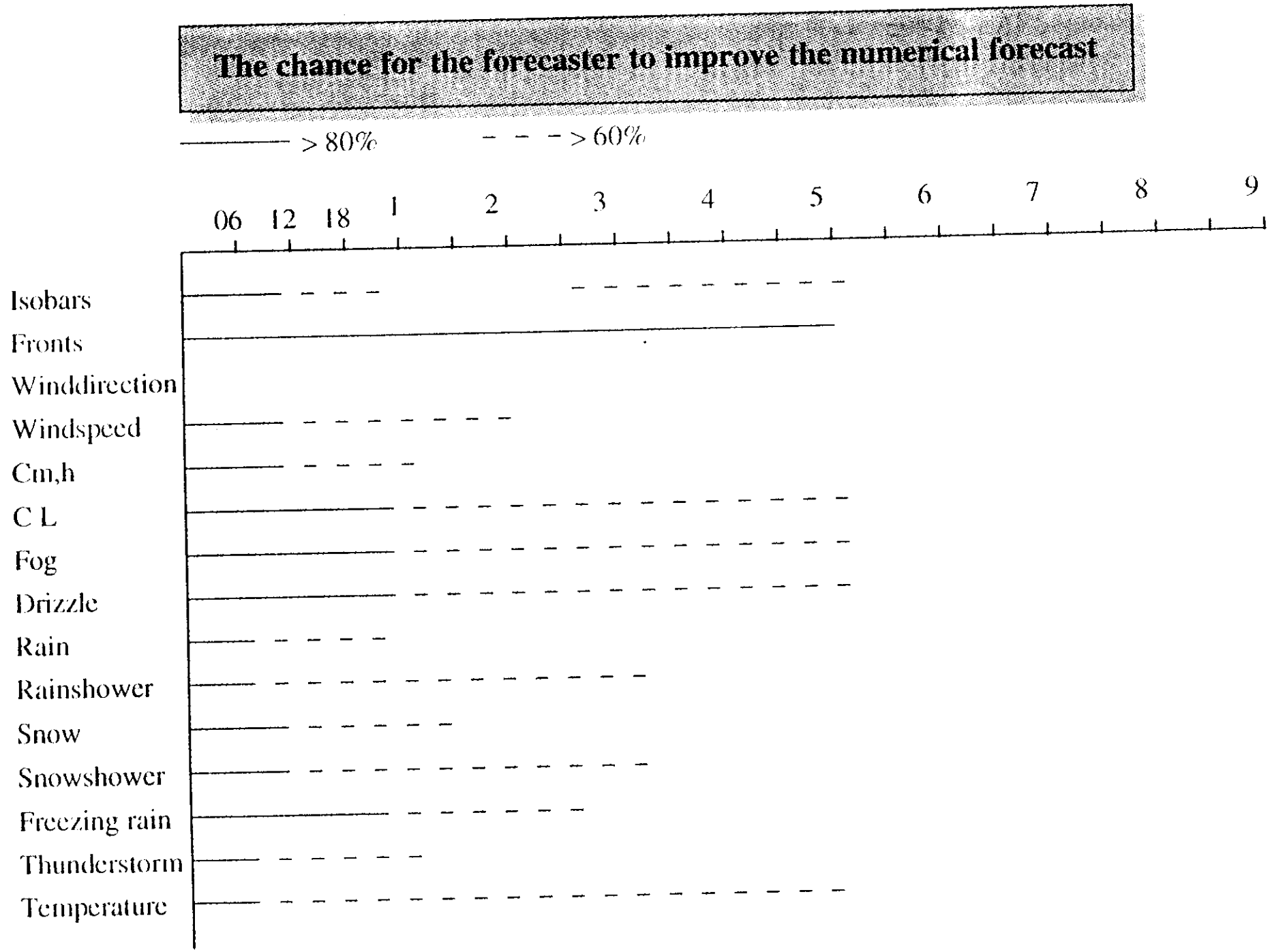
SMHI
Swedish Meteorological and Hydrological Institute, S-601 76 Norrköping
Telephone +46 11 15 80 00, Telefax +46 11 17 02 07, 17 02 08

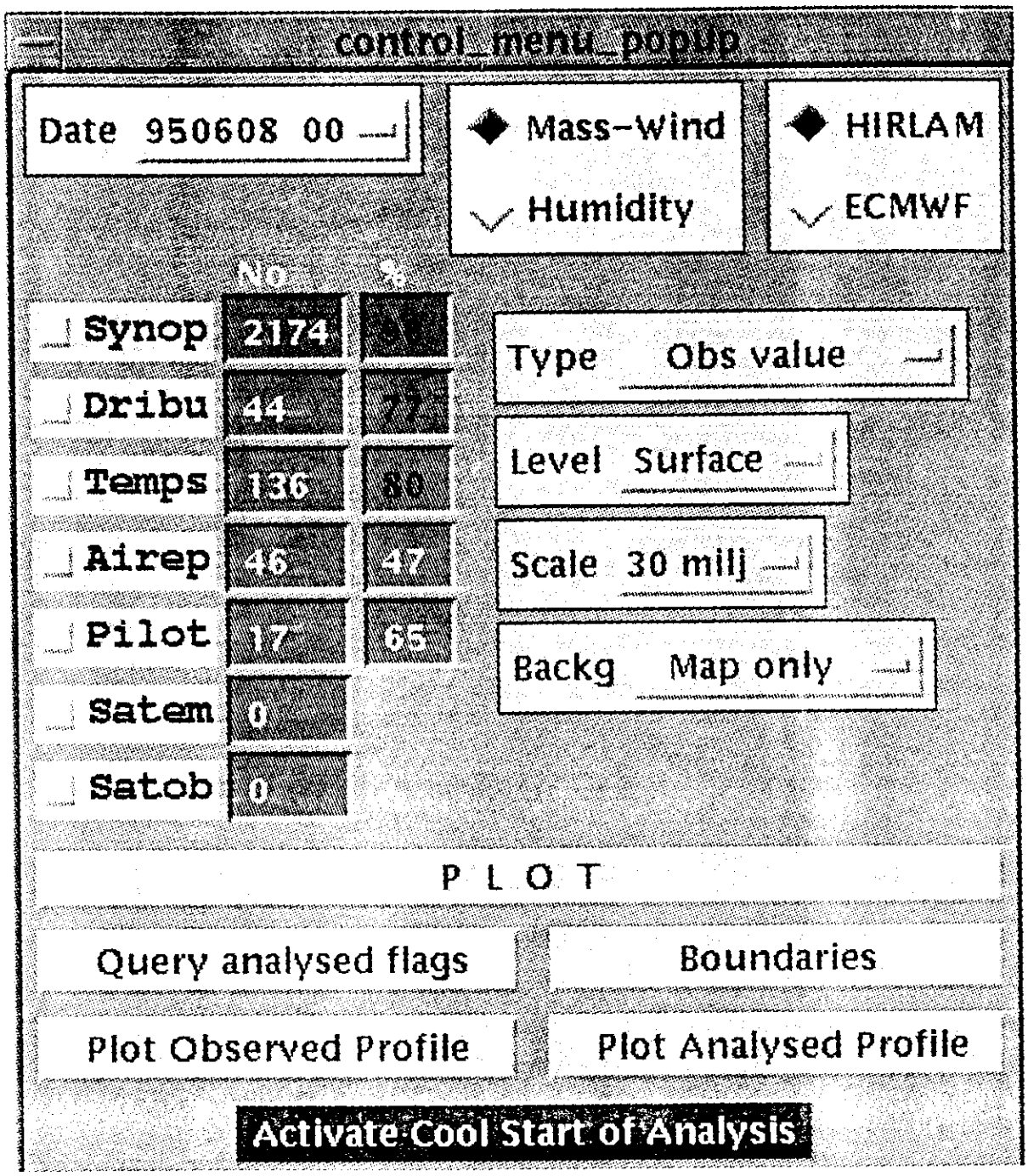
SMHI

SMHI's future weatherservice



Norrköping 1995-05-10


The chance for the forecaster to improve the numerical forecast
> 80%
> 60%
06
12
18
1
2
3
4
5
6
7
8
9
Isobars
Fronts
Winddirection
Windspeed
Cm,h
C L
Fog
Drizzle
Rain
Rainshower
Snow
Snowshower
Freezing rain
Thunderstorm
Temperature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Pilot
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Type Obs value
Level Surface
Scale 30 milj
Backg Map only
P L O T
Query analysed flags
Boundaries
Plot Observed Profile
Plot Analysed Profile
Activate Cool Start of Analysis

EGOWS 6
Vienna , 19-22 June 1995

Session : Meteorological Applications

Alan R A D F O R D

Automating The Forecast Production Process

Alan Radford
Manager, Forecast Automation & Innovative Workstation Applications
UK Met. Office

Background

The desire to reduce costs within national meteorological services is leading to increasing pressure to automate the forecasting process - an accurate forecast from a numerical model is a prerequisite to achieving this goal. Over the last 10 to15 years, the skill of numerical weather prediction models has improved significantly. Not so long ago, forecasters would simply use model output as guidance while basing the forecast very much on their own synoptic expertise. Forecasters are now relying more and more on model products, but there are still occasions when a forecaster thinks, or even knows, that the model prediction is wrong. This results in the manually produced forecast disagreeing with any automated products, and this disagreement can cause inconsistency when manual and automated products are mixed, e.g. TV forecasts.

It is therefore becoming clear that we need a database containing *amended* model fields. Automated products could then be generated directly from this database in the knowledge that they would be consistent with the forecaster's ideas. One solution enabling the forecaster to amend the model fields would be a graphical editing tool on a powerful workstation (e.g. HORACE). Ideally the fields would also be consistent in 3 dimensions but this may not be possible yet, bearing in mind the computing power that would be needed and the time constraints on producing a forecast. At the Met. Office we have already developed one application that uses interactive graphical editing - the semi-automated production of significant weather charts for civil aviation.

Aviation Significant Weather (SigWx)

(a) Background

In 1982 the International Civil Aviation Organisation (ICAO) proposed the World Area Forecast System (WAFS), whereby 2 World Area Forecast Centres (WAFCs) would eventually produce forecasts of SigWx and gridded wind & temperature world-wide. The two centres designated to be WAFCs were Washington and Bracknell.

As a Regional Area Forecast Centre (RAFC), Bracknell already has the responsibility of issuing high-level SigWx forecast charts for the North Atlantic area 4 times a day (e.g. see Figure 1). This used to be done manually using pencil, stencil & eraser. However in the early 1990s, development began of a graphical editing package, which would allow the forecaster to overlay background fields on screen and use drawing and editing tools to create the final product. This software has been used operationally since April 1993.

It was then decided to take the next step towards global operation, by incorporating the responsibilities of RAFC Frankfurt - a high-level chart covering Europe and Asia, and a medium-level chart over Europe. This work has been operational since April 1995. The next step will be to take over the responsibilities of RAFC Toulouse (high-level charts for Europe-Africa, and Europe-South America). Finally, we will incorporate the facility to produce a SigWx chart for any specified area on the globe.

(b) Background Fields

Background fields, derived directly from the model output, are used as underlays by the forecaster when developing the product. Table 1 gives a list of those fields that are currently used.

Tropopause Height
Mean Sea-Level Pressure
1000-500 hPa Thickness
850 hPa Wet-Bulb Potential Temperature
Probability of Clear Air Turbulence
250 hPa Height
Maximum Wind
* *isotachs*
* *arrows*
* *height*
Convective Cloud
* *top*
* *depth*

Table 1: List of Background Fields

The fields are plotted on the mainframe and transferred to the workstation as CGMs. (In the future it is intended to plot the fields directly on the HORACE workstation from the fields database.) The forecaster uses each field (or group of fields) in turn as guidance for each SigWx parameter. He is able to draw jet streams, areas of cloud, etc. using menu options and mouse clicks. This procedure mirrors the old manual method, whereby the working chart would be placed on top of a plotted chart containing model output on a light table.

(c) First-Guess Products

So far, nothing that has been described can be said to be 'automated'. However, researchers at the Met. Office have been developing algorithms to produce '*first-guess*' products directly from model fields. Table 2 gives a list of those products currently generated.

Tropopause Boxes
Jet Streams
Areas of Clear Air Turbulence
Embedded Cumulonimbus
Sandstorms
Tropical Cyclones

Table 2: List of First-Guess Products

The software runs on the mainframe and creates files containing objects, which are then transferred to the workstation. They are defined internally in exactly the same way as an equivalent object drawn by the forecaster (e.g. a length of jet stream, or an area of cloud). They can therefore be edited on screen in exactly the same way.

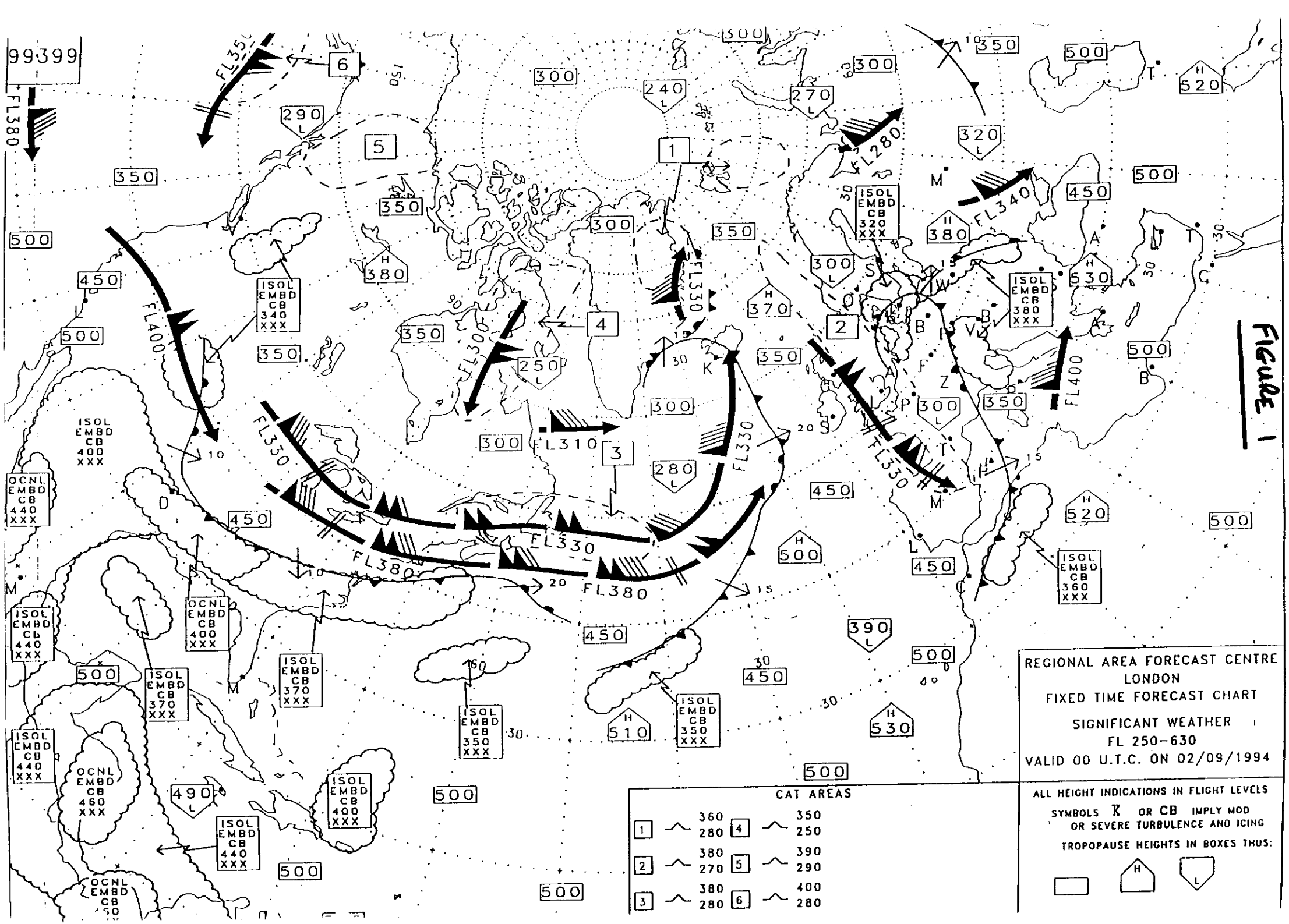
As we take over more responsibility for other areas, the first-guess will become increasingly important because of time restrictions on forecasters.

(d) Database

Another area of development is a database to hold all the objects. Because chart areas overlap so much (there are several charts covering the European area, for instance) the forecaster does not want to re-draw the same jet stream, or area of cloud, 4 or 5 times. The 'global database' is being developed so objects can be re-drawn, with the appropriate projection, on whichever map background is appropriate.

(e) The Future

The SigWx charts are currently produced operationally using 2 stand-alone Hewlett Packard 735-Series workstations. Since HORACE will very soon be available widely in the Central Forecasting Office, SigWx needs to be integrated. This will take place in stages, so initially the code will be made to conform to certain HORACE standards. Later, we will draw the background fields locally from the HORACE model fields database, rather than transfer CGMs from the mainframe. It should also be possible to run the first-guess algorithms locally, but this may be CPU intensive. Finally, a HORACE-compatible Motif GUI will be designed to replace the existing GKS menu.


99399
FL380
FL350
FL400
FL330
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FL330
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FL330
FL380
ISOL EMBD CB 400 XXX
OCNL EMBD CB 440 XXX
ISOL EMBD CB 440 XXX
OCNL EMBD CB 400 XXX
ISOL EMBD CB 370 XXX
ISOL EMBD CB 440 XXX
OCNL EMBD CB 460 XXX
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OCNL EMBD CB 460 XXX
ISOL EMBD CB 400 XXX
ISOL EMBD CB 350 XXX
ISOL EMBD CB 350 XXX
ISOL EMBD CB 320 XXX
ISOL EMBD CB 340 XXX
ISOL EMBD CB 380 XXX
ISOL EMBD CB 360 XXX
CAT AREAS
1 360 280
2 380 270
3 380 280
4 350 250
5 390 290
6 400 280
REGIONAL AREA FORECAST CENTRE
LONDON
FIXED TIME FORECAST CHART
SIGNIFICANT WEATHER
FL 250–630
VALID 00 U.T.C. ON 02/09/1994
ALL HEIGHT INDICATIONS IN FLIGHT LEVELS
SYMBOLS K OR CB IMPLY MOD OR SEVERE TURBULENCE AND ICING
TROPOPAUSE HEIGHTS IN BOXES THUS:

FIGURE 1

EGOWS 6

Vienna 19-22 June 1995

Automating The Forecast Production Process

Alan Radford

Forecasting Systems

UK Met. Office

Background

- improving NWP models
- increasing reliance on model output
- occasional amendment necessary, but ..
- some products are direct NWP, leading to ..

INCONSISTENCY

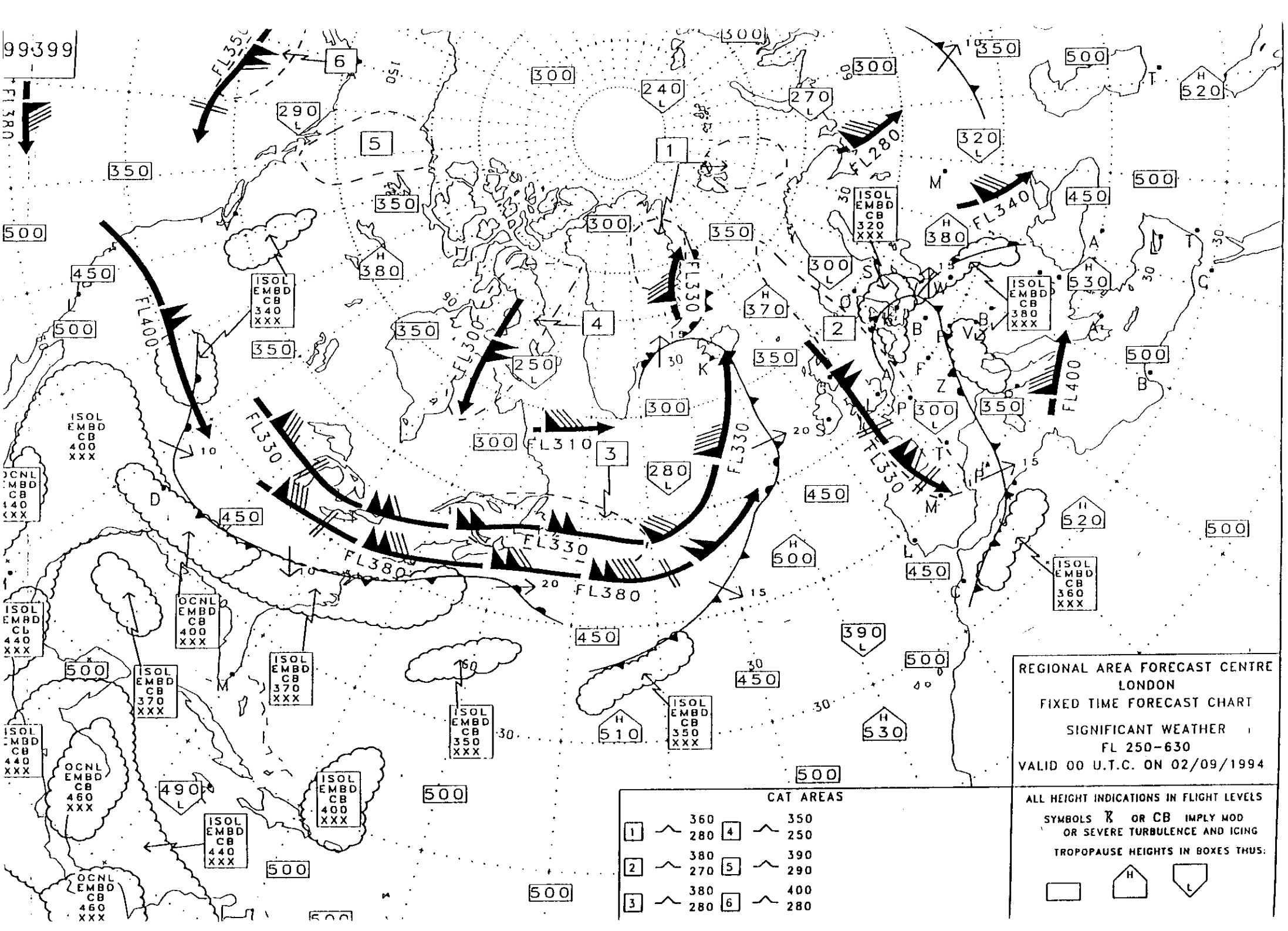
Requirement

- fields database
  - *consistent with forecaster guidance*
  - *consistent in 3D*
- one option:

GRAPHICAL EDITING

SigWx Background

- 2 WAFCs - Bracknell & Washington
- NAT SigWx every 6 hours (RAFC)
- RAFC Frankfurt responsibility
- Future
  - *–RAFC Toulouse*
  - *–any chart (global)*


99399
REGIONAL AREA FORECAST CENTRE
LONDON
FIXED TIME FORECAST CHART
SIGNIFICANT WEATHER
FL 250-630
VALID 00 U.T.C. ON 02/09/1994
CAT AREAS
1 360 280
2 380 270
3 380 280
4 350 250
5 390 290
6 400 280
ALL HEIGHT INDICATIONS IN FLIGHT LEVELS
SYMBOLS ℞ OR CB IMPLY MOD OR SEVERE TURBULENCE AND ICING
TROPOPAUSE HEIGHTS IN BOXES THUS:
FL350
FL280
FL340
FL400
FL330
FL300
FL310
FL380
ISOL EMBD CB 400 XXX
ISOL EMBD CB 340 XXX
ISOL EMBD CB 380 XXX
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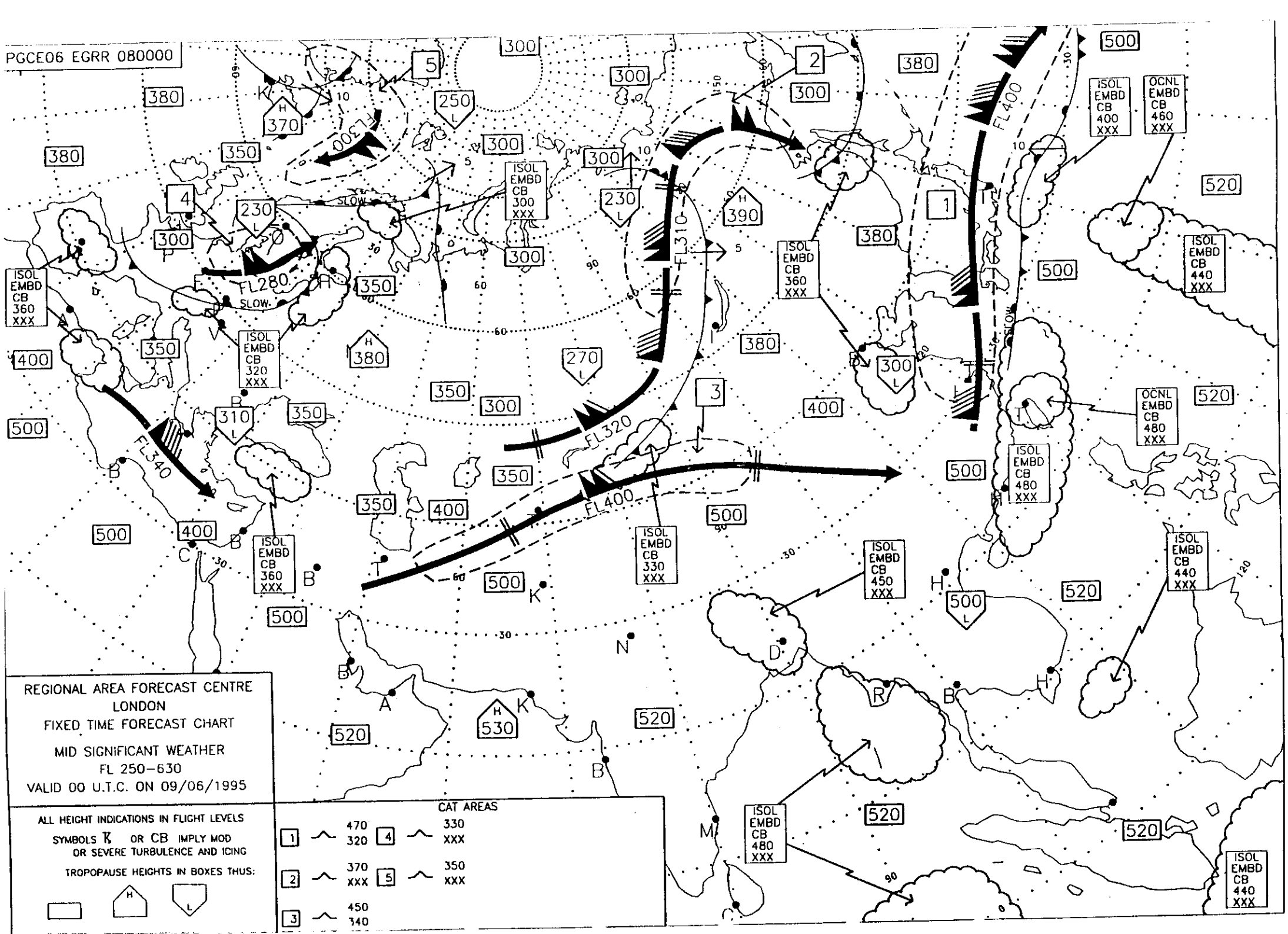
OCNL EMBD CB 460 XXX
ISOL EMBD CB 440 XXX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REGIONAL AREA FORECAST CENTRE
LONDON
FIXED TIME FORECAST CHART
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FL 250–630
VALID 00 U.T.C. ON 09/06/1995
ALL HEIGHT INDICATIONS IN FLIGHT LEVELS
SYMBOLS K OR CB IMPLY MOD OR SEVERE TURBULENCE AND ICING
TROPOPAUSE HEIGHTS IN BOXES THUS:
CAT AREAS
1 470 320
2 370 XXX
3 450 340
4 330 XXX
5 350 XXX
FL400
FL340
FL320
FL310
FL280
ISOL EMBD CB 360 XXX
ISOL EMBD CB 320 XXX
ISOL EMBD CB 300 XXX
ISOL EMBD CB 330 XXX
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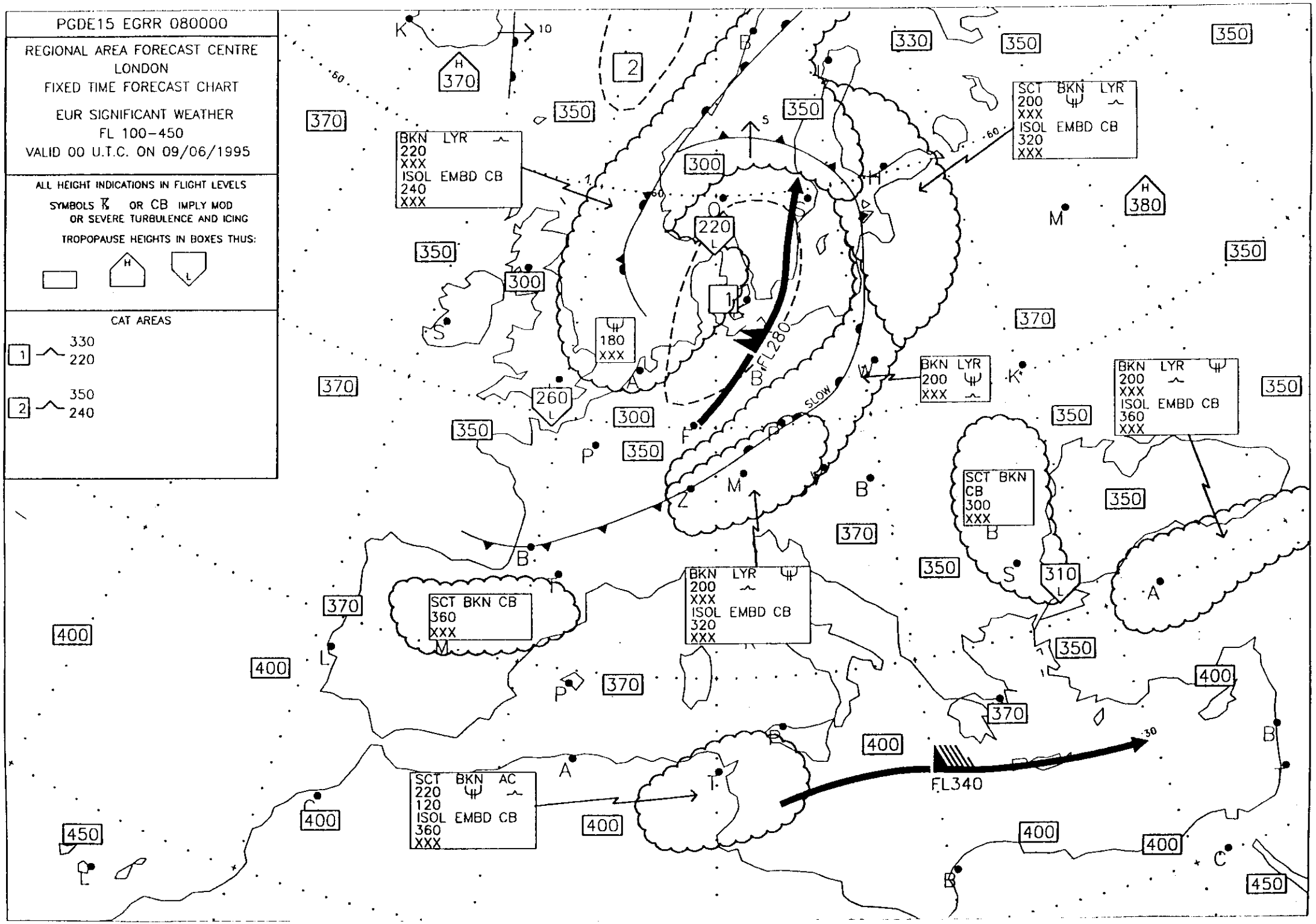
ISOL EMBD CB 440 XXX
SLOW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REGIONAL AREA FORECAST CENTRE
LONDON
FIXED TIME FORECAST CHART
EUR SIGNIFICANT WEATHER
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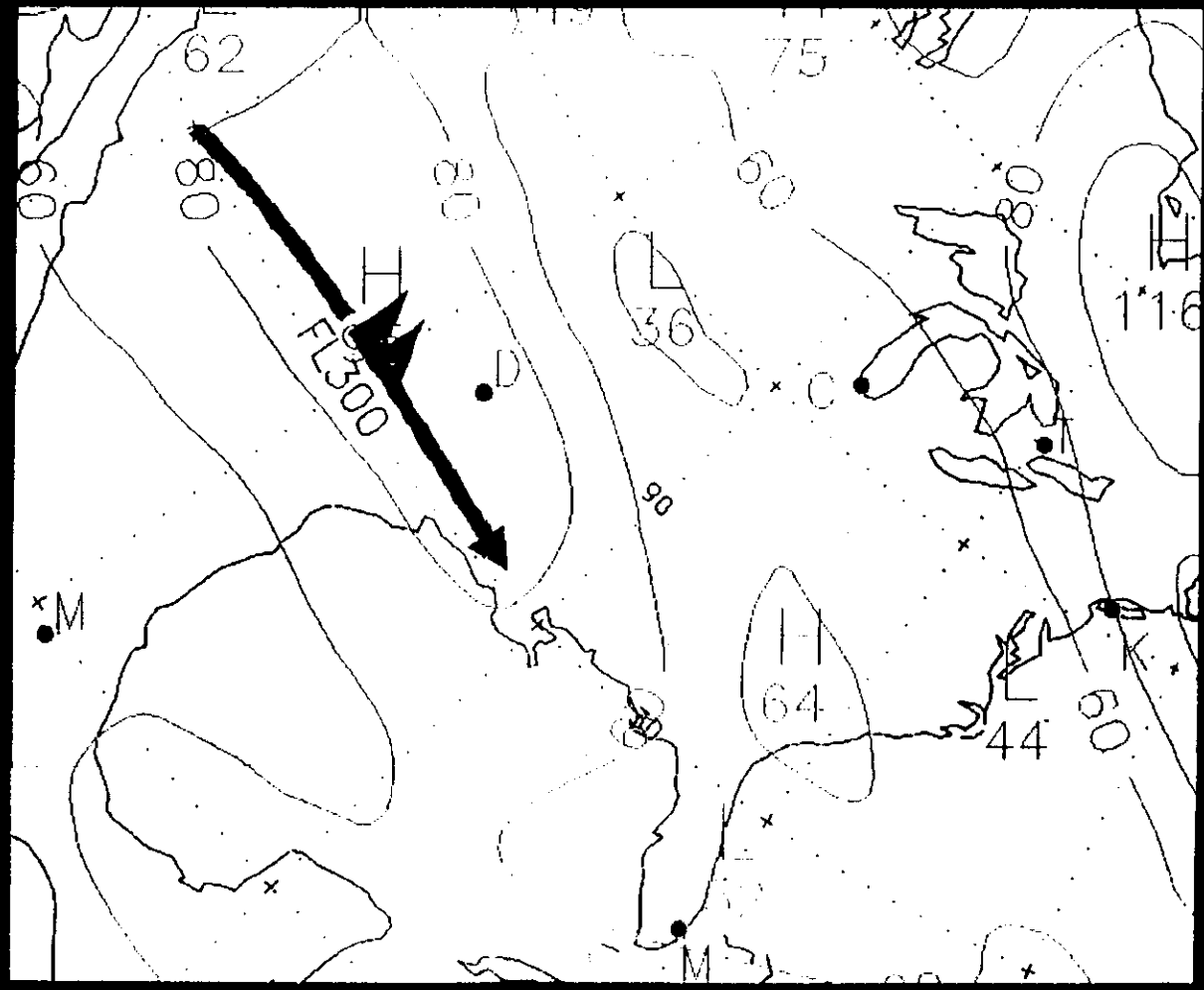
VALID 00 U.T.C. ON 09/06/1995
ALL HEIGHT INDICATIONS IN FLIGHT LEVELS
SYMBOLS ⅓ OR CB IMPLY MOD OR SEVERE TURBULENCE AND ICING
TROPOPAUSE HEIGHTS IN BOXES THUS:
CAT AREAS
1 330 220
2 350 240
BKN LYR
220
XXX
ISOL EMBD CB
240
XXX
SCT BKN LYR
200
XXX
ISOL EMBD CB
320
XXX
180
XXX
BKN LYR
200
XXX
BKN LYR
200
XXX
ISOL EMBD CB
360
XXX
SCT BKN
CB
300
XXX
SCT BKN CB
360
XXX
BKN LYR
200
XXX
ISOL EMBD CB
320
XXX
SCT BKN AC
220
120
ISOL EMBD CB
360
XXX
FL280
SLOW
FL340

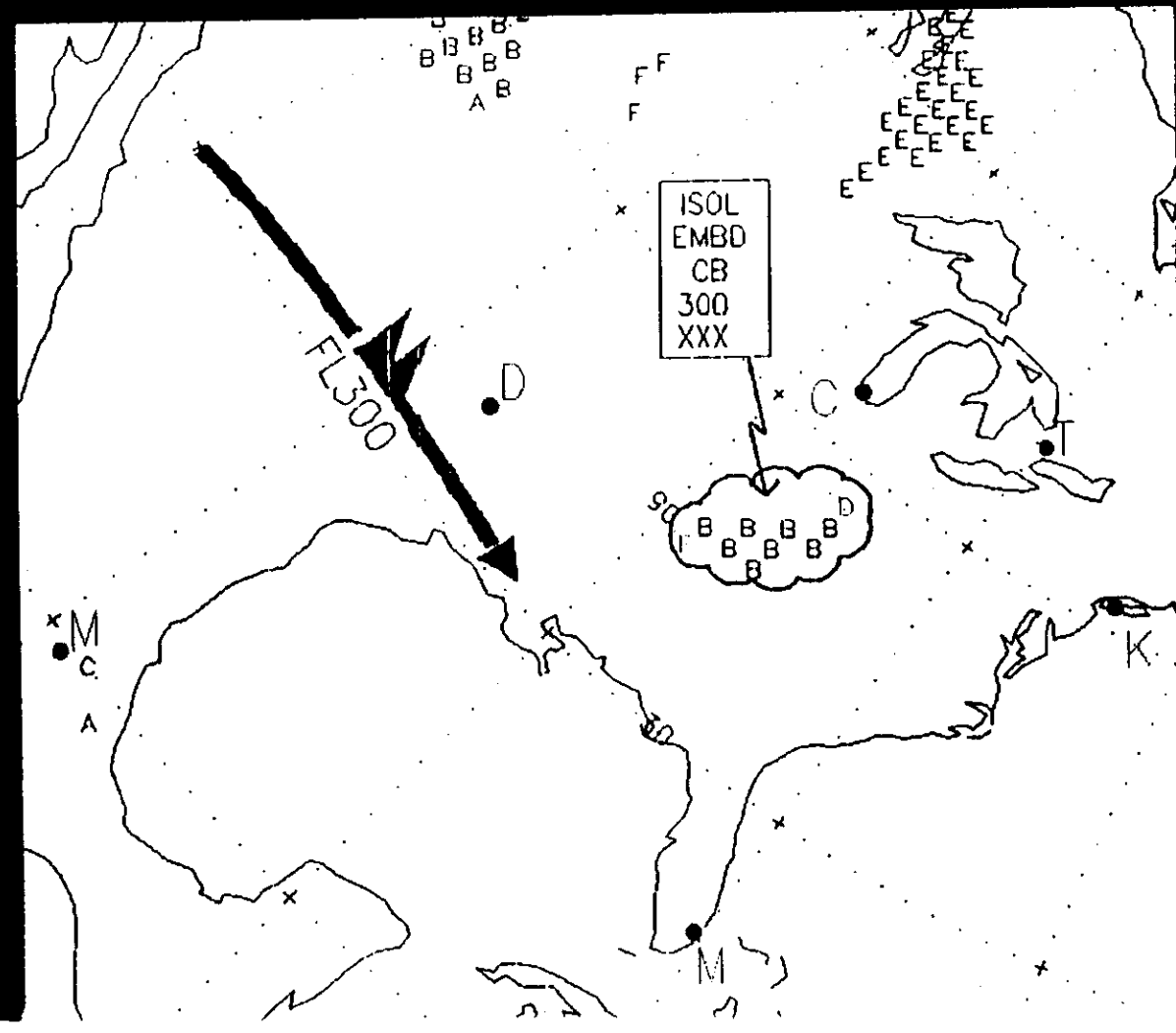
Background Fields

- tropopause height
- mslp
- 1000-500 thickness
- 850 wbpt
- CAT probability
- 250 hPa height
- max wind
  - *isotachs*
  - *arrows*
  - *height*
- convective cloud
  - *top*
  - *depth*

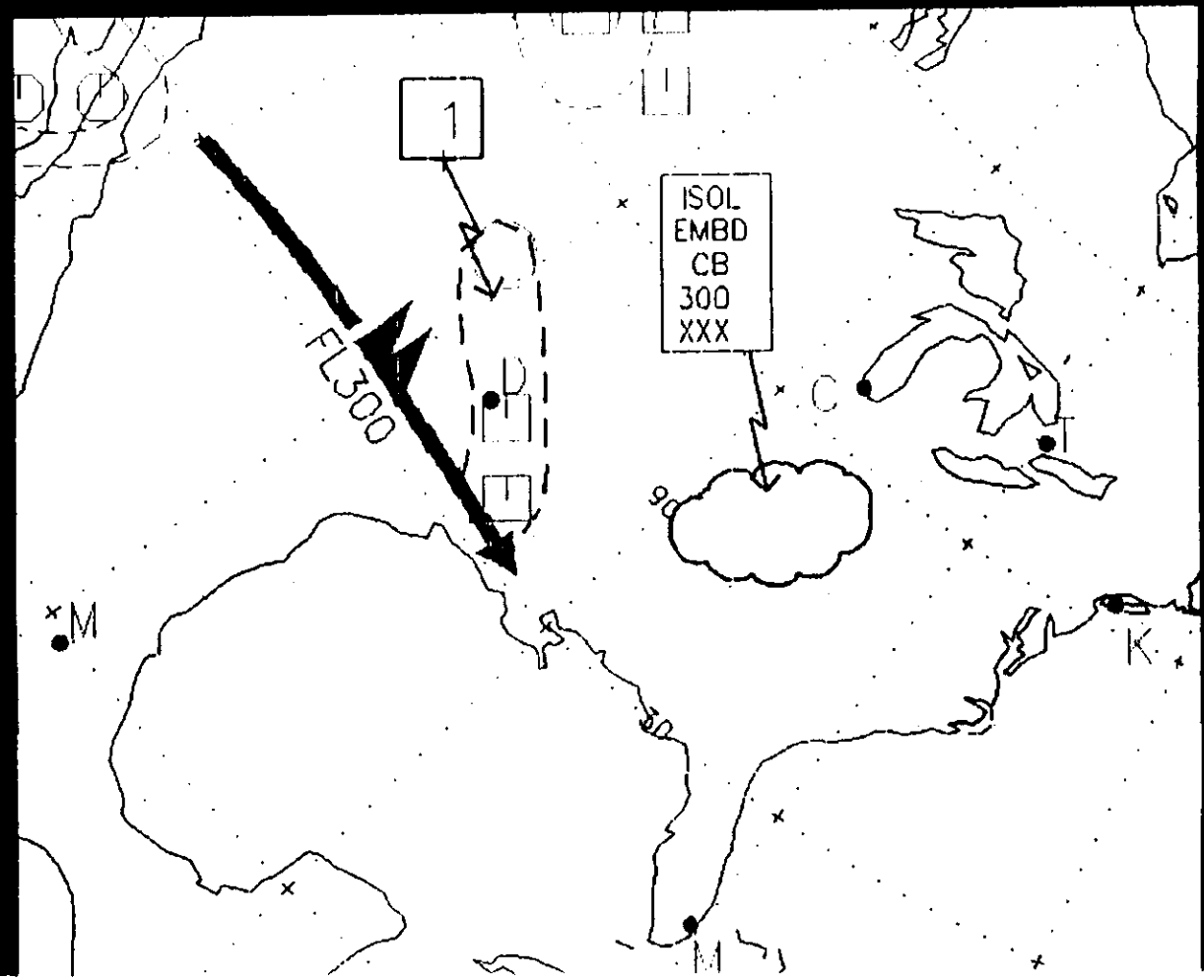
SigWx



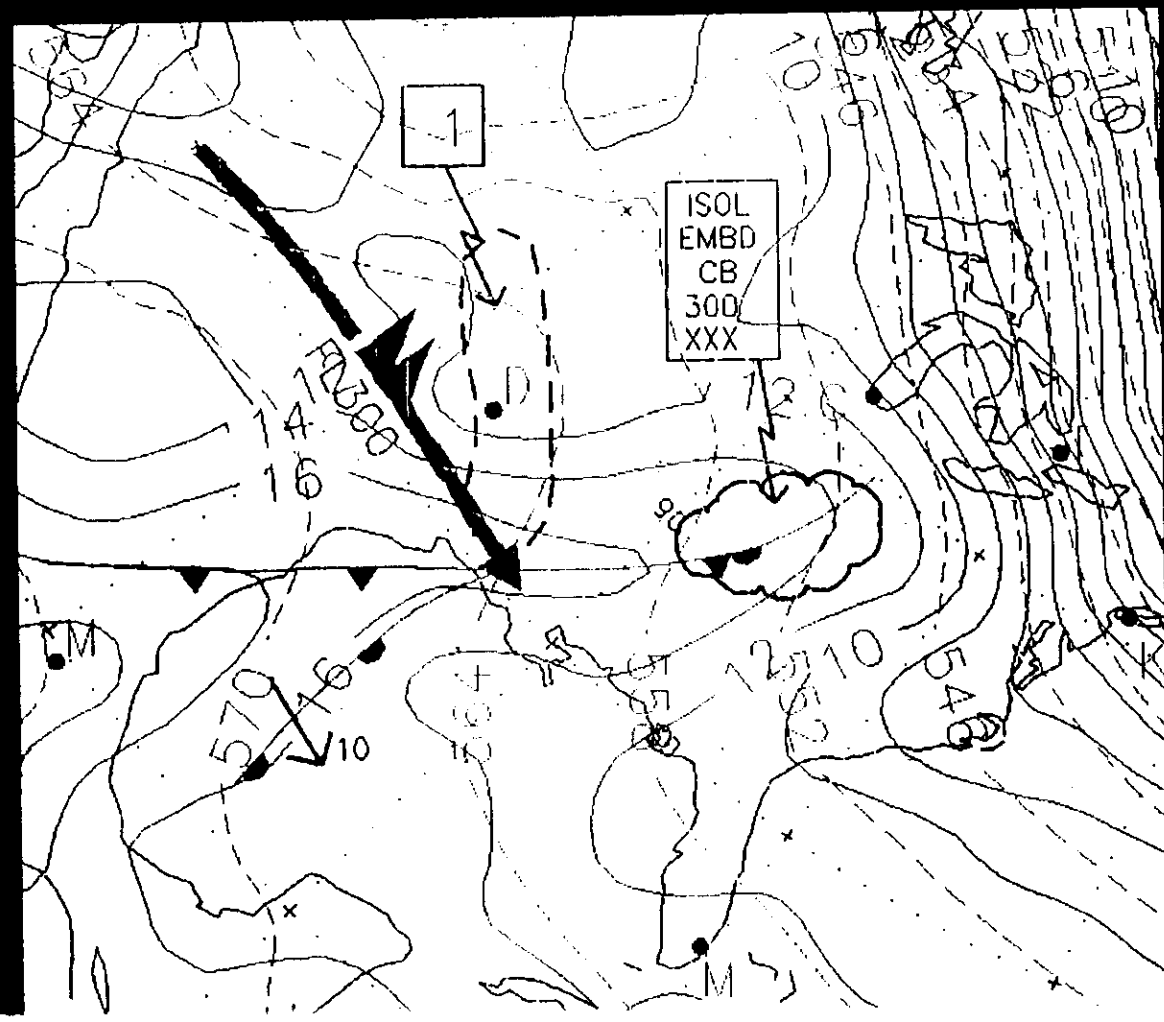
SigWx



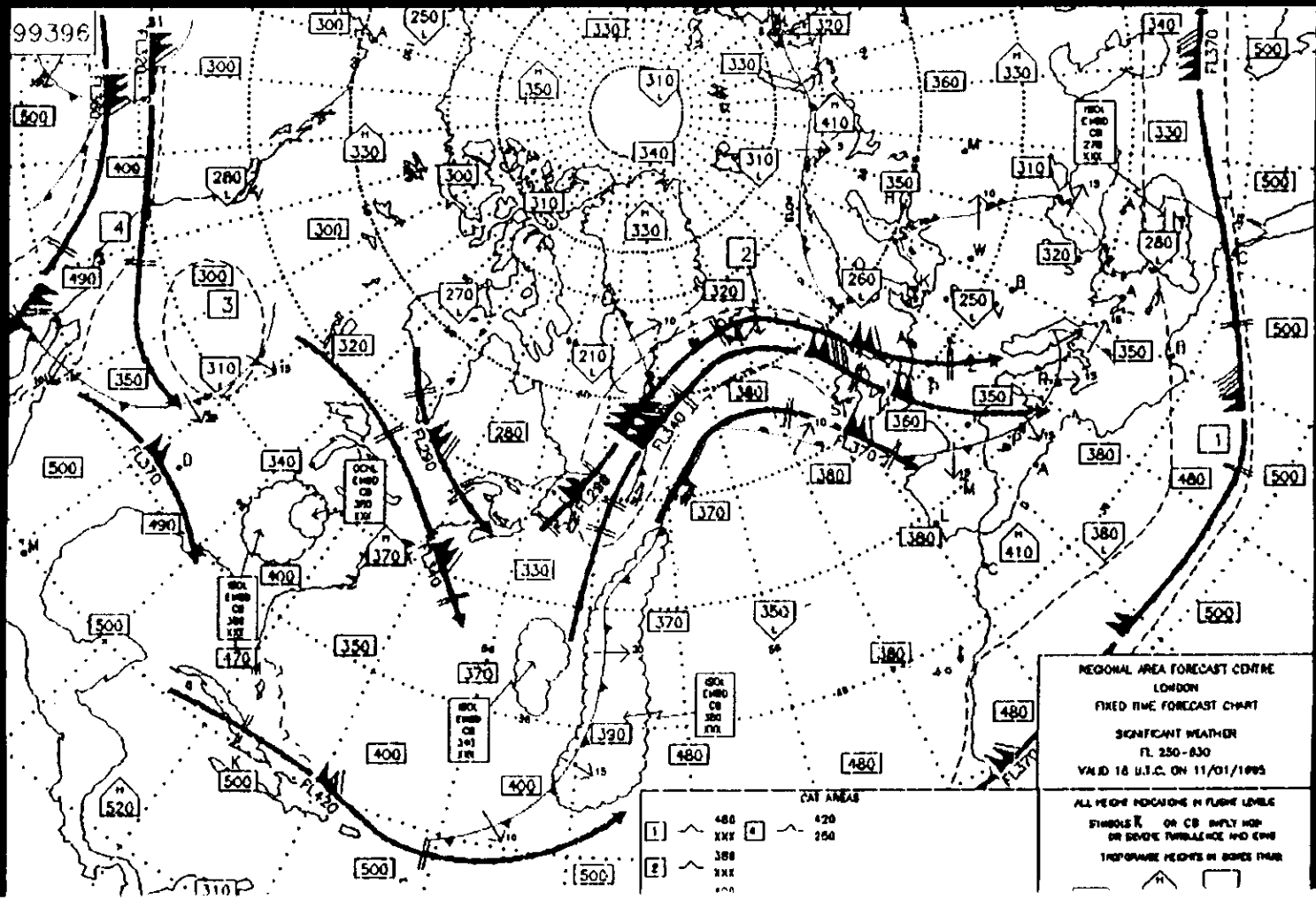
SigWx



SigWx



SigWx

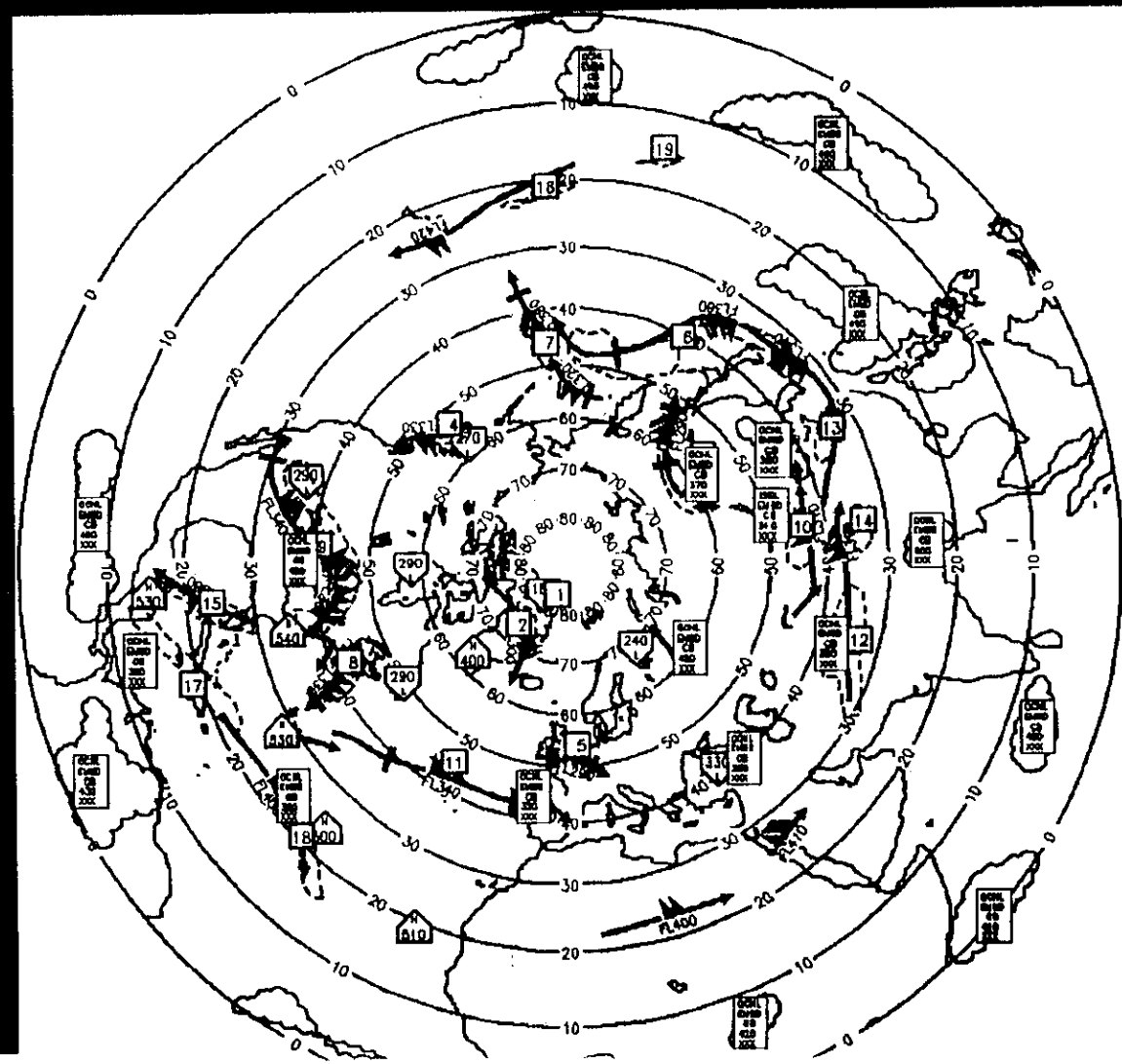

99396
REGIONAL AREA FORECAST CENTRE
LONDON
FIXED TIME FORECAST CHART
SIGNIFICANT WEATHER
FL 250 - 630
VALID 18 U.T.C. ON 11/01/1995
CAT AREAS

First-Guess Products

- tropopause boxes
- jet streams
- CAT areas
- embedded Cb
- sandstorms
- tropical cyclones
- surface fronts
- convergence zones (ITCZ)

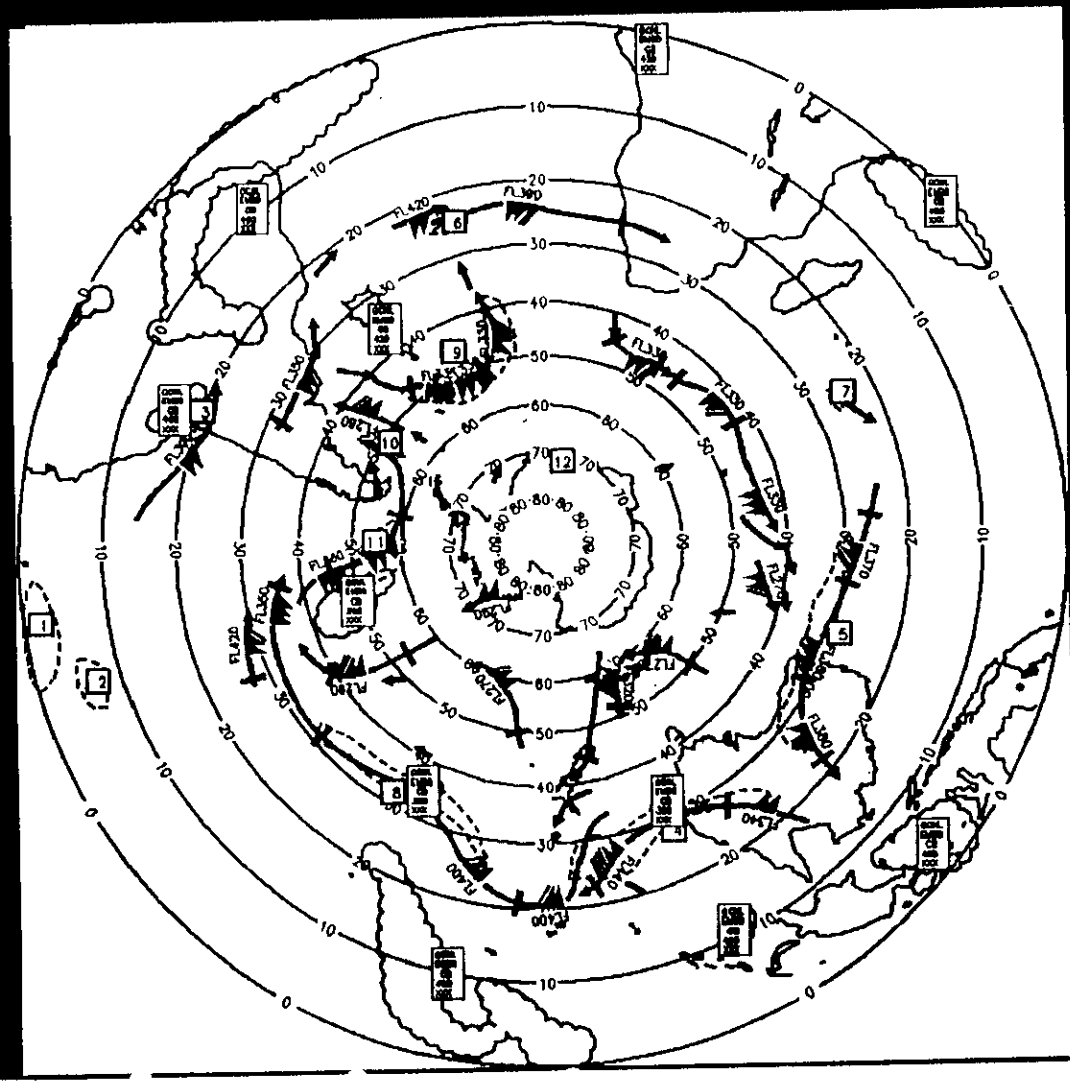
SigWx

Global First Guess - Northern Hemisphere



SigWx

Global First Guess - Southern Hemisphere



Future

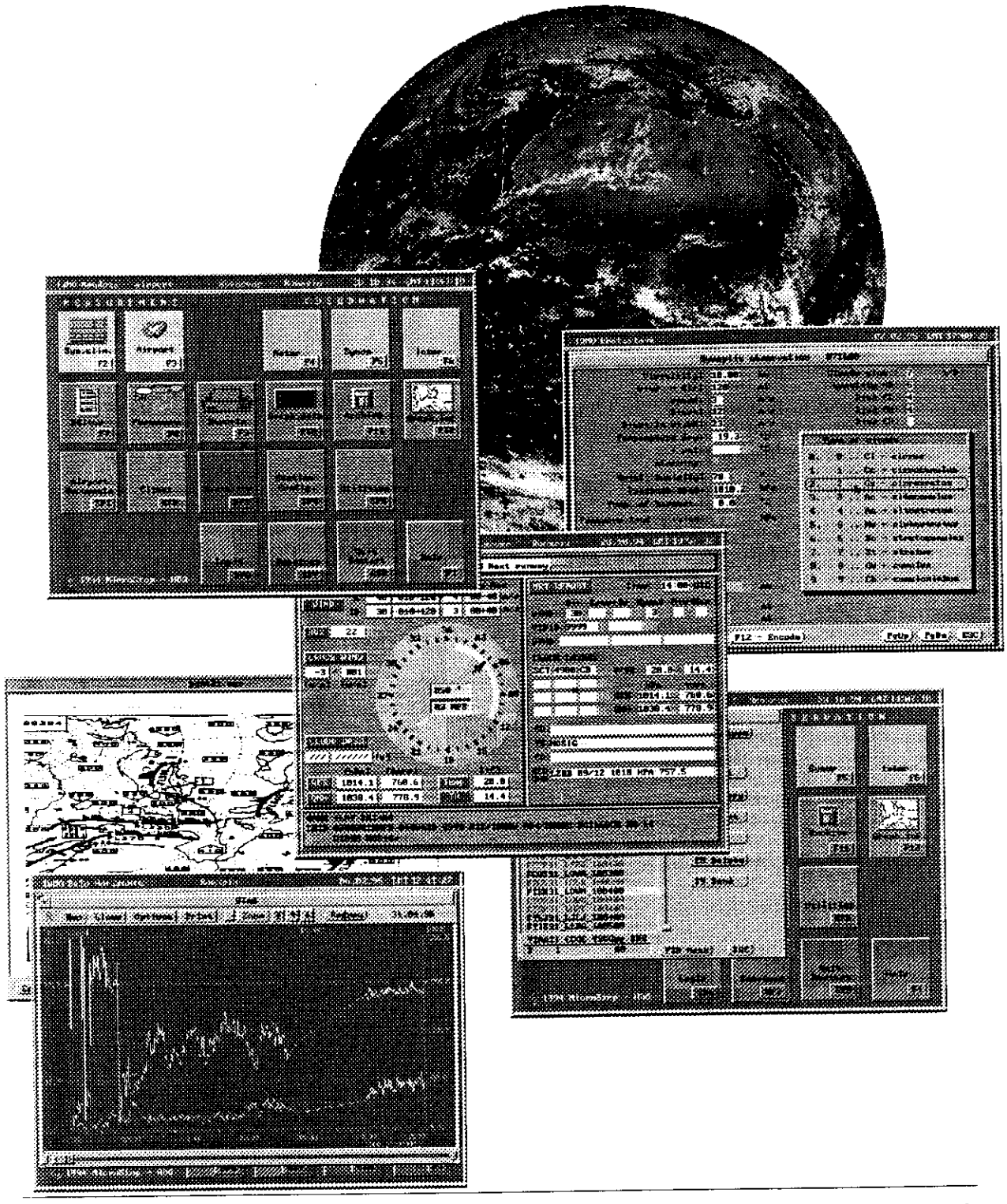
- integration with HORACE
  - *code conforms to HORACE standards (e.g. error trapping)*
  - *MOTIF GUI*
- model fields from HORACE
  - *background*
  - *first-guess*
    - ✳ *CPU intensive? (-)*
    - ✳ *improve backup capability (+)*

EGOWS 6
Vienna , 19-22 June 1995

Session : Meteorological Applications

Oldrich S P A N I E L

Integrated Workstation for Meteorological Observer



Slovak Hydrometeorological Institute , Jeséniova 17, 833 15 Bratislava, Slovakia

Phone: +42 7 374 052 Fax: +42 7 373 620

MicroStep - HDO Ltd., Ilkovičova 3, 812 19 Bratislava, Slovakia

Phone: +42 7 791 816, +42 7 791 469 Fax: +42 7 722 480, +42 7 728 364

Integrated Workstation for Meteorological Observer

MicroStep - HDO Ltd., Ilkovičova 3, 812 19 Bratislava, Slovakia
Phone : +42 7 791 816 Fax : +42 7 722 480
+42 7 791 469 +42 7 728 364
e-mail: omelka@decef.elf.stuba.sk

Slovak Hydrometeorological Institute, Jesénlova 17, 833 15 Bratislava
Phone: +42 7 374 052 Fax: +42 7 373 620

IWMO is a software product, which has been designed to cover most of services, which are expected to be useful at meteorological stations. It has been created with assistance of skilled meteorologists, whose experience is built in it.

The main functions of IWMO can be described in the following points:

1. Data collecting
2. Organization of the database of measured and observed data
3. Data presentation
4. Creation of meteorological messages
5. Communication with National Telecommunication Center (NTC)
6. Meteorological message managment
7. Distribution station
8. Presentation station
9. Airport station
10. Education and training station
11. Module for updating the IWMO
12. Forms and reports
13. Data maintaining
14. Station configuration
15. Checking of privileges
16. System of protocols

Using the system you get a lot of advantages:

- the same software system for various meteorological stations
- minimizing of errors in created messages
- easy and cheap connection of existing software systems to NTC
- utilization of all existing hardware devices which are able to communicate with computer
- high ratio performance / price

IWMO system is running well on this configuration:

- PC 386DX 40MHz with coprocessor
- at least 8MB RAM
- at least 80MB HardDisk
- mouse
- 5 1/4 or 3 1/2 floppy disk

IWMO requires this software environment:

- QNX 4.21 operating system
- QNX Windows 2.3

Integrated Workstations for Meteorological Observer are installed and used in Slovak republic.

For references please contact:

RNDr. Ondráš Miroslav CSc.
Deputy for meteorology and climatology
Slovak Hydrometeorological Institute.
e-mail: ondras@SHMUVAX.SHMU.SK
Phone: +42 7 374 052
Fax: +42 7 374 620

If you are interested in Integrated Workstation for Meteorological Observer please contact us for more information.

EGOWS 6
Vienna , 19-22 June 1995

Session : Meteorological Applications

Claude B E R T O U

Main objectives

Help forecasters **analyze** and **understand** the weather situation through interaction with :

- alphanumeric data,
- radar and satellite images,
- observations,
- model outputs.

Provide forecasters with specific tools for elaborating **meteorological production :**

- within met. services,
- towards end users.

Standards

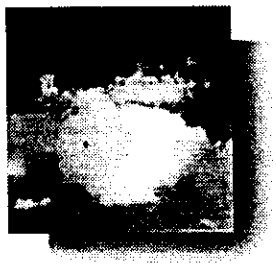
Industrial standards :

- UNIX
- X-WINDOWS
- GKS (GKX, XELION)
- SGBD (ORACLE)
- C, FORTRAN
- POSTSCRIPT, T4
- MOTIF
- X-DESIGNER
- APPLIX

Meteorological standards :

- GRIB
- BUFR
- NEONS
- MAGICS

Key dates



may 89	Synergie project launched
end 91	Synergie_0 prototype
end 92	Synergie_1 requirements
beg.93	beginning of specific production development
end 93	beginning of training and WS implementation

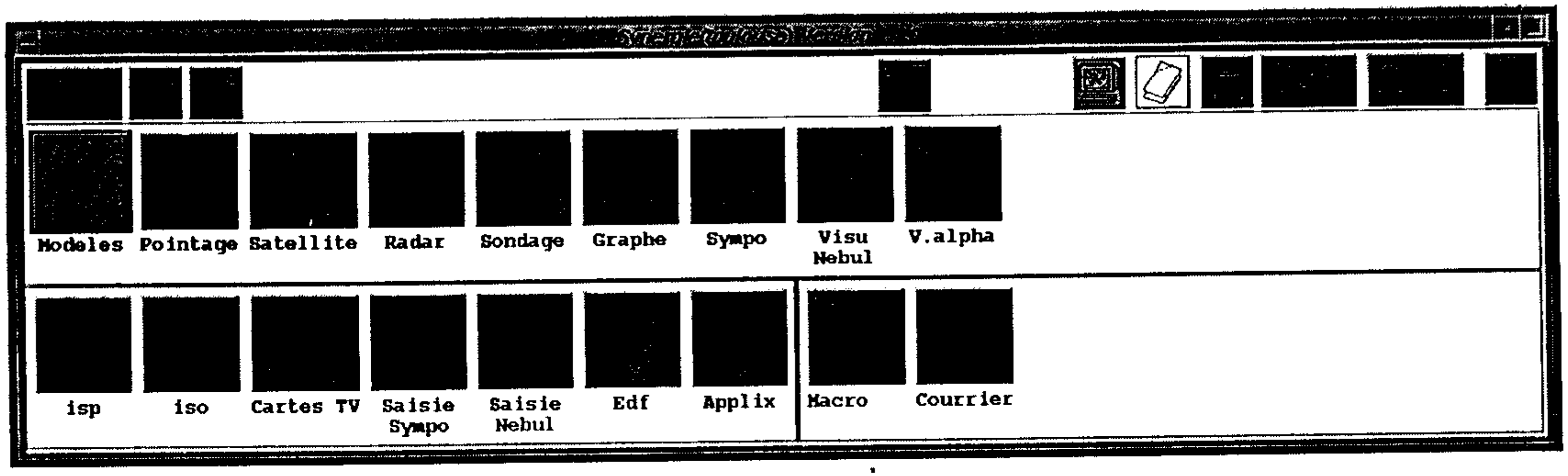
Key-dates

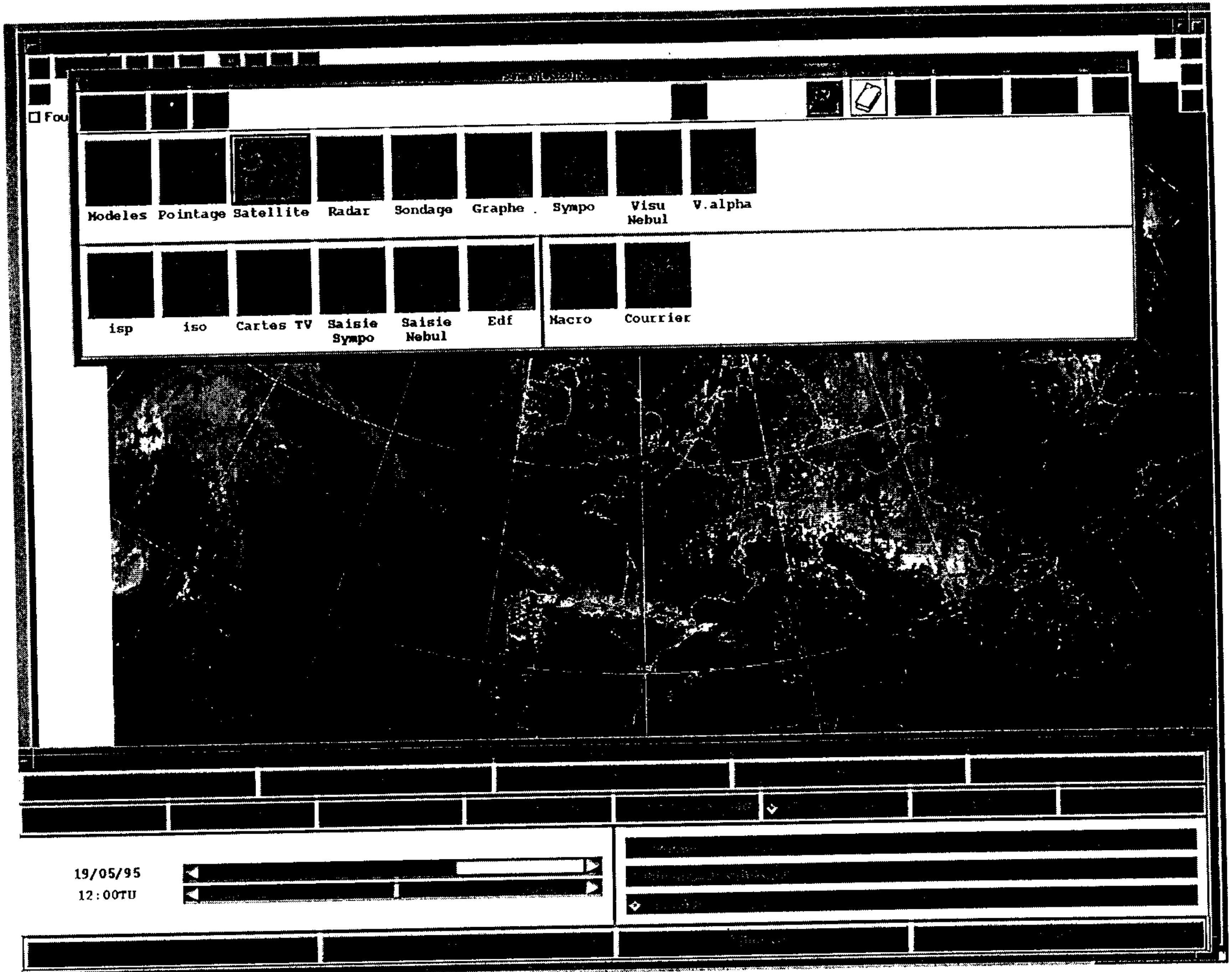
june 94 Synergie_1.0 operational at Meteo-France; first production features

end 94 end of WS implementation in France

1995 production features; export versions

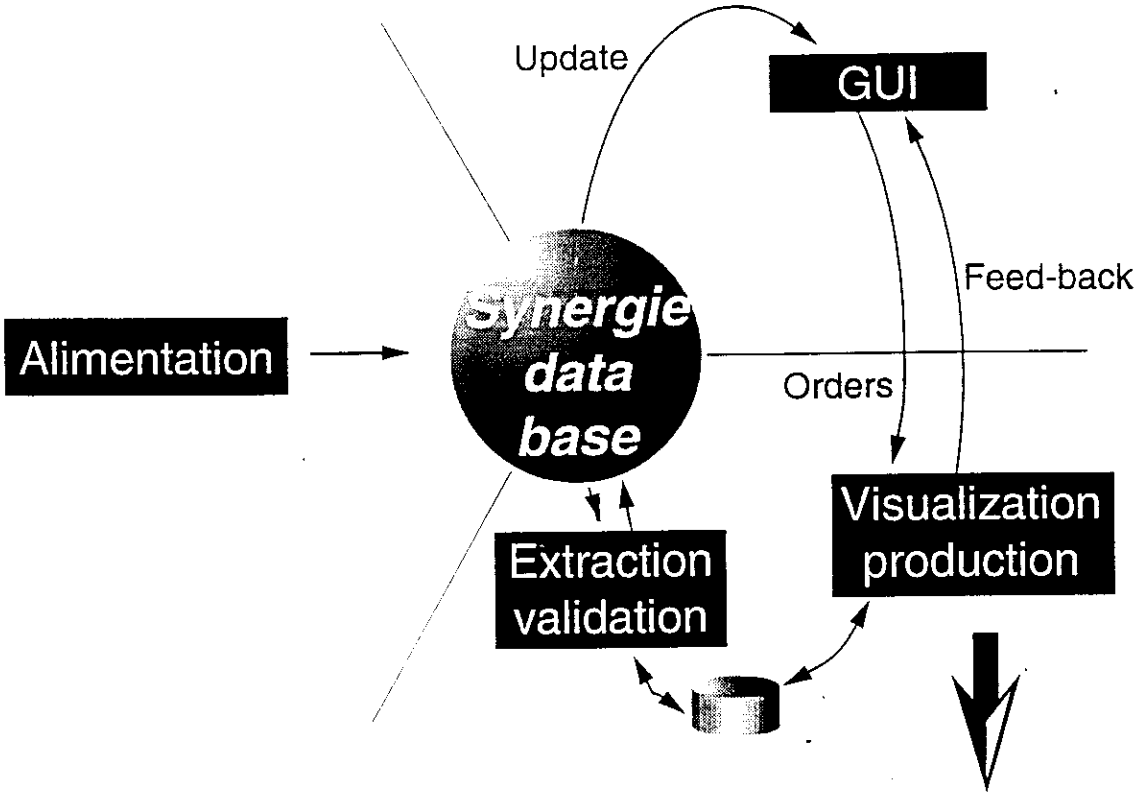
METEO FRANCE

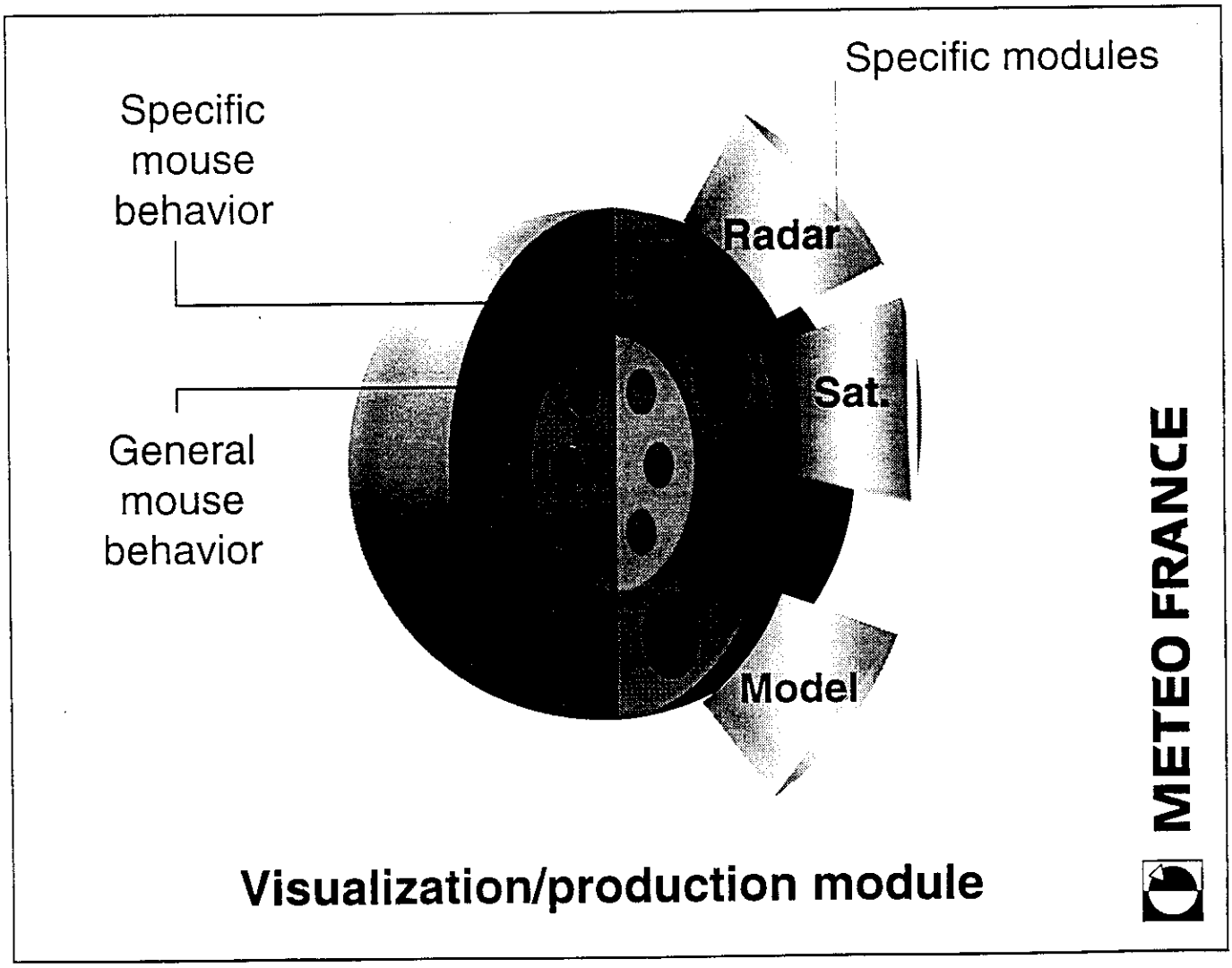

Modeles
Pointage
Satellite
Radar
Sondage
Graphe
Sympo
Visu Nebul
V.alpha
isp
iso
Cartes TV
Saisie Sympo
Saisie Nebul
Edf
Applix
Macro
Courrier



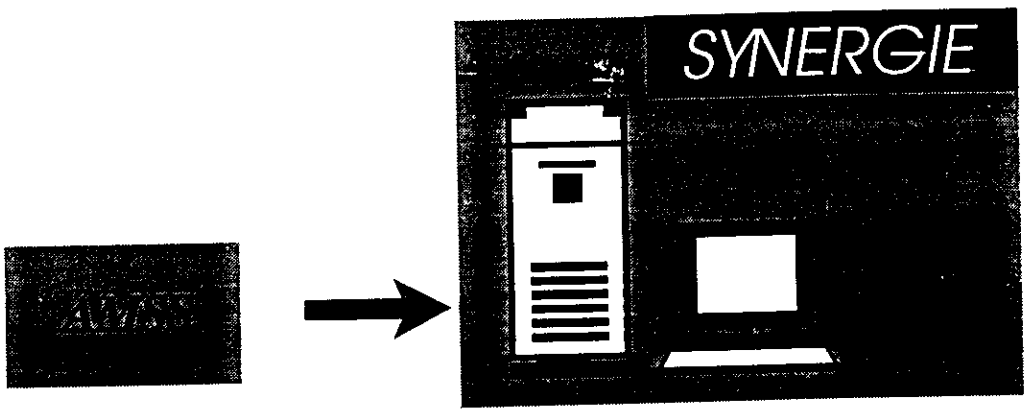
Modeles
Pointage
Satellite
Radar
Sondage
Graphe
Sympo
Visu Nebul
V.alpha
isp
iso
Cartes TV
Saisie Sympo
Saisie Nebul
Edf
Macro
Courrier
19/05/95
12:00TU

Synergie architecture

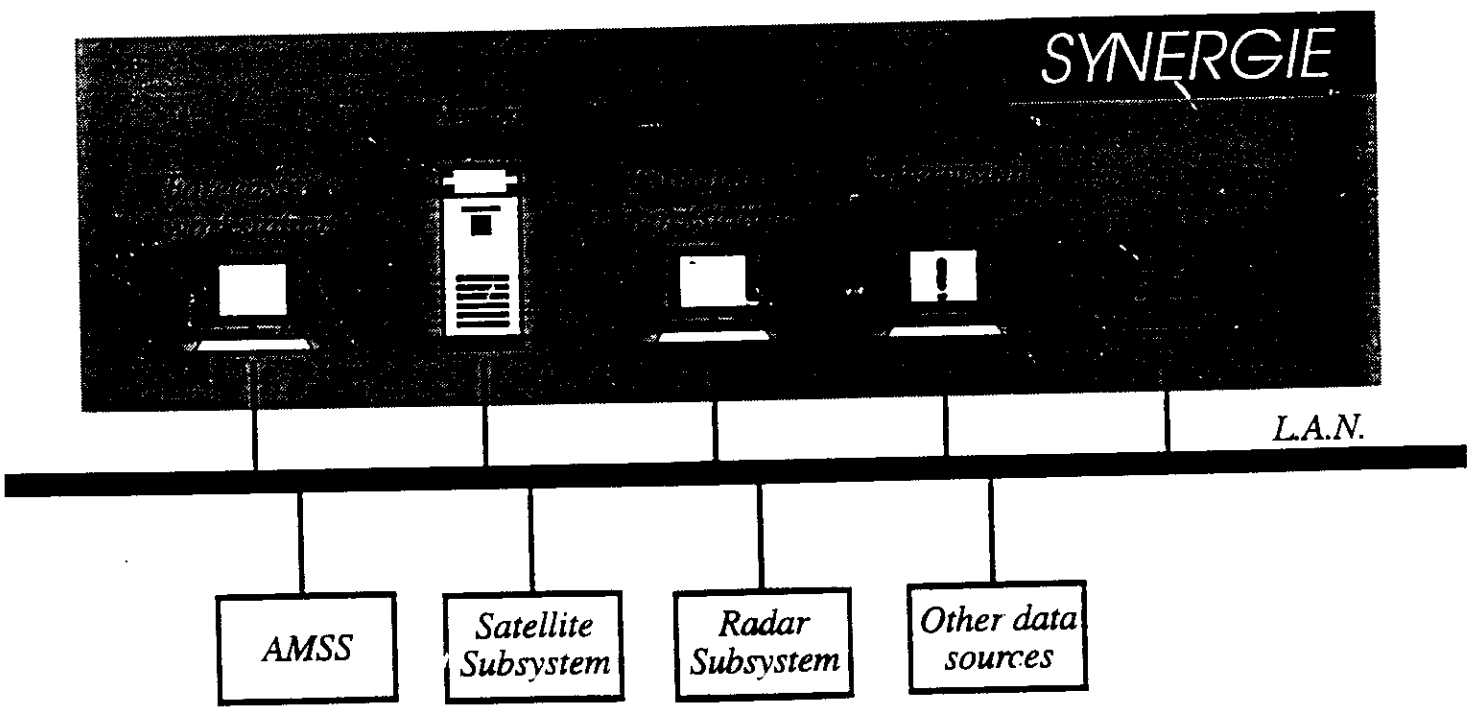




From the simplest situation...



...to more complex configurations



The Synergie 2.0 release

Data types :

- model output
- observations and MOS forecasts
- radar pictures
- satellite pictures
- lightning impacts
- alphanumeric messages

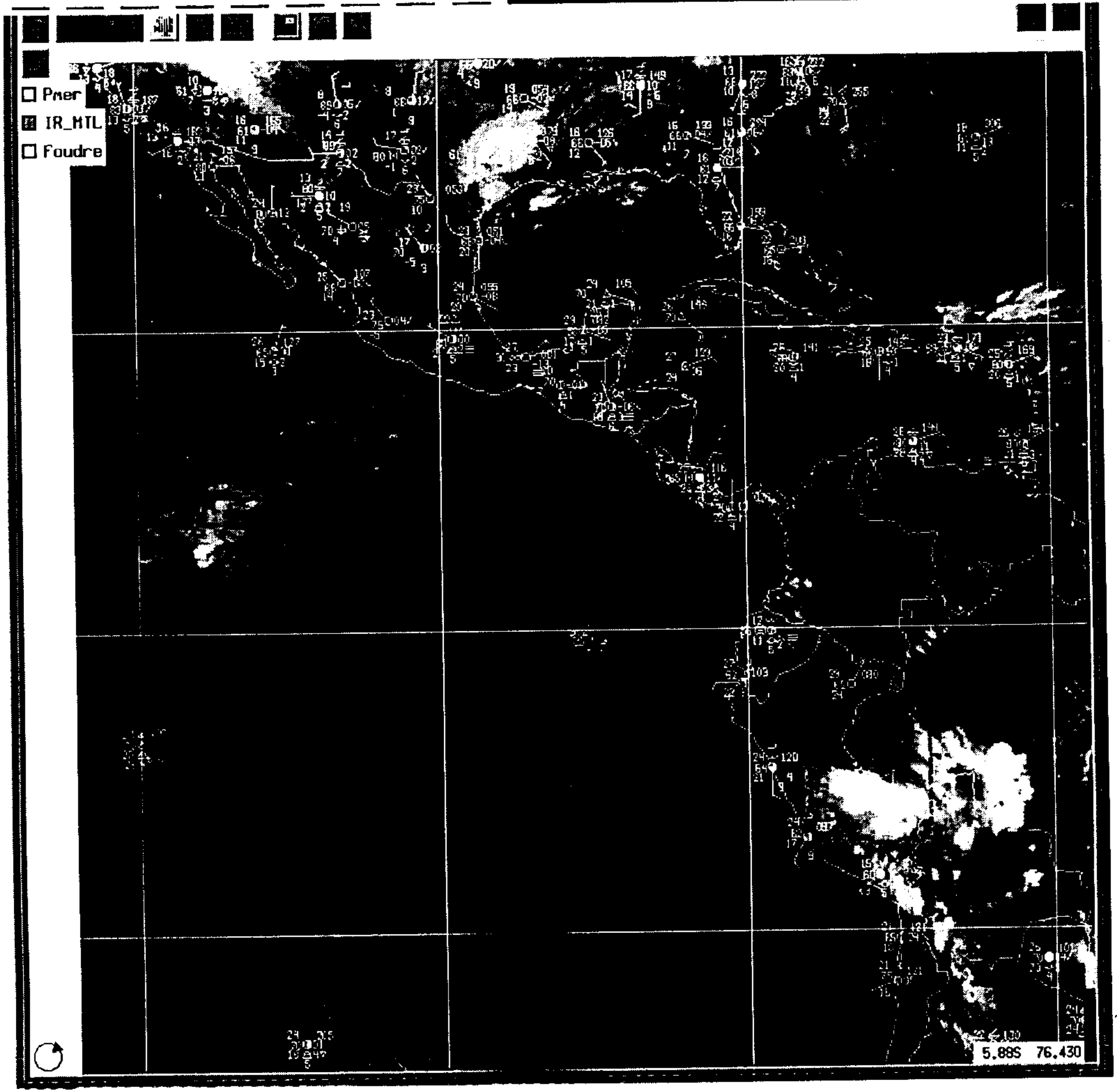
METEO FRANCE

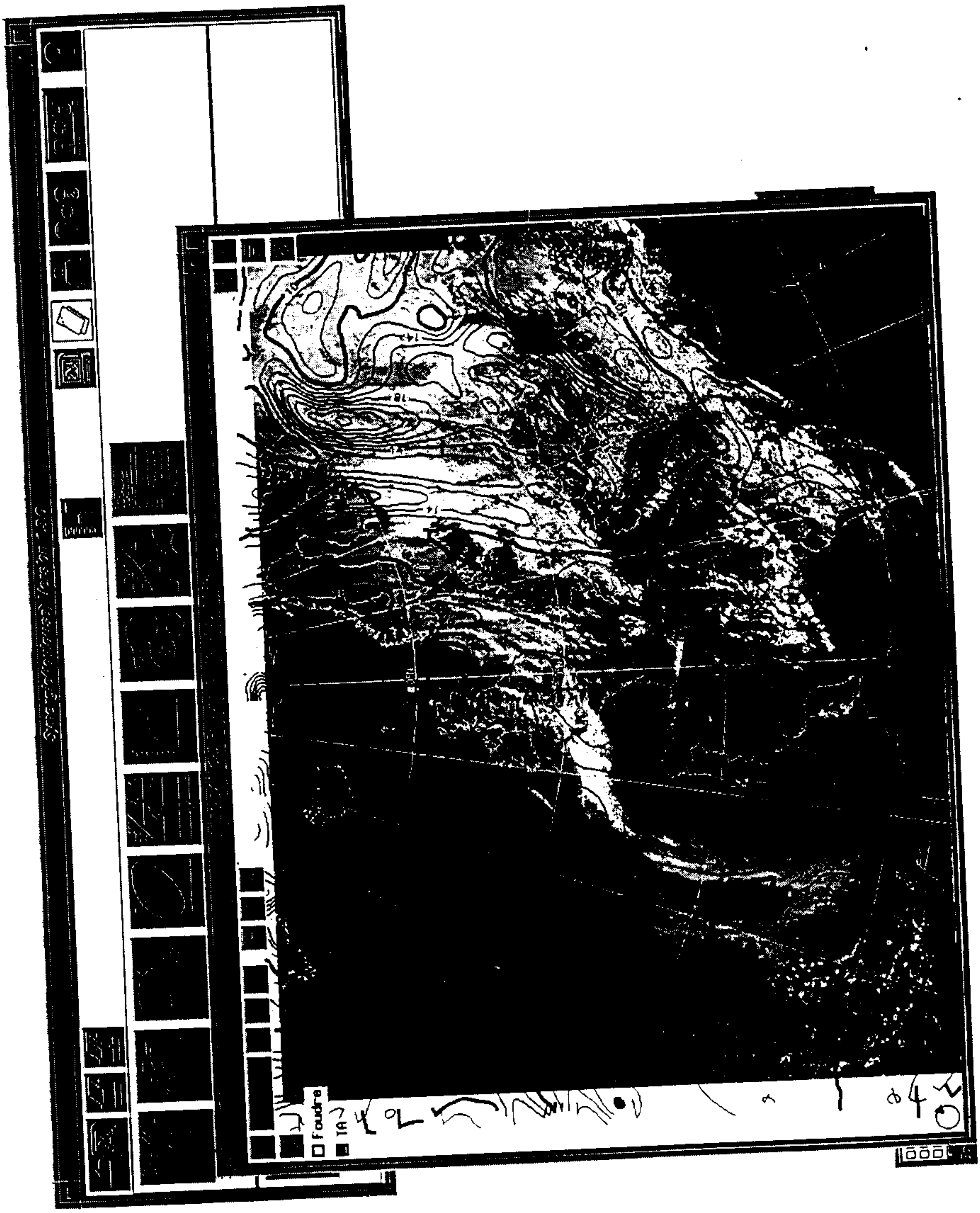
The Synergie 2.0 release

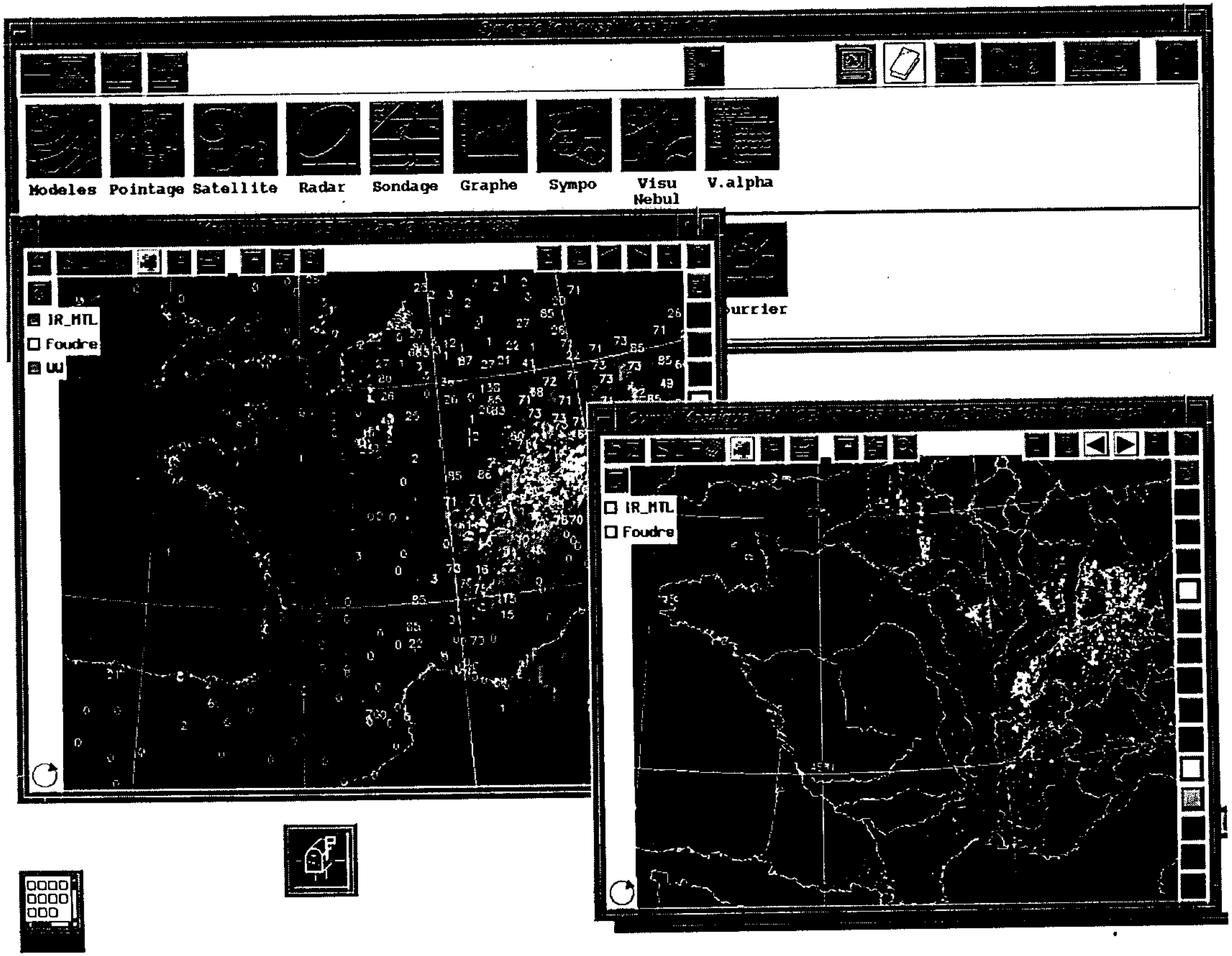
Visualisation features :

- plotting
- time series
- contouring
- animation
- zoom, panning
- cross section, vertical profile
- radar rainfall amounts
- satellite multichannel composition
- heterogeneous combinations

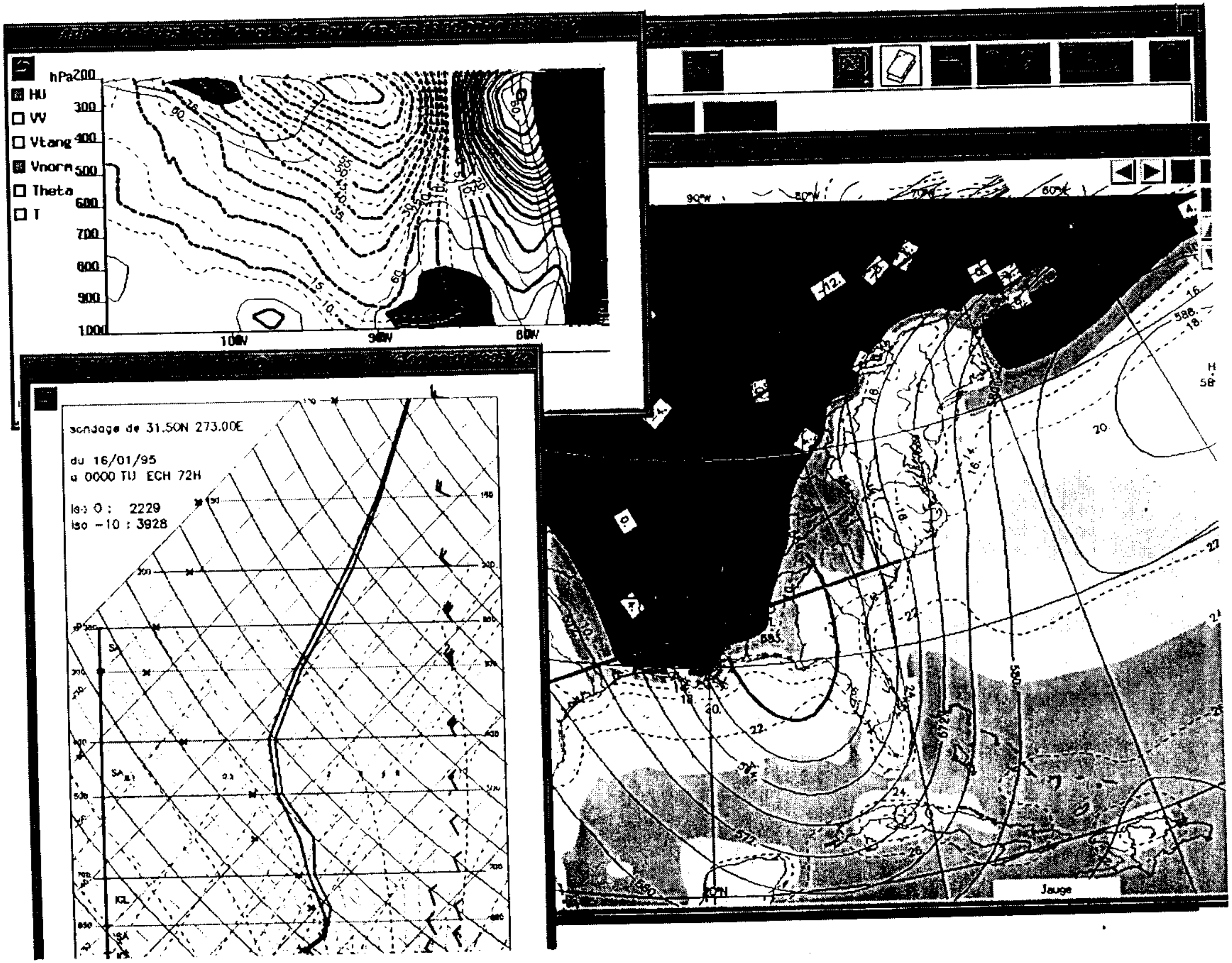
Configuration


Pmer
IR_MTL
Foudre
5.88S 76.430

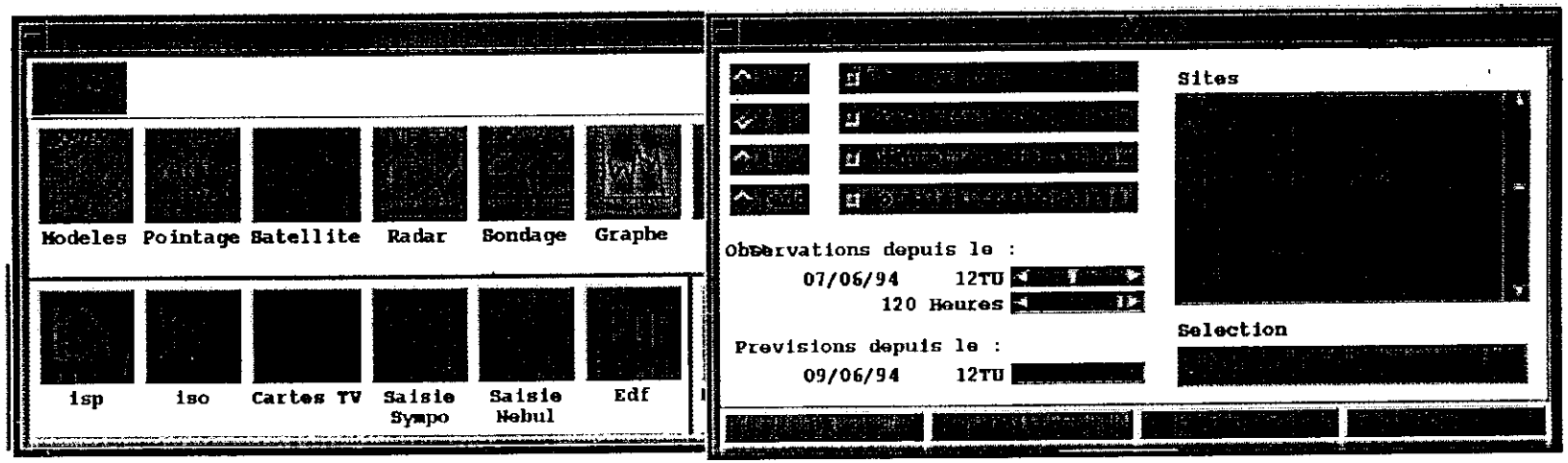

Foudre
TA

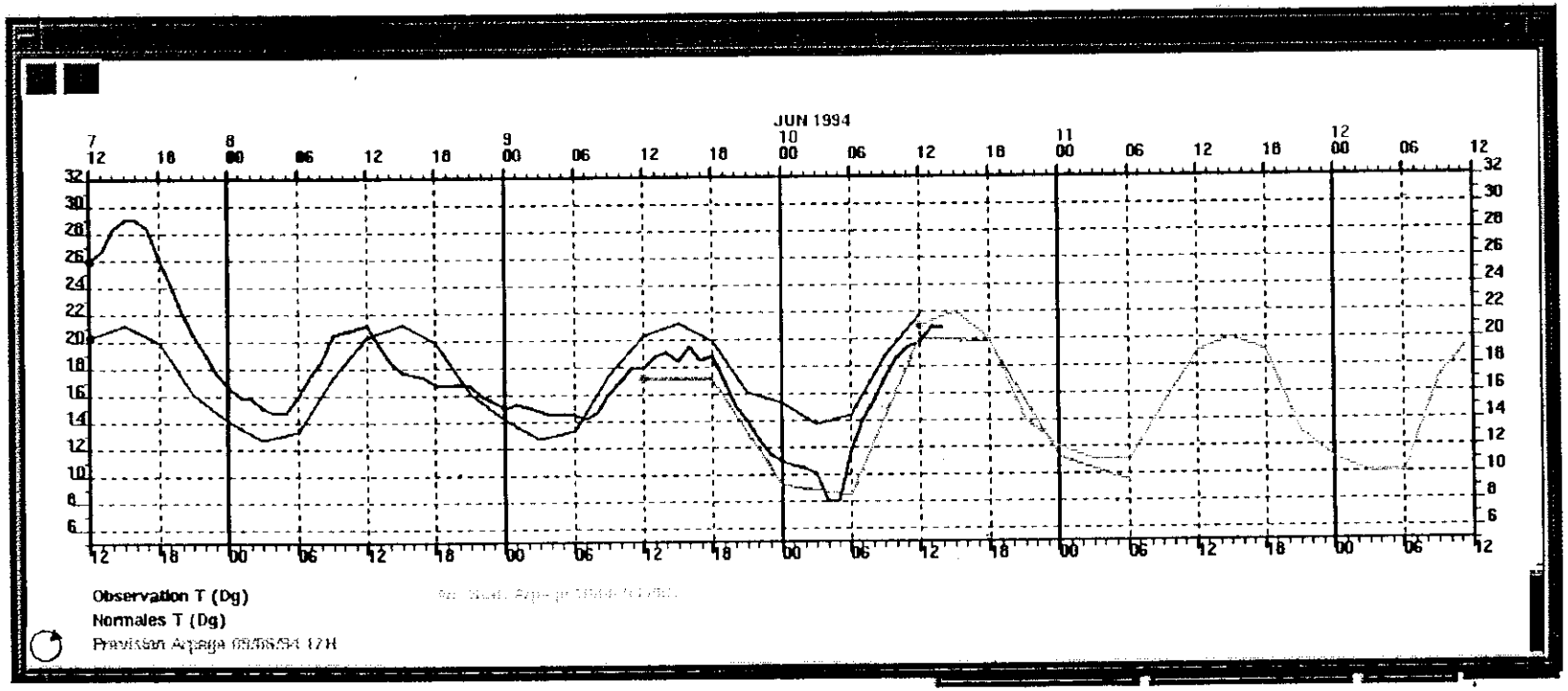


METEO FRANCE CNRM operator cti_01 13/01/95 16:15:48



hPa200
HU
VV
Vtang
Vnorm
Theta
T
100W
90W
80W
sondage de 31.50N 273.00E
du 16/01/95
a 0000 TU ECH 72H
iso 0 : 2229
iso -10 : 3928
Jauge


Modeles
Pointage
Satellite
Radar
Sondage
Graphe
isp
iso
Cartes TV
Saisie Sympo
Saisie Nebul
Edf
Observations depuis le :
07/06/94 12TU
120 Heures
Previsions depuis le :
09/06/94 12TU
Sites
Selection


JUN 1994
Observation T (Dg)
Normales T (Dg)

The Synergie 2.0 release

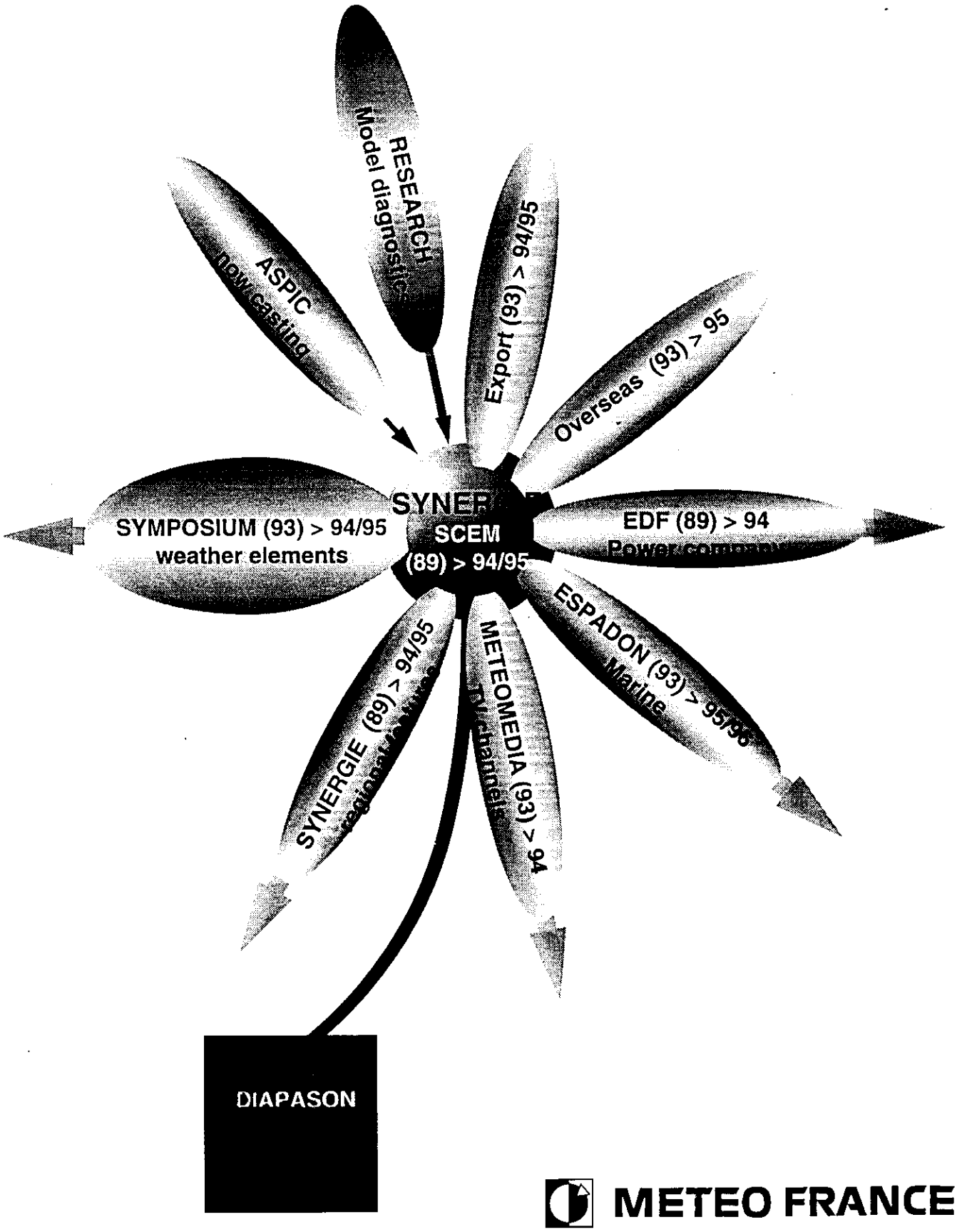
Operational production features :

- TV channels production
- EDF temperature and cloudiness
- National Guidance products
- Weather elements over France
- Production to end users

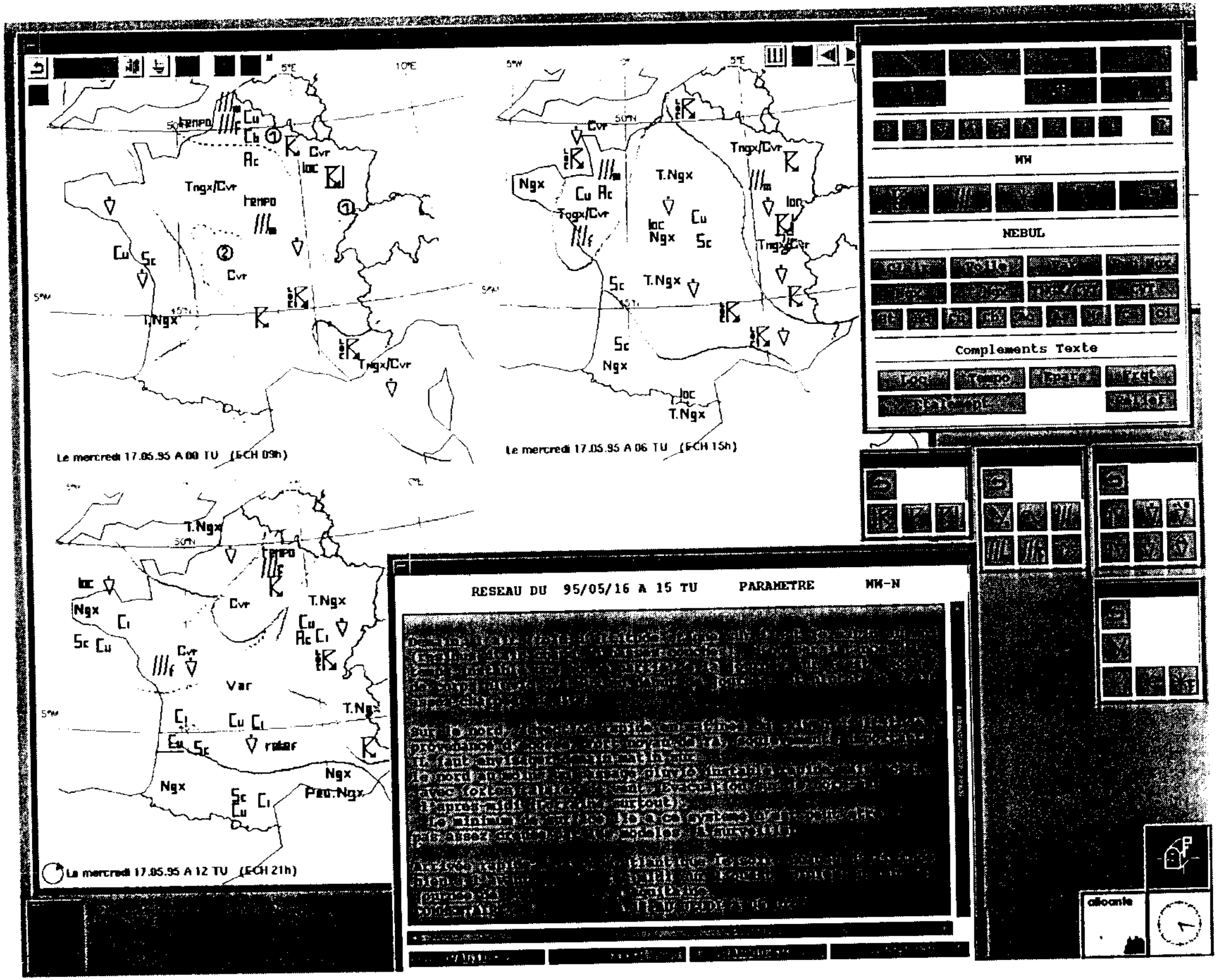
Production features under validation :

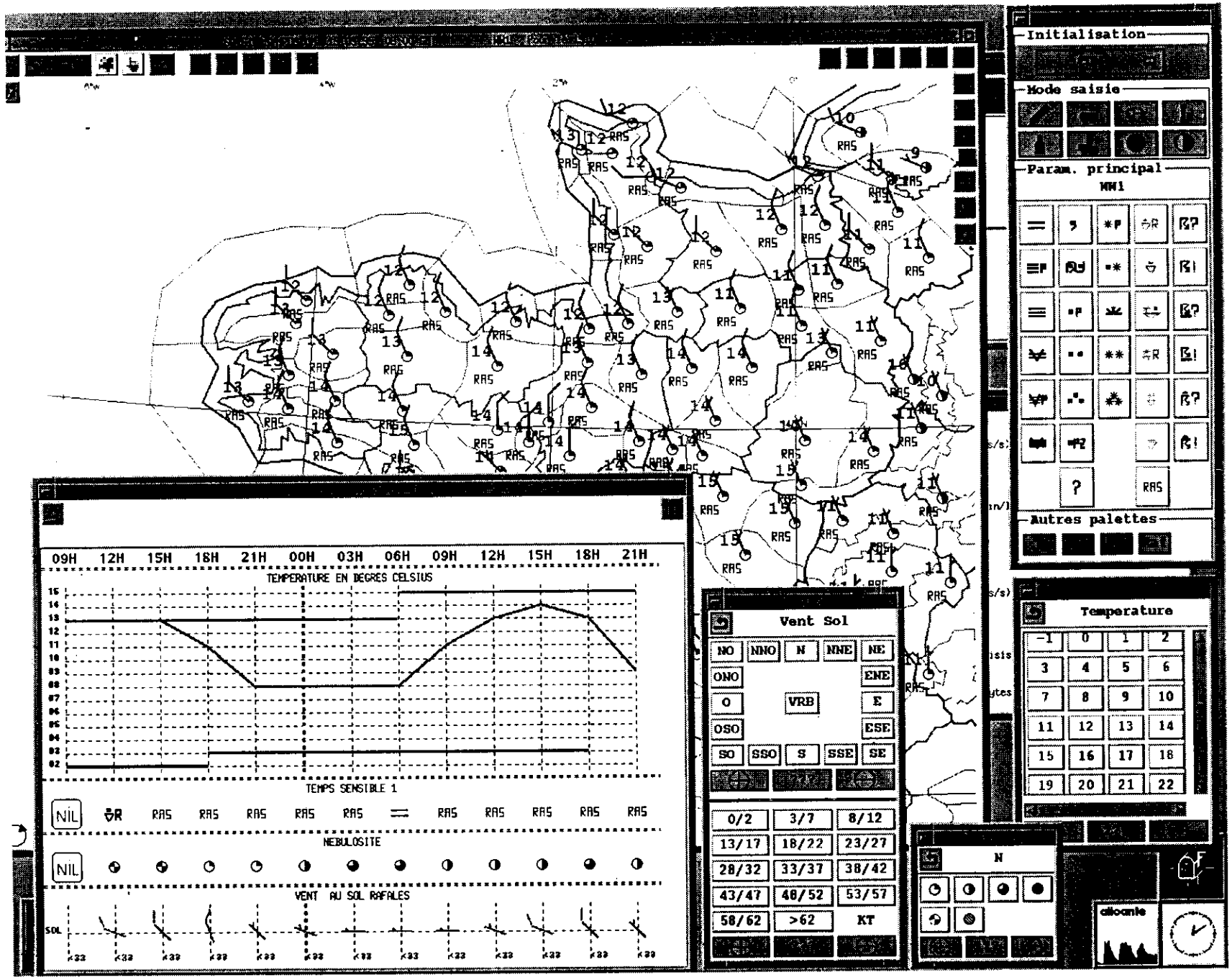
- Signifiant weather charts

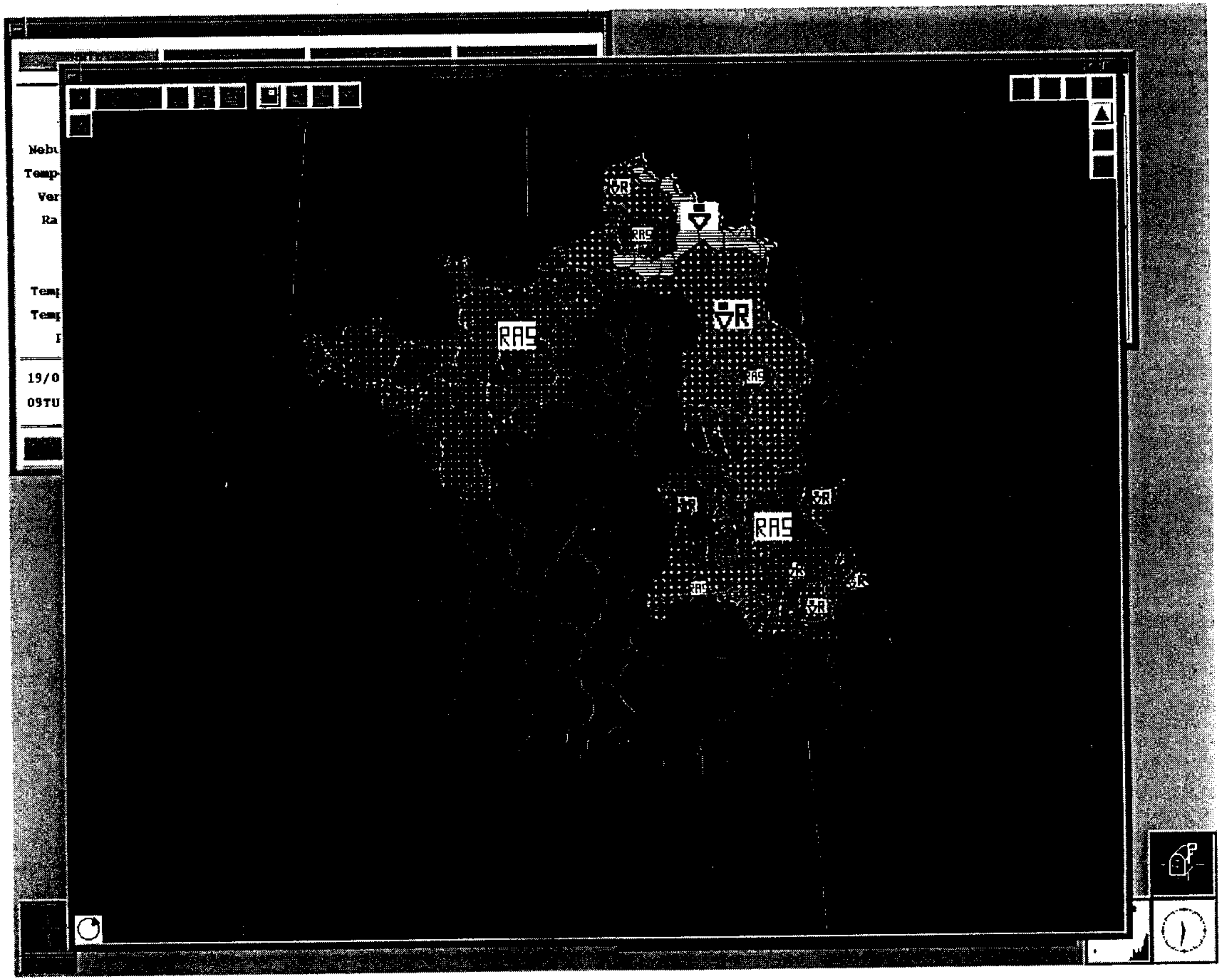
Synergie effect

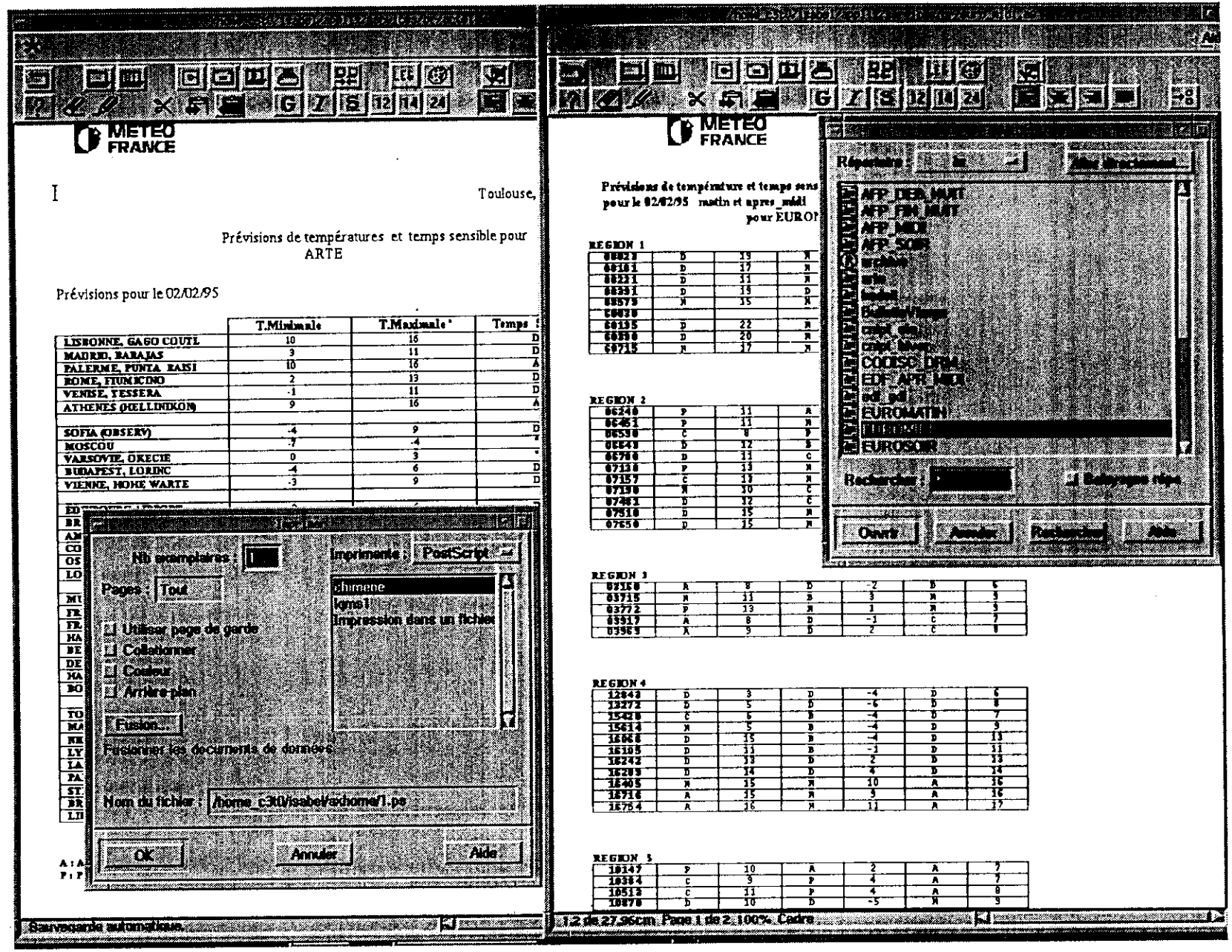


METEO FRANCE


Le mercredi 17.05.95 A 00 TU (ECH 09h)
Le mercredi 17.05.95 A 06 TU (ECH 15h)
Le mercredi 17.05.95 A 12 TU (ECH 21h)
RESEAU DU 95/05/16 A 15 TU PARAMETRE MW-N
NEBUL
Complements Texte


Initialisation
Mode saisie
Param. principal
MW1
Autres palettes
RAS
09H 12H 15H 18H 21H 00H 03H 06H 09H 12H 15H 18H 21H
TEMPERATURE EN DEGRES CELSIUS
TEMPS SENSIBLE 1
NIL
NEBULOSITE
VENT AU SOL RAFALES
SOL
Vent Sol
NO NNO N NNE NE
ONO ENE
O VRB E
OSO ESE
SO SSO S SSE SE
0/2 3/7 8/12
13/17 18/22 23/27
28/32 33/37 38/42
43/47 48/52 53/57
58/62 >62 KT
Temperature
N


Nebu
Temp
Ver
Ra
Temp
Temp
19/0
09TU
RAS
RAS
RAS
RAS


METEO FRANCE
Toulouse,
Prévisions de températures et temps sensible pour ARTE
Prévisions pour le 02/02/95
T.Minimale
T.Maximale
Temps
LISBONNE, GAGO COUTI
MADRID, BARAJAS
PALERME, PUNTA RAISI
ROME, FIUMICINO
VENISE, TESSERA
ATHENES (HELLINIKON)
SOFIA (OBSERV)
MOSCOU
VARSOVIE, OKECIE
BUDAPEST, LORINC
VIENNE, HOHE WARTE
Nb exemplaires :
Imprimante :
PostScript
Pages :
Tout
chimene
lgms1
Impression dans un fichier
Utiliser page de garde
Collationner
Couleur
Arrière-plan
Fusion...
Fusionner les documents de données
Nom du fichier :
/home_c30/isabel/archome1.ps
OK
Annuler
Aide
Sauvegarde automatisée...
Prévisions de température et temps sens
pour le 02/02/95 matin et apres_midi
pour EUROP
REGION 1
REGION 2
REGION 3
REGION 4
REGION 5
AFP_DEB_MAT
AFP_FIN_MAT
AFP_MIDI
AFP_SOIR
EDF_APR_MIDI
EUROMATIN
EUROSOIR
Ouvrir
Annuler
Aide
12 de 27,96cm Page 1 de 2 100% Cadre

METEO FRANCE

(20/04/94/00)

Bulletin destiné à
GDF Régional

Paris , le 20/04/94 à 12h30

Observations du 20/04/94
Prévisions du 21/04/94 au 22/04/94 sur Paris et sa banlieue

TEMPERATURES (degrés Celsius) TN : température minimale, TX : température maximale

	Observations		Prévisions				
Date	J-1	J	J	J+1		J+2	
	TX	TN	TX	TN	TX	TN	TX
Paris	3	0	0	0	0		
Ban-lieue	1	0	0	0	0		

VENT

	Observations		Prévisions		
Date	J-1	J	J	J+1	
heure	19h	07h	19h	07h	19h
Direc-tion	O	N	NE	S	SO
Force (km/h)	7	1/5	5/10	5/10	5/10

NEBULOSITE

Date	Observations		Prévisions		
	J-1	J	J	J+1	
heure	17h	11h	17h	11h	17h
Nébulosité	●	●	☀	☀	☀

Légende des nébulosités

☀ éclaircies peu nuageux | ● très nuageux à couvert

Direction Interrégionale Ile-de-France, Centre
T : 45 56 72 52

METEO FRANCE

(5)

Bulletin destiné à
GDF Régional

Paris , le {4 } à

Observations du {1 }
Prévisions du {2 } au {3 }sur Paris et sa banlieue

TEMPERATURES (degrés Celsius) TN : température minimale, TX : température maximale

	Observations		Prévisions				
Date	J-1	J	J	J+1		J+2	
	TX	TN	TX	TN	TX	TN	TX
Paris	{6}	{7}	{8}	{9}	{10}	{11 }	{12 }
Ban-lieue	{13}	{14}	{15}	{16}	{17}	{18 }	{19 }

VENT

	Observations		Prévisions		
Date	J-1	J	J	J+1	
heure	19h	07h	19h	07h	19h
Direc-tion	{20}	{21}	{22}	{23}	{24}
Force (km/h)	{25}	{26}	{27 }	{28 }	{29 }

NEBULOSITE

Date	Observations		Prévisions		
	J-1	J	J	J+1	
heure	17h	11h	17h	11h	17h
Nébulosité	●	●	☀	☀	☀

Légende des nébulosités

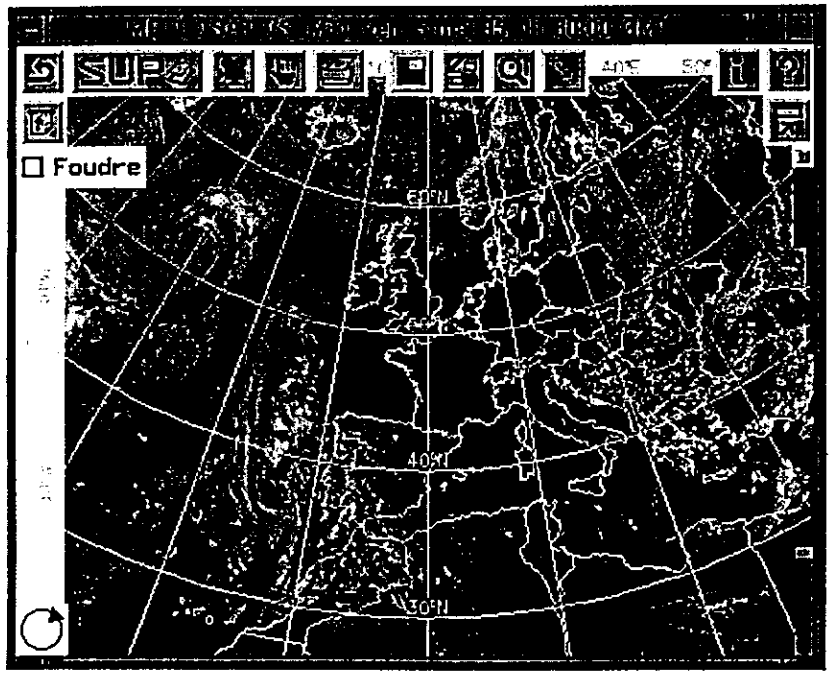
☀ éclaircies peu nuageux | ● très nuageux à couvert

Direction Interrégionale Ile-de-France, Centre
Tel : 45 56 72 52

Vendredi 05 mai 1995

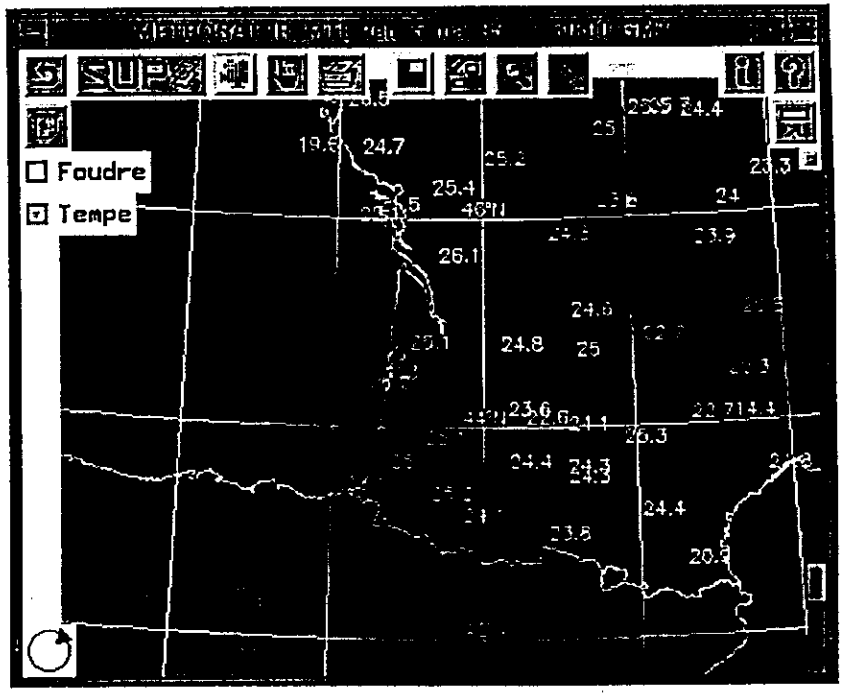
Le temps sur l'Europe a 13.30 locales

Grand beau aujourd'hui sur l'Europe. Seul le Portugal souffre d'une nebulosite importantes sous nuages orageux.



Le temps sur le Grand Sud-Ouest

Pas un nuage et chaleur estivale avec 25 a 26 degres sur toute la region (voir cadre). On se prend a rever d'un ete precoce qui nous amenerait en douceur a l'epoque des vendanges.



Et dimanche?

Le modele ARPEGE de Meteo-France nous permet d'esperer une superbe journee, du moins sur la plaine aquitaine. Les reliefs Pyreneens pourraient connaitre toutefois des developpements orageux en fin de journee. Le champ montre ci-dessous est un champ d'humidite relative a 700 hPa (3000m environ).

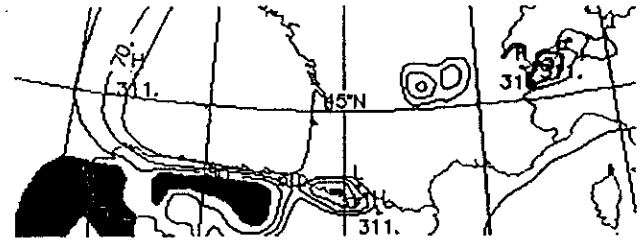
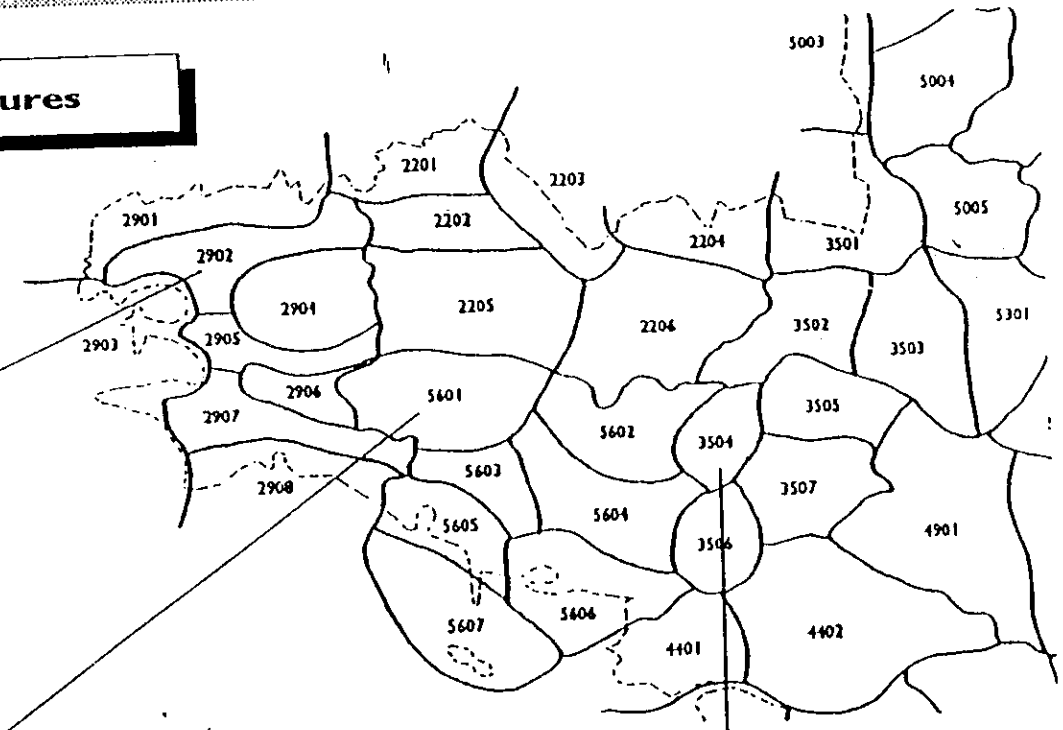


Figure 3.1 : Exemple de météogramme issu de Symposium

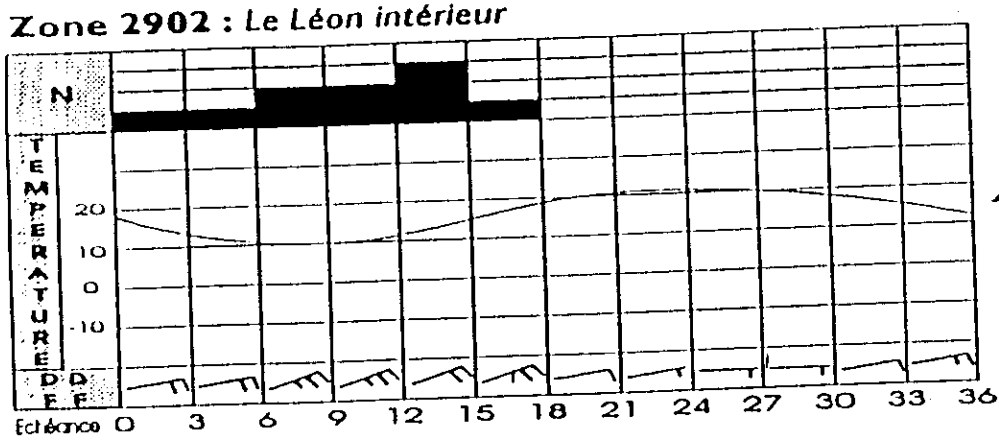
METEOGRAMME DE ZONES METEOROLOGIQUES

– Projet Symposium –

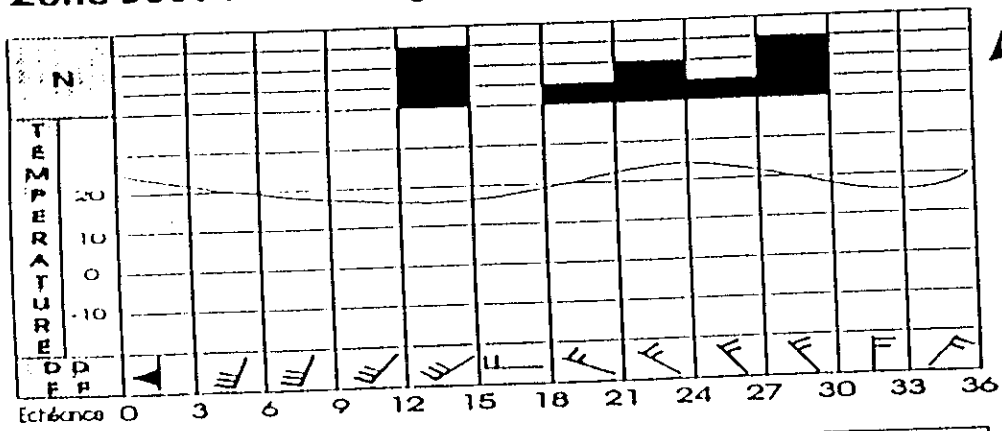
Le 13 juin à 12 heures



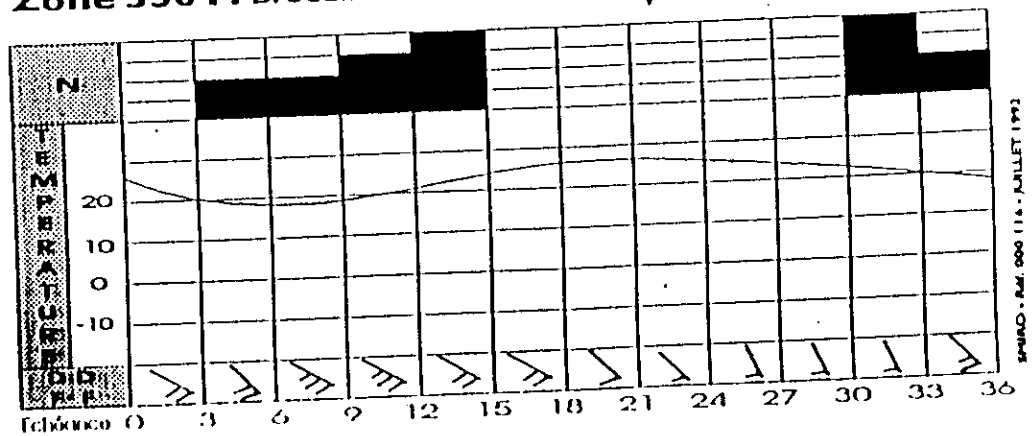
Zone 2902 : *Le Léon intérieur*



Zone 5601 : *Les Montagnes Noires*

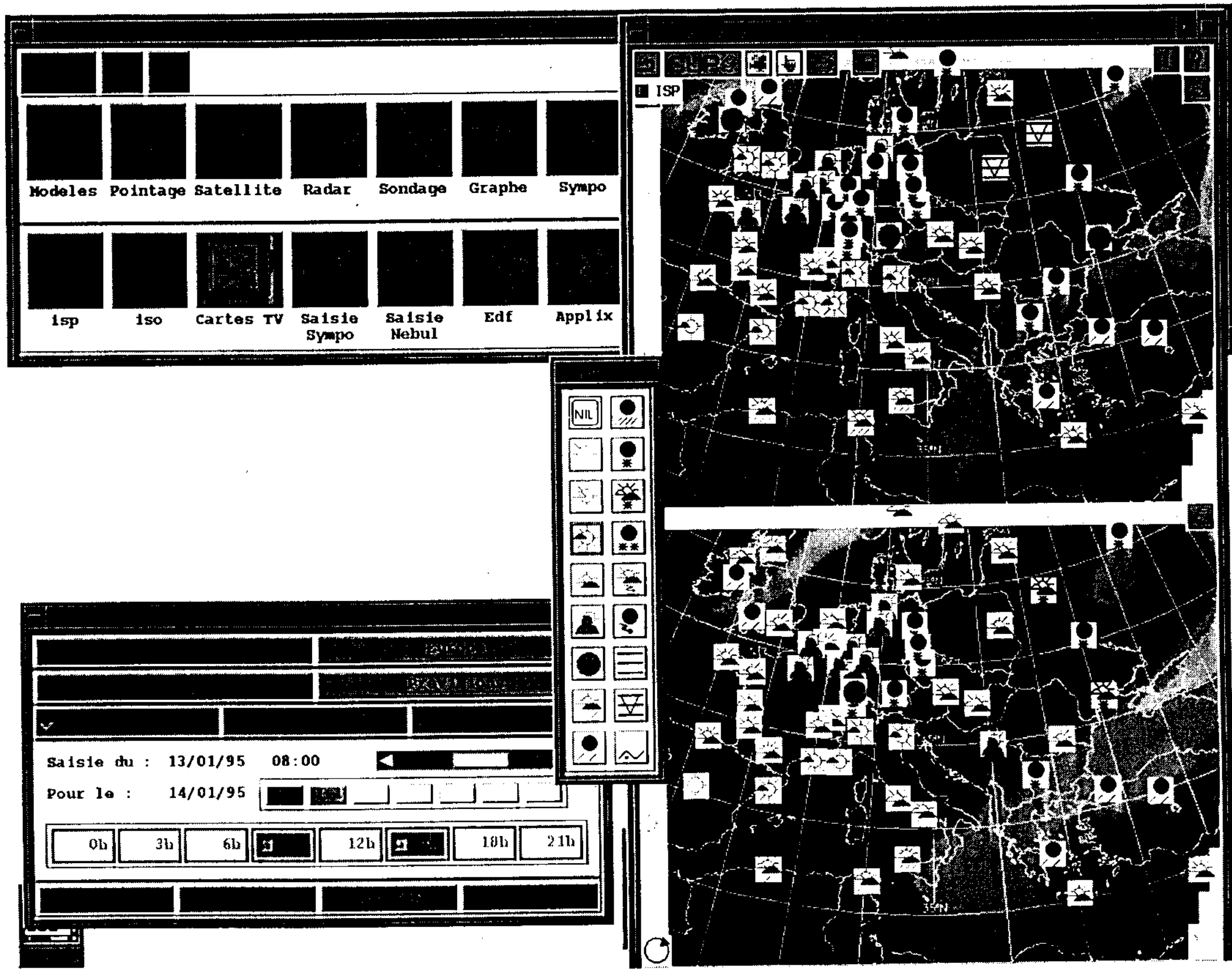


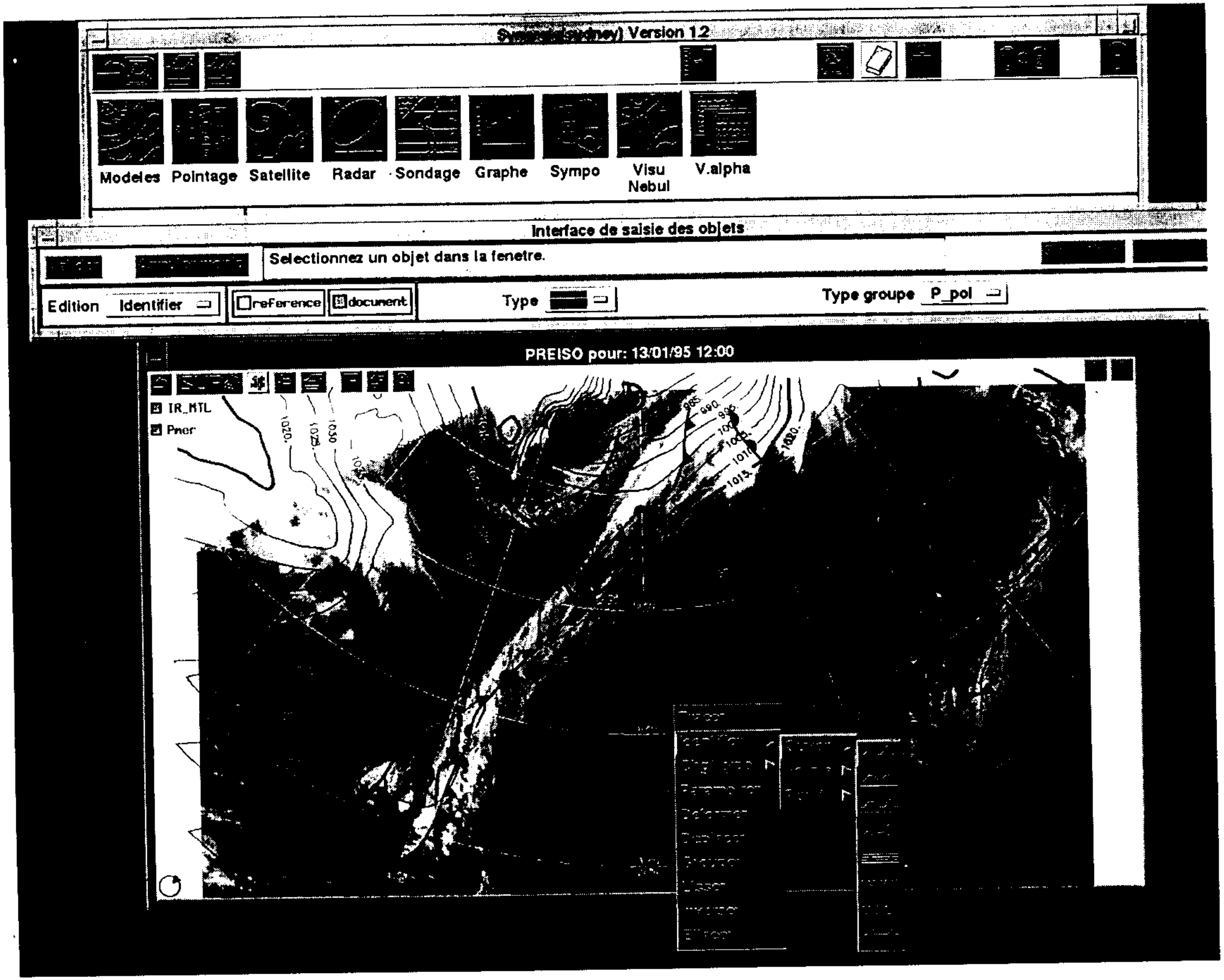
Zone 3504 : *Brocéliande*



PARAMETRES TRIHORAIRES		
	N	*couverture nuageuse*
	Température	*(°c)*
	DDFF	*direction et force du vent à 10 mètres*

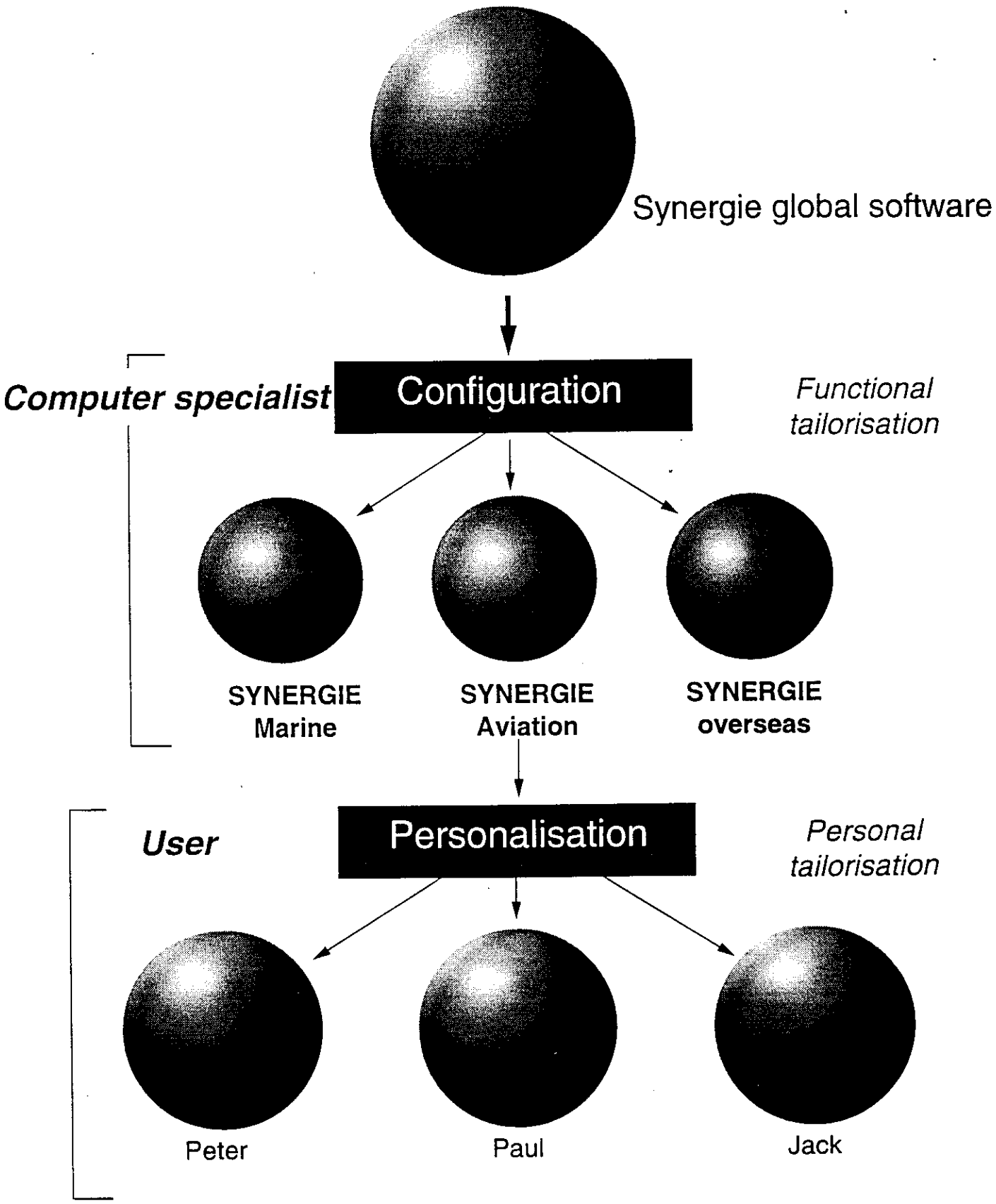
SPMO - FM 000 114 - JUILLET 1992


ISP
Modeles
Pointage
Satellite
Radar
Sondage
Graphe
Sympo
isp
iso
Cartes TV
Saisie Sympo
Saisie Nebul
Edf
Applix
NIL
Saisie du : 13/01/95 08:00
Pour le : 14/01/95
0h
3h
6h
12h
18h
21h



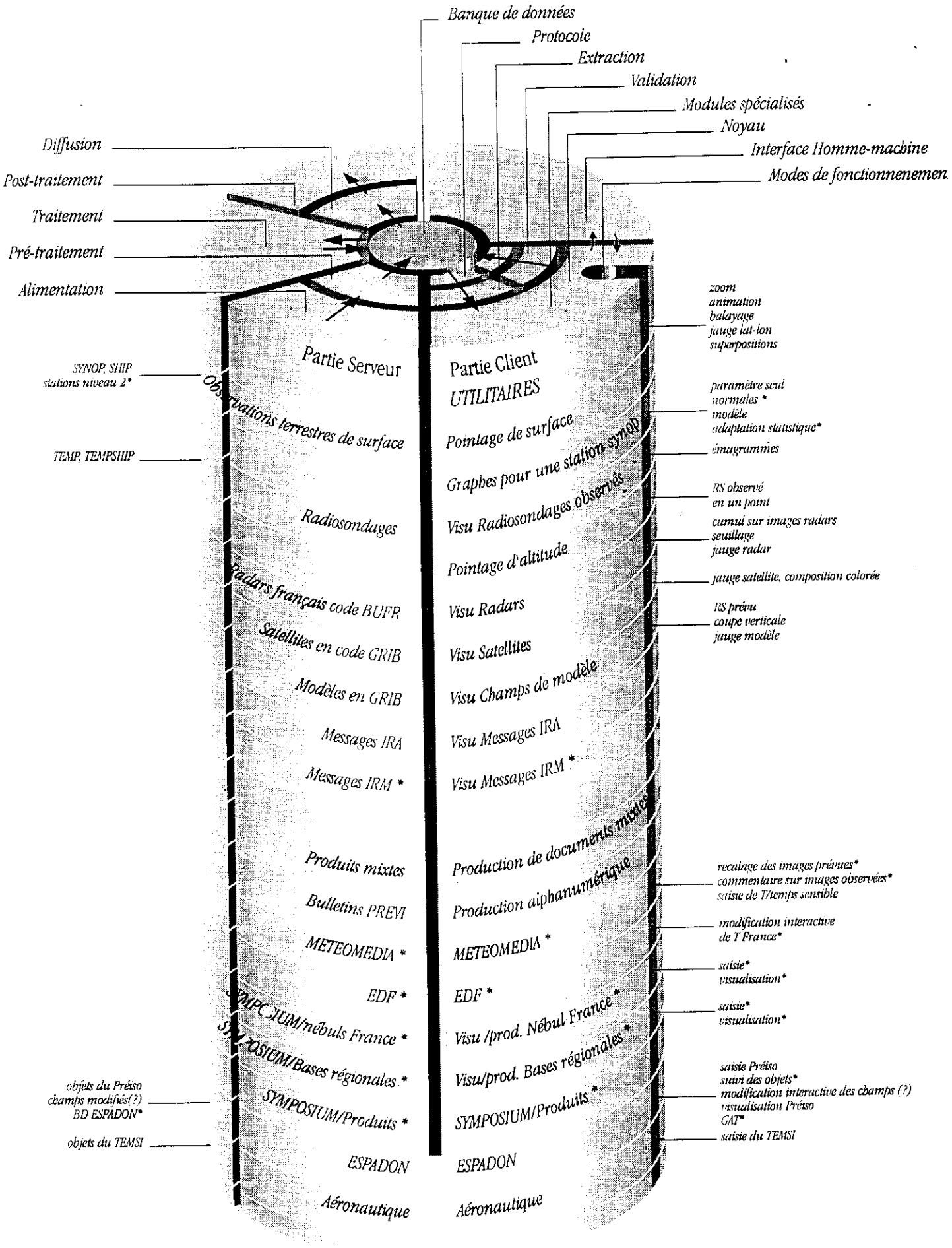
Version 1.2
Modeles
Pointage
Satellite
Radar
Sondage
Graphe
Sympo
Visu Nebul
V.alpha
Interface de saisie des objets
Selectionnez un objet dans la fenetre.
Edition
Identifier
reference
document
Type
Type groupe
P_pol
PREISO pour: 13/01/95 12:00
IR_MTL
Pmer

Synergie architecture



METEO FRANCE

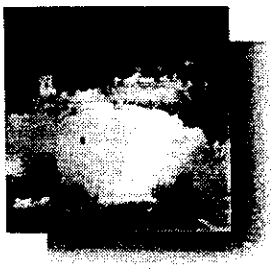
Architecture générale de Synergie (Février 95)



(*) : modules non proposés à l'export

METEO FRANCE

Integration strategy



SYNERGIE

Synergie announces a revolution in terms of tools and methodologies in the forecasting activities.

Step 1 : Synergie is a complementary tool for decision making (end of 94) :

-intensive use,

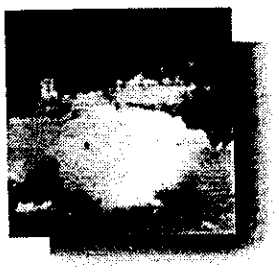
- birth of new methodologies.

Step 2 : Synergie becomes an operational production tool (1995) :

- alphanumerical production,
- weather element production,
- aviation & marine production.

METEO FRANCE

From the Synergie 0 prototype...



... to the Synergie 1 operational system

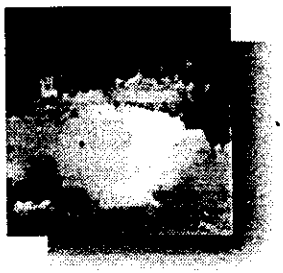
Development :

- continuous dialog between users and developers,
- validation by users.

Operations : an uneasy transition from paper to screen :

- shift working,
- work under pressure (peak hours),
- work on "unlimited" amount of data,
- multiwindow environment,
- interactive production on WS.

Training Program



SYNERGIE

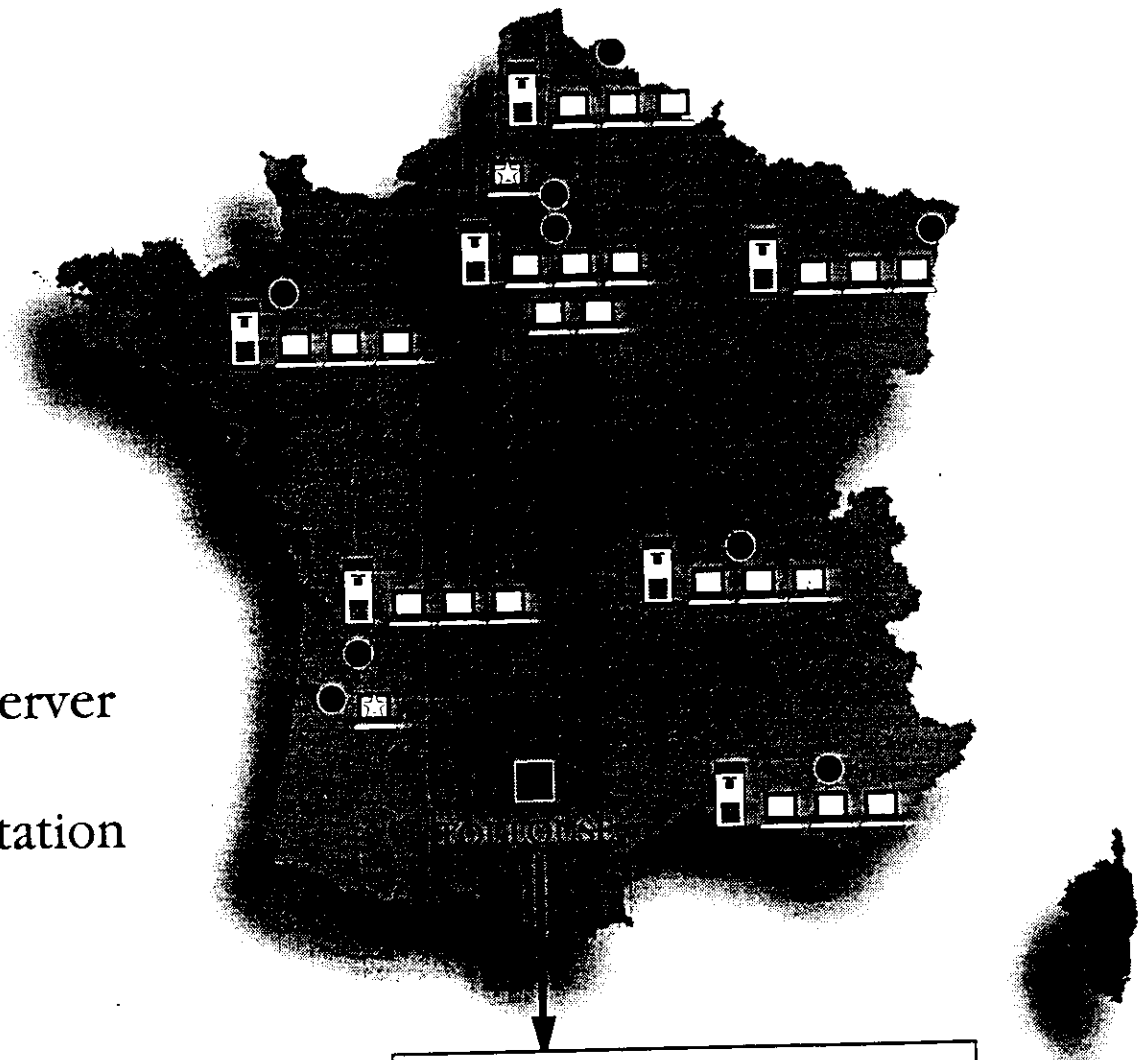
Specific Synergie implementation (6 WS) at the National School.

Training for :

- computer specialists (installation),
- operators (supervision),
- school teachers,
- forecaster trainers,
- forecasters.

SYNERGIE
January 95

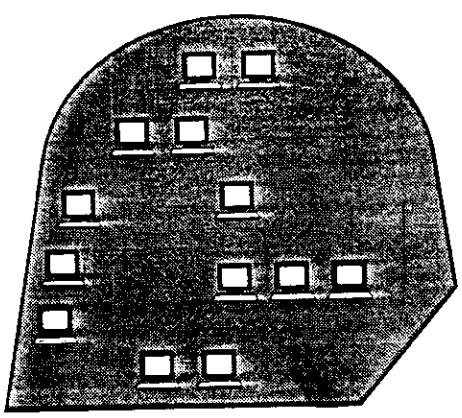
METEO FRANCE



: server

: station

2 servers & 15 stations



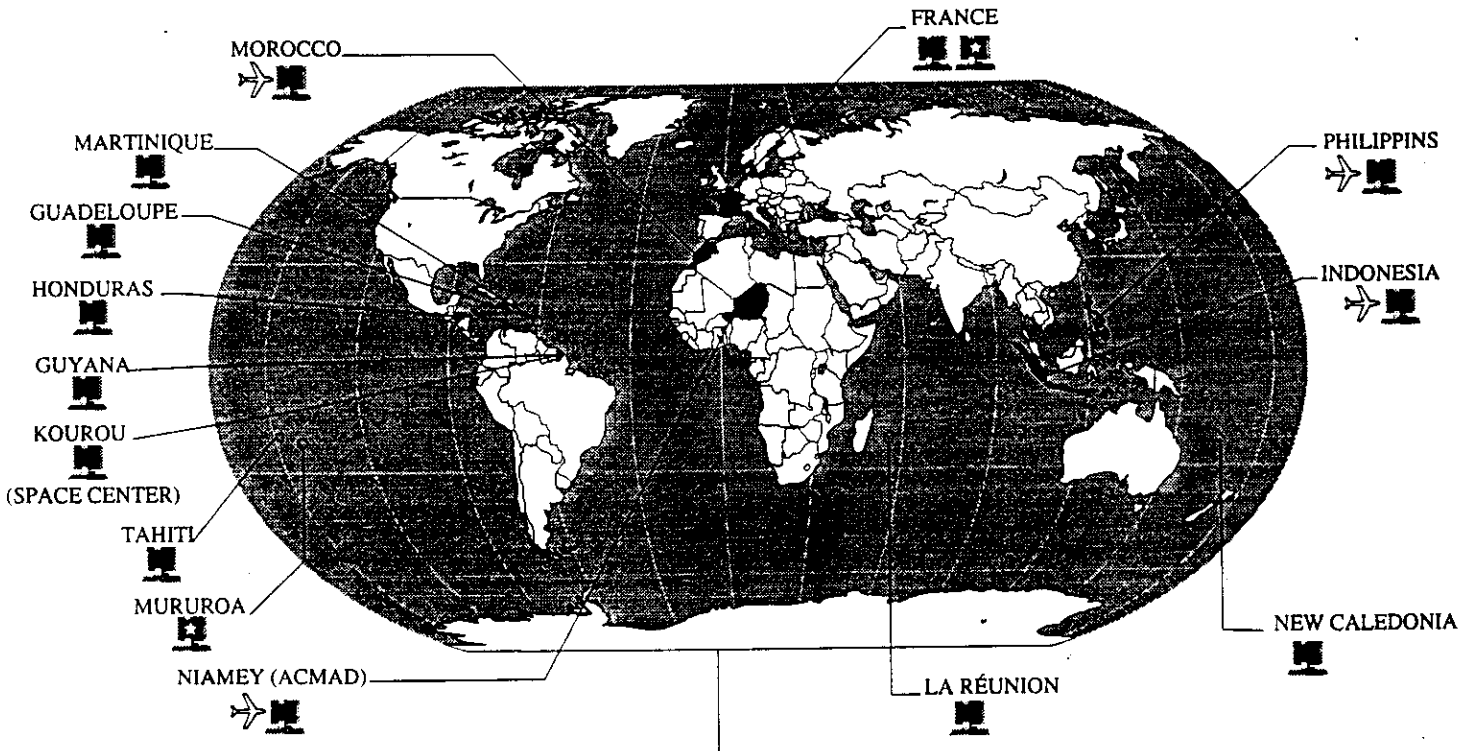
Crisis : Spare :

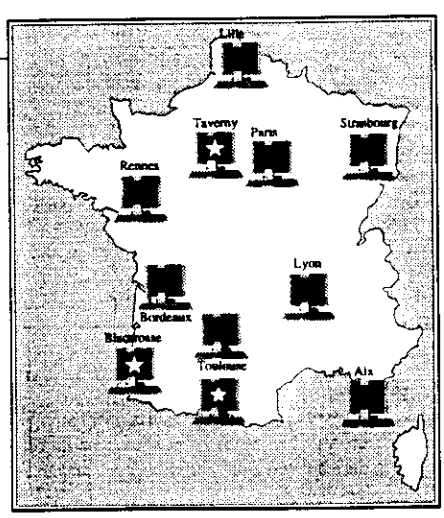
Forecast room

CELENV

National school

Synergie sites





French & overseas stations

Export stations

Military stations

METEO FRANCE

Synergie in figures

1989-1995	a 32 men year development
1990-1995	a 200 000 lines source code
1993-1995	a 3 M$ hardware investment

METEO FRANCE

Conclusion

Interactive forecasting operational tools are :

- Difficult to specify,
- Hard to develop,
- uneasy to put into operations but they are,
- The future in operational forecasting.

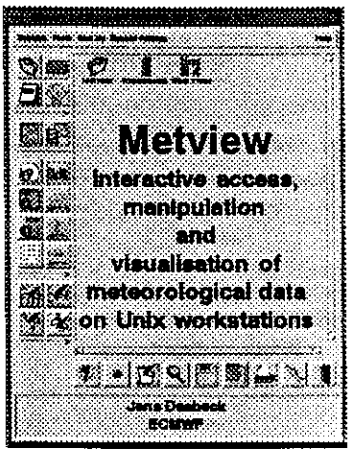
Synergie is an example of :

- operational tool, widely spread,
- fully integrated and tailorable tool,
- Dialog between services or forecasters,
- Support for new methodologies.

EGOWS 6
Vienna , 19-22 June 1995

Session : Meteorological Applications

Jens D A A B E C K



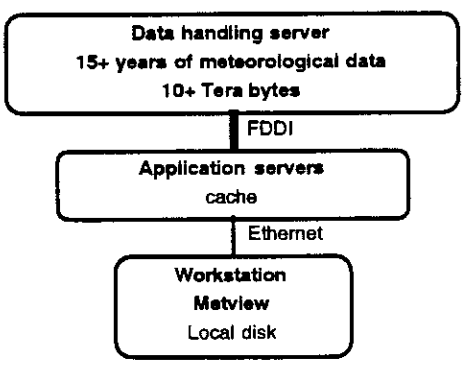
Overview

- Introduction
- Metview concept
- Features
- Plans
- Summary

Metview

- Data access, data manipulation and visualisation of fields, images and observations
- Application modules
- Unix workstations
- Motif based graphical user interface
- Distributed processing
- Full functionality performed by macros
- Batch support

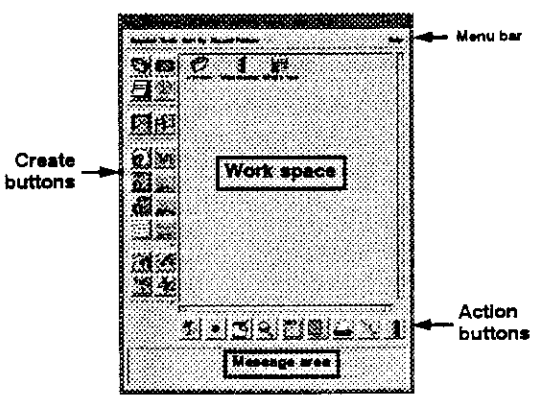
ECMWF data archive Mars



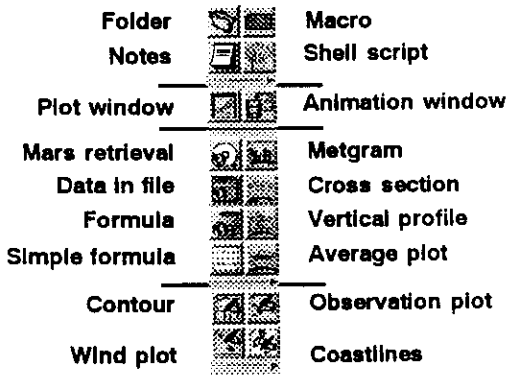
The Metview concept

- User creates definitions and performs operations on them
- Metview icons
- Icons hold definitions e.g.
  - Mars request
  - Magics attributes for plotting
  - Specification of geographical area
- User performs operations on icons e.g.
  - Visualise
  - Edit

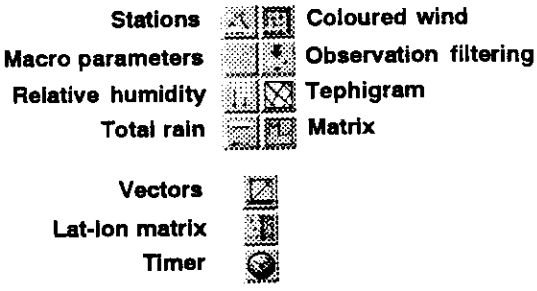
Metview main user interface window



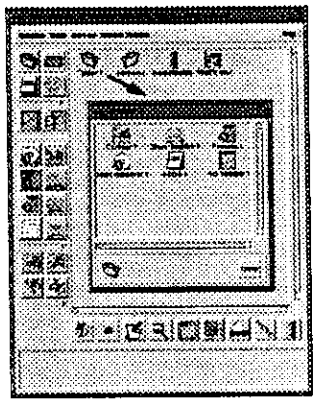
Create buttons



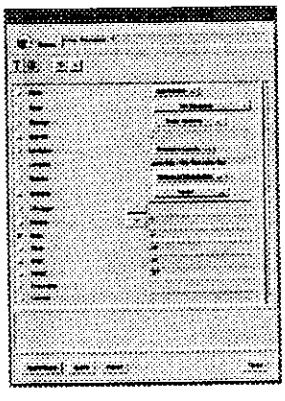
Create buttons (continued)



Folder



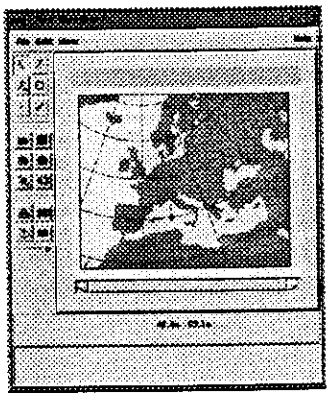
Editor window for Mars retrieval



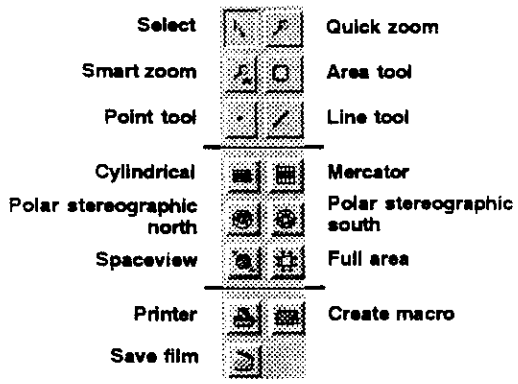
Supported data formats

- WMO GRIB format for fields
- WMO BUFR format for observations
- The experimental extended WMO GRIB format for satellite images
- Matrix
- Geographical points

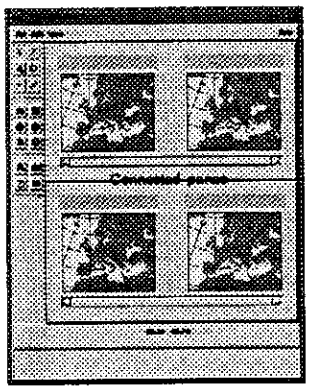
Plot window



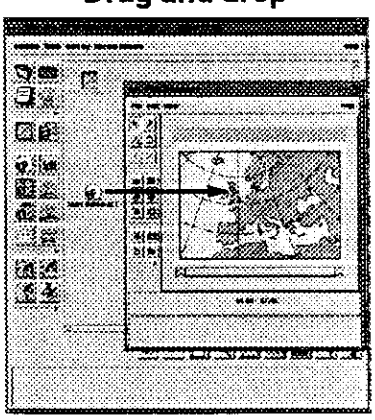
Plot window tools



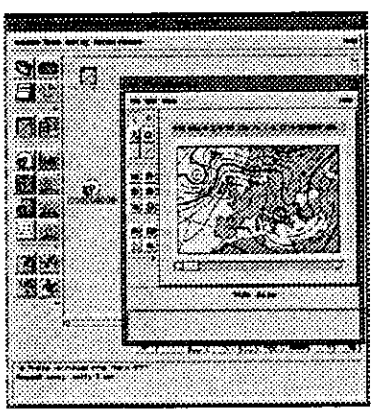
Plot window with 2 x 2 panes



Drag and drop



Plot window with default plotting attributes

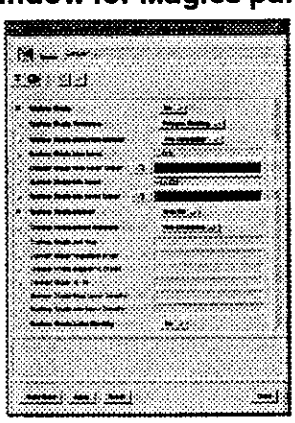


Icon status

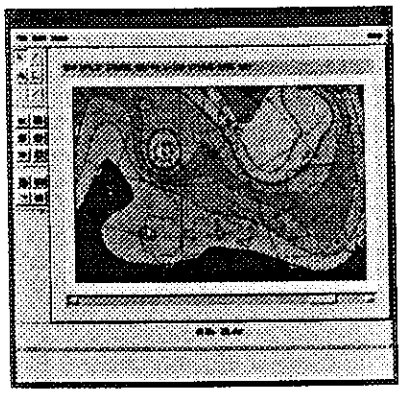
The colour of the name of an icon shows its state:

- Black - Default
- Yellow - Busy
- Green - Ready
- Red - Error

Editor window for Magics parameters

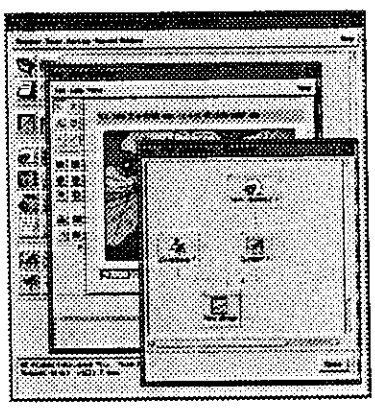


Plot window with enhanced contouring



Animation window

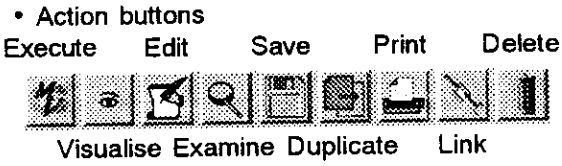
Plot window contents



Icon operations

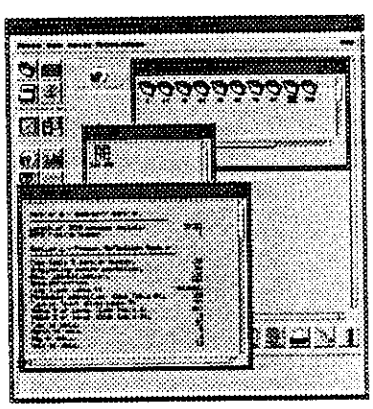
Icons can be operated upon in the following ways:

- Action buttons

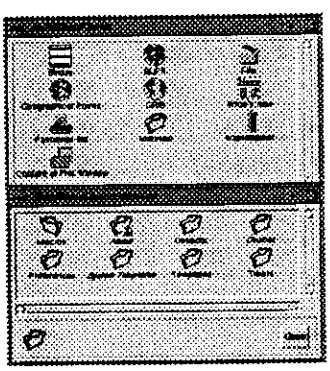


- By pop-up menus
- Drag and drop
- Double click

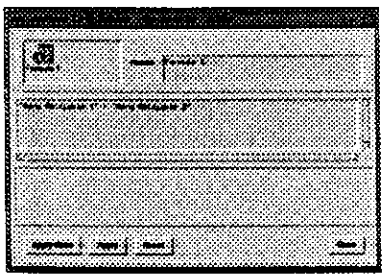
Examine action



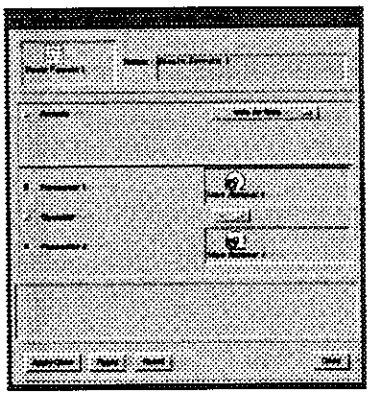
Additional icons



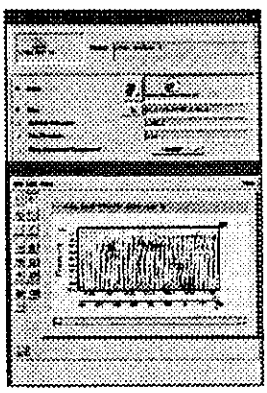
Formula



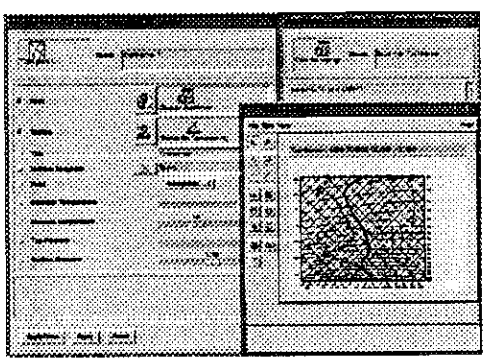
Simple formula



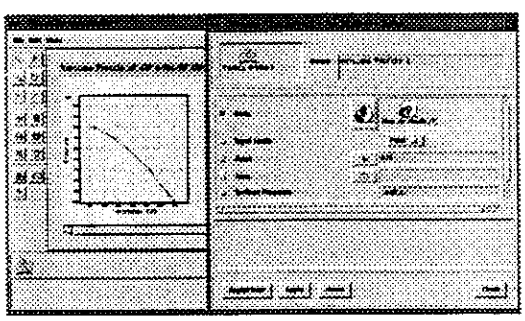
Cross section



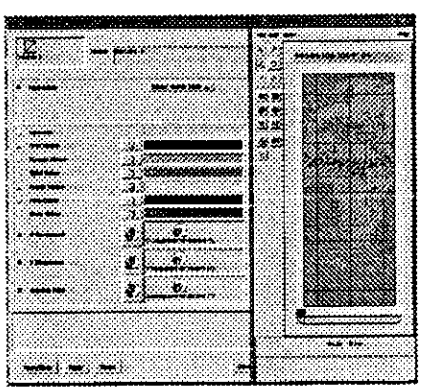
Tephigram



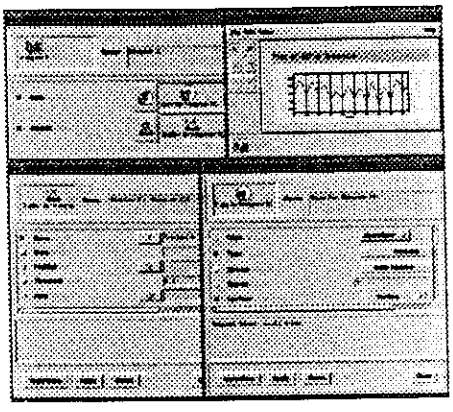
Vertical profile



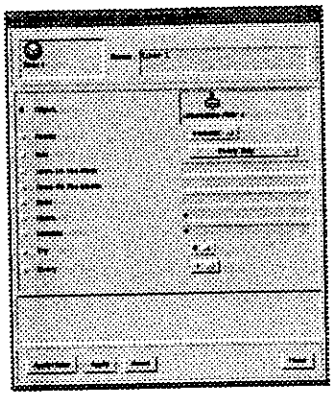
Vectors



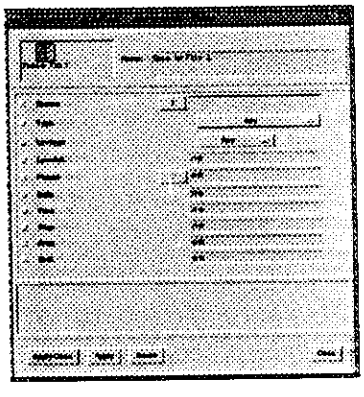
Metgram



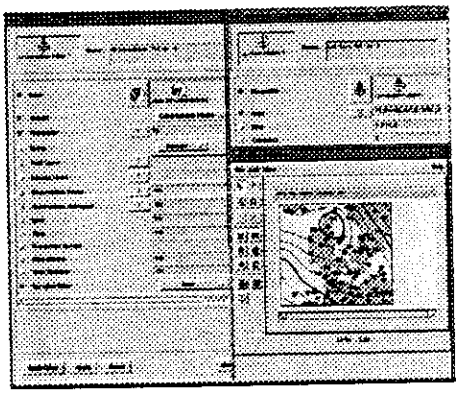
Timer



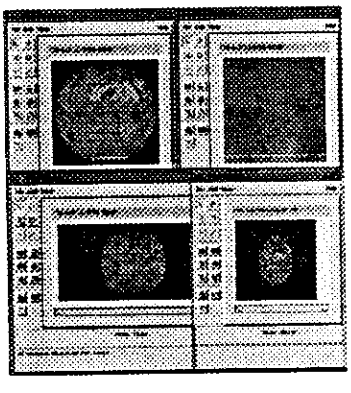
Data in file



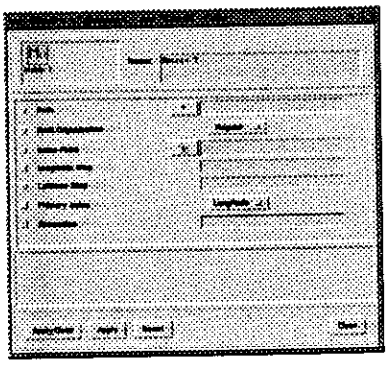
Observation filtering and Lat-lon matrix



Satellite images



Matrix



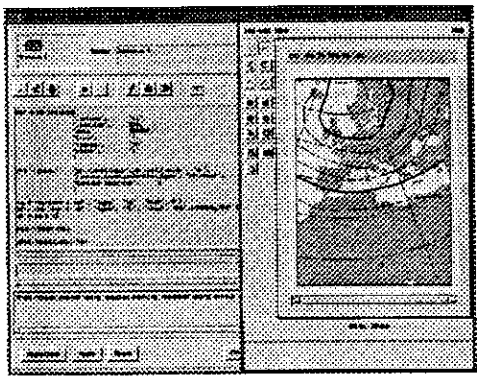
Metview macro language

- Perform data access, manipulation and plotting from within the Metview environment
- Object-oriented design
- Example

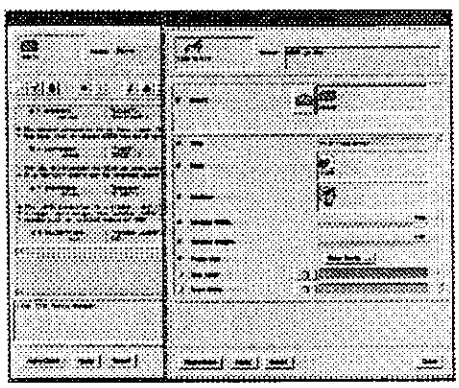
```
w = plotwindows ("height", 1000, "width", 1000)
r = retrieve ("date", -1, "param", ["u", "v"])
p = pcont ("wind_arrow_colour", "red")
plot (w, r, p)
```

- Writing macros
  - Enter text
  - Drag icons
  - Create macro from plot window content
- Automatic building of GUI
- Calling FORTRAN or C routines

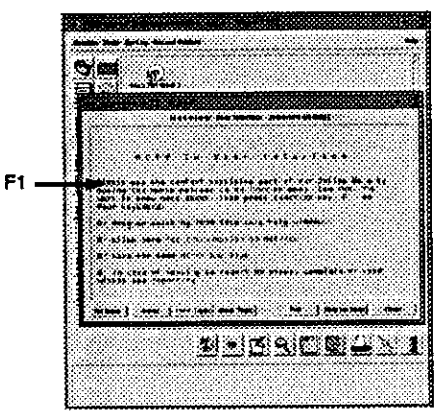
Macro



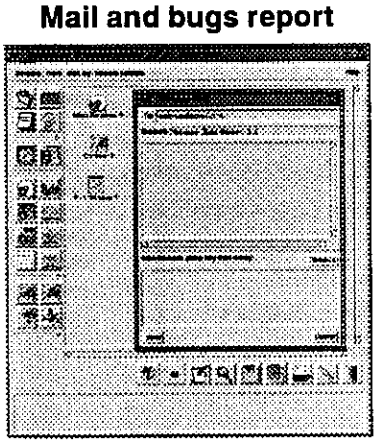
Macro parameters



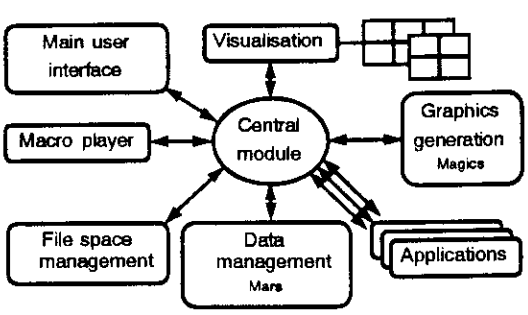
Help



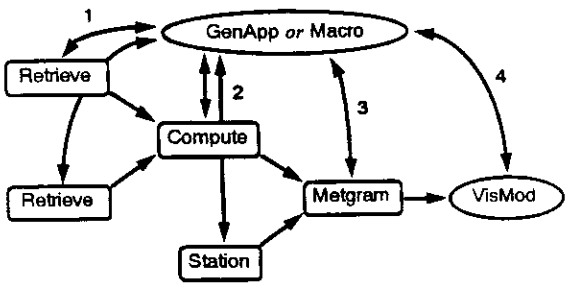
Mail and bugs report



Metview modules



Functional flow and request flow



Software tools

- X Window System
- OSF Motif
- C++, C and Fortran 77
- Xelion S-GKS (ISO GKS with X interface)
- Magics (ECMWF graphics package)
  - Conicon
- Mars access (ECMWF)
- X-Designer GUI builder

Platforms

- SGI (ECMWF)
- DEC Alpha (INPE/CPTEC)
- HP (MétéoFrance)
- SUN (planned - MétéoFrance)
- IBM (planned - INPE/CPTEC)

The Metview project

- Co-operative project between ECMWF and INPE/CPTEC
- ECMWF has been assisted by a staff member from MétéoFrance

Plans

- Adding application modules
  - Porting of 30+ Metview/batch applications
  - New applications
- Enhanced title facilities
- Colour image editor
- Support for Member States use of Metview with transparent access to Mars data via a proxy server running at ECMWF

Summary

- Version 1.2 has been released at ECMWF
- Modular and expandable system
- Icon based user interface
  - Create definitions
  - Actions
- Mars data retrieval
- Magics visualisation

EGOWS 6
Vienna , 19-22 June 1995

Session : Meteorological Applications

Manfred G Ö S T L

Central Institute for Meteorology and Geodynamics, Vienna, Austria

Ing. M. Goestl

TPVIS V1.8

TAWES Project Visualisation

As usual some of the functions mentioned in the EGOWS report 1994 as "Future Plans" concerning TPVIS could be implemented during the last 12 month, some others not, and some features we did not think about at that time were implemented too.

Starting with summer 1994 the main effort of our division was the migration of quite a lot of applications from NOSVE to UNIX as we stoped running our old CDC mainframes at the end of 1994. Thus there was not too much time left for further development of TPVIS.

The new functions include:

* Display of lightning observations using color coding to indicate the age of a distinct lightning compared to a give date. This functions also includes animation of the lightnings.

* A Front Editor allowing to draw front lines and place front symbols in a graphical interactive manner and to store all that as a front overlay for further use.

* Improved map display by coloring geographical maps according to a land/sea mask. If desired the land/sea mask can be applied to satellite images used as a background too.

* A hard copy facility to receive screen snapshots of TPVIS in various graphic formats like GIF, TIFF, JPEG, EPS etc. This function is used to generate end user products e.g. for newspapers.

* A special plot function for producing a weather map to be delivered dayly by FAX to our customers: By simply pressing a button SYNOP observations dated today, 6:00 AM, a PMSL analysis chart of the same date and the appropriate front overlay are loaded automatically and assembled in a plot file. The plot file is output on a local printer and additionally sent to another computer for further processing. Afterwards the display is restored automaically, i.e. all maps, observations, superimpositions etc, which were on the screen befor, are displayed again.

* Lambert's Cosine Correction (LCC) for visible satellite images. A special algorithm allows to calculate a corrected image within less then 10 seconds on a SUN SPARCstation 2 while introducing only insignificant errors. Though there are some system dependent problems with the LCC it is a great help when comparing visible images of different dates.

* The SatRep-Editor (Satellite image Report) allows to annotate meteorological phenomenons visible in a satellite image by placing a marker choosen from a list of phenomenons. By clicking such a marker the user can pop up a menu providing a list of preselected additional informations concerning the specific phenomenon. The user may then choose to load and display these informations in form of charts by a simple button press.

Future plans include:

* The migration of TPVIS from SUNOS to SOLARIS and from SUNGKS to XELION SGKS.

* Automatic shift of stations which are too close to be displayed at the same time.

* Display of upper air observations and radar images.

* Facilities for batch plotting.

* As SUN makes it possible we decided to keep our OPEN LOOK GUI in TPVIS!

EGOWS 6
Vienna , 19-22 June 1995

Session : Meteorological Applications

Przemyslaw I G N A T O W I C Z

Weather Forecaster Support System WEATHER-95

1. Introduction

In Institute of Meteorology and Water Management the Weather Forecaster Support System is used operationally since 1989. The latest version of the system, called WEATHER-95, is a real time meteorological data processing system based on IBM PC compatible equipment running OS/2 operating system. As an input, the system uses raw GTS data.

The WEATHER-95 system was developed in Institute of Meteorology and Water Management. It was written in C, Fortran and Pascal programming languages. Visualization of meteorological data was developed under Presentation Manager windowed environment.

The system WEATHER-95 is running operationally in Polish Central Forecast Office, regional weather services and several commercial sites. The special version of this system is used in Fraunhofer Institute fur Atmospharishe Umweltforschung in Garmisch-Partenkirchen, Germany.

2. Data processing.

At Institute of Meteorology and Water Management as a multiplexer of GTS data is used UNIX microcomputer running Weather Man meteorological data switching system. The WEATHER-95 data processing station receives GTS data through RS-232 serial port from UNIX machine. The data processing station performs the following functions:

- managing of the system
- receiving and storing the GTS data
- quality control and interpolation
- printing charts
- plotting charts
- preparing the the metafiles for external users
- performing numerical tasks for different users using schedule script
- transmission to the UNIX machine the text forecasts developed by weather forecasters

3. Graphical presentation.

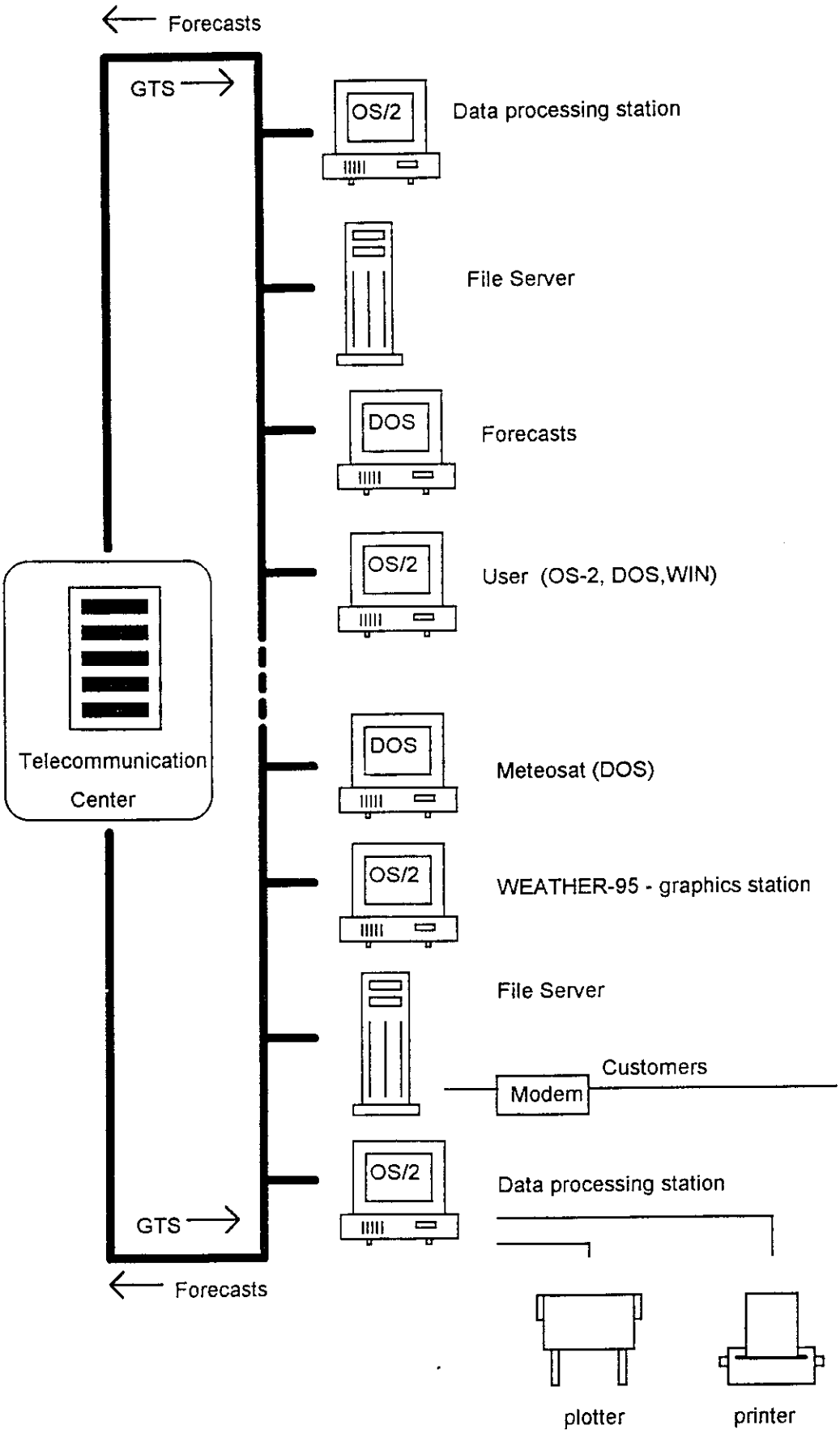
Graphical presentation of meteorological data was developed under OS/2 Presentation Manager windowed environment. The following graphical programs are used operationally in Central Forecast Office:

- Polish synoptic chart
- diurnal course of meteorological elements at Polish synoptic stations
- European synoptic chart
- aerological synoptic chart
- aerological diagram
- GRID charts from Offenbach and Bracknell
- trajectory model developed in cooperation with Finnish Institute of Meteorology
- METAR, SIGMET, TAF messages
- Kalmann filter
- 5 day forecast prepared by weather forecaster

4. Customers.

Institute of Meteorology and Water Management prepares for customers (Railroads , Public Roads and Central Power Management Authority) weather forecast and meteorological data metafiles which can be accessed via modem. The metafiles are used by customers for visualization of meteorological data. For presentation the customers use OS/2 Presentation Manager or Microsoft Windows environments.

In the winter time, for Warsaw Road Service the prediction model based on energy balance equation on the road surface is running operationally. Every hour the prediction for 6 hours of road surface temperature and humidity can be accessed by customer via modem.



Data processing scheme of WEATHER-95 system in Central Forecast Office

EGOWS 6
Vienna , 19-22 June 1995

Session : Meteorological Applications

Peter R O T H

Overview

Subject: SRDB and applications on the SRDB
(SRDB: Short Range DataBase)

- **Contents of the SRDB**
- **Distribution of the SRDB**
- **Applications**

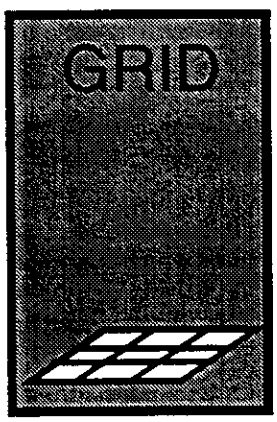
Contents of the SRDB (cont.)

SM

EM

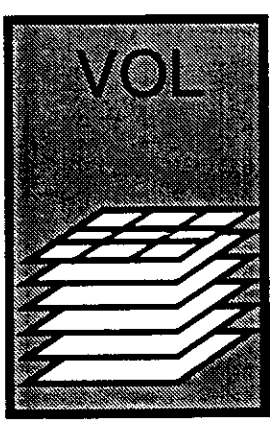
ECMWF

WAFS



RADAR

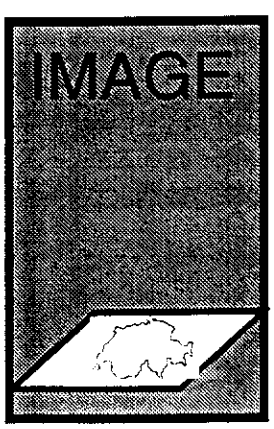
SM



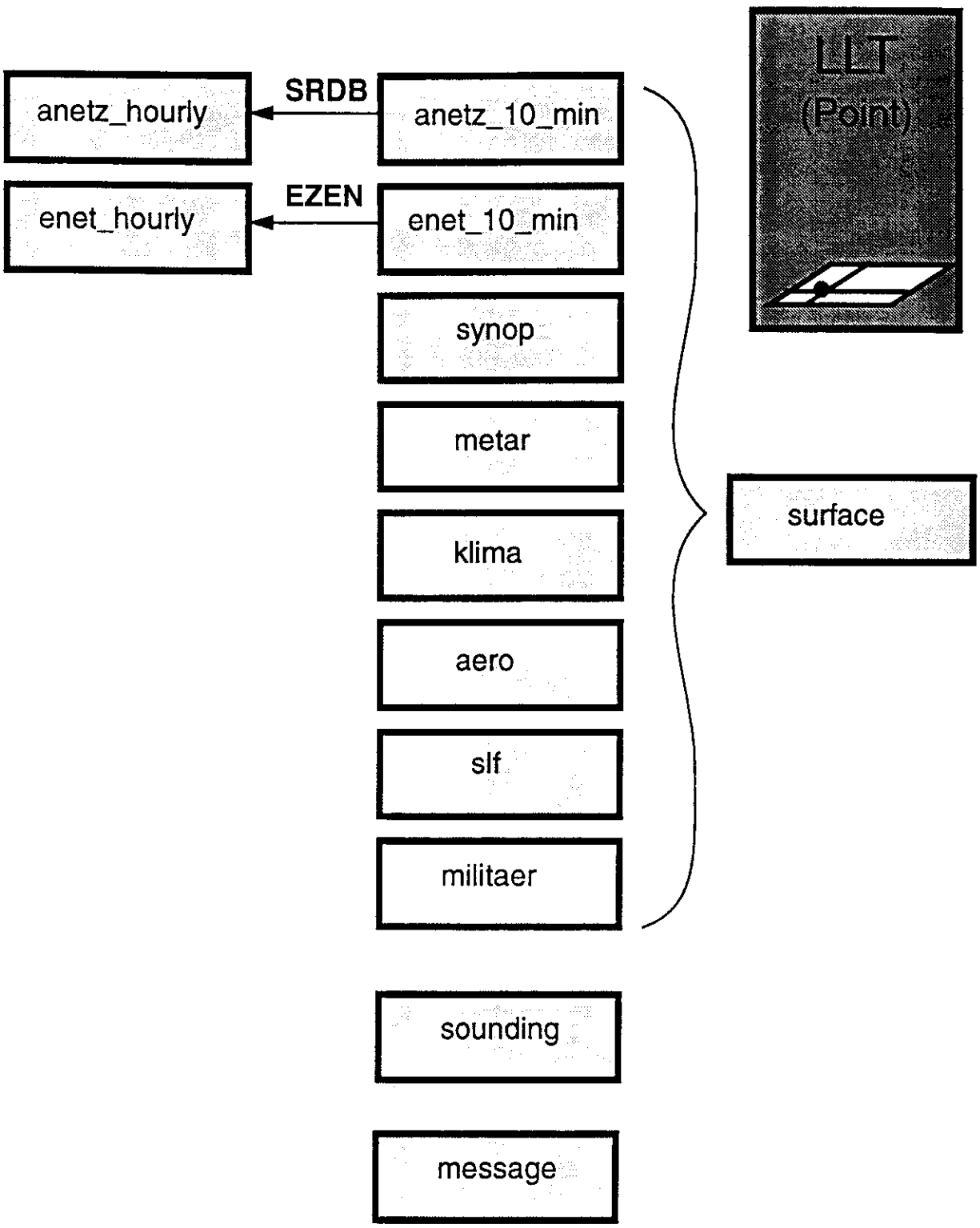
METEOSAT

RADAR_CH

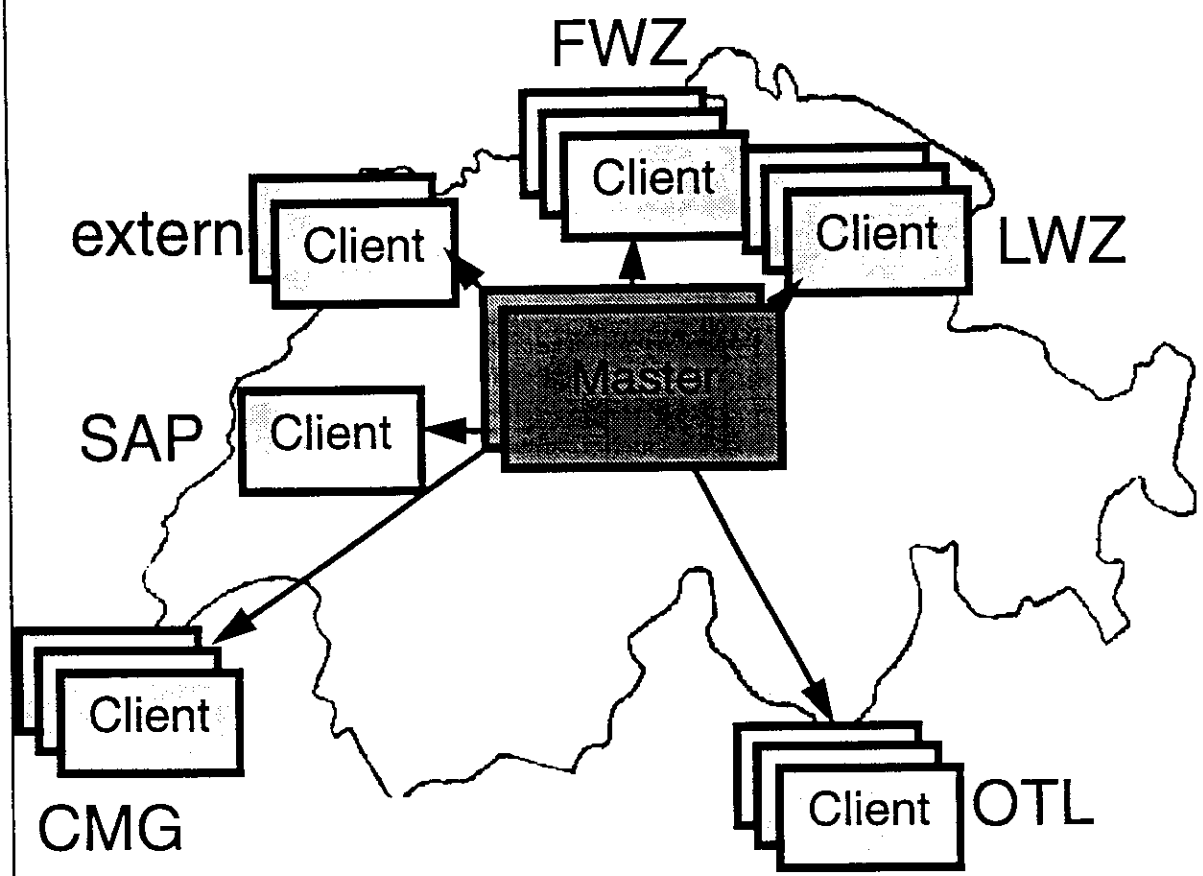
RADAR_EU



Contents of the SRDB



Distribution of the SRDB



- better performance
- reduce network traffic
- 'certain independence' in the regional offices
  -> reingest data into the client-db
- system will be defined these days
- operational at the end of 1995

Applications

- Using SRDB
- IDL 3.6
- C (retrieve data from the SRDB)
- Solaris 2 only
- 4 applications ready for testing

Applications (cont.)

TAMSI (LLT, IMAGE)

- INFO system for Pilots
- TAf / Metar / Sigmet
- Radar
- Meteosat
- Interactive user interface (touch screen)

DATA-Display (LLT)

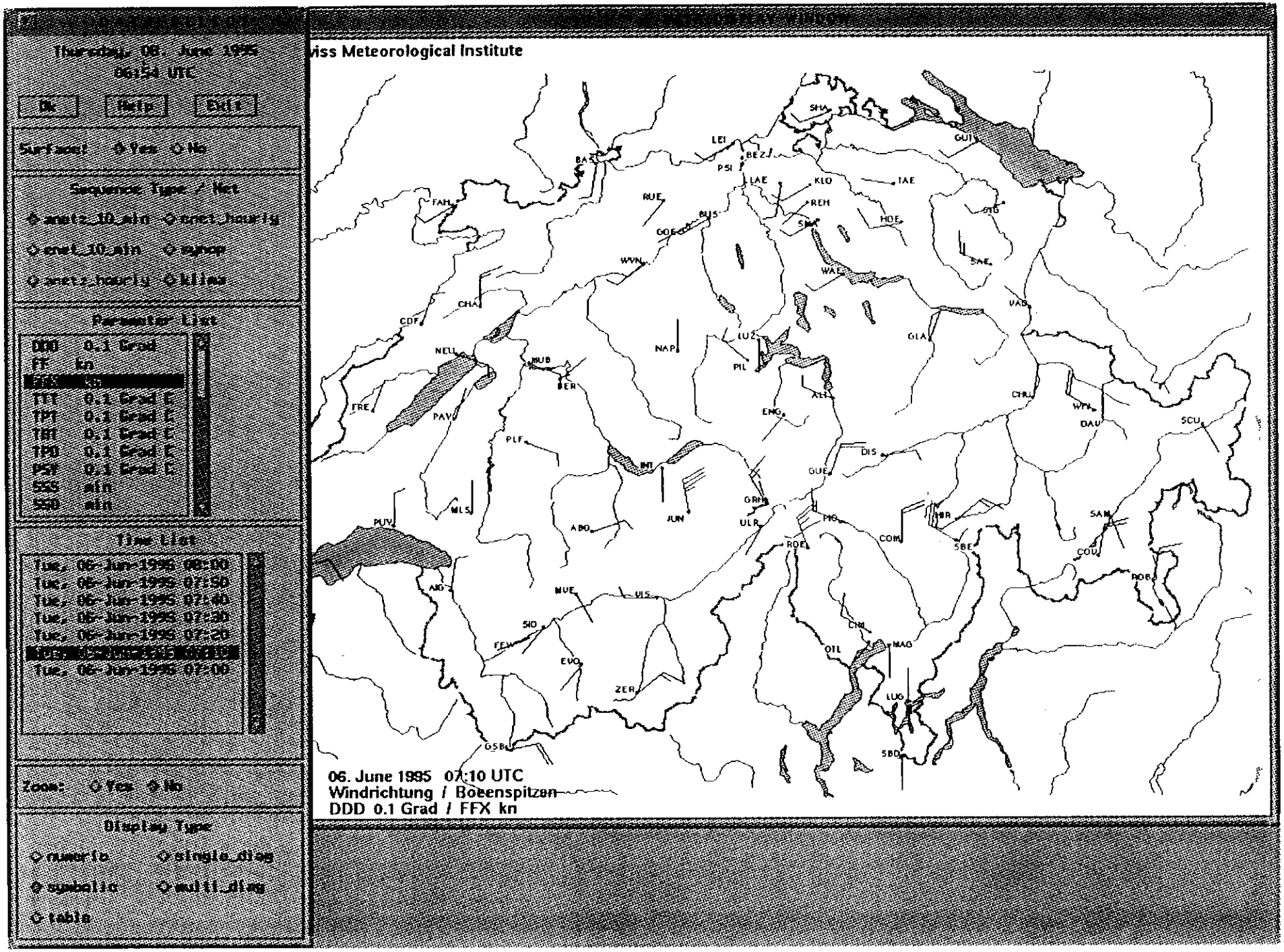
- Visualise LLT-Data over CH
- Data from various nets
- Different types of display
- Interactive user interface

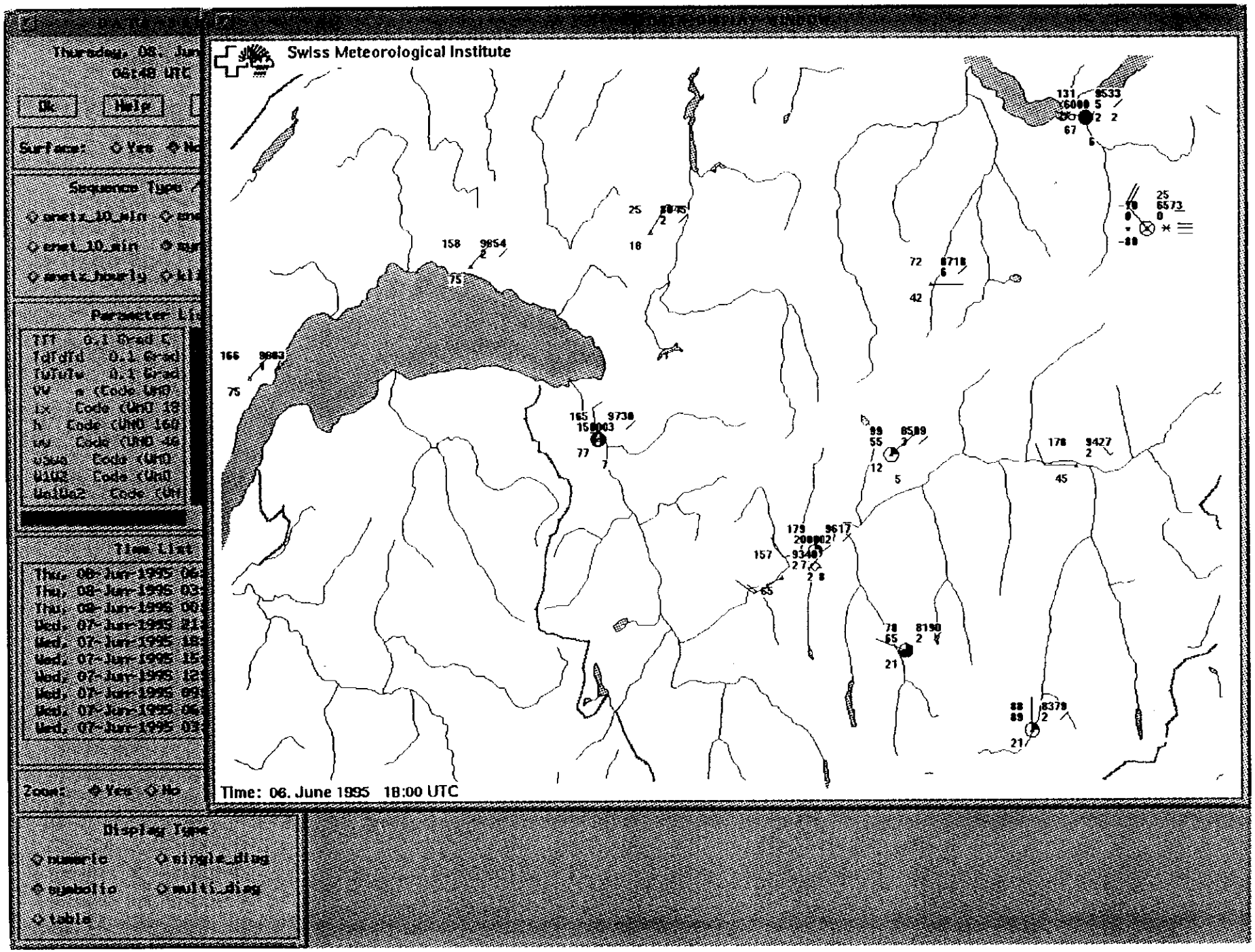
NWP-Display (GRID)

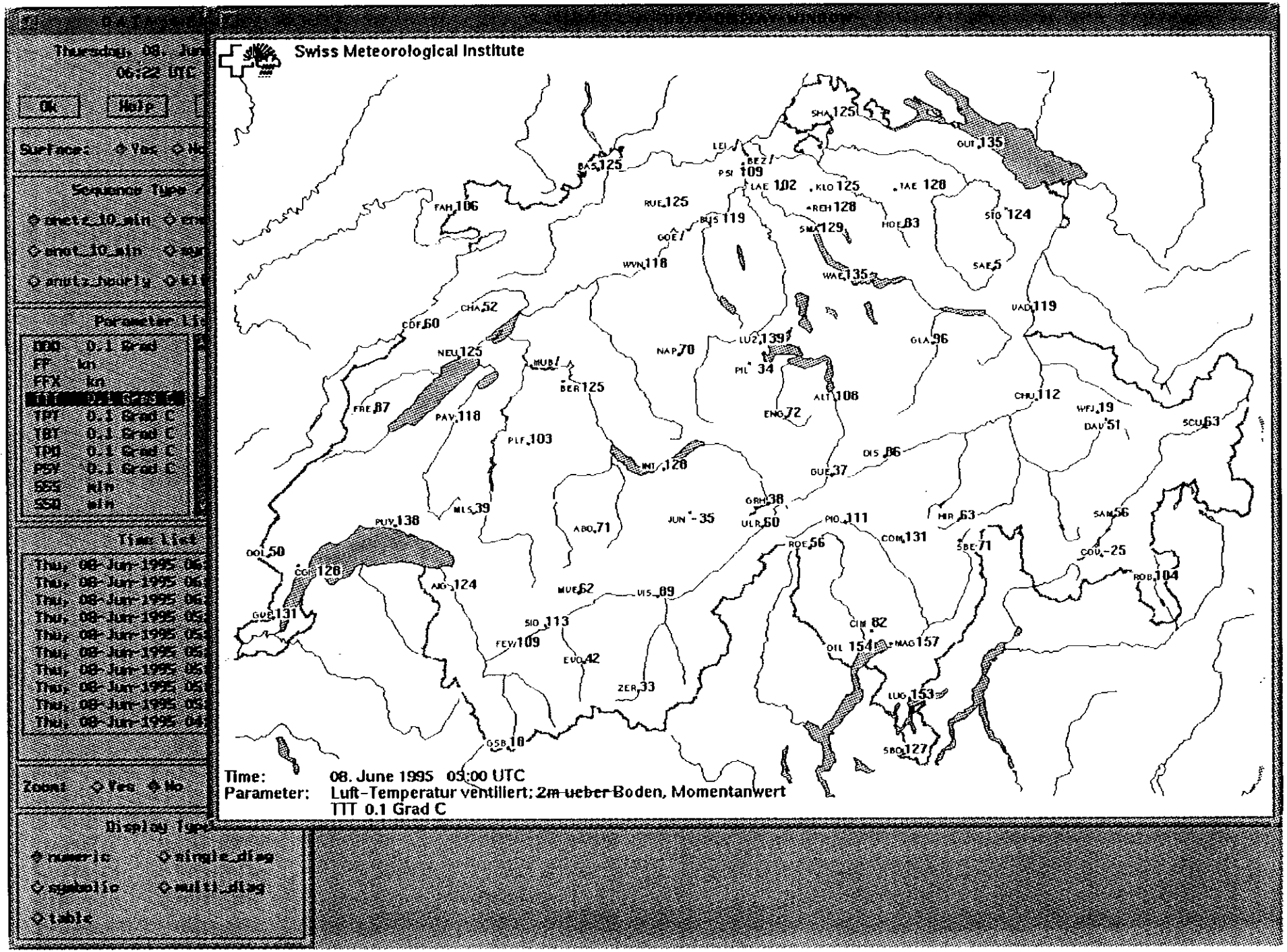
- Visualise results from NWP-programs
- Animation
- Pre-generation of graphics is possible
- Interactive user interface

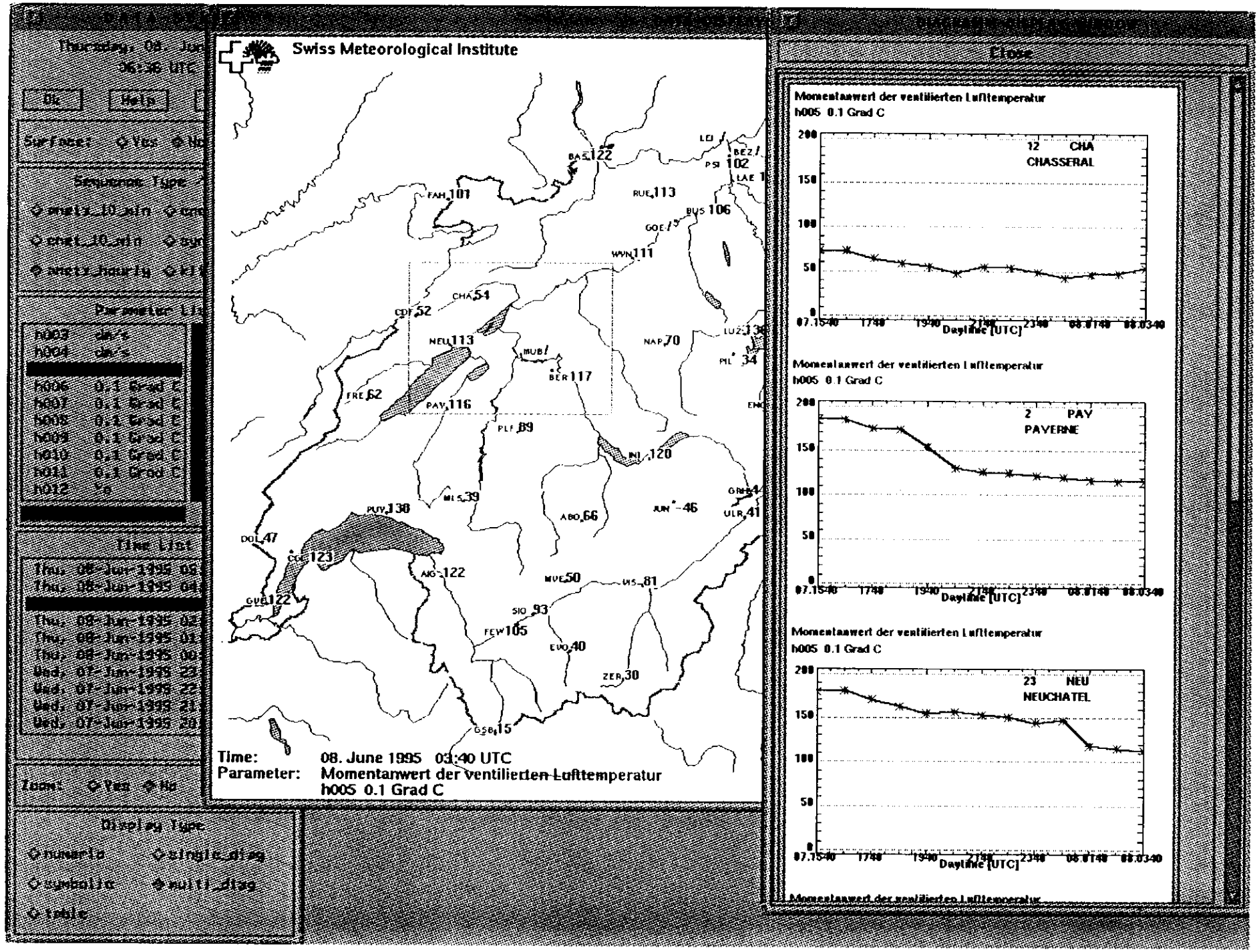
WAFS-Charts (GRID)

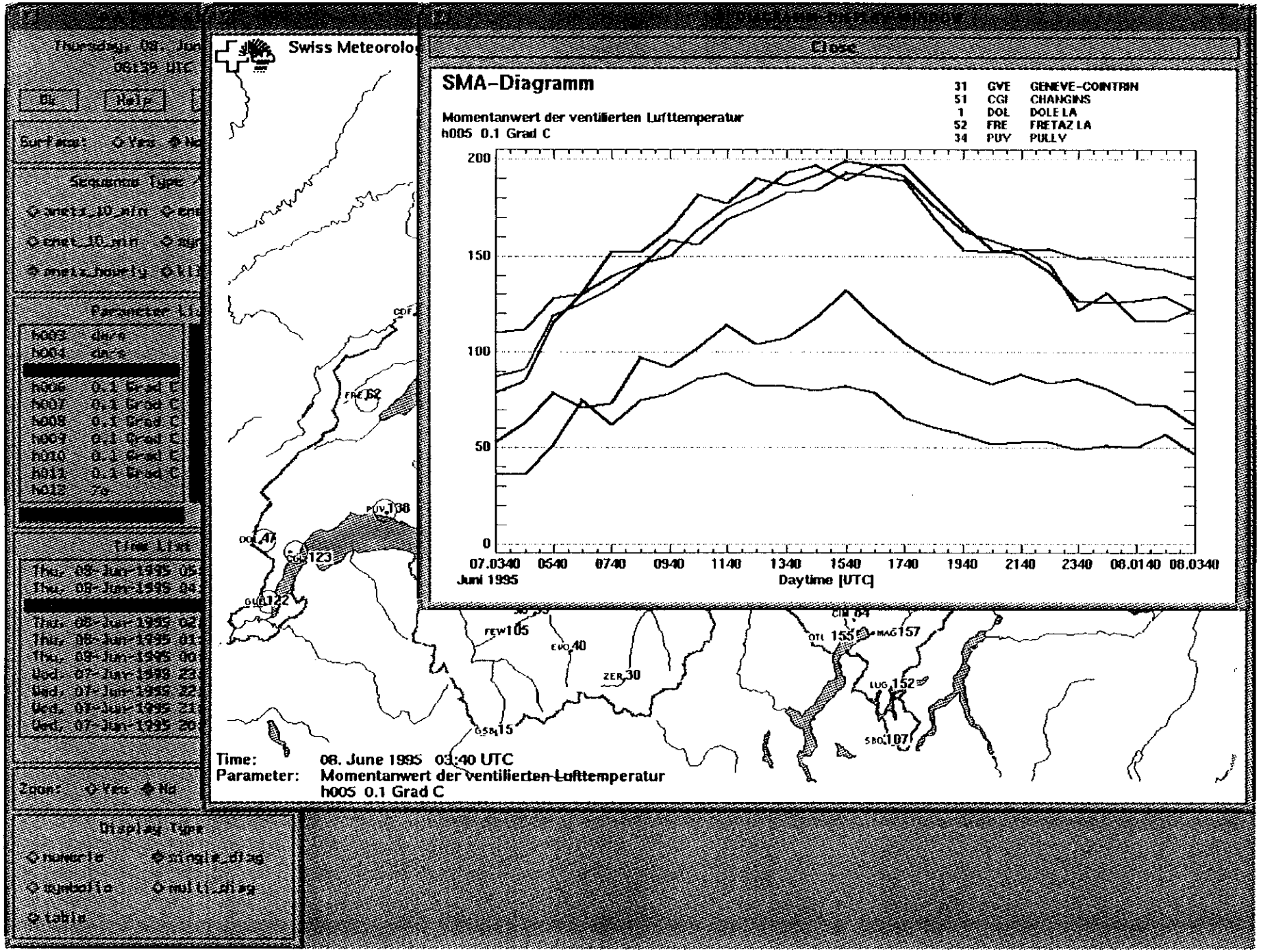
- Upper winds and upper-air temperatures
- Plots are generated automatically
- Prints (PostScript)

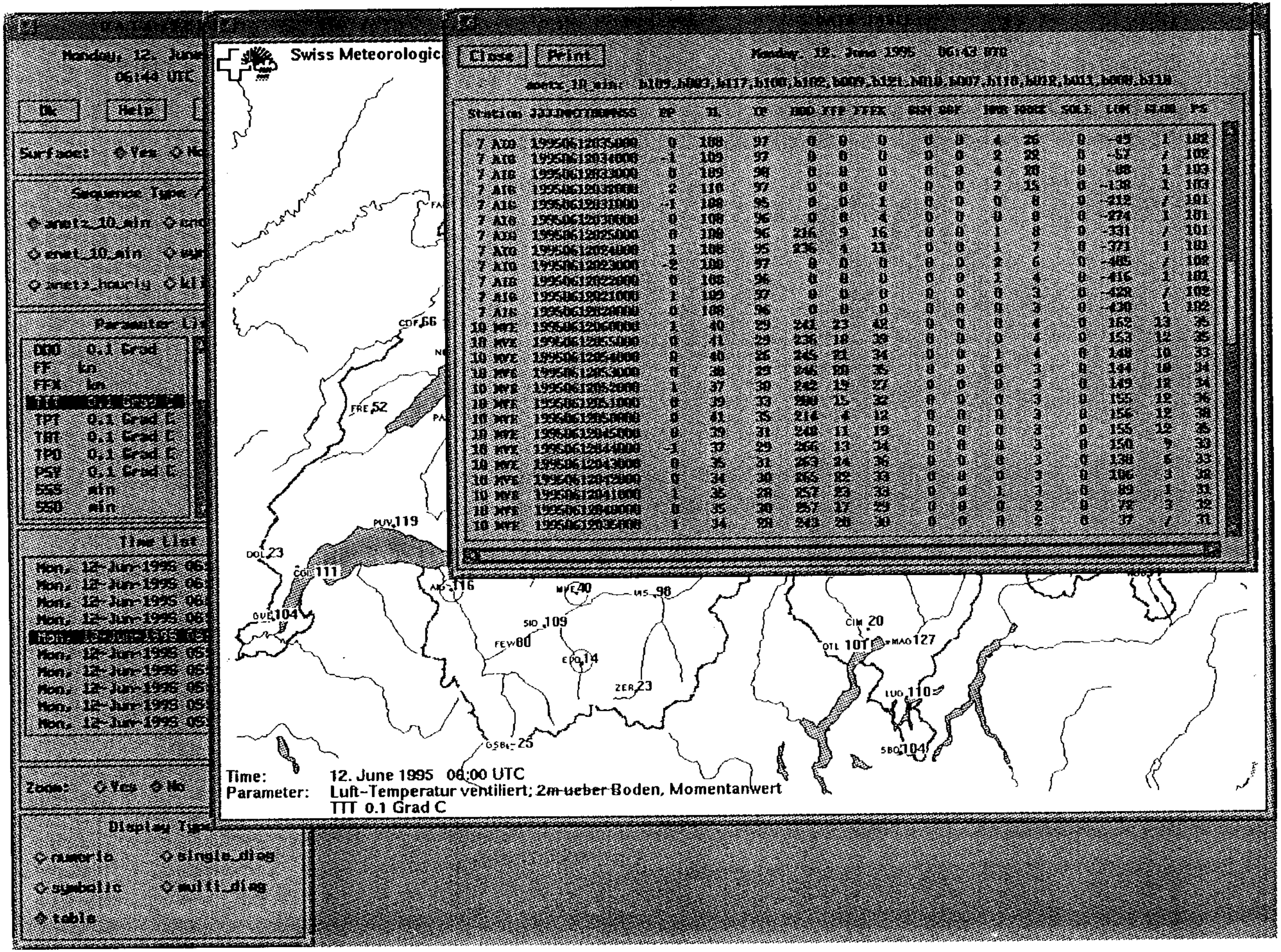

Thursday, 08. June 1995
06:54 UTC
Ok
Help
Exit
Surface: Yes No
Sequence Type / Net
anetz_10_min
anet_hourly
anet_10_min
synop
anetz_hourly
klima
Parameter List
DDD 0.1 Grad
FF kn
FFX kn
TTT 0.1 Grad C
TPT 0.1 Grad C
TBT 0.1 Grad C
TPO 0.1 Grad C
PSF 0.1 Grad C
SSS min
SSO min
Time List
Tue, 06-Jun-1995 08:00
Tue, 06-Jun-1995 07:50
Tue, 06-Jun-1995 07:40
Tue, 06-Jun-1995 07:30
Tue, 06-Jun-1995 07:20
Tue, 06-Jun-1995 07:00
Zoom: Yes No
Display Type
numeric
single_diag
symbolic
multi_diag
table
iss Meteorological Institute
SHA
GUT
LEI
BEZ
PSI
BAS
LAE
KLO
TAE
RUE
FAH
BUS
REH
HOE
GOE
SMA
GTB
WYN
WAE
SAE
CHA
VAD
CDF
LUZ
GLA
NAP
NEU
MUB
PIL
BER
ALT
CHU
WYN
DAU
SCU
FRE
PAV
EMO
PLF
DIS
INT
GUE
GRH
ULR
MLS
PUY
ABO
JUN
PIG
SAM
ROE
COM
SBE
COU
ROB
AIG
MUE
VIS
SIO
FEL
CHM
OTL
MAG
EVO
ZER
LUG
GSB
SBO
06. June 1995 07:10 UTC
Windrichtung / Boenspitzen
DDD 0.1 Grad / FFX kn

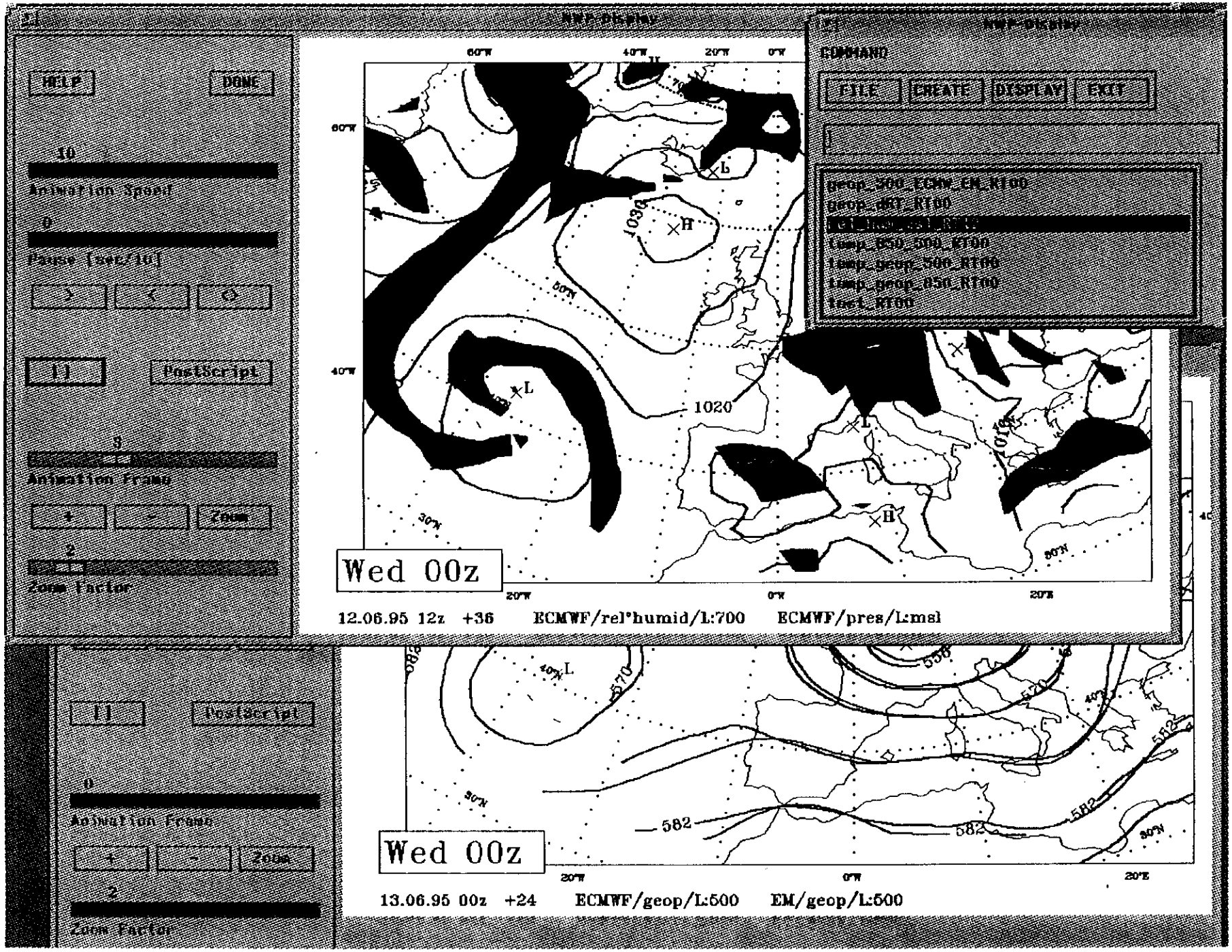

Swiss Meteorological Institute
Time: 06. June 1995 18:00 UTC
Ok
Help
Surface:
Yes
Sequence Type
Parameter List
Time List
Thu, 08-Jun-1995 06:
Thu, 08-Jun-1995 03:
Thu, 08-Jun-1995 00:
Wed, 07-Jun-1995 21:
Wed, 07-Jun-1995 18:
Wed, 07-Jun-1995 15:
Wed, 07-Jun-1995 12:
Wed, 07-Jun-1995 09:
Wed, 07-Jun-1995 06:
Wed, 07-Jun-1995 03:
Zoom:
Yes
No
Display Type
numeric
single_diag
symbolic
multi_diag
table

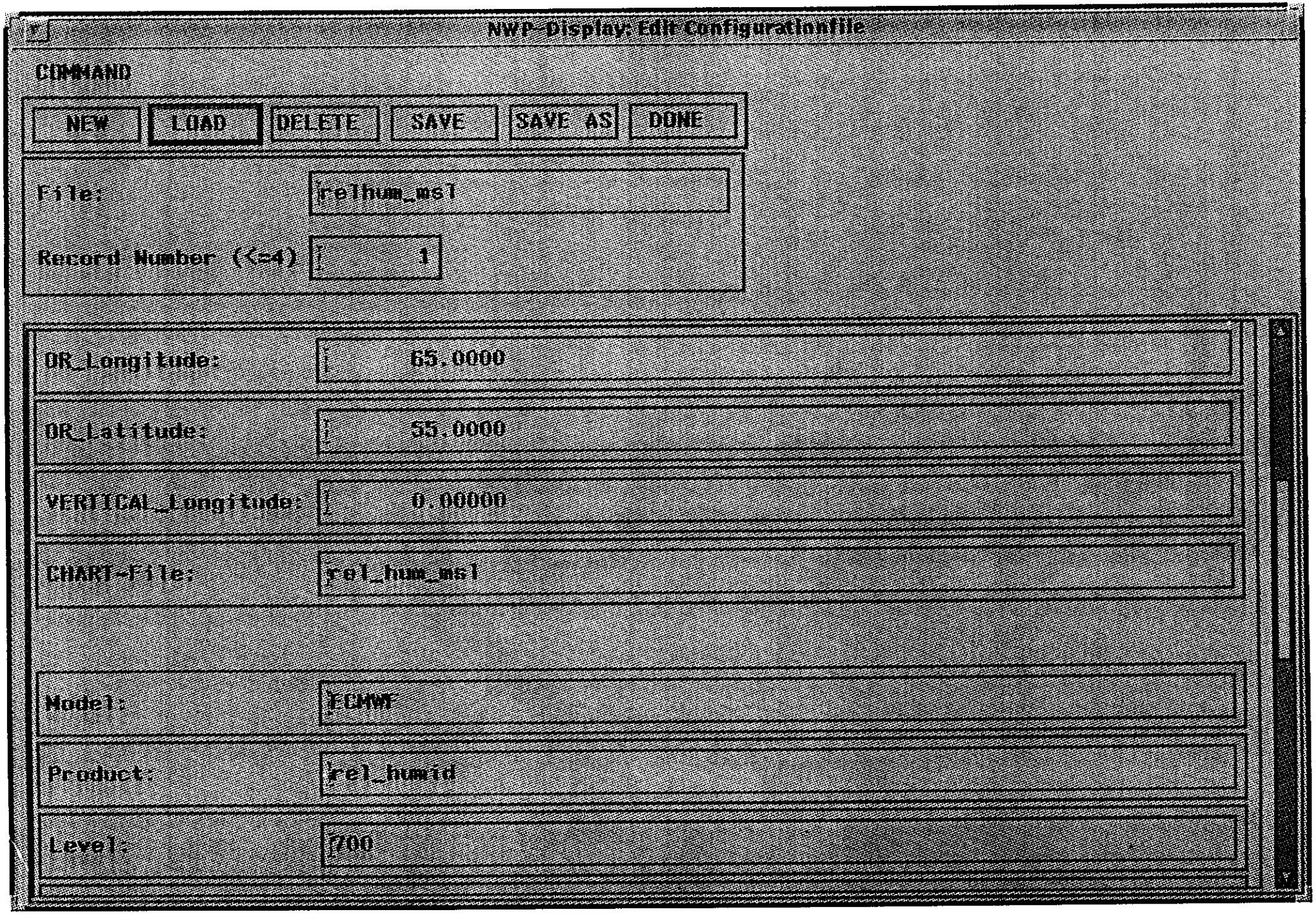

Thursday, 08. Jun
06:22 UTC
OK
Help
Surface:
Sequence Type
smetz_10_min
smet_10_min
smet_hourly
Parameter List
DDD 0.1 Grad
FF km
FFX km
TPT 0.1 Grad C
TBT 0.1 Grad C
TPD 0.1 Grad C
PSY 0.1 Grad C
SSS min
SSD min
Time List
Thu, 08-Jun-1995 06:
Thu, 08-Jun-1995 06:
Thu, 08-Jun-1995 06:
Thu, 08-Jun-1995 05:
Thu, 08-Jun-1995 05:
Thu, 08-Jun-1995 05:
Thu, 08-Jun-1995 05:
Thu, 08-Jun-1995 05:
Thu, 08-Jun-1995 05:
Thu, 08-Jun-1995 04:
Zoom
Yes
No
Display Type
numeric
single_diag
symbolic
multi_diag
table
Swiss Meteorological Institute
SHA 125
GUT 135
LEI
BEZ
PSI 109
BAS 125
LAE 102
KLO 125
TAE 128
RUE 125
FAH 106
REH 128
BUS 119
SMA 129
HOE 83
SIO 124
GOE
WYN 118
WAE 135
SAE 5
VAD 119
CHA 52
CDF 60
LUZ 139
GLA 96
NEU 125
NAP 70
MUB
PIL 34
BER 125
ALT 108
CHU 112
WFJ 19
FRE 87
PAY 118
ENG 72
DAV 51
SCU 63
PLF 103
DIS 86
INT 126
GUE 37
GRH 38
MLS 39
PUY 138
ABO 71
JUN 35
ULR 60
PIO 111
HIR 63
SAM 56
OOL 50
ROE 56
COM 131
SBE 71
COU 25
CGI 128
ROB 104
AIG 124
MVE 62
VIS 89
GUE 131
SIO 113
CIM 82
FEV 109
OIL 154
MAG 157
EVO 42
ZER 33
LUG 153
OSB 10
SBO 127
Time: 08. June 1995 05:00 UTC
Parameter: Luft-Temperatur ventiliert; 2m ueber Boden, Momentanwert
TTT 0.1 Grad C


Swiss Meteorological Institute
Thursday, 08. Jun
06:38 UTC
Ok
Help
Surface: Yes No
Sequence Type
Dw meteor Lis
h003 deg's
h004 deg's
h006 0.1 Grad C
h007 0.1 Grad C
h008 0.1 Grad C
h009 0.1 Grad C
h010 0.1 Grad C
h011 0.1 Grad C
h012 %
Time List
Thu, 08-Jun-1995 03
Thu, 08-Jun-1995 04
Thu, 08-Jun-1995 02
Thu, 08-Jun-1995 01
Thu, 08-Jun-1995 00
Wed, 07-Jun-1995 23
Wed, 07-Jun-1995 22
Wed, 07-Jun-1995 21
Wed, 07-Jun-1995 20
Zoom: Yes No
Display Type
numeric
single_diag
symbolic
multi_diag
table
BAS 122
LEI
BEZ
PSI 102
LAE
FAH 101
RUE 113
BUS 106
GOE
WYN 111
CHA 54
CDF 52
NEU 113
BUB
BER 117
NAP 70
LUZ 138
MIL 34
FRE 62
PAY 116
PLF 89
INT 120
MLS 39
PUY 138
ABO 66
JUN 46
GRH 41
ULR 41
DOL 47
CGI 123
AIG 122
MVE 50
VIS 81
GVE 122
SIO 93
FEW 105
EVO 40
ZER 30
GSB 15
Time: 08. June 1995 03:40 UTC
Parameter: Momentanwert der ventilierten Lufttemperatur
h005 0.1 Grad C
Close
Momentanwert der ventilierten Lufttemperatur
h005 0.1 Grad C
12 CHA
CHASSERAL
Momentanwert der ventilierten Lufttemperatur
h005 0.1 Grad C
2 PAY
PAVERNE
Momentanwert der ventilierten Lufttemperatur
h005 0.1 Grad C
23 NEU
NEUCHATEL
Daytime [UTC]


Swiss Meteorolo
Close
SMA-Diagramm
Momentanwert der ventilierten Lufttemperatur
h005 0.1 Grad C
31 GVE GENEVE-COINTRIN
51 CGI CHANGINS
1 DOL DOLE LA
52 FRE FRETAZ LA
34 PUY PULLY
200
150
100
50
0
07.0340 0540 0740 0940 1140 1340 1540 1740 1940 2140 2340 08.0140 08.0340
Juni 1995
Daytime [UTC]
Time: 08. June 1995 03:40 UTC
Parameter: Momentanwert der ventilierten Lufttemperatur
h005 0.1 Grad C


Swiss Meteorologic
Close
Print
Ok
Help
Surface:
Yes
Sequence Type
anetz_hourly
Time List
Zoom:
Yes
No
Display Type
numeric
single_diag
symbolic
multi_diag
table
CDF 66
FRE 52
PUY 119
DOL 23
COI 111
DVE 104
AIG 116
MVE 40
VIS 98
SIO 109
FEW 80
EVO 14
ZER 23
GSB 25
CIM 20
OTL 101
MAO 127
LUG 110
SBO 104
Time: 12. June 1995 06:00 UTC
Parameter: Luft-Temperatur ventiliert; 2m ueber Boden, Momentanwert
TTT 0.1 Grad C


NWP-Display
HELP
DONE
10
Animation Speed
0
Pause [sec/10]
<
>
<>
II
PostScript
8
Animation Frame
+
-
Zoom
2
Zoom Factor
60°W
40°W
20°W
0°W
60°N
40°N
30°N
20°W
0°W
20°E
L
H
1030
1020
1010
Wed 00z
12.06.95 12z +36 ECMWF/rel°humid/L:700 ECMWF/pres/L:msl
COMMAND
FILE
CREATE
DISPLAY
EXIT
geop_500_ECMW_EM_R100
geop_diff_R100
temp_850_500_R100
temp_geop_500_R100
temp_geop_850_R100
test_R100
II
PostScript
0
Animation Frame
+
-
Zoom
2
Zoom Factor
L
570
582
Wed 00z
13.06.95 00z +24 ECMWF/geop/L:500 EM/geop/L:500


NWP-Display: Edit Configurationfile
COMMAND
NEW
LOAD
DELETE
SAVE
SAVE AS
DONE
File:
relhum_ms1
Record Number (<=4)
1
OR_Longitude:
65.0000
OR_Latitude:
55.0000
VERTICAL_Longitude:
0.00000
CHART-File:
rel_hum_ms1
Model:
ECMWF
Product:
rel_humid
Level:
700

NWP Display

HELP DONE

10

Animation Speed

0

Pause [sec/10]

> < <>

[ ] PostScript

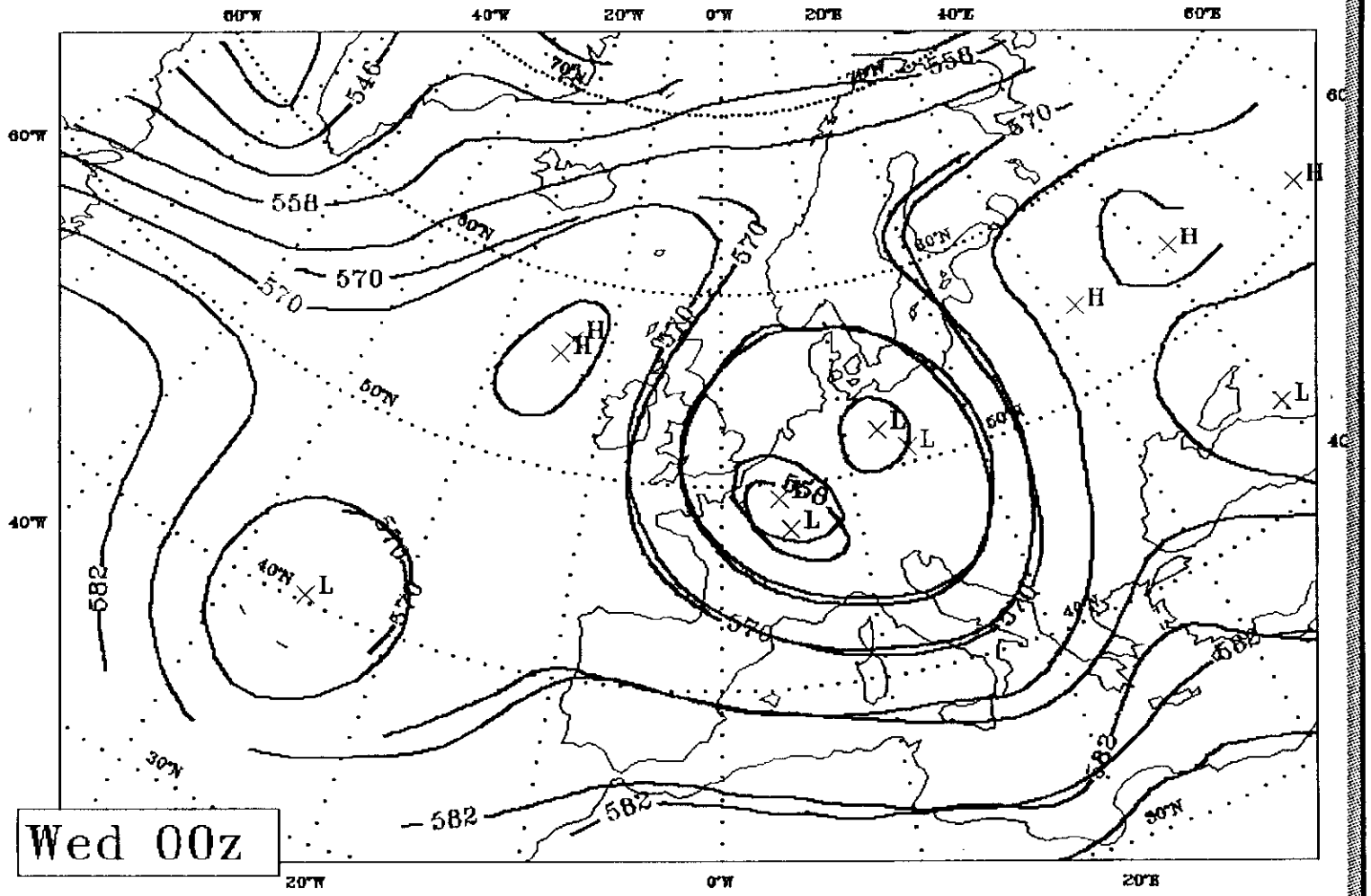
5

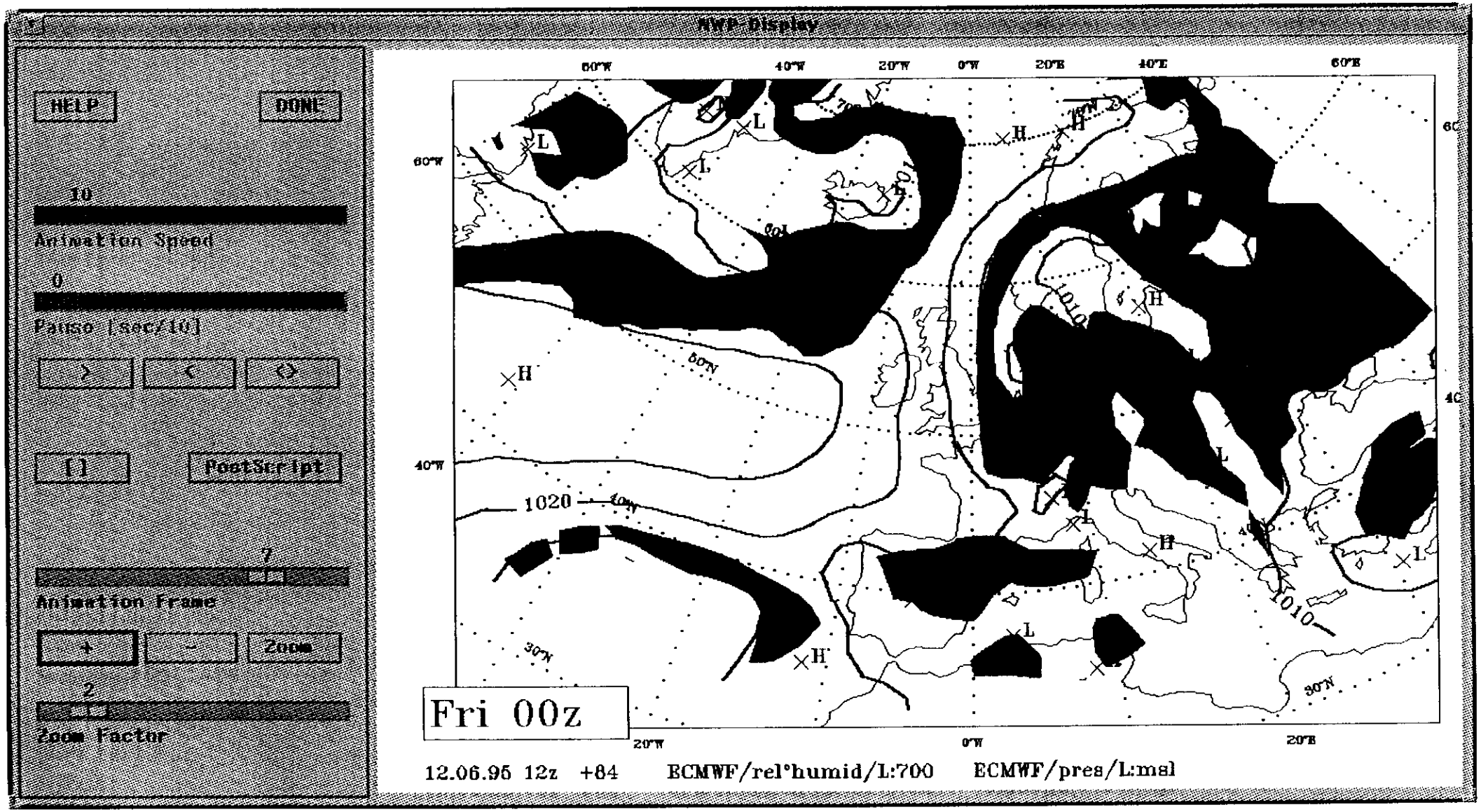
Animation Frame

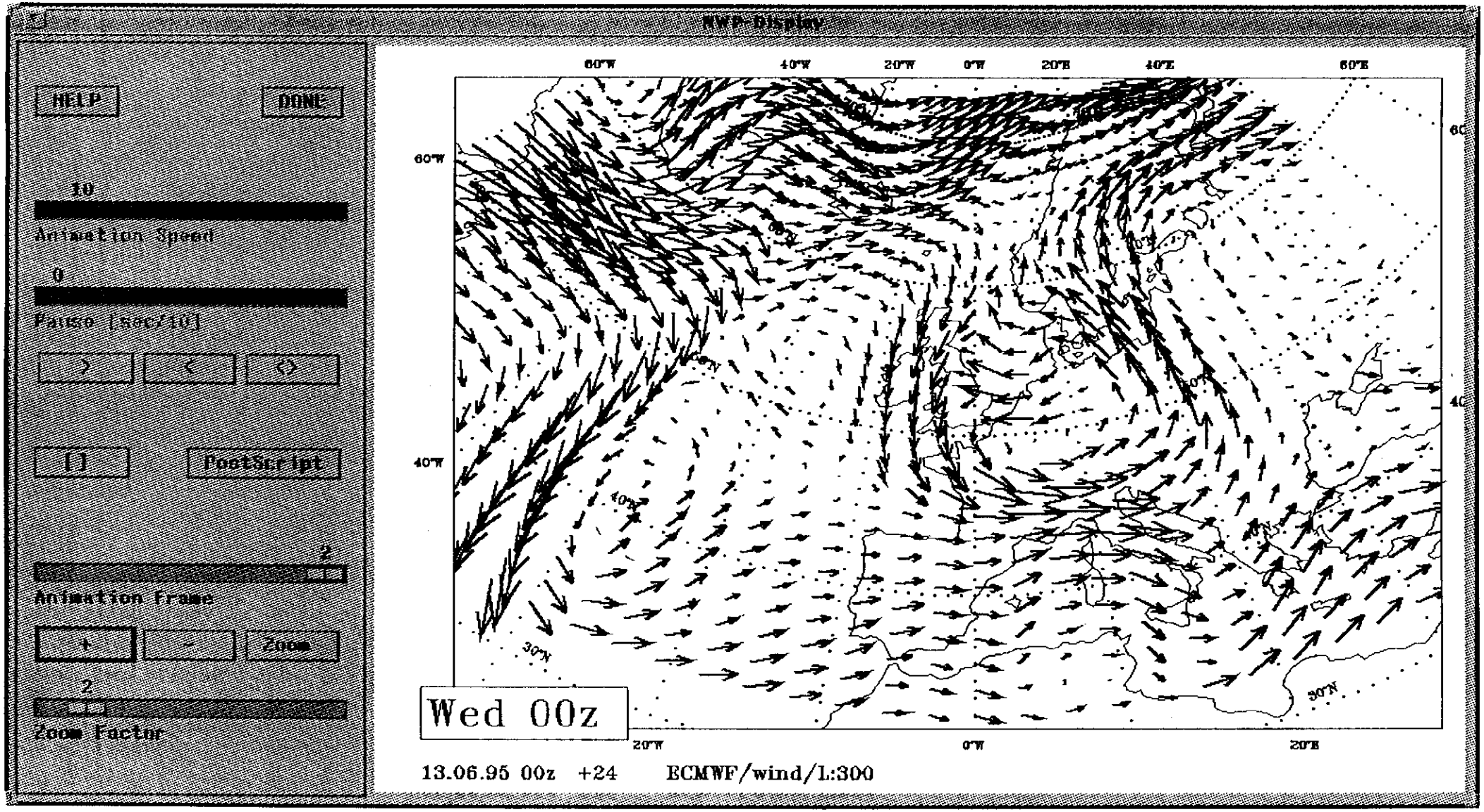
+ - Zoom

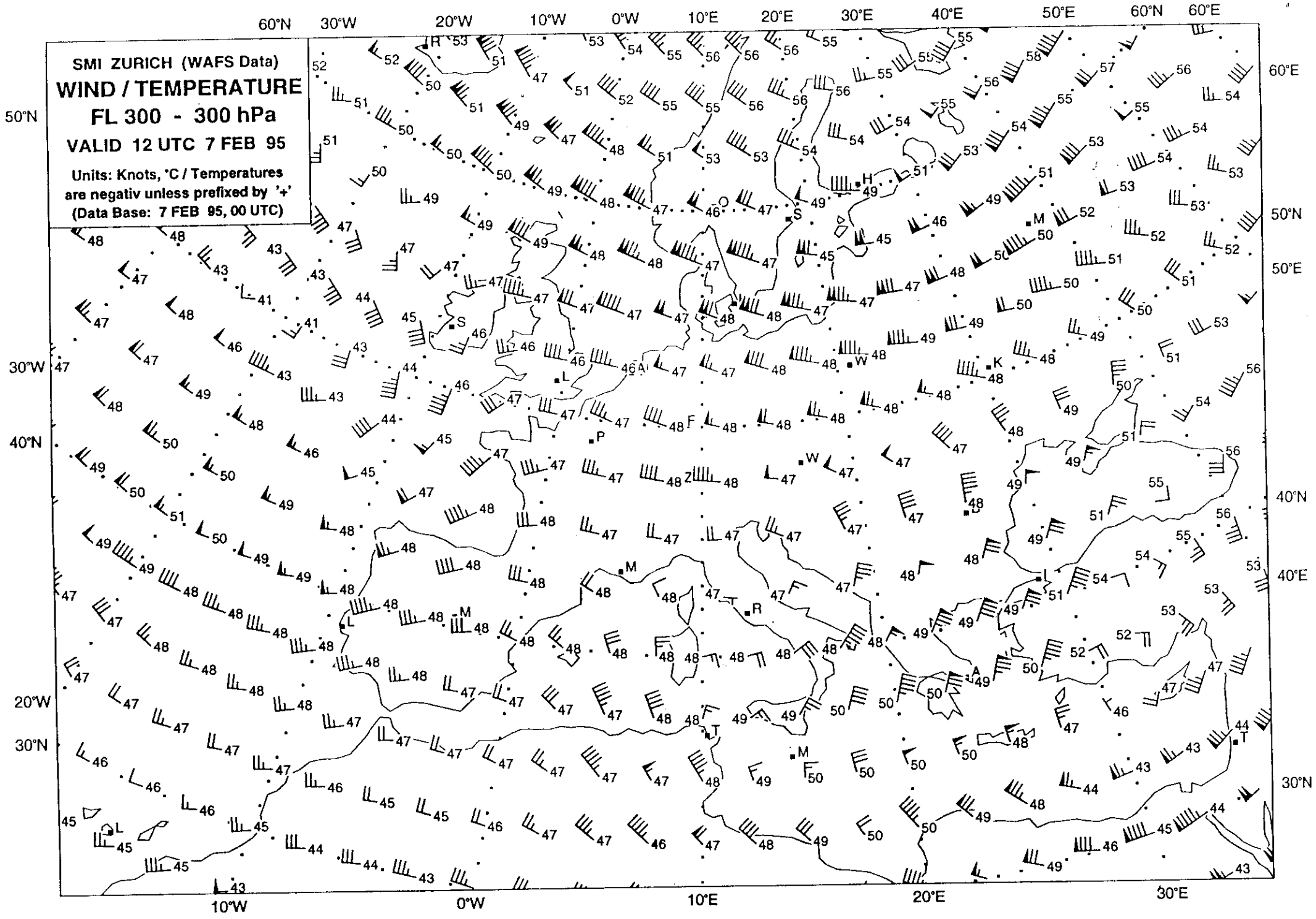
2

Zoom Factor




NWP Display
HELP
DONE
10
Animation Speed
0
Pause [sec/10]
>
<
<>
[ ]
PostScript
7
Animation Frame
+
-
Zoom
2
Zoom Factor
60°W
40°W
20°W
0°W
20°E
40°E
60°E
60°N
40°N
30°N
1020
1010
Fri 00z
12.06.95 12z +84
ECMWF/rel°humid/L:700
ECMWF/pres/L:msl


NWP-Display
HELP
DONE
10
Animation Speed
0
Pause [sec/10]
>
<
<>
[ ]
PostScript
2
Animation Frame
+
-
Zoom
2
Zoom Factor
60°W
40°W
20°W
0°W
20°E
40°E
60°E
60°W
40°W
20°W
0°W
20°E
30°N
30°N
Wed 00z
13.06.95 00z +24 ECMWF/wind/L:300


SMI ZURICH (WAFS Data)
WIND / TEMPERATURE
FL 300 - 300 hPa
VALID 12 UTC 7 FEB 95
Units: Knots, °C / Temperatures are negativ unless prefixed by '+'
(Data Base: 7 FEB 95, 00 UTC)
60°N
30°W
20°W
10°W
0°W
10°E
20°E
30°E
40°E
50°E
60°N
60°E
50°N
40°N
30°N
40°E

Applications (cont.)

METAP
(Meteorol. WS)

- 'Swiss' solution
- Project started to begin of this year
- Project will be defined at present
- METAP will use SRDB

Recommendations

RECOMMENDATIONS ON METEOROLOGICAL WORKSTATION DEVELOPEMENT

(as agreed on by EGOWS 6 , Vienna , June 22, 1995)

1: Requirements for a MWS

- Access to all types of meteorological data: messages, plotted observations, satellite and radar images, fields from NWP, elaborated maps and products, climatological databases and geo-graphical data.
- Manipulation of data: interpolation from NWP fields, derivation of additional parameters, trajectories, image manipulation, dynamical or statistical interpretation, verification procedures.
- Access to all products (automatically generated information).
- Visualisation of the above.
- A short response time is important.
- Interactive display of observations and other sources of meteorological information.
- Interactive data manipulation of all products issued from NWP and their display (including cross-sections and meteogramms).
- Display manipulation including superimposition, animation, roaming, zooming, retransformation and colorisation.
- Facilities to edit maps (adding information and modification of automatically generated infor-mation).
- On-the-fly production of as many products as possible instead of using precomputed products
- Graphic editing and interactive field modification.
- Two-dimensional graphical display is the main purpose of operational MWS. The problem of 3D graphics still looks too expensive. Also it should be investigated in which way it can be used in operational forecasting. ECMWF is testing the product Vis-5D.
- Need to give the forecaster an easy user interface based on icon representation and mouse or equivalent equipment for interactions. Accelerator keys and funktion keys can be used.
- Modularity of applications with clear separation between data handling, graphics and user inter-face is essential.

2: Recommendations on Standards

A: Meteorological

- GRIB and BUFR WMO codes for data representation.
- For data, the exchange format should be uniform (following WMO guidelines) but each country should be able to keep ist own internal storage format. In particular, for internal handling of observations, an alternative format to BUFR may be considered for performance reasons.
- For the exchange of Satellite Image Data the extended GRIB-format should be cinsidered. The extended GRIB format is used by ECMWF, France and Brazil. The current recommendation for an extended GRIB has some problems storing tracking information for polar orbiting satellites.
- The use of BUFR for exchange of radar images is recommended.
- BUFR-code should be used for the exchange of autromatically generated additional informations (Jet streams).

B: Computational

- No recomendation on the hardware Platform is given.
- MAC/PC for DTP purposes, eventually commercial DTP-software as an integral part of the MWS. Interactive work based on precomputed maps.
- UNIX operating system or equivalent is desirable.
- C and C++ programming languages (FORTRAN 90 may be considered).
- Object oriented methods and programming should be consiedered when designing the next generations of meteorological systems.
- X-Windows System for visualisation using the MOTIV toolkit to develop user interfaces.
- The look and feel of meteorological applications should follow the look and feel of general applications.
- The X Windows Sytem (Xlib) and GKS are the accepted graphic standards. Developments using PEX/PHIGS might also be considered.
- Open GL should be investigated as an upcoming standard.
- The ISO Compouter Graphics Metafile (CGM) format might be considered.
- For printing purposes, Post Script is a good solution. As an interchange format Encapsulated Postscript (EPS) and T4 Code might be considered.
- Be carefull about the memory limit on X Terminals.
- SQL, for accessing organised databases, should be investigated. Awaiting extended form, which the majority is using anyway.
- The overhead of operational monitoring, supervision and support should not be overlooked.

List of Participants

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SMHI

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