Contents

Foreword

The 9th meeting of the European Working Group on Operational Meteorological Workstations (EGOWS) was held at SMHI in Norrköping, Sweden. We were glad to welcome 31 participants from 18 countries.
Many interesting presentations were held, several systems were demonstrated and there were a lot of discussions among the participants.
The 'Recommendations' were updated from discussions held both at a special teamwork session and at the final plenary session at the end of the meeting.

It was decided that contacts and information exchange through an updated mail list should be used more frequently. Maybe it could be useful to set up a web-page for EGOWS in the future. Dick Blaauboer, KNMI will still be responsible for maintaining the mail list.

A suggestion was that it is important to inform about the plans of future projects in each country, as it then will be easier to find projects to co-operate upon.

Thank you all for making this meeting so fruitful and interesting, and I would like to thank Helena Sundelin for her work with the organization of the meeting, Rafael Urrutia for the work with the computers and the systems for the demonstrations.
I would also like to thank Hong Zhu and Fredrik Lundström, Hewlett Packard, and Gennar Beetz, Digital who made it possible to make every computer and system running for the demonstrations.

Next meeting will take place at KNMI in the Netherlands 7-10 June 1999.

Anna Hamström

Recommendations on
Meteorological Workstation Development

as agreed at the 9th EGOWS meeting (June 1998)

1. Recommendations on European cooperation

1.1 Lessons from the recent past

- The Egows group is now 9 years old.
- Exchanges of ideas has been very fruitful, but met.services may regret not to have been able to go any further (i.e. exchange of source code,...)
- Advanced technical cooperation has been proved quite weak in the last years, due to technical and architectural choices on the one hand, to more strategical or political reasons on the other hand.
- The EGOWS members observe, as a logical consequence, that their systems, when developed, have not much in common, but (some times) the basic layers (system, RDBMS, graphical packages,...)

1.2 Problems to solve

- Meteorological workstation (MWS) development is often compared to NWP model development : this comparison looks relevant as for the size of the corresponding source codes, but cooperation in the field of MWS seems much more tricky : source architecture may be more complex, as MWS mean both interactivity and integration ; Moreover, some requirements may differ from one meteorological institute to another, specially in the field of graphical interaction and meteorological production.
- The EGOWS group has not found in the recent past the convenient political frame at the met.services HQ level (Eumetnet ?), to make cooperation a priority or a necessity.
- New development environments might make module exchange easier (Corba,...). There has to be a possibility for each country to make their own modifications.
- Standards have to be used (JAVA, C++, OpenGL).
- For small countries which cannot afford the development of a MWS, cooperation or purchase of an OTS (off the shelf) system may be the only ways.
- It would be hard to achieve a common library to be used by all european meteorological services but a common architecture could be more useful. Then each country have control of their library to ensure that the bricks are compatible. On the other hand for meteorological services that are now starting to build a MSW it could be very useful to have a common library available.
- What is the timescale for this kind of cooperation? Should there be a distinct result after each conference or do we work in a longer timescale (5 years)?

1.3 Examples of european cooperation

- HIRLAM
- TIPS (TAF automation)

1.4 Recommendations

- Make more use of the EGOWS mailing list! Use this year to evaluate the mailing list. If it is frequently used may be it would be a good idea to have a newsgroup on Internet.
- Merge EGOWS/COST78 wgGI
    1. Informal exchange of ideas
    2. Make up an agenda on beforehand with particular projects to discuss

2. Requirements for a Meteorological Workstation System (MWS)

2.1 Scope of MWS

There is now an agreement on a larger definition of what a MWS should offer to its users :

- access to data
- data visualisation and manipulation
- graphical interaction and database feeding by forecasters
- product derivation if requirement for a human intervention

Meteorological production, when human intervention is necessary, is the combination of graphical interaction by forecasters and product derivation from a forecaster's database.

2.2 Access to data

- Access to all types of meteorological data, messages, plotted observations, satellite and radar images, fields from NWP, elaborated maps and products, climatological databases and geographical data.
- Access to all products including those created from automatically generated information.

2.3 Data visualisation and manipulation features

2.3.1 Interactive features

- An intuitive user-interface for the forecaster, based on icon representation and mouse (or equivalent) interactions. Accelerator keys, function keys and macro functions can be used.
- Personal configuration of default interface variables, maps etc.
- As short a response time as possible.
- A 2-D graphical display. This is still the main purpose of an operational MWS, though 3-D graphics should be investigated to identify how they can best be used in operational forecasting.
- Display manipulation including superimposition, animation, roaming, zooming, retransformation and colorisation.
- Automatic updating of the observations and other meteorological information.
- Interactive manipulation of NWP data to create and display products such as cross-sections and meteograms.
- Manipulation of data : including interpolation from NWP fields, derivation of additional parameters, trajectories, image manipulation, dynamical or statistical interpretation, verification procedures.
- On-demand computation of as many products as possible in preference to using pre-computed products.

2.3.2 Background features

- Monitoring of observational and NWP data on arrival
- Issue of an alarm to the user when pre-set criteria are matched. Ability to point out spurious data.

2.3.3 Discussion

- Should we consider MWS as something that only operational forecasters uses, or even researchers? That is, what´s the definition on MWS? No defintion could be found but the EGOWS members opinion was that researchers can use the same MSW as the operational forecasters but they also need other tools.
- The usefulness of 3D-presentation for the forecaster was discussed. Some opinions:
    1. Since the "weather" is three-dimensional it certainly should be interesting, especially for local scale problems!?
    2. If a 3D-tool shall be used in forecasting, it has to have a very good GUI.
    3. It is mainly a question of training of the meteorologists.

2.4 Graphical interaction and database feeding by forecasters

- On-screen graphical editing, addition of new information and interactive modification of automatically generated information. Facilities to edit maps.
- More generally speaking, facilities to fill a database allowing forecasters to add value to raw data through " graphical interaction " within a geo-referenced (or not) frame.
- Graphical interaction (together with the subsequent forecaster's database) seems necessary to the Egows member to implement a massive production process.

2.5 Product derivation

- This field of development should be considered, at this requirements level, as a part of the MWS purpose.
- Product generation tools may anyway be developed separately from the MWS. In this case, a generic interface for forecaster's data access is required.
- Ability to save and disseminate output products.
- Not any country is going toward a fully automated product derivation process, but it is agreed that the concept of forecasting assistant is slightly vanishing.

2.6 Miscellaneous

- The ability to archive data and/or products.

3. Recommendations on Standards

3.1 Meteorological

- The GRIB and BUFR WMO codes should be used for data representation.
- The exchange format for data should be uniform, following WMO guidelines, but each country should be able to keep its own internal storage format. For internal handling of observations in particular an alternative format to BUFR may be considered for performance reasons.
- Standard GRIB format is currently being updated and should be able to handle 3-D information in future.
- Extended GRIB format, currently in use by ECMWF, France and Brazil, should be considered for the exchange for satellite image data. There may still be a problem storing tracking information for polar-orbiting satellites.
- It is recommended that BUFR is used for the exchange of radar images. Specifications are expected from OPERA/Eumetnet by 1998.
- Extended BUFR code should be used for the exchange of additional information such as jet streams, or more generally for " forecasters data " exchange, when these data deal with significant weather objects. A proposal for the extension has been accepted by the code sub-group of WMO.

3.2 Computational

3.2.1 Hardware

- No recommendation is given on the hardware platform to be used. Care should be taken to specify sufficient memory if X-terminals are used. Screen sizes should be maximised.

3.2.2 MWS architecture

- Modularity of applications, where clear separation between data handling, graphics and the user-interface is essential.
- The overheads of operational monitoring, supervision and support should not be overlooked.
- A multitasking capability using a UNIX operating system, Windows NT or equivalent is desirable.
- Object-oriented methods should be considered when designing the next generation of meteorological systems.

3.2.3 System and commercial softwares

- The X-Windows system is ideal for visualisation using the MOTIF tool-kit to develop the user-interfaces. Windows NT can be considered too.
- PC/MAC Desk Top Publishing (DTP) software could be part of the MWS, ideally via integrated command libraries.
- The look-and-feel of meteorological applications should follow the look-and-feel of less specialised IT applications. A uniform style guide should be developed as this reduces user training costs.
- The Common Desktop Environment (CDE) is useful for style management and work area personalisation although some network dependencies can prove troublesome.
- The X-Windows system (Xlib), GKS and Open GL are the accepted graphics standards. The ISO Computer Graphics Metafile (CGM) output format should be considered for the exchange of graphics information as its rich format maps onto many drivers.

3.2.4 Programming languages

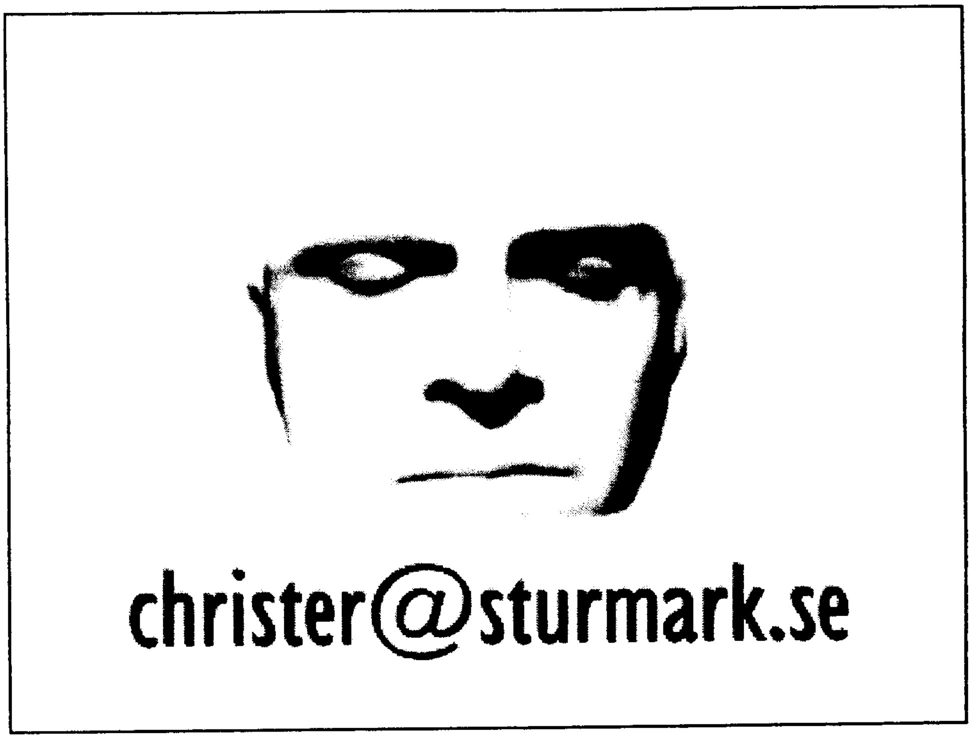
- C++ and Java are the recommended programming languages. FORTRAN 90 can be considered too.

3.2.5 Data storage and access, Formats

- An extended form of SQL is already in use and is worth considering for accessing organised databases. Several sites successfully use NEONS, but a replacement is under development and is awaited from the US Navy.
- Compression techniques suited to the data type can be used to improve data transfer rates and storage capacity. MPEG is suitable for animations without too many colour variations. GRIB is good for NWP data. Fractal techniques can be considered for imagery.
- Intranet systems are useful for the internal exchange of data across a network. HTML is recommended for on-line documentation.
- For printing purposes Postscript, Encapsulated Postscript, T4, PCL and PDF (which is 90% postscript) might be considered.
- MWS should have the ability to convert data into GIF, MPREG, JPEG (images), or into HTML (text). Beware that GIF may need a licence.

Guest Speaker

Christer Sturmark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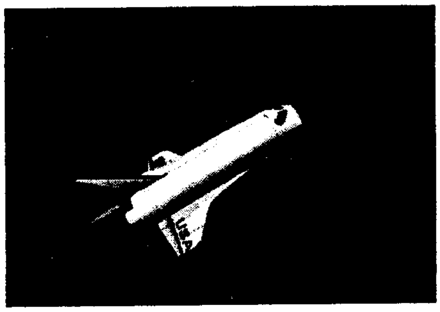
A paradigmshift



Information society

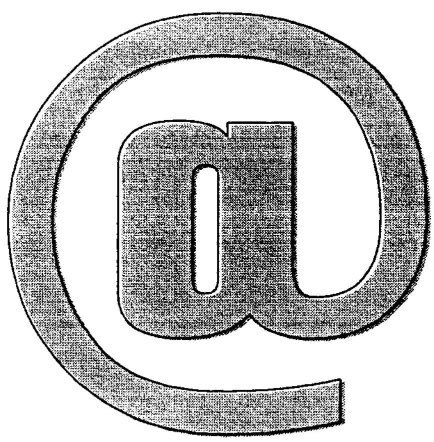
- Global economy, new company structures
- New methods and company cultures
- New relations to information and communication
- IT and Internet is the enabling technology

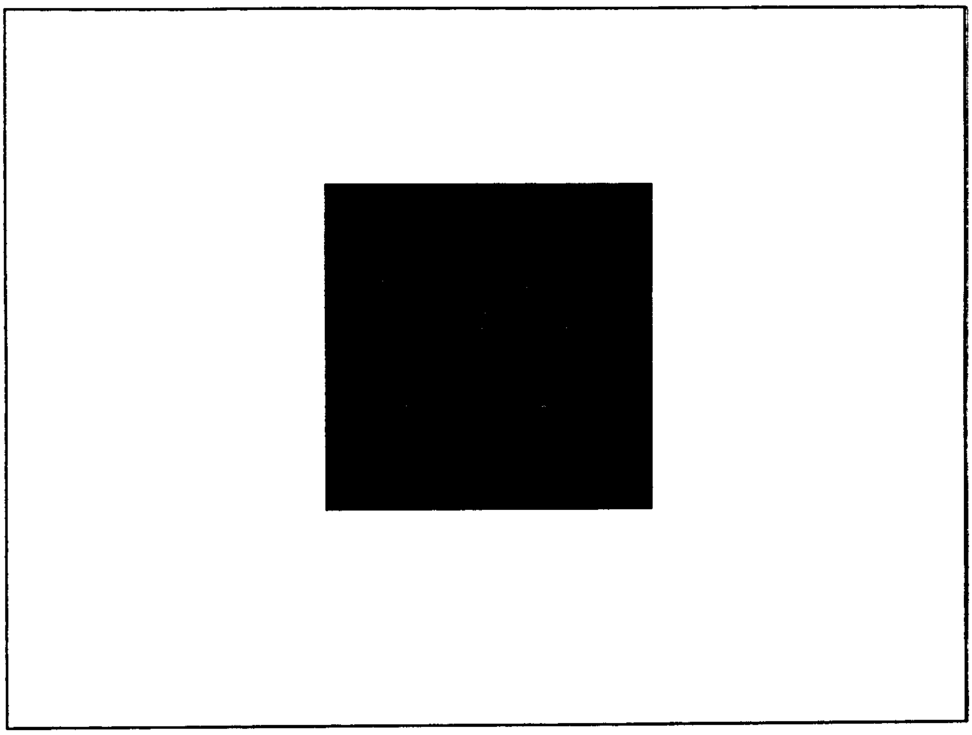
Vannevar Bush

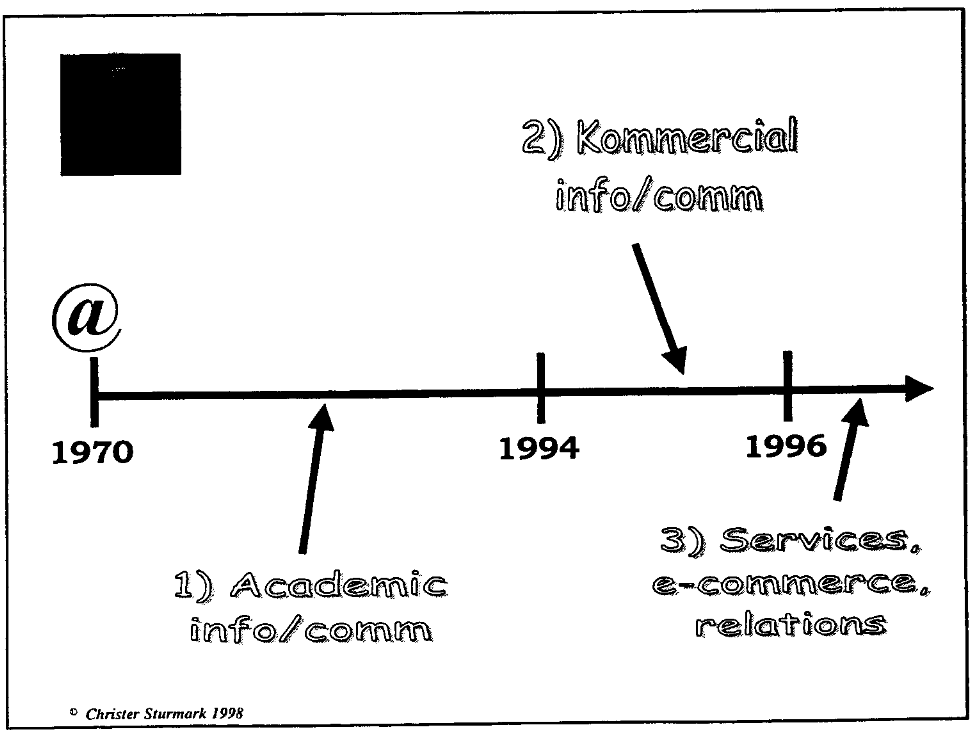
- Vannevar Bush - Roosevelt advisor
- "As we may think" - Atlantic Monthly 1945
- The MEMEX

[redacted]riven by metaphorical development

- **Spreadsheet**
- **Desktop Publishing**
- **GUI**
- **World Wide Web**






2) Kommercial
info/comm
1970
1994
1996
1) Academic
info/comm
3) Services,
e-commerce,
relations
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5

key qualities

1

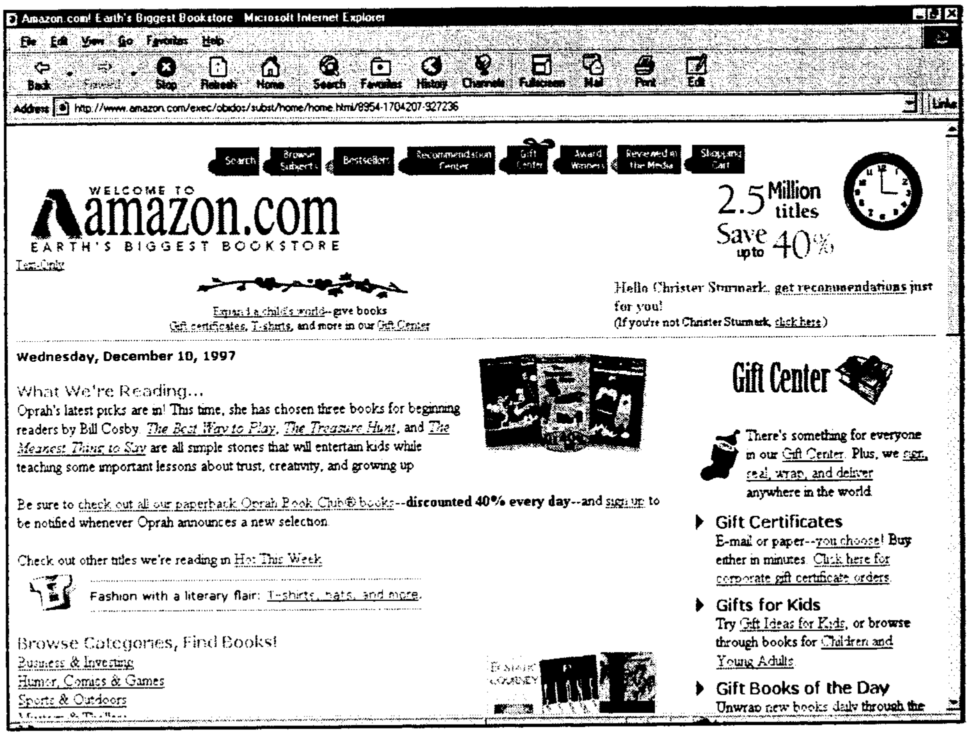
Global

2

Interactive

3

Individual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Hello Christer Sturmark, get recommendations just for you!
Wednesday, December 10, 1997
What We're Reading...
Oprah's latest picks are in! This time, she has chosen three books for beginning readers by Bill Cosby. The Best Way to Play, The Treasure Hunt, and The Meanest Thing to Say are all simple stories that will entertain kids while teaching some important lessons about trust, creativity, and growing up.
Gift Center
There's something for everyone in our Gift Center. Plus, we sign, seal, wrap, and deliver anywhere in the world.
Gift Certificates
Gifts for Kids
Gift Books of the Day
Browse Categories, Find Books!
Business & Investing
Humor, Comics & Games
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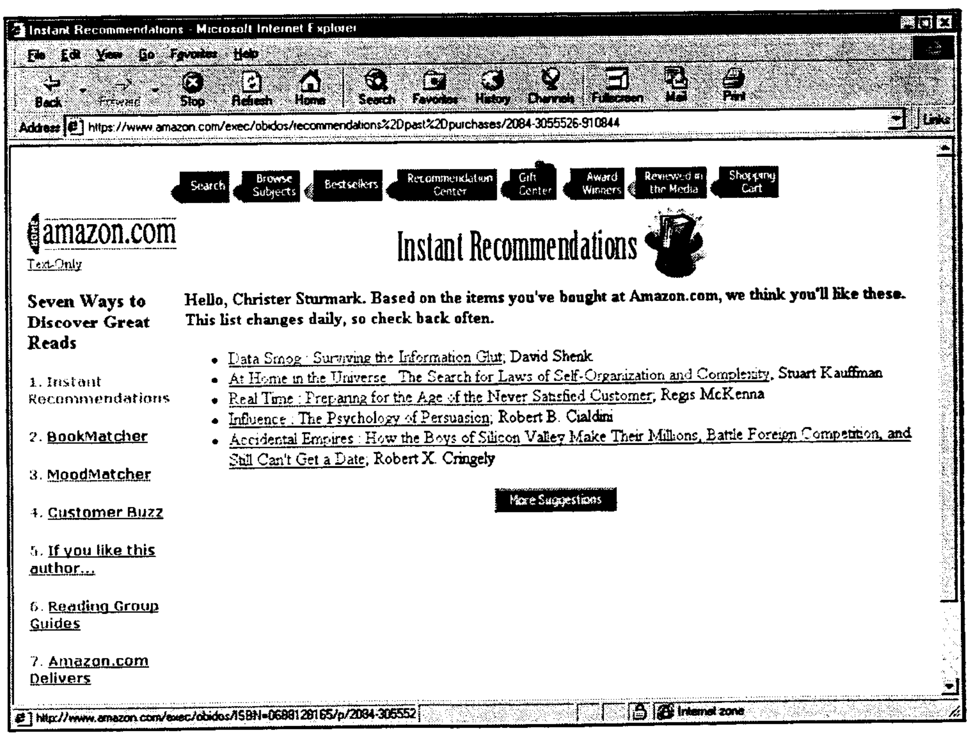
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Instant Recommendations
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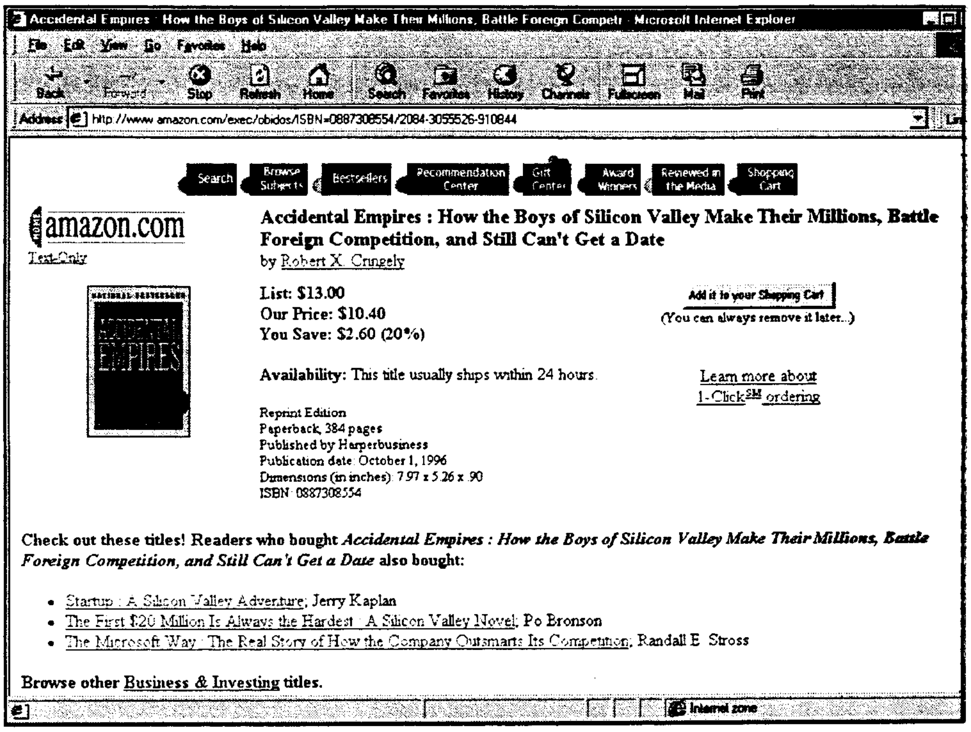
Real Time : Preparing for the Age of the Never Satisfied Customer; Regis McKenna
Influence : The Psychology of Persuasion; Robert B. Cialdini
Accidental Empires : How the Boys of Silicon Valley Make Their Millions, Battle Foreign Competition, and Still Can't Get a Date; Robert X. Cringely
More Suggestions

4

Active part

5

"Virtual Community"



New business logic,
new possibilities,
new problems

"We shape our tools,
then our tools shape us"
Marshall McLuhan 1964

Thank you!

christer@sturmark.se

Session 1- Recent Developments

2 June 1998

ECMWF METVIEW and MAGICS

METVIEW is an interactive meteorological application, which enables operational and research meteorologists to access, manipulate and visualise meteorological data on UNIX workstations.

MAGICS is a software library that permits the plotting of contours, satellite images, wind fields, observations, symbols, streamlines, isotachs, axes, graphs, text and legends.

METVIEW 1.7 and MAGICS 5.4 have been tested on UNIX workstation platforms and are available to the Member States on request via the ECMWF Data Services:

Data.Services@ecmwf.int

Information on METVIEW and MAGICS is available on ECMWF Member States Internet pages (SecureID required):

http://ra.ecmwf.int:80/ecmwf/info/local_documentation/Graphics/index.html

It is planned that the METVIEW and MAGICS user manuals will be made available on Internet to Member States users.

MAGICS 6 has been implemented in two variants with different drivers: MAGICS/OpenGL and MAGICS/PostScript. Current development includes a new visualization module for METVIEW 2 to cater for new user requirements. METVIEW 2 requires MAGICS 6/OpenGL

MAGICS 5.4

MAGICS 5.4 has added support for the plotting of new observational data types including PROFILER, ERS1/scatterometer and SSM/I data and plotting of 4DVAR feedback data. T639 GRIB fields are now supported. There has been a complete rewrite of the ordinary observation plotting (i.e. not feedback) to make it faster and accessible to Centres outside ECMWF and to facilitate the addition of new features. MAGICS 5.4 supports external BUFR parameter tables. Cell shading has been extended to cylindrical subareas and polar stereographic projections.

The new MAGICS user documentation should become available later this year. As for METVIEW, the user manual will be issued in stages. The first chapters are ready and will soon be distributed.

MAGICS 6

A MAGICS test version 6.0 has been installed on SGI systems. Tests on other UNIX platforms will follow shortly. It is a major new release replacing GKS with a new virtual graphics interface. Two variants with different drivers have been implemented: MAGICS/OpenGL and MAGICS/PostScript.

MAGICS/PostScript

As the X11 Windows environment is not available to batch jobs and OpenGL has no concept of hardcopy paper output, a PostScript driver has been developed. This driver is stand-alone, it does not require any underlying graphics package or Windows system to run. This makes it suitable for both METVIEW hardcopy and straight MAGICS jobs.

MAGICS/PostScript is a test version currently installed on the SGI servers only. Both single and double precision versions are available. Except for the new driver this is basically the same as version 5.4. No changes to user programs are required but alternative parameters are available to control various aspects of PostScript.

Linking must be done with C++ as all drivers are written in C++. A compile and linkage environment is provided. The main program is still FORTRAN (f77/f90) and everything can be done automatically using a simple Makefile which is provided.

There is a new approach to PostScript, recognizing the fact that PostScript files are neither metafiles nor device independent. A target PostScript device must be selected and a PostScript file will be tailored to print correctly at least on this device. It may or may not print well on other devices depending on the software and hardware capabilities available on those other devices.

Three PostScript hardware fonts are supported to provide high quality text plotting. The full extended character set in each font is available which means special symbols and national characters.

A new feature is that both portrait and landscape formats are supported in the same file.

MAGICS/OpenGL

MAGICS/OpenGL runs in an X11 Windows environment and is aimed at METVIEW 2 but can also be made available on its own. It requires an OpenGL implementation that supports the new tesselation (GLU 1.2) and not all native OpenGL implementations yet include this feature.

Mesa

Mesa (http://www.ssec.wisc.edu/~brianp/Mesa.html) is a 3-D graphics library with an API (Application Programming Interface) which is identical to that of OpenGL. Mesa is distributed under the terms of the GNU Library General Public License.

Mesa can run on an X Server. OpenGL outperforms Mesa as OpenGL can bypass the X Server when graphics hardware is available to render graphics primitives directly to the frame buffer. Mesa can also be used for low-end workstations and X-terminals, provided at least one TrueColor visual is available. MAGICS/OpenGL will become fully compliant with Mesa but Mesa does not yet support the new tesselation (GLU 1.2).

METVIEW 1.7

At ECMWF, METVIEW version 1.7 is in use on SGI workstation platforms and has also been implemented on HP, DEC Alpha and SUN platforms. At INPE/CPTEC (Brazil), METVIEW has been implemented on an IBM platform. Additions to the latest release include support for new features in MAGICS 5.4 and new modules to display data coverage plots. Plotting of winds and observations has become very much faster. The content of messages in observation and feedback files can now be listed in text form. A new procedure which considerably simplifies the installation of the METVIEW suite in the Member States has been developed. Several small enhancements have been done to adapt it to the changes in ECMWF environment, to user requirements and to be Year 2000 compatible.

The user documentation for METVIEW (Chapters 1-6) have been completed and includes the revised chapter 4 on METVIEW Macros and the new chapter 6 METVIEW Modules (second part in print).

The latest external METVIEW release is METVIEW 1.7B-export, released 24.10.1997. METVIEW 1.8-export is in preparation and will include all changes and bug fixes since METVIEW 1.7B-export was released (see the ECMWF Member States Internet pages for details on known bugs).

METVIEW 2

METVIEW 2 is under development and includes the new visualization module ***PlotMod*** which combines the facilities for batch and interactive visualisation which are currently available separately within METVIEW.

Background

A feature of meteorological graphics is the great variety of possible presentations associated with the same data set. Consider, for example, a 4D distribution (space and time) of one meteorological variable (e.g. temperature) as produced by a NWP model. Such distribution will consist of as many fields as there are vertical levels in such a model representing the atmosphere, multiplied by the time-steps produced during the integration. Therefore, in the case of a 10-day forecast, there are many different ways of presenting this data set, including:

- A 2D sequence of contour maps presented on the screen or printed;
- A 3D visualisation, with animation, usually of selected isosurfaces of the interpolated values;
- A *cross-section* of a set of vertical fields, showing a 2D vertical slice of the atmosphere;
- A *vertical profile* of one time-instance of a set of vertical fields. In this case, the different values associated with one single point in the earth's surface are shown in a graph, where the horizontal axis shows the variation of the variable, and the vertical axis is associated with the different vertical levels of the atmosphere;
- A *meteogram*, which shows the time evolution of one single location, on a fixed vertical level. In this case, the horizontal axis is associated with time and the vertical axis indicates the variation of the variable.

These different types of graphical presentations are widely used in the meteorological area. Ideally, users would like to combine these types of presentations, a feature which is not easily available in the current generation of meteorological visualisation systems. These limitations were the motivation for the work presented in the next sections.

Multidimensional data visualisation

In the context of this work, the concept of multidimensional data visualisation can be described as the presentation of different and coherent perspectives of the same data set. The idea of different perspectives (or views) of the same data set stems from the discussion outlined in the previous section. The notion of *coherence* states the fact that these views are linked i.e. changing the data set should affect all presentations simultaneously.

Practical application in METVIEW

The concept of multidimensional visualisation has been applied in practice as the conceptual basis for a new visualisation module for METVIEW.

Choosing appropriate interface metaphors

One very important problem, which arises in connection with multidimensional visualisation, is the appropriate choice of a user interface metaphor which would allow the definition of the different drawing areas and allow easy selection of the data to be visualised. In METVIEW, a *tree metaphor*, coupled with a direct manipulation mechanism, provides appropriate support for both needs.

The *tree metaphor* uses the following concepts:

- A *superpage* contains one or more *pages* and can be thought of as a collection of related plots. Different *superpages* will be drawn on separate drawing areas (screen or canvas);

- A *page* contains a *subpage* and may have a title, legend and axes that annotates it;

- The smallest entity referred to is a *subpage*, which can contain one chart, e.g. contours or wind fields superimposed on a background map of coastlines. Whilst the actual number of *subpages* is data-dependent, not all *subpages* of a given *page* are displayed simultaneously. A scrolling bar allows the user to display all *subpages*;

- Each *page* is associated with one *view*, which defines how the graphical output is produced.

The combination of this page hierarchy with direct manipulation allows the user to drag data from an icon-based interface, such as the one used by METVIEW, and drop it onto a *superpage* or onto a *page*. In the former case, data dropped at nodes will be applied recursively down the tree, until they reach the lowermost level. In other words, data dropped at this level will be visualised in all *pages* (which can have different *views*).

This recursive descent allows the user to view the same data in different ways. For example, the same set of fields could be seen as a set of contours, cross sections, vertical profiles or time axes.

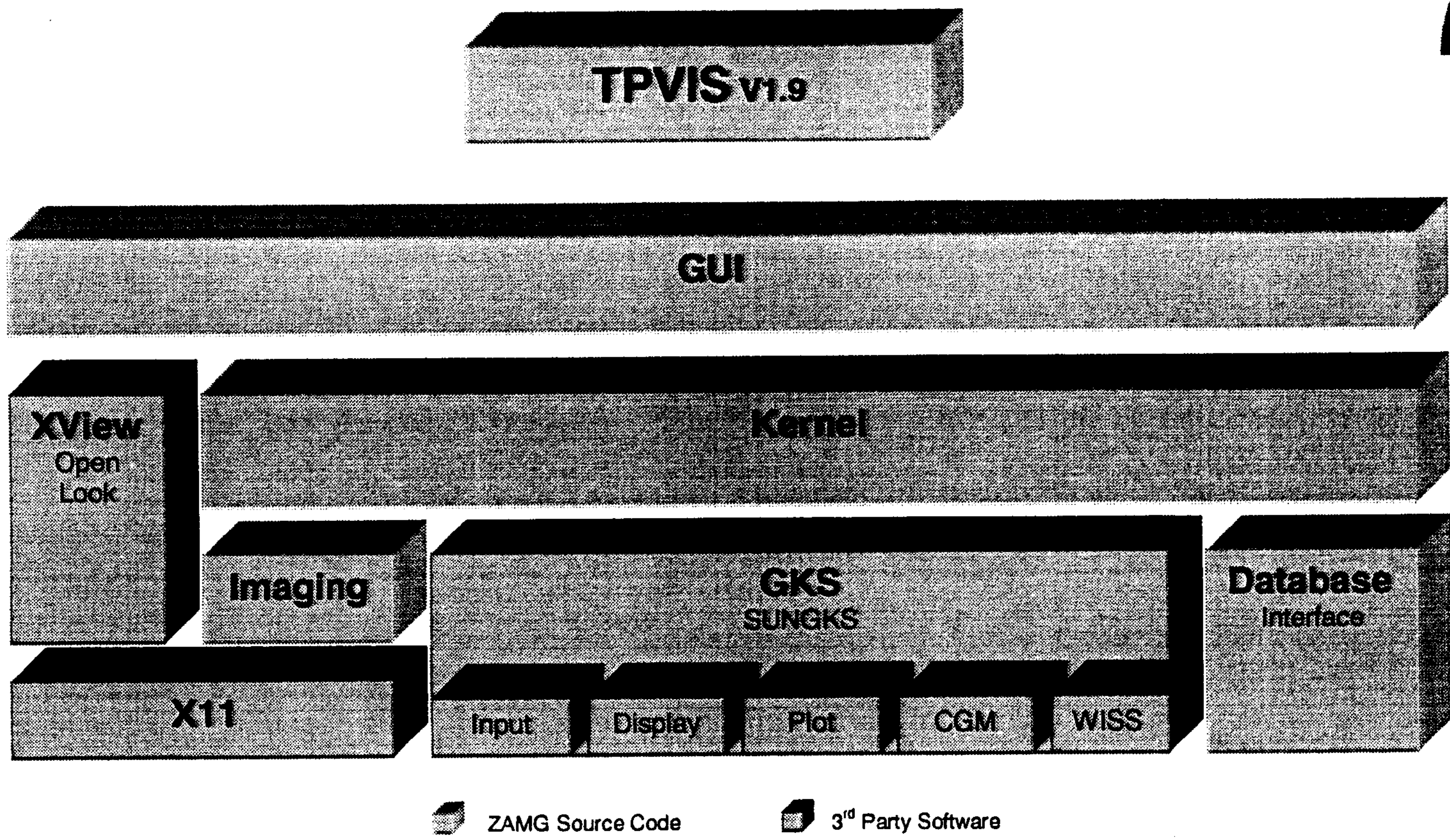
Implementation and User Acceptance

The ideas outlined have been implemented in the new visualisation module of METVIEW. Implementation started in mid-1997 and, in 1998 an initial version of this module will be made available internally to ECMWF users. After a trial and evaluation period, the module will then be made available as part of the forthcoming general METVIEW releases.

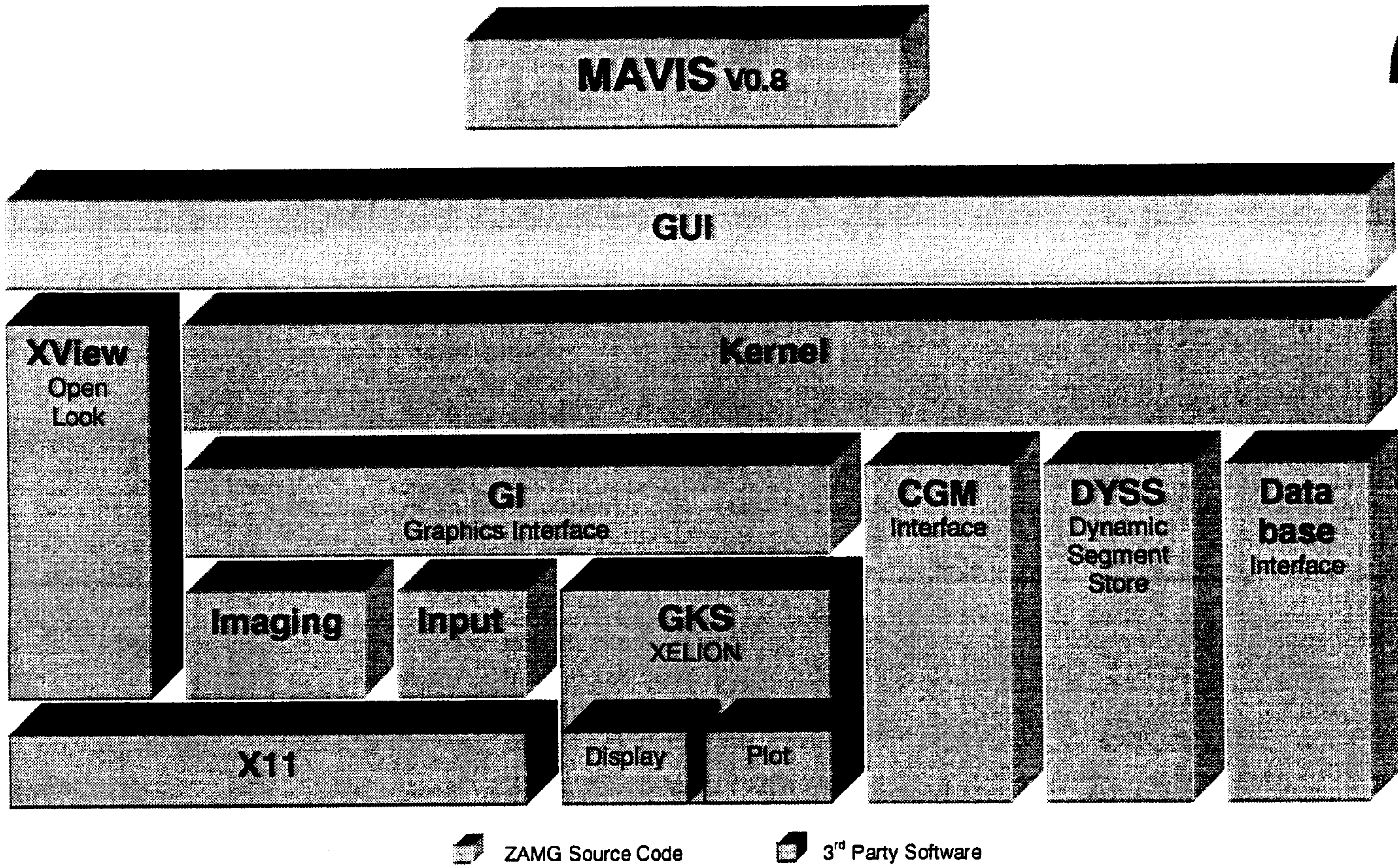
METVIEW 2 requires MAGICS 6/OpenGL. For some time a METVIEW user will be able to switch between PlotMod using OpenGL and the current VisMod visualisation module using GKS.

Central Institute for Meteorology and Geodynamics Vienna

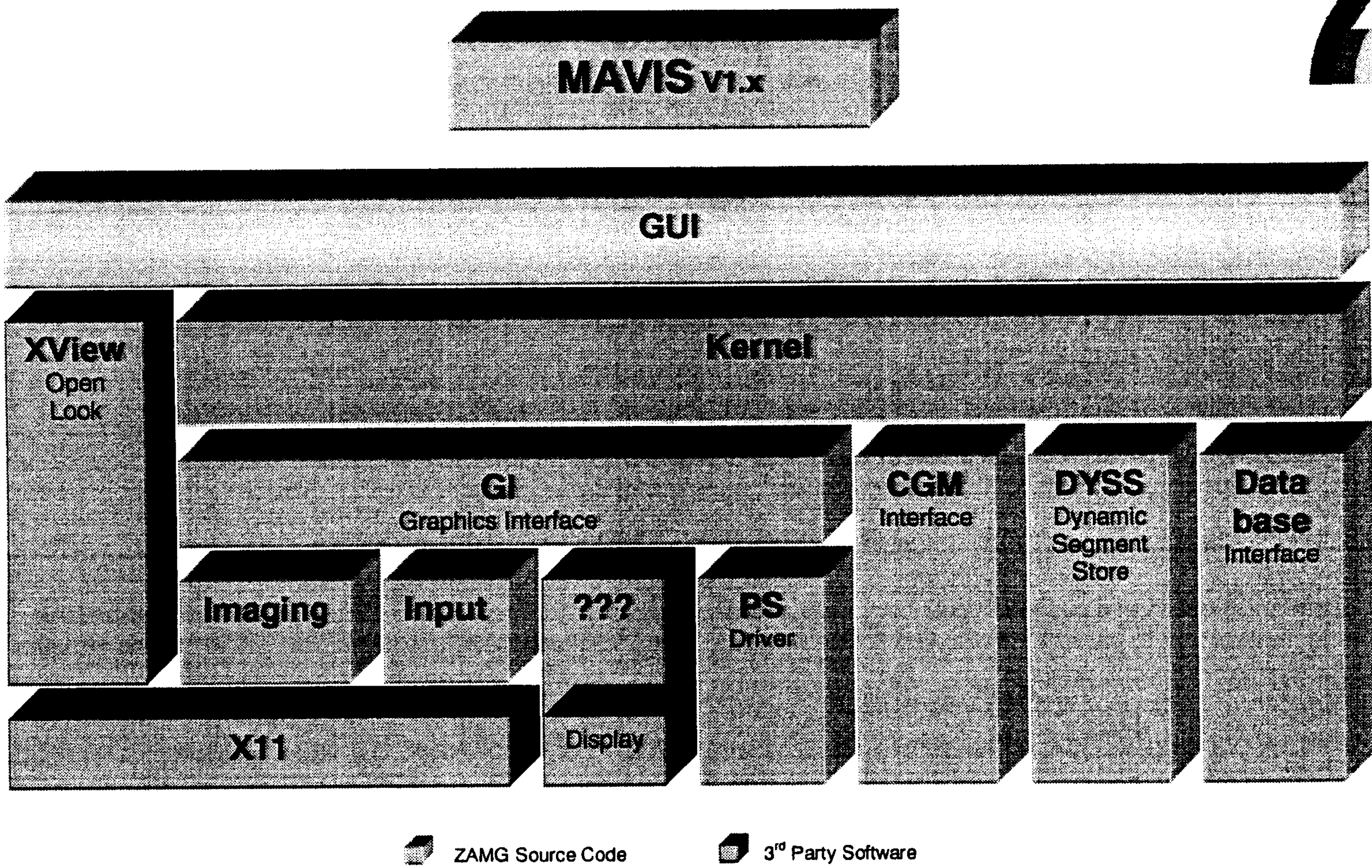
Manfred Göstl



Implementation Period:	1991 - 1996
Hardware Platform:	SUN SPARCstation
Operating System:	SUNOS 4.1.x
# Installation Locations:	5 (4xZAMG, BMGK)



Implementation Period:	1996 - 1998
Hardware Platform:	SUN SPARCstation/Ultra, Intel PC, IBM RS6000
Operating System:	SOLARIS 2.5/2.6, LINUX 2.0.3x, AIX
# Installation Locations:	24 (6xZAMG, BMGK, 7xACG, Uni Innsbruck, Bozen, BOKU, 7xMil)



That's where we want to go ... tomorrow ;-)

"Doing it yourself"

Advantages:

- Increased performance
  e.g. CGM read/interprete/display: Factor 1.6 faster
- Additional functionality
  e.g. Locator prompt/echo type "moving rectangle" for pan function
- Better maintenance
  In case of a bug: just solve the problem instead of waiting for a 'next release'
- Portability
  The application doesn't depend on the availability of a certain software package on a specific hardware platform/operating system

Caveats:

- Time for implementation
  A factor to be seen relative: Trying to find a way to implement a certain functionality on base of an insufficient 3rd party package is time consuming too!

MAVIS - Future Plans, Ideas, Dreams ...

- **Batch operation**
  Plotting of charts based on interactively/graphically set up configuration files.

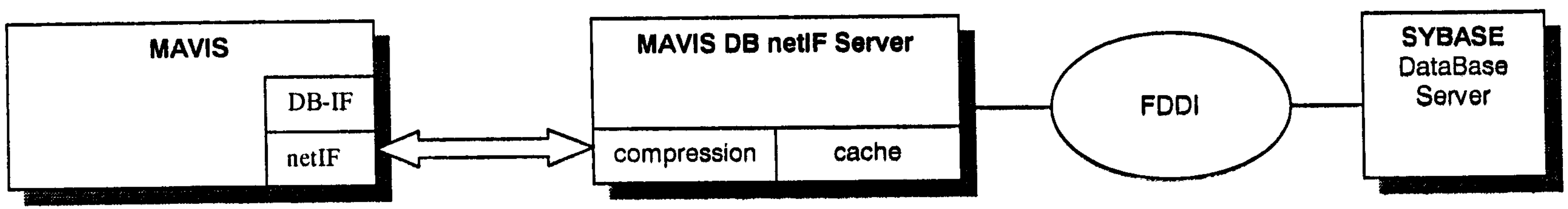
- **Automatic station shift**
  The position of stations too close together for both being plotted shall be shifted – if the user allows it.

- **Display of additional meteorological informations**
  Ship-Synops, Temps, Radar (CERAD) ...

- **Remote control**
  MAVIS on a remote screen or remote host controlled by the local MAVIS, usefull for:
  - "n"-screen configurations
  - teleteaching

- **Animations**
  Of course.

- **External (remote) database interface process**



The LINUX Adventure

Things that had to be done:

- Install SYBASE database client.
- Build SGKS libraries.
- MAVIS: Some minor changes concerning header files (dropped fileio.h and systeminfo.h, included unistd.h), net functions (replaced sysinfo() by gethost[by]name()) and libraries (dropped –lnsl and –lX).
- Add a swap_bytes() function for reading binary data files (geographical data, SatRep and Front overlay) as INTEL is a high endian CPU whereas SAPRC is a low endian CPU.
- Compile and link MAVIS

Experiences:

- The SOLARIS C compiler is much more tolerant than the GNU C compiler (concerning structures SOLARIS cc seems to know what is meant, gcc doesn't ;-)
- The LINUX source code of MAVIS was brought to run on AIX in less than 1 hour

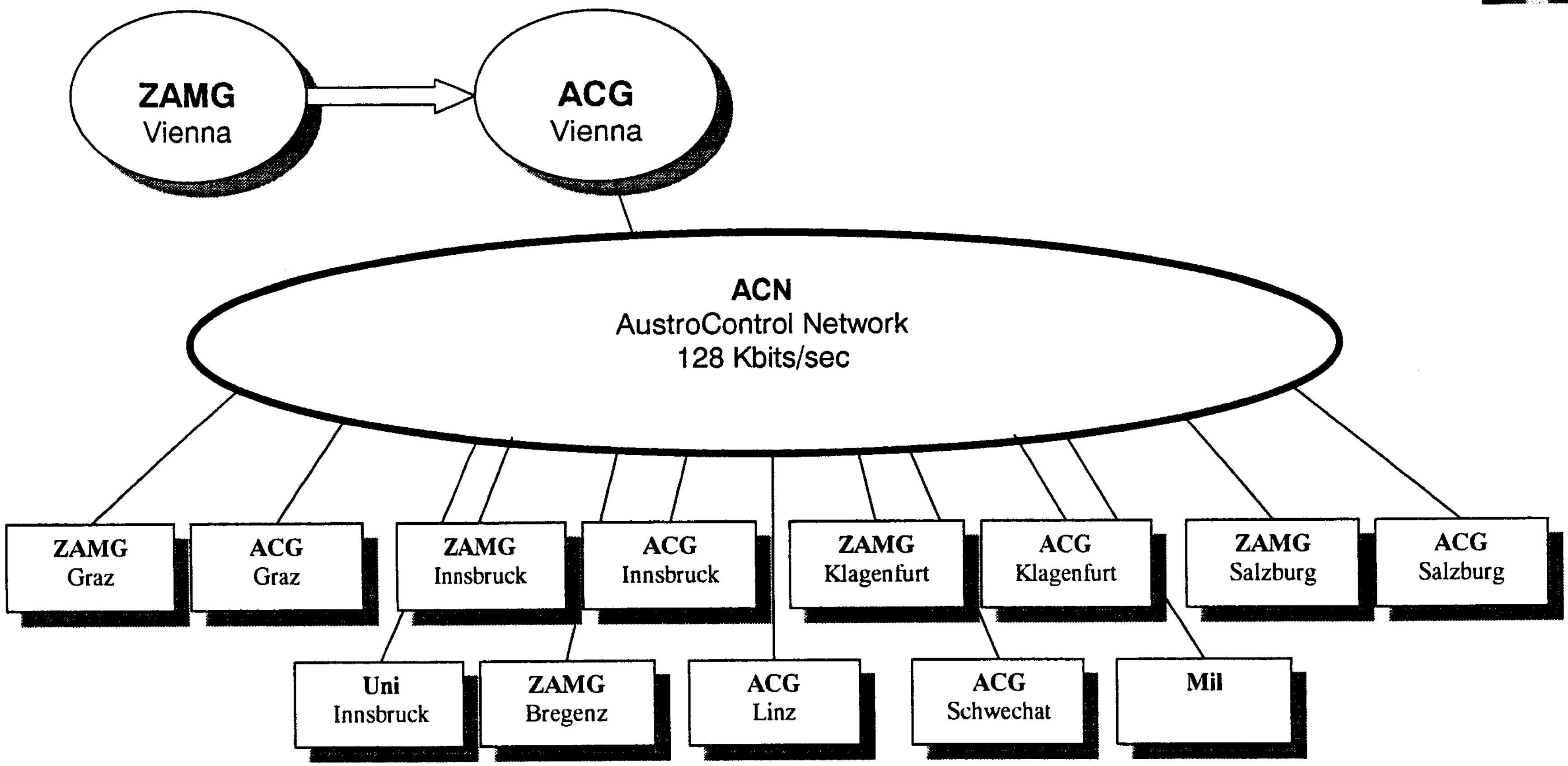
GKSperf

GKS Performance Test

Function	SUN SOLARIS sec	PC LINUX sec
draw lines	6.651	7.994
draw lines into seg	6.305	9.836
redraw lines seg	4.087	6.339
draw marker	6.744	7.565
draw marker into seg	9.379	10.404
redraw marker seg	5.792	6.076
draw filled rectangles	5.967	7.285
draw filled rectangles into seg	7.717	10.381
redraw filled rectangles seg	5.096	6.035
draw filled circles	7.773	5.691
draw filled circles into seg	8.408	6.736
redraw filled circles seg	7.488	4.965
draw texts	5.801	6.547
draw texts into seg	6.060	6.989
redraw texts seg	6.279	6.381
TOTAL	99.584	109.689

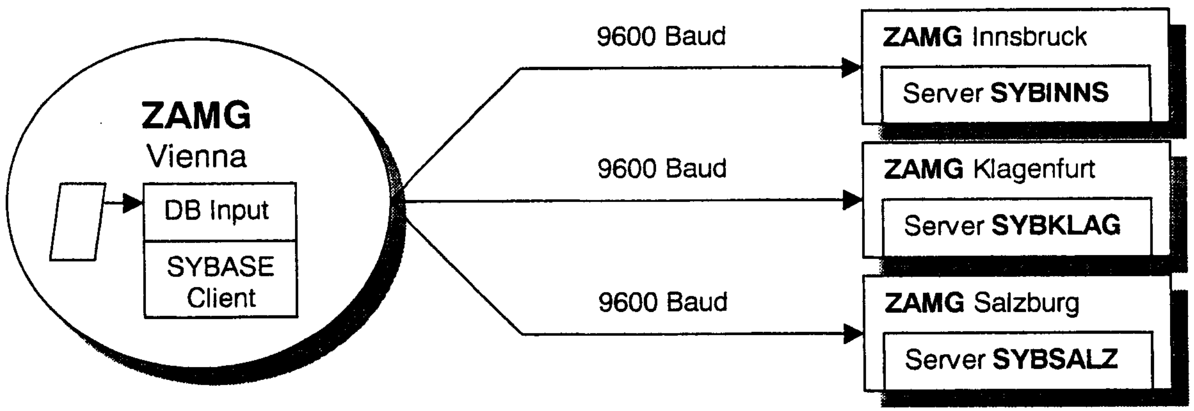
SUN: Ultra 1 Creator 3D, 96 MB - **PC:** PENTIUM I 166 MHz, Matrox Millennium II, 128 MB

3 GB of Data per Day on a 128 Kbit Network ?

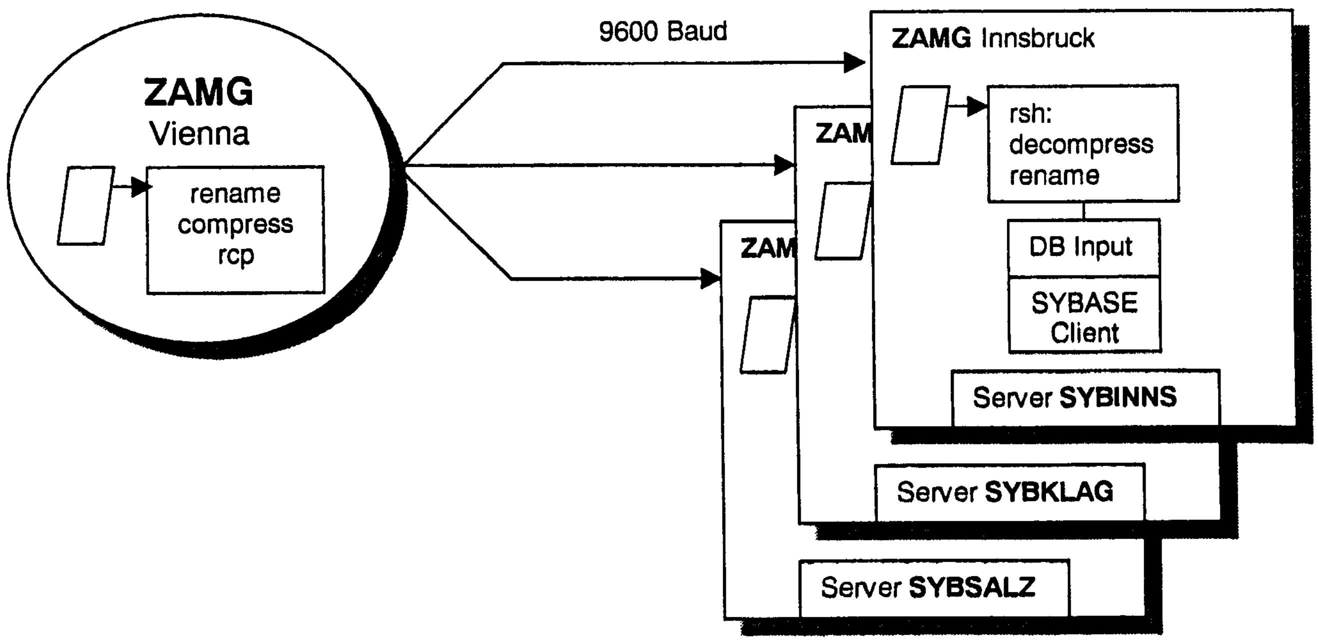


- 14 hosts receive >200 MB of data (sat images, NWP-, GTS- and similar data, NowCast data ...) per day.
- A 128 kbit/sec network is able to transport 1080 MB per day.

History: The Early 90's



As the amount of GTS and similar data to be put in the databases grew it turned out that the lines were too slowly.
So we changed the procedure:



Pro‘s and Con‘s of compress/rcp/rsh

ZAMG

Pro’s:

- GTS and similar data for the database are compressed down to 10...15% of their original size, NWP data down to 20...30%.
- Though further increasing the amount of GTS and similar data we were able to distribute (reduced) satellite images on 9600 Baud lines!

Con’s:

- For rcp and rsh to be able to work it is necessary to „open“ the account on the remote host completely for the user who sends the data. This is no problem if the users on both sides are the same (it is assumed that they know what they do) but a big problem if they are different.
- rsh has an (operating system independent!) bug: If the line is too busy rsh falls in a timeout procedure which requests an user input. If the rsh is run in batch there is no one present who could answer the request. Result: All further transmission of files is blocked.

Solution:

- crcp – **C**ompressing **R**emote **C**o**P**y

crcp V1.0

Compressing Remote CoPy - © 1995 ZAMG

- Client/Server architecture
- On the fly compression of data (data are divided into blocks of 16KB; the decission if a block should be sent compressed or uncompressed is individually made for each block).
- Supports (almost) all options of rcp
- Verbose mode
- No „login“ on the remote host; data may be sent if the users or the primary group of the users are idenitical.
- On the server side: Access may be allowed for single hosts, for subnets and/or domains (crcp.hosts file).
- Files are created on remote using a temporary file name and renamed after transmission.
- On request: create a <filename>.ok file after transmission.
- (Yes, of course, it is available on LINUX too.)

crcp V2.0 Multi Target

Begin of 1997: Moving from 9600 Baud lines to 128 kbits/sec ACN (Austro Control Network).

Summer 1997: 12 locations which run MAVIS and therefore need data are connected to the ACN.

Today: 14 locations connected to the ACN, each of them receive more than 200 MB of data per day.

The task is to transfer 3 GB (or more) of data where more than half of the data cannot be compressed because they are already compressed (e.g. Sat images) or they contain uncompressable binary data (e.g. NowCast CGMs).

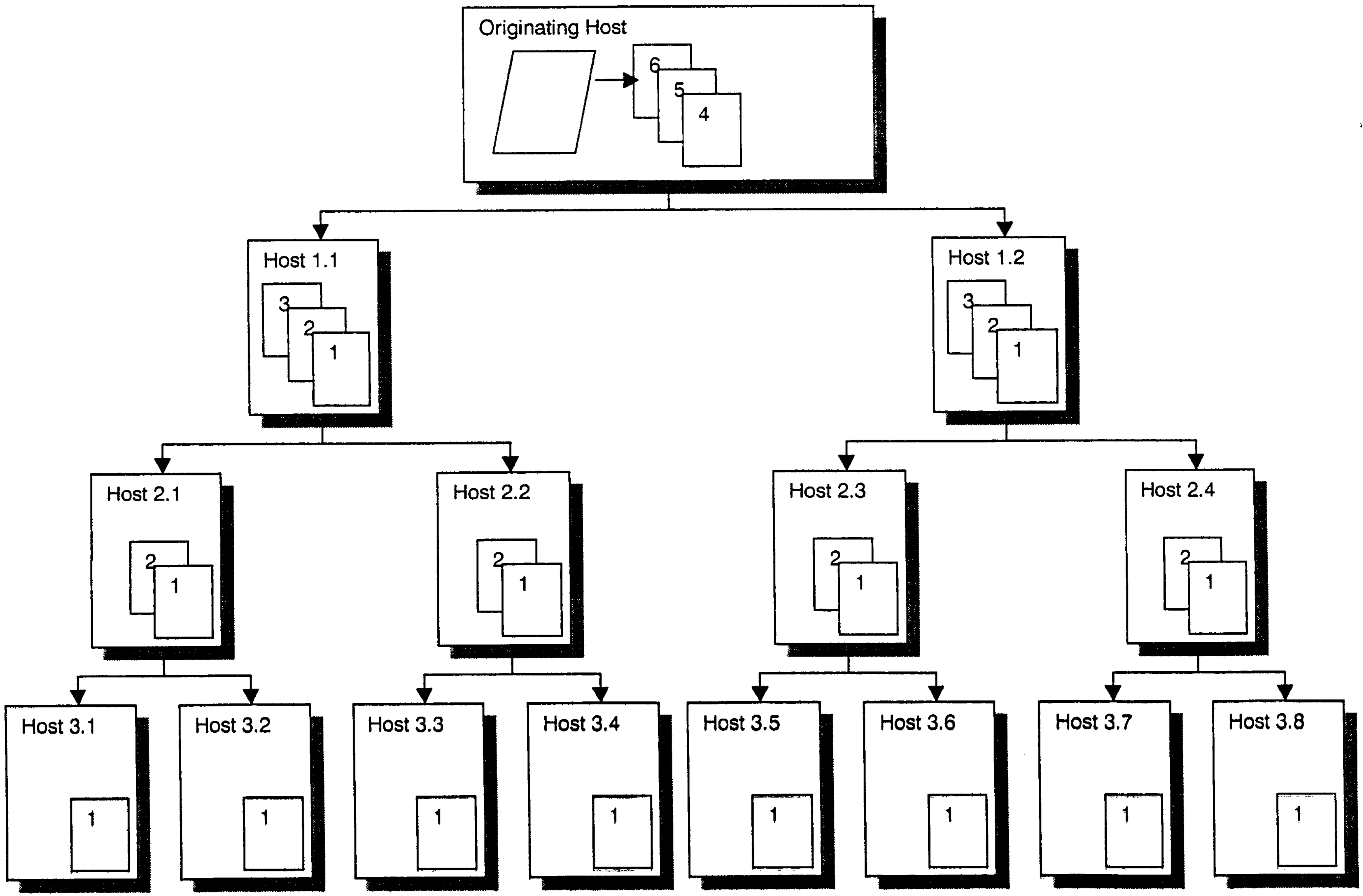
This is done using **crcp Multi Target**:

- crcp MT is crcp V1.0 extended by Multi Target functions, i.e.
- Instead of specifying a single host a list of hosts is given (Multi Target)

```
crcp [options] <source> host_1:host_2:host_3[...]host_n:<destination>
```

- Each host in the hosts list forwards each (compressed) block of data to the next as soon as it has received it.
- Thus the delay for each host is the transfer time of a single (compressed) block of data.
- The hosts in the list may be grouped using brackets: All hosts in the same bracket level receive data in parallel.

crcp Multi Target Transfer



crcp.mt – Transfer Definitions File

```
crcpMT V2.0 Multi Target Configuration
#
#
#
# ACN host structure:
#
#
# level 0:                               ZAMG
#                                          |
#                                          |
#                                          |
# level 1:                               amz1
#                                          |
#             -----------------------------+---------------------
#            |                             |                |      |
# level 2:  rk1                           ams1             amw1   mil
#            |                             |                |
#     -------+--------              -------+--------        |
#    |                |            |                |       |
# level 3: amk1      amg1         rs1              ri1     aml1
#                     |                             |
#                     |                      -------+-------
#                     |                     |               |
# level 4:           rg2                  ami1            mui1
#
set RK1     rk1  ( amk1 : amg1 ( rg2 ) )
set RI1     ri1  ( ami1 : mui1 )
set AMS1    ams1 ( rs1 : $RI1 )
set AMW1    amw1 ( aml1 )
#
set SAT_HOSTS     amz1 ( $RK1 $AMS1 $AMW1 mil )
#
#
rsat
      $SAT_HOSTS /satellit/tmp
#
#
# EOF
```

Using crcp Transfer Definitions

To send e.g. a single sat image (e.g. „sat.ir") to all of the above mentioned hosts using the transfer definition named „rsat" defined in the file „crcp.mt" the command, according to the syntax:

```
crcp [options] <source> -mt <name>
```

is as simple as that:

```
crcp sat.ir –mt rsat
```

Doing the same without transfer definition the command looks like:

```
crcp sat.ir amz1(rk1(amk1:amg1(rg2))ams1(rs1:ri1(ami1:mui1))amw1(aml1)mi1)/satellit/tmp
```

Additional features using transfer definitions:

- „set SKIP <host_list>" defines hosts which are known to be down for a longer time and therefore shall be excluded from receiving files.
- „set SUID <user_list>" within a transfer definition specifies a list of users who may use the specific definition. This is most usefull in context with the following:
- A different destination user may be specified (user A sends files to user B on the remote hosts). This is save because the file crcp.mt may be edited by the superuser only.

Logfile: Sending a 450 KB WV Image

```
====== 1998-06-02 09:17:00, 896779020, rsat.779020 ======

TTT:    1998-06-02 10:02:00, 896781720
TTL:    1998-06-02 10:02:00, 896781720

[  0]: Level:  1,  IP: 193.80.145.132    mavisz1.zentrale.acg
[  1]: Level:  2,  IP: 193.170.169.21    zarksun1.zamg.ac.at
[  2]: Level:  3,  IP: 193.80.133.132    mavisk1.lowk.acg
[  3]: Level:  3,  IP: 193.80.138.132    mavisg1.lowg.acg
[  4]: Level:  4,  IP: 193.170.171.22    zargsun2.zamg.ac.at
[  5]: Level:  2,  IP: 193.80.136.132    maviss1.lows.acg
[  6]: Level:  3,  IP: 193.170.170.21    zarssun1.zamg.ac.at
[  7]: Level:  3,  IP: 193.170.168.21    zarisun1.zamg.ac.at
[  8]: Level:  4,  IP: 193.80.140.132    mavisi1.lowi.acg
[  9]: Level:  4,  IP: 193.170.173.18    muibk1.zamg.ac.at
[ 10]: Level:  2,  IP: 193.80.158.132    mavisw1.loww.acg
[ 11]: Level:  3,  IP: 193.80.132.132    mavisl1.lowl.acg
[ 12]: Level:  2,  IP: 193.171.153.66    LOXB-S.lrue.ac.at
[ 13]: Level:  1,  IP: 138.22.197.21     zaimpws1.zamg.ac.at

REPORTS:
[  0]: 09:17:16, 896779036,  1, *** OK ***
[ 12]: 09:17:31, 896779051,  2, *** OK ***
[ 13]: 09:17:31, 896779051,  1, *** OK ***
[  1]: 09:17:34, 896779054,  2, *** OK ***
[  5]: 09:17:34, 896779054,  2, *** OK ***
[  2]: 09:17:34, 896779054,  3, *** OK ***
[  7]: 09:17:35, 896779055,  3, *** OK ***
[  8]: 09:17:36, 896779056,  4, *** OK ***
[ 10]: 09:17:36, 896779056,  2, *** OK ***
[  3]: 09:17:42, 896779062,  3, *** OK ***
[ 11]: 09:17:42, 896779062,  3, *** OK ***
[  4]: 09:17:43, 896779063,  4, *** OK ***
[  6]: 09:18:05, 896779085,  3, *** OK ***
[  9]: 09:18:08, 896779088,  4, *** OK ***
```

crcp MT – A Perfect Solution?

Experiences:

- A network is a „living body“ (anything bad that can happen will happen).
- You may well handle 100 error situations. But one day the 100 and 1st situation will happen.

What crcp MT does handle:

- Read/write errors on the line
- Timeouts
- One or more hosts unreachable
- The whole ACN may be down for a couple of hours.

The answer to the above question:

No, it’s not a perfect solution, but it works!

RECENT DEVELOPMENTS IN THE USE OF WORKSTATIONS AT MET EIREANN

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1. INTRODUCTION

This paper summarises recent developments in the use of workstations at Met Eireann - the Irish Meteorological Service.

The first part concentrates on a description of **xcharts**. This is an application [written directly in X and Motif] which is used to display the output of a number of NWP models including the local version of Hirlam, and the models of ECMWF, UKMO and DWD. The user can display but cannot modify the output. A selection of observations can also be shown. Features of the program include a user-friendly graphical interface, an intelligent zoom option, an animation feature, cross-sections and a scripting option. Model data is stored in standard GRIB code but observational data is stored in a non-standard ASCII code. [It is planned to replace this by BUFR code]. Recent enhancements include facilities for displaying Meteosat PDUS satellite images and for calculating and displaying various SATREP products.

The second part of the paper looks at an application which allows the user to modify a computer generated forecast – displayed in meteogram form – using graphical interaction.

2. MAIN FEATURES AND MENUS OF xcharts

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.

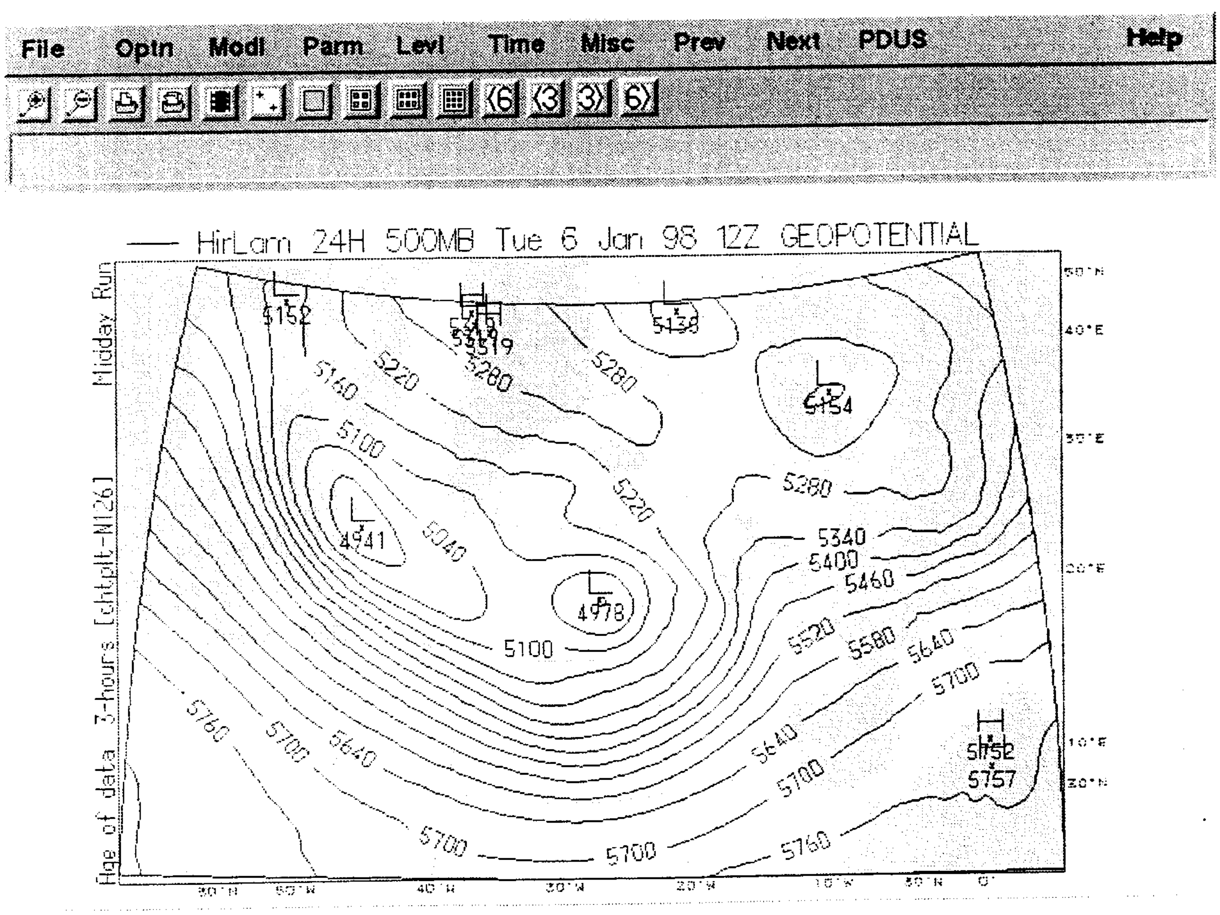
Using CHARTS the forecaster can access NWP output from the Hirlam model as well as the models of ECMWF, DWD and UKMO. Wave-model output is also available [from the local WAM model and the wave models of ECMWF and UKMO]. Finally, observation plots are available both at standard levels and as tephigrams.

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** [Hamilton 1997a, Hamilton 1997b] and it includes extra options such as cross-sections, animation and the display of satellite images [PDUS data from Meteosat].

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

Pressing a menu button or icon generates a text string [*i.e.* a command] which is then sent to the command processor for parsing.

The following figure shows the menu interface and a typical plot.



The menu buttons are used to specify script ['obey'] files [File]; various display options

[Optn]; choice of model, parameter, level and forecast length [**Modl/Parm/Levl/Time**]; miscellaneous options [Misc]; previous and next forecast chart [**Prev/Next**]; satellite image data [PDUS] and Help [Help]. The icons specify zooming and un-zooming, single and multiple hardcopy, animation, cross-sections, various page-layouts and the selection of the next and the previous plot. [See Nishimura [1995] for a discussion of the icons].

The main 'Plot' button is available as a pop-up menu when the user presses the right-hand mouse button in the drawing area. It produces the main menu of which the following is a [greatly-simplified] version :

HIRLAM	Pressure	Surface	Analysis
ECMWF	Geopotential	1000mb	12hour
UKMO	Temperature	925mb	24hour
DWD	Rainfall	850mb	36hour
	WindArrows	700mb	48hour
	Isotachs	500mb	60hour
	CloudCover	400mb	72hour
	etc	etc	etc

Plot	Overplot

The procedure is for the user 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 system 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' [option] and 'Misc' [miscellaneous] buttons on the main menubar allow the user to specify various options, such as the colour of the plot, which are of secondary importance.

The 'Modl', 'Parm', 'Levl', and 'Time' 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 a similar 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 plot. Thus, if the plot consists of a number of superimposed charts, these buttons will retard/advance all the charts. The 'Prev' button has the options '-3hours', '-6hours', '-12hours', '-18hours' and '-24hours' with similar options for 'Next'. In addition there are arrow icons corresponding to 'Prev-6', 'Prev-3', 'Next+3' and 'Next+6', respectively.

The 'Zoom' icon 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. All charts are recontoured after the zoom; if observations are being displayed a 'de-clutter' algorithm is applied.

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

The 'Animate' icon allows the user to animate the display. This option was developed by E. Nishimura [1995]. The 'Cross-section' button is used to select two points to define a track and the cross section along the track is then displayed in another window.

The user can divide the screen into sections and plot four, six or nine charts.

Finally, the user can display tephigrams by first selecting a plot of the data available and then pointing at the required station.

3. 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 Quarter=1 Hirlam surface press 6Hour
Underplot Quarter=2 12Hour
Underplot Quarter=3 18Hour
Underplot Quarter=4 24Hour
Display

The 'Underplot' command stores a chart for later plotting. Thus the first four 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.

Versions of **xcharts** has been installed in the general forecast office [*viz.* CAFO] in Dublin and in the aviation forecast office [*viz.* CAO] in Shannon Airport. The latter is approx. 200 Km from Dublin.

The raw field data, used by **xcharts** in CAFO, is stored as a set of GRIB fields on a server machine, within the same building. 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. So, in this case, as soon as the GRIB products become available [either from a run of Hirlam or from one of the sets of model output we receive over the GTS] they are copied to Shannon where they are stored locally on the workstation. This makes the response time much faster. It also makes the system more resilient to line outages, server breakdowns *etc.*

4. PDUS SATELLITE IMAGE DATA

Met Eireann recently acquired a PDUS [Primary Data User Station] receiver for Meteosat data. The system [built by VCS] receives data on the satellite projection but it can make data available on a polar-stereographic projection by performing its own grid transformations. This greatly simplifies the interface between the PDUS system and **xcharts**.

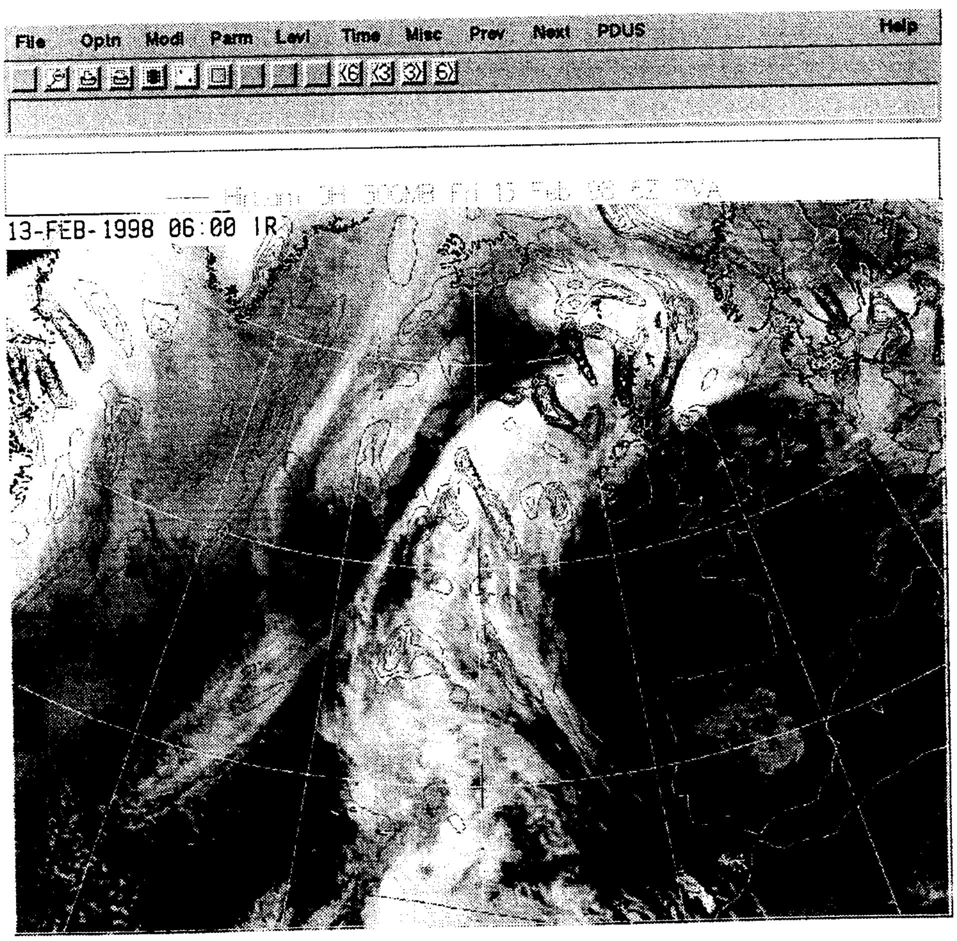
A polar-stereographic map is defined for the image data and visual/infra-red/water-vapour files are prepared by the PDUS and copied to a disk accessible to **xcharts**. A new menu button [called PDUS] was added to **xcharts**. When this is pressed, the program looks at the disk and makes a list of the eight most recent visual, eight most recent infra-red and eight most recent water-vapour images. The dates/times of these 24 images are displayed as the PDUS menu [plus a 25th entry – 'Switch Off PDUS'] and, by clicking on one of these entries, the user resizes the window to the size of the PDUS image [actually 900x700 pixels] and draws the image as an underlay for the current NWP chart. Subsequent NWP products will be displayed on this image until the user either asks for a new image or selects the 'Switch Off PDUS' button. (See Hamilton [1998a] for a more detailed description).

Hardcopies of the PDUS charts are available [*via* Postscript files which are generated, on request, by **xcharts**]. However, at present, there is no zoom or animation option for the image data.

5. EXTRA PRODUCTS FOR SATREP ANALYSIS

SATREP is a technique [developed at ZAMG - the Austrian Meteorological Service] for analysing satellite images. A SATREP course took place at Met Eireann in Dec 1997 and extensive modifications were made to **xcharts** to facilitate its use with the course. In addition to the ability to display PDUS data, the product list was extended to include (a) divergence; (b) absolute, relative, shear and curvature vorticity; (c) advection of relative vorticity; (d) PVA *i.e.* positive vorticity advection *viz.* advection of relative vorticity with just the positive values plotted; (e) advection of temperature; (f) advection of thickness and (g) various frontal parameters.

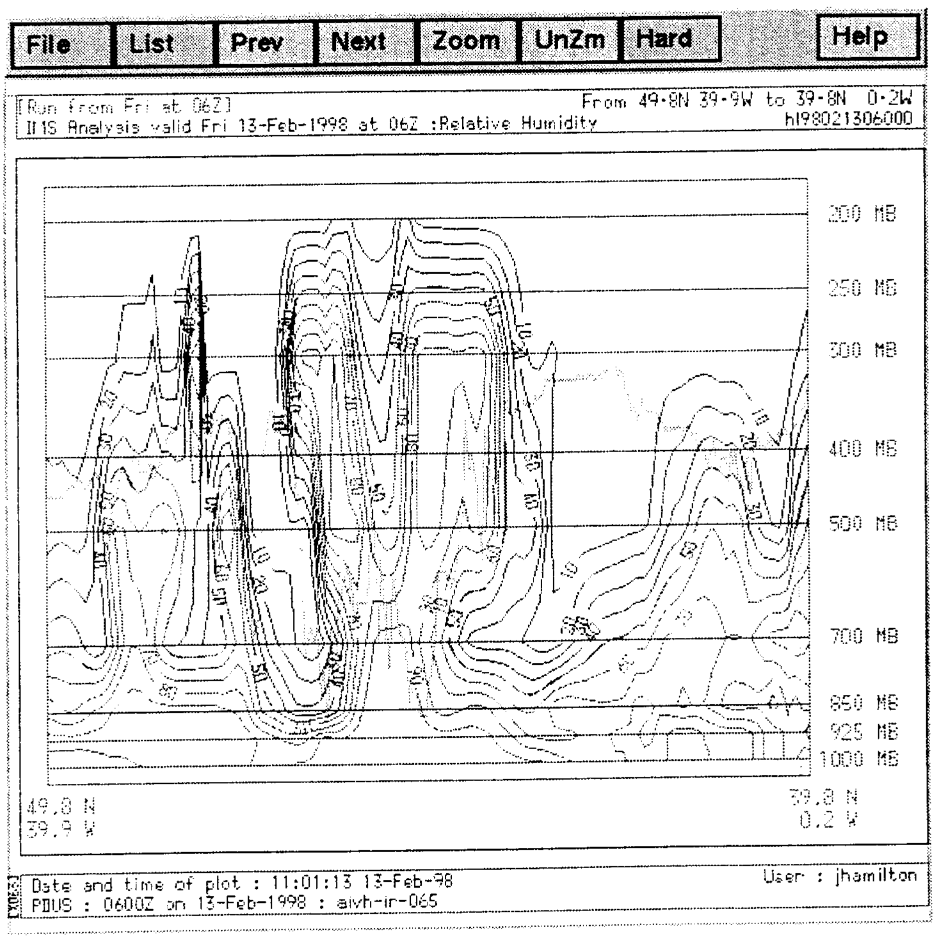
The following figure shows a PDUS infra-red image with a superimposed PVA field at 300MB :



Note that the satellite image and the PVA field verify at the same time. This is bacause the user requested a Hirlam field with the correct verifying time. In the present case, the user could have requested an analysis starting from 06Z on 13-Feb, or a 6-hour forecast from 00Z on 13-Feb, or a 12-hour forecast from 18Z on 12-Feb or an 18-hour forecast from 12Z on 12-Feb. All these forecasts verify at the same time.

6. OTHER ENHANCEMENTS TO xcharts

In addition to including the extra products needed for the SATREP analysis process, **xcharts** was extended to plot PDUS pixel values in cross-sections and to include a threshold option. The following is an example of a cross-section plot :



The extension of the cross-section option to include pixel values means that, if the user requests a cross-section while a PDUS image is being displayed, then pixel values from that image will be included in the cross-section. Note that the coastlines and latitude-longitude marks, included with the PDUS image, have an intensity of zero. This makes it easy to pick out such points on the cross-section and helps the user to locate land-sea boundaries. The pixel values are just intensity values plotted on the same chart as the cross-sections *i.e.* the cross-section vertical axis [in millibars] does NOT refer to these values.

The threshold option is especially useful for making charts more readable by reducing clutter and highlighting significant features. Thus, for example, the user can locate the jet-stream by making a request such as 'Plot Isotachs MinValue=100' [*i.e.* only plot wind values of at least 100knots]. Such a command can be issued either *via* the command line or *via* the menu system. Note that setting MinValue and MaxValue to the same value just plots a single contour line. So, for example, the command 'Plot Temperature MinValue=7.123 MaxValue=7.123' will draw the Temperature=7.123 contour line.

7. FUTURE PLANS FOR **xcharts**

It is hoped to continue the development of **xcharts** and **xcrosec** – the cross-section option – in the light of forecaster experience [in both CAFO and the CAO]. In particular, it is hoped to improve the cross-section plots to make it easier to overlay multiple fields. Also, there are plans to look at the use of colours in **xcharts** to improve the readability of charts with superimposed multiple products. Finally, it is indended to include a 'PDUS' command in the command language to facilitate the writing of 'Obey' files which use PDUS data.

8. GRAPHICAL MODIFICATION OF METEOGRAM DATA

Two programs have been developed which use graphical techniques to modify raw NWP data in Meteogram format – the first is used to edit the input data for an ice-cast model for predicting road surface temperatures [Moran and Hamilton, 1998]; the second is used to edit a sea/swell/wind forecast for an oil-rig customer [Hamilton 1998b]. This section deals with the second program [called **modi-oil**].

modi-oil is a complete system consisting of a set of co-operating programs. It uses separate programs to (a) extract and interpolate appropiate Hirlam and ECMWF data; (b) generate and display a meteogram forecast of the sea, swell and wind conditions at a point [54.5North, 11West] off the West coast of Ireland; and (c) allow the forecaster to modify the computer generated forecast by interacting with graphs on an SGI workstation.

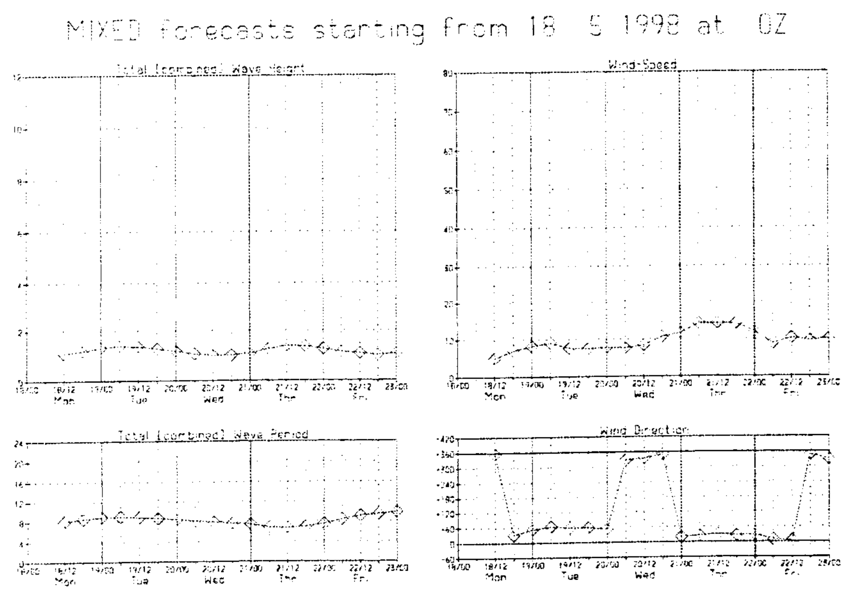
An important feature of the design is that the graphical display modified by the forecaster is different to the one sent out to the customer – in particular, it does not contain derived products [such as gusts] which are generated from the basic data, and it does not contain the Met Eireann logo which, otherwise, would take up space on the screen.

9. BASIC DATA AND DERIVED PRODUCTS

The data extraction program is designed to run, automatically, once a day in the early morning. It uses data from both the Hirlam/WAM and ECMWF models. It extracts the 10-metre wind speed and direction, the wave sig-height and period, and the swell sig-height, period and direction. This data is written to a file and it is this basic data which the forecaster is allowed to modify. However, the customer also requires some extra products, *viz.* the wind speed at 50-metres, the strength of the gust at 10-metres and at 50-metres, and the wave max-height. These are derived from the basic data after the basic data has been modified by the forecaster.

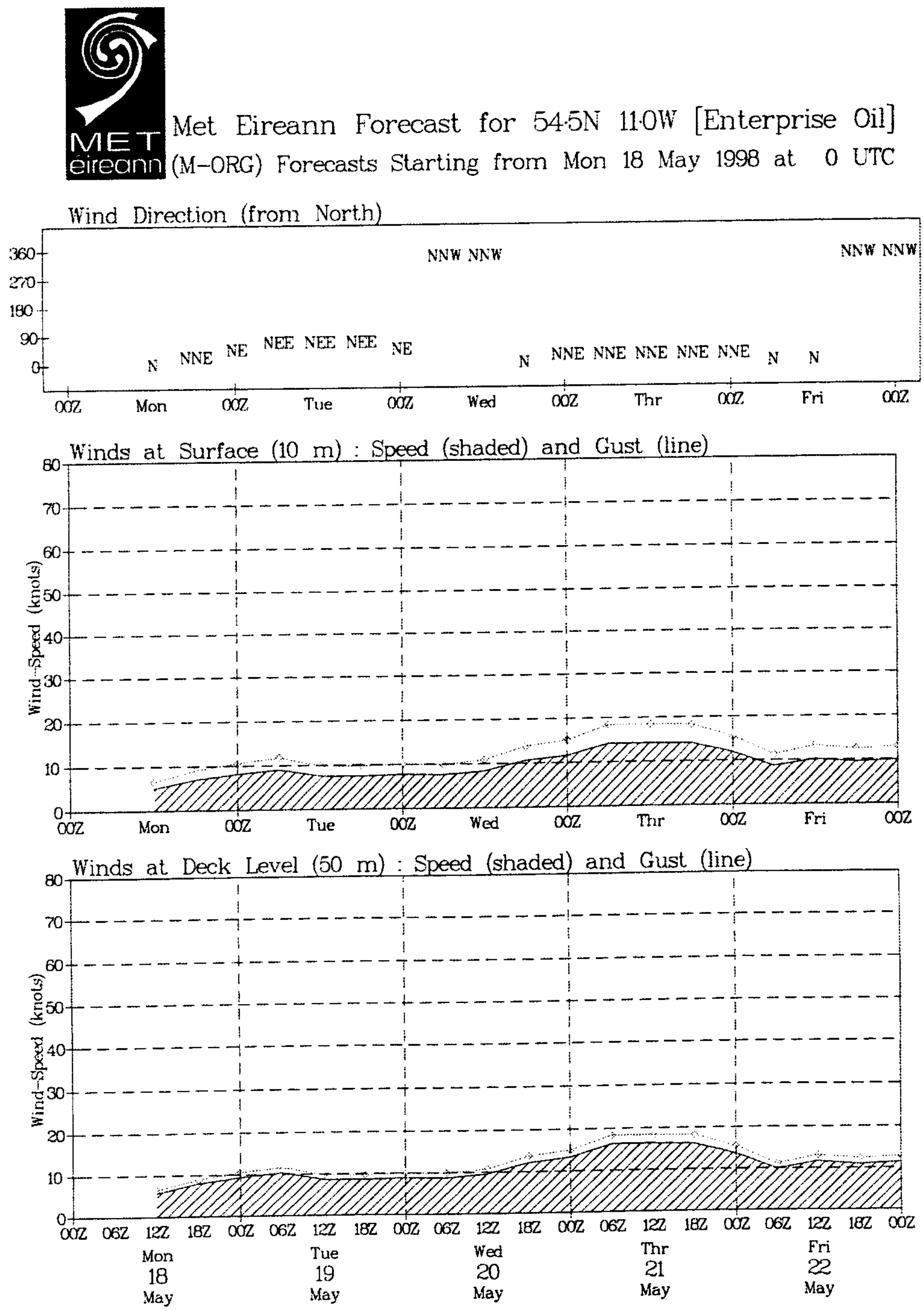
10. MODIFYING THE DATA

The forecaster can modify the total [combined] wave height and period and/or the 10-metre wind speed and direction. The various derived products are then automatically calculated. The swell cannot be modified. The forecaster starts with a display like the following :



This example shows the MIXED [*i.e.* combined ECMWF/Hirlam] forecast. The forecaster modifies the data by dragging the data points up or down. He/she does this by clicking on a point on one of the graphs, moving it up or down and then clicking again at the new position. This must be done for each point, as required.

The user interface [not shown] includes a RESET button to restore the original data and various buttons to move an entire graph either up or down. The program is terminated *via* the FILE button and the program will produce the appropiate hardcopy for transmission to the customer. The actual plot is much more elaborate than the display used by the forecaster – it occupies two pages and includes things like logos and the various derived parameters discussed earlier. The following is an example of the first page :



11. FINAL REMARKS

We have made a large number of changes to **xcharts** since the last meeting and we continue to introduce new options. However, the biggest change from last year is that we now have two applications which use graphical techniques to modify forecast products. We are likely to develop more such applications in the future.

All the programs discussed here run on SGI hardware. But, we have just bought a 400-Mhz Pentium-II PC [with 128-Megabytes of memory], and we hope to port the applications to GNU gcc/g77.

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The state of Meteorological Workstations at DMI as of

EGOWS '98

Jacob Brock
Head of Graphical Applications Development

At the Danish Meteorological Institute, the past year has been greatly influenced by a change to a new HIRLAM model with higher resolution, and a great public interest in our web pages.

New HIRLAM

A new version of the HIRLAM model has been introduced operationally. It is run for 4 different areas with varying resolution, the finest of which is appr. 5 km. Apart from producing huge data files, which have to be managed, we have experienced problems in contouring data. For one, the contouring lines are often quite jaggered, but the main problem is that the plotting of highs and lows is next to useless, as numerous highs and lows are scattered all over the plot. We are using MetView from ECMWF to do our contouring plots, but the problem is not within MetView. MetView is doing it's work correctly, but in running models at such high resolution, mathematical noise is often greater than the change of value from one gridpoint to the neighbouring point. The problem is to find a filtering method, that will remove noise without changing data too much, so at the moment, we do not plot highs and lows.

All plots that are going to be used on the workstations, are produced centrally with MetView. Each field for each available area for each model is produced as a partial PostScript file, which is distributed to the presentations systems. Here several fields can be overlayed in a special application, which will also produce labels and legends. However, this strategy has by now reached it's limits, as we can not produce and distribute any more fields than we do already. Instead we will have to look into distributing GRIB-files, probably based on client-server technology, and doing contouring locally at the workstations.

Apart from "ordinary" NWPs, we also produce and distribute a number of Ensemble Prediction System based products.

WWW

On the internal side, the meteorologist now have access to the internet using Netscape. It is used for finding information, and through our intranet for reading program documentation.

On the external side, our homepage has become more and more popular. In May '98 appr. 880.000 HTML-documents were fetched by appr. 95.000 users, and the numbers seem to increase rapidly. In order to minimize the amount of data to transmit, we have introduced Java applets in some places to take care of displaying graphics.

Intel platform

Most of our operational workstations are by now based on Solaris running on Intel hardware, and more than half the workstations are equipped with two screens. Solaris itself seems to be as stable in the Intel version as we have been used to, running on Sparc hardware. The number of harware failures have been slightly higher, but generally cheaper to fix.

However, one of the big disadvantages, we have experienced, is that it is not possible to move a system disk from one machine to another. The system disk has to be installed residing with the hardware it has to manage.

Another problem, we are facing, is the fact that Solaris for Intel only supports one screen. Hence it was necessary to buy a third-party X-server. We are using XAccel from X-Inside. It supports two screens, but until recently only with one type of visual. We also see that the mouse cursor during periods of high load of the workstation gets unstable for short periods, sometimes moving around spontaneously, sometimes activating menus. We are still investigating what the reason for this behavior can be. It might a be BIOS configuration, as the problem is only seen when we are using a PS2 based mouse, not when we use a serial mouse. But a serial mouse tends to make the mouse cursor move in jumps across the screen, where the PS2 based mouse has smooth cursor movement.

But despite the drawbacks, we are reasonably happy with the Intel based systems.

Porting

The introduction of a new HIRLAM model led to a major revision of our libraries for accessing GRIB-data. We do not use a database program for storing GRIB data, just a structured Unix file system. Previously data were accessed using Fortran routines, but Fortan is not used in presentaion programs, only known by a few of our developers and hard to integrate with object oriented programming. Now data access is based on C-libraries reading files using NFS. Next version, which is being designed at the moment, will be implemented in C++ and use multi-layered client/server technology.

Some time is still being spent on porting programs into Sun OS 5 from previous versions of the operating system, and a few program still need to be ported to the Intel platform.

Production in general

Apart from the presentation programs, used by the forecasters at the workstations, we have numerous programs doing all kinds of pre- and post-processing, and automated production. They have become so numerous that is has been necessary to have formalized and automated ways of controlling and monitoring their work.

To avoid - or at least minimize - the risk of loosing products or not getting the results on time due to computer failure, all critical programs are installed on at least two computers. Each of these computers has a central registration of, which programs to run currently. All programs are started at the appropriate time on both of the computers where they are installed, but will check against the local register to see whether they are operational or on stand-by. If a computer fails, the tasks of this computer can be taken over by another, by human intervention. We have considered automating the switching, but found that an operator usually is better at prioritizing what has to be done.

Having a large number of workstations has made it necessary to automate the monitoring of them. So a product called Patrol has been installed, and can guide the operator to areas of trouble as soon as they arise. The things to monitor is of course configurable, and you can write your own programs, which can interface to Patrol, but in general machine load, disk usage and data queue lengths are monitored.

Work is being done to make a generalized production system. At the moment almost all jobs are controlled by cron, that is, started at a specified time of day. This is OK most of the time, but if for instance a model run is delayed, a lot of programs will try to run without being able to get data. Usually they will just wait for data, but it is an active wait, using processing resources. With a sort of event driven production system, in which program and data dependencies are described, jobs can be scheduled in the correct order and at the correct time, so the time gaps, which are necessary today, can be avoided.

Agricultural data

Meteorological information in greater detail than they are given in the general forecasts have been of interest to the agricultural community for quite some time. The problem for us has been how to deliver the products and get the payment in the easiest way for both the customers (generally farmers) and us. In the "early days" of the internet, we have experimented with different ways of internet payment, but none were succesfull.

By now we have come to an agreement with the agricultural organizations that we deliver our information to their central site, and they make it available to their members as part of the sotware systems, they have developed for member usage.

Standardization

Some work is being put into converting a number of our internal data formats into international standards. It is our goal to have all observational data in BUFR-format. Sealevel data are internally stored in BUFR, even if they are transmitted from stations in another format. Observations on road conditions are being stored in BUFR as well.

Work is in progress as goes for radar data. However, in this particular area there does not seem to be a general standard. And of the implementations, we have seen, none has as much precision of data as we would like.

Software management

Nearly all of our software has by now been put into a release system, in which versions can be tracked. A release procedure with a number of check points has been put up to improve software and configuration quality.

Also all user manuals have been re-released in HTML format in an on-line manual.

Road warning system for ice and snow conditions

By Bjarne Riis Laursen, The Danish Meteorological Institute (DMI)

INTRODUCTION

In 1995 the counties of Denmark and The Danish Road-Directorate made the decision that they wanted a new system for warning against ice and snow conditions on the roads. One of the major demands was that the system should be able to collect data from the existing net of app. 270 climatological road stations, and make it easy to incorporate any new type of stations. In the summer 1995 DMI was given the task of developing the new system. The system was tested in the 1996/97 season and has now been running its first season 1997/98.
The remainder of this document describes the developing process and the resulting system.

BASIC DEMANDS

Some of the major demands from the customers were:

- All types of stations should be easy to incorporate in the system
- Each county wanted one central unit capable of collecting data from stations of their choice
- End-users should have access to the central units either by network or by phone
- Presentation of data to the end-users should be very simple and intuitive since many of the end-users were unfamiliar with computers
- A possibility to access data through standard programs

SYSTEM DESIGN

The demands to the system and the considerations about user-access resulted in the following system components and technical solutions:

- Program for the county centrals: The kernel of the system, collecting and storing data and serving the end-user program. Name of program: GlatKern.
- Automatic meteorological stations: Interfacing the kernel through a dynamic link library (DLL) written for each type of station.
- DMI, supplier of forecast-data, radar-images and observations: Interfacing the kernel through an ISDN-line to the DMI communication centre.
- Standard database for storing the collected data: Accessed from the kernel through ODBC.
- Program for the end-users: Communicating the kernel through TCP/IP. Name of program: GlatTerm.

The interactions between the above components are shown in Figure 1, and a typical way for a county to configure the system is shown in Figure 2.

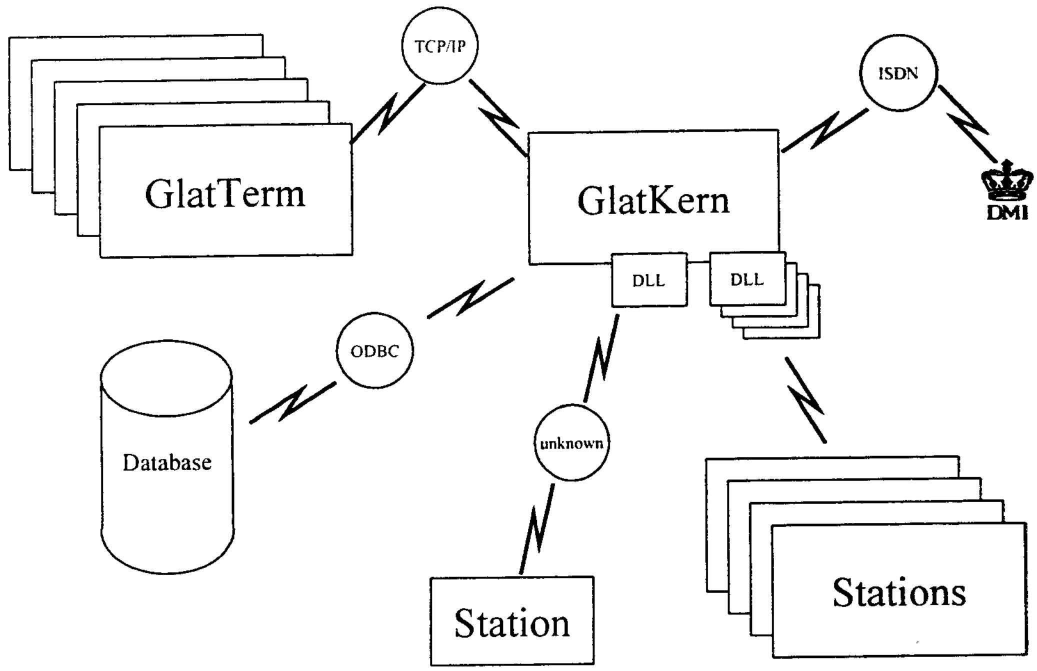


Figure 1 System components and communication

The program was developed to run under windows 95/NT, since most counties had people familiar with these systems. Each county is expected to have a capable person responsible for the system.
The tool for developing the system was Visual C++ from Microsoft (the development tool normally used at DMI for windows applications).
All data received by the kernel are in BUFR-format, meaning that all stations supplies BUFR-data directly or convert data into BUFR-format in the DLL.

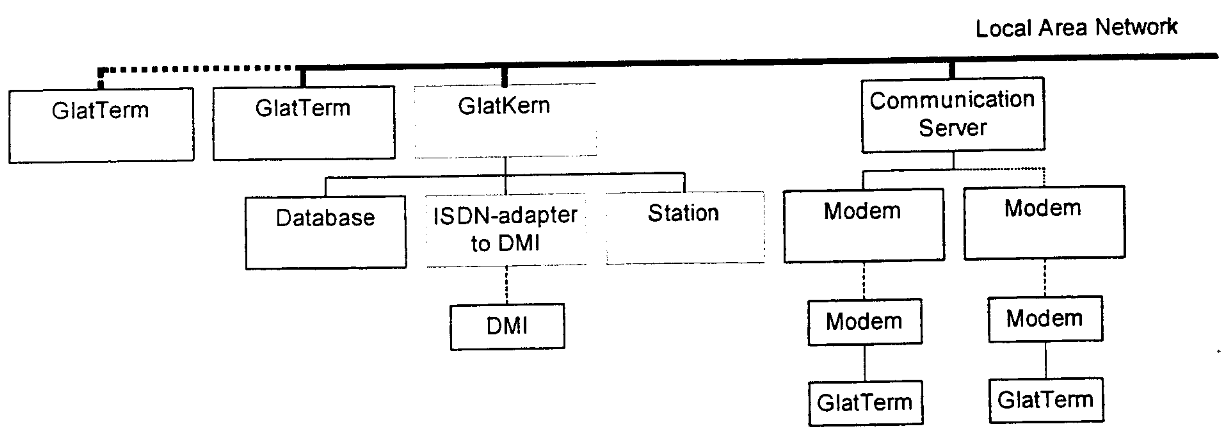


Figure 2 Typical county configuration

THE KERNEL

The kernel contains facilities for configuring database and communication, has been designed as a multithreaded application and presents nothing but a boring standard window with some text messages (this window is shown in **Figure 3**).

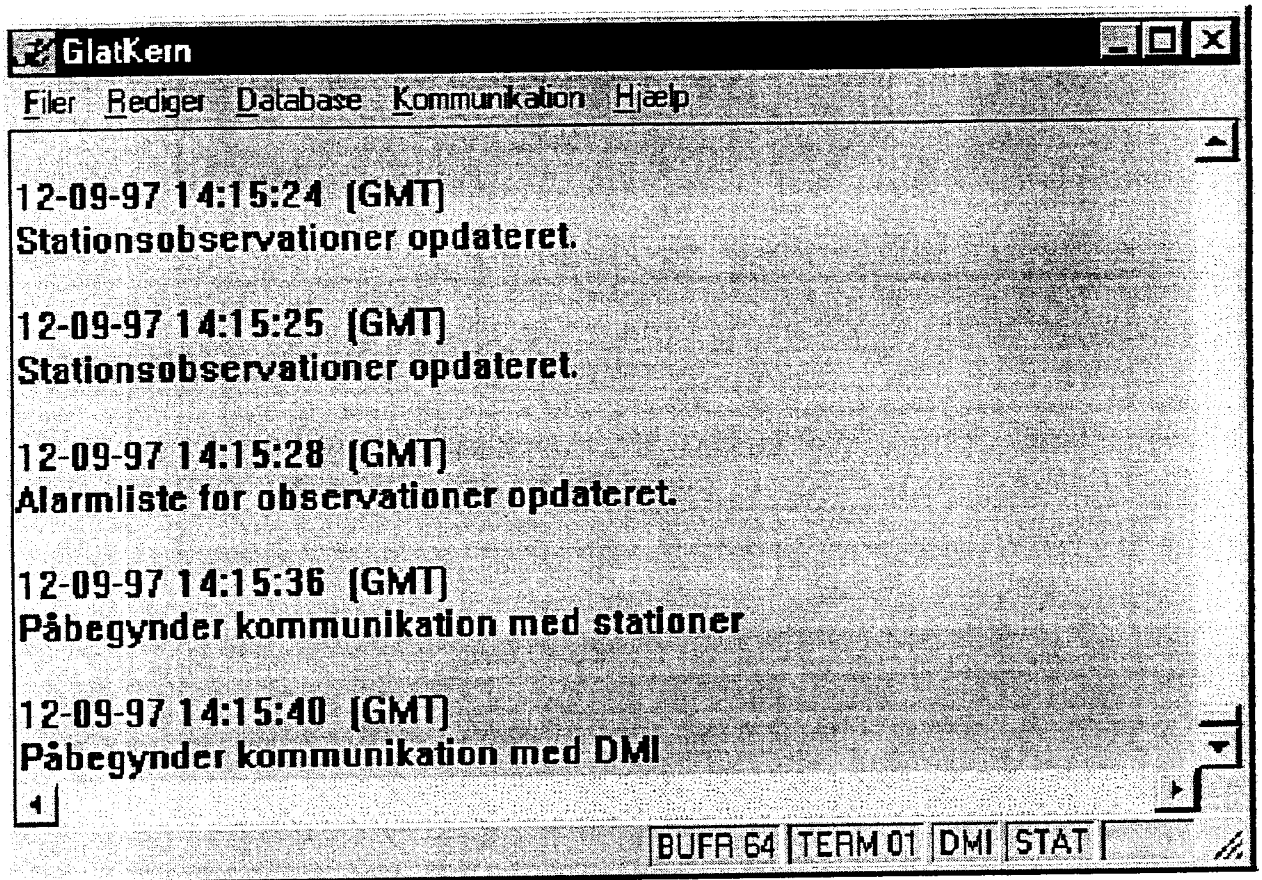


Figure 3 Window of the kernel

The different types of threads in the kernel includes:

- The main process: Takes care of the user interaction and synchronises the creation of the other threads.
- DMI process: Handles communication with the DMI communication centre.
- Station process: Handles communication with the DLL's for the stations.
- BUFR process: Decodes all BUFR-packages and stores them in the database.
- TCP/IP server: Processes requests from the terminals, and spawns a new thread to handle each connection.
- Other types of processes performing cleanup, synchronisation and so on.

The ways in which these threads interact are shown in Figure 4.

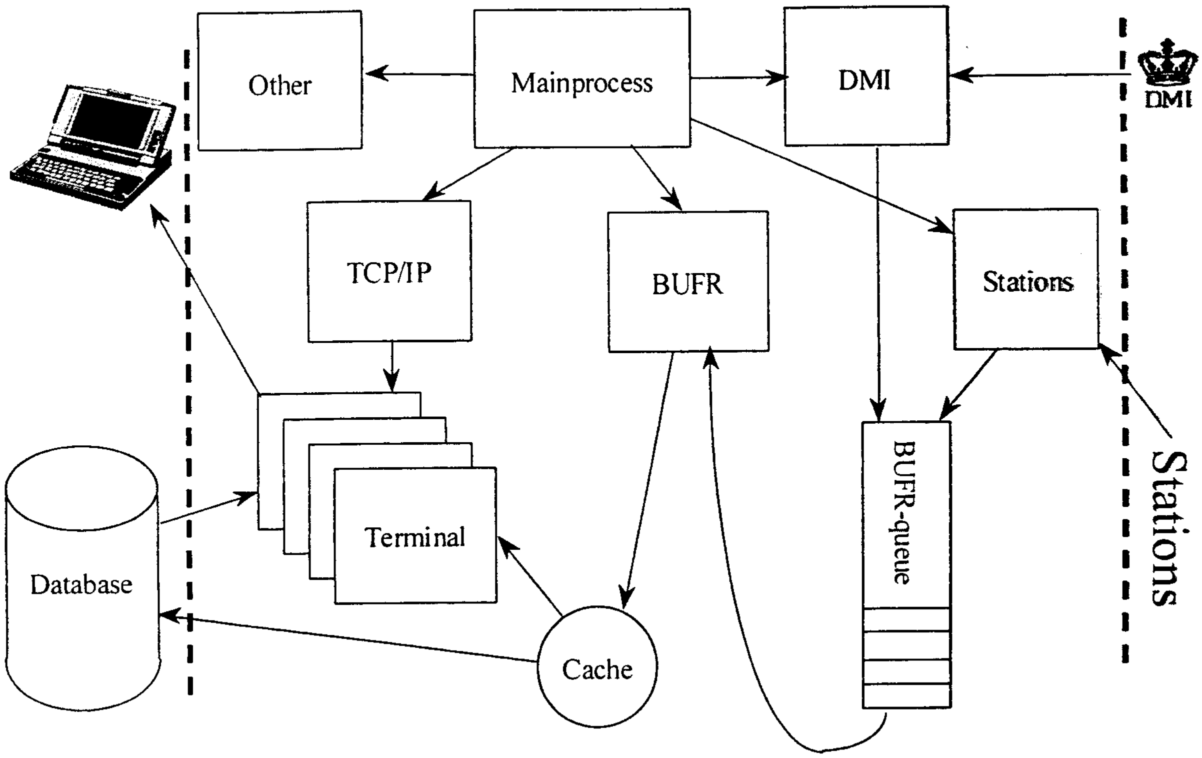


Figure 4 Elements of the kernel

THE TERMINAL

The terminal presents data to the end-user, to enable him to decide when to call out the snowploughs or the salt spreaders. All the users they have been trained in using the program and interpreting the data by persons from the DMI. The users use the different screens of the program in the following way:

- DK map: Shows all stations in the country and their current status indicated by colour. The status is shown based on the last observation as well as the forecast for the station. Status colours include: Grey (or question mark) indicates missing data. White indicates normal condition. Yellow indicates that the road temperature has dropped below 2 °C. Orange indicates that the road temperature has dropped below zero. Red indicates that the road temperature has dropped below zero *and* the dewpoint temperature is above the road temperature.
- Local map: Same as above but on a map shoving only the actual county.
- Station data: Shows primary parameters, observed and forecast data, for one station graphically.
- Recent data: Shows the last observations for all parameters and stations in the county as a table.
- Stationtable: Displays all observations for one station the last 24 hours.
- 3-hour forecast: Shows a special forecast with the primary parameter tendencies for each county.
- Barcharts: Displays latest observed primary parameters in bar charts for all stations.
- Weather forecast: Displays the weather forecast as delivered by DMI.
- Radarimages: Displays or animates radar images for the last 3 hours.
- DMI-stations: Offers extra observations.

On the following pages some examples of these screens are shown.

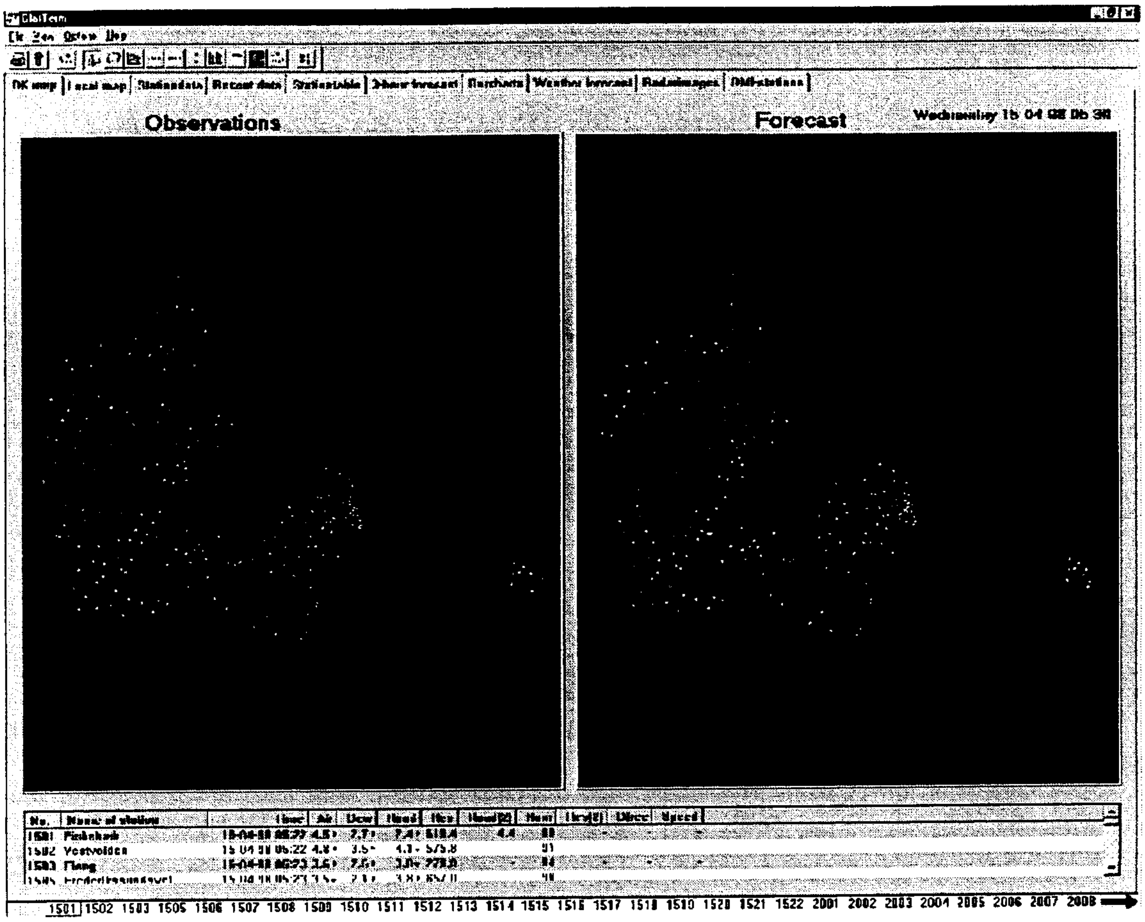


Figure 5 The DK map

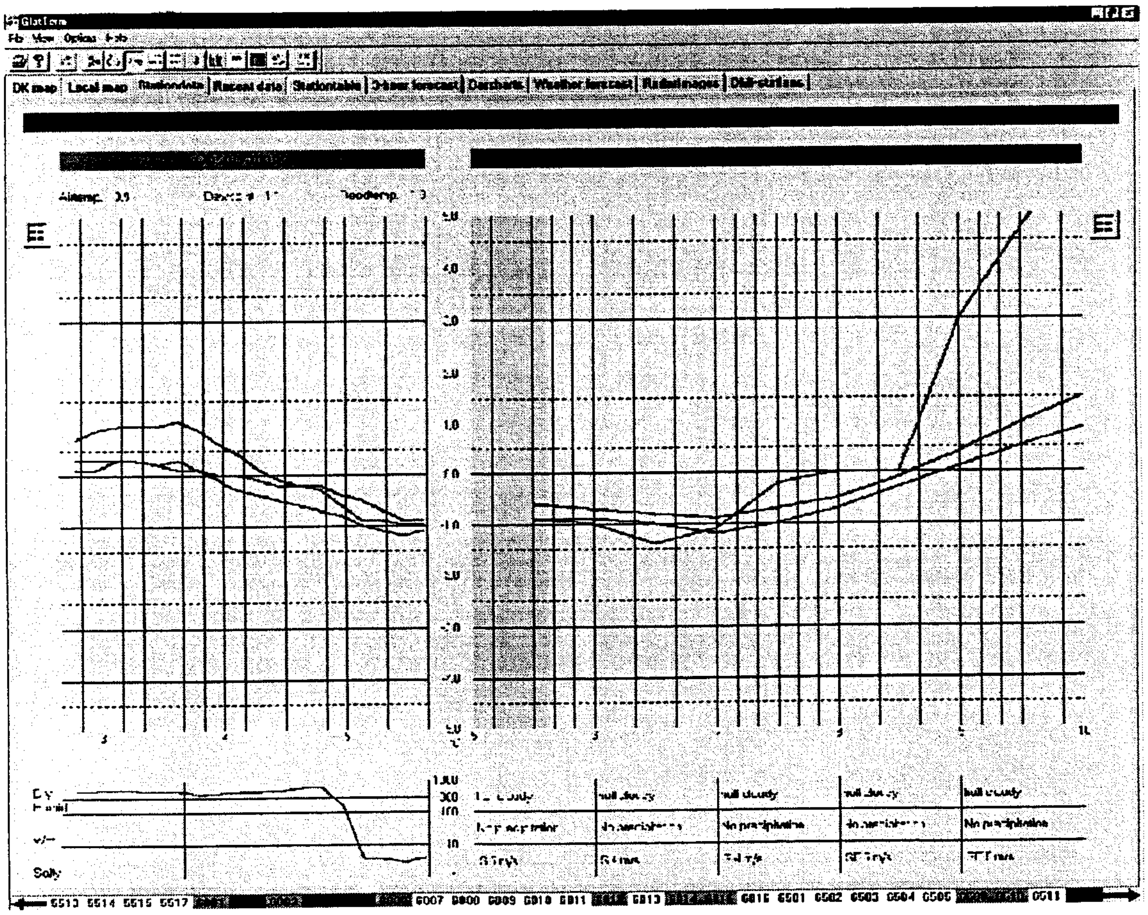


Figure 6 Stationdata

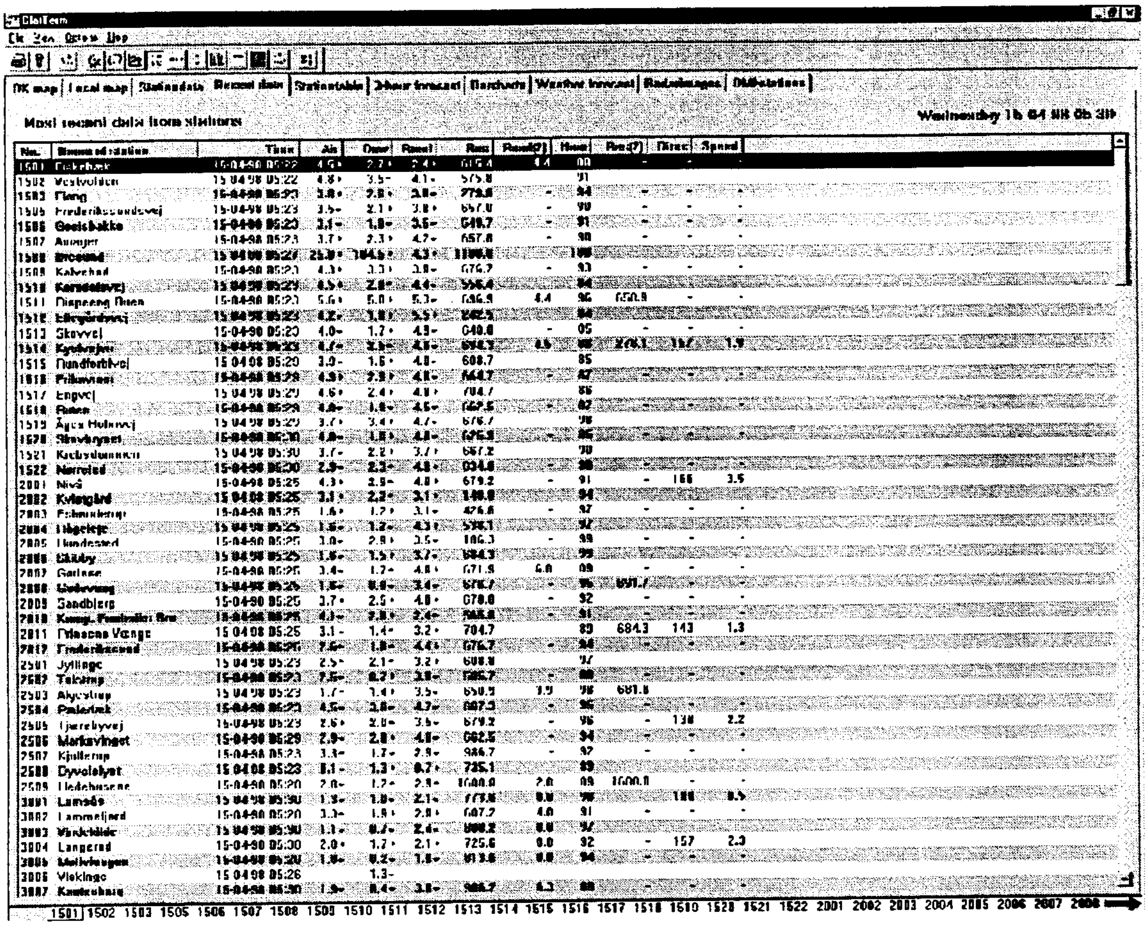


Figure 7 Recent data

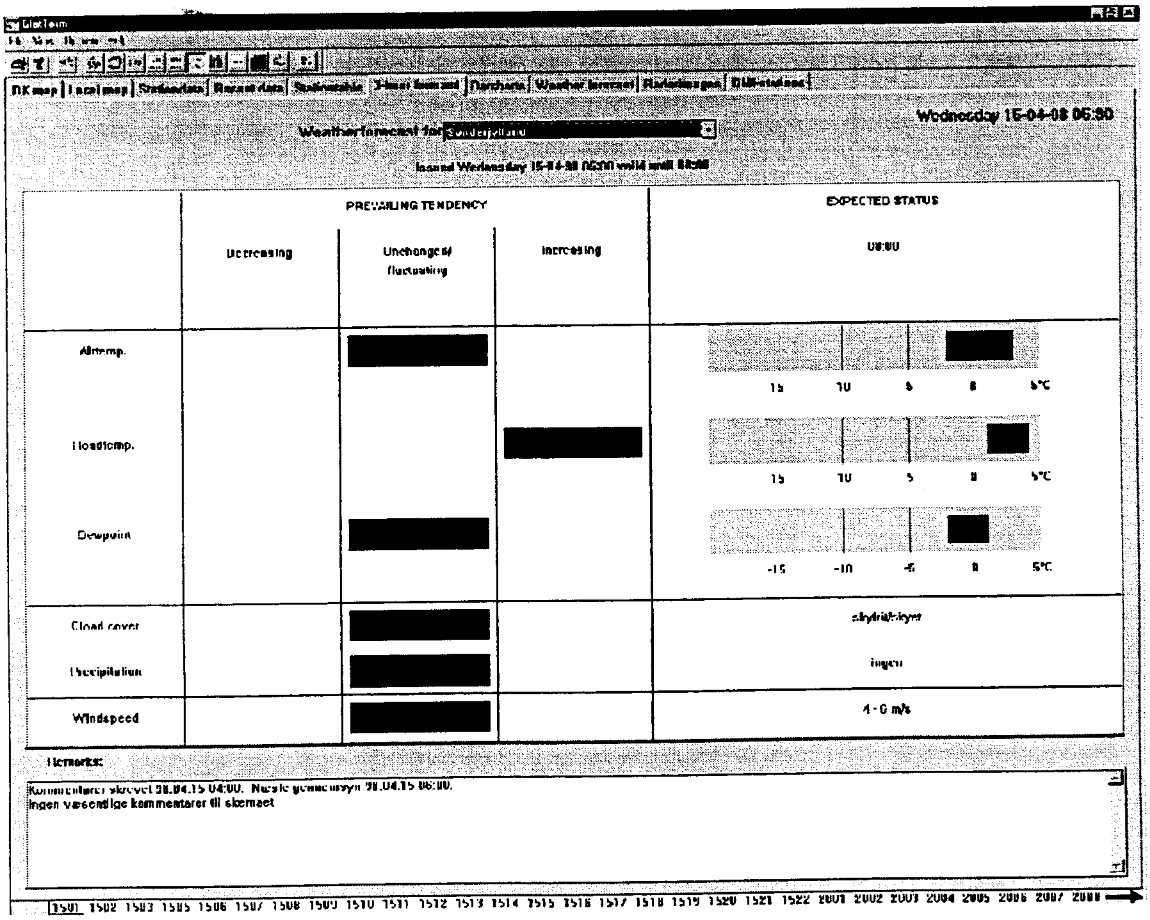


Figure 8 3-hour forecast

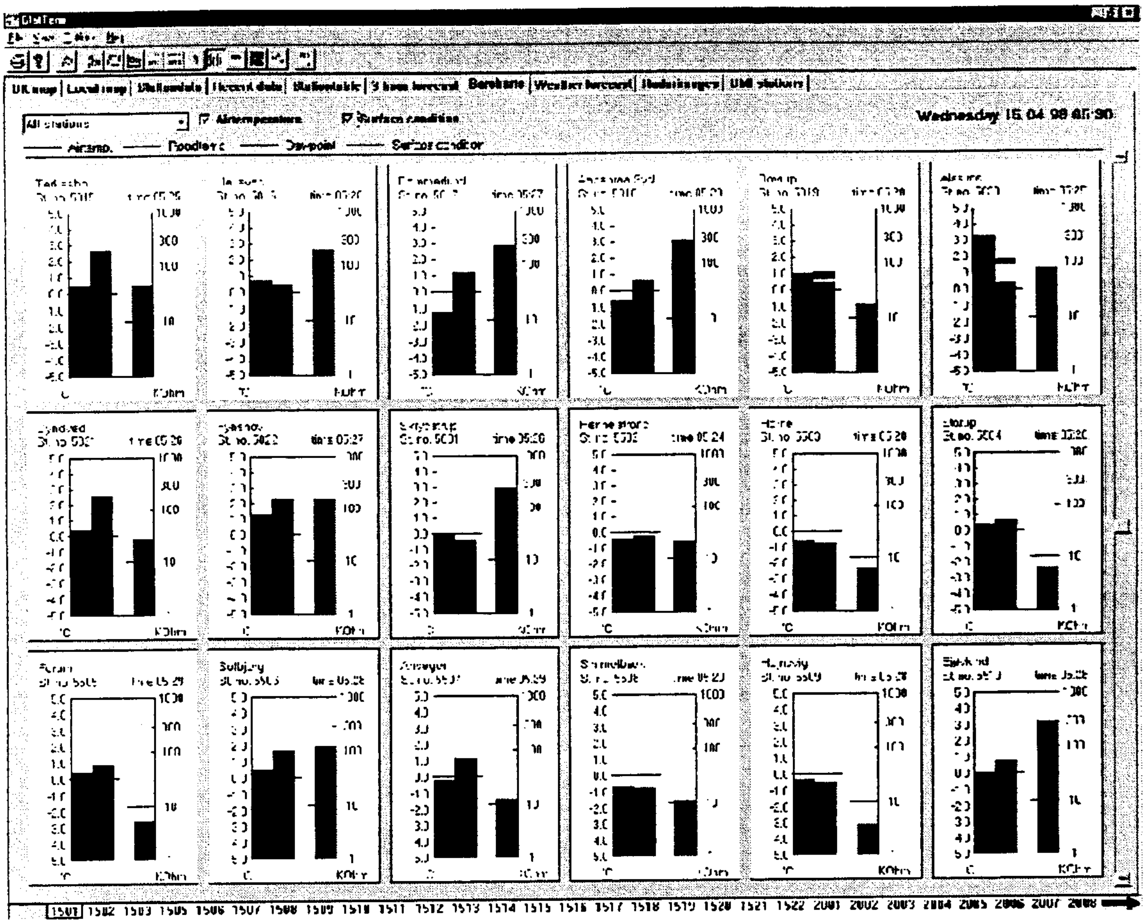


Figure 9 Barcharts

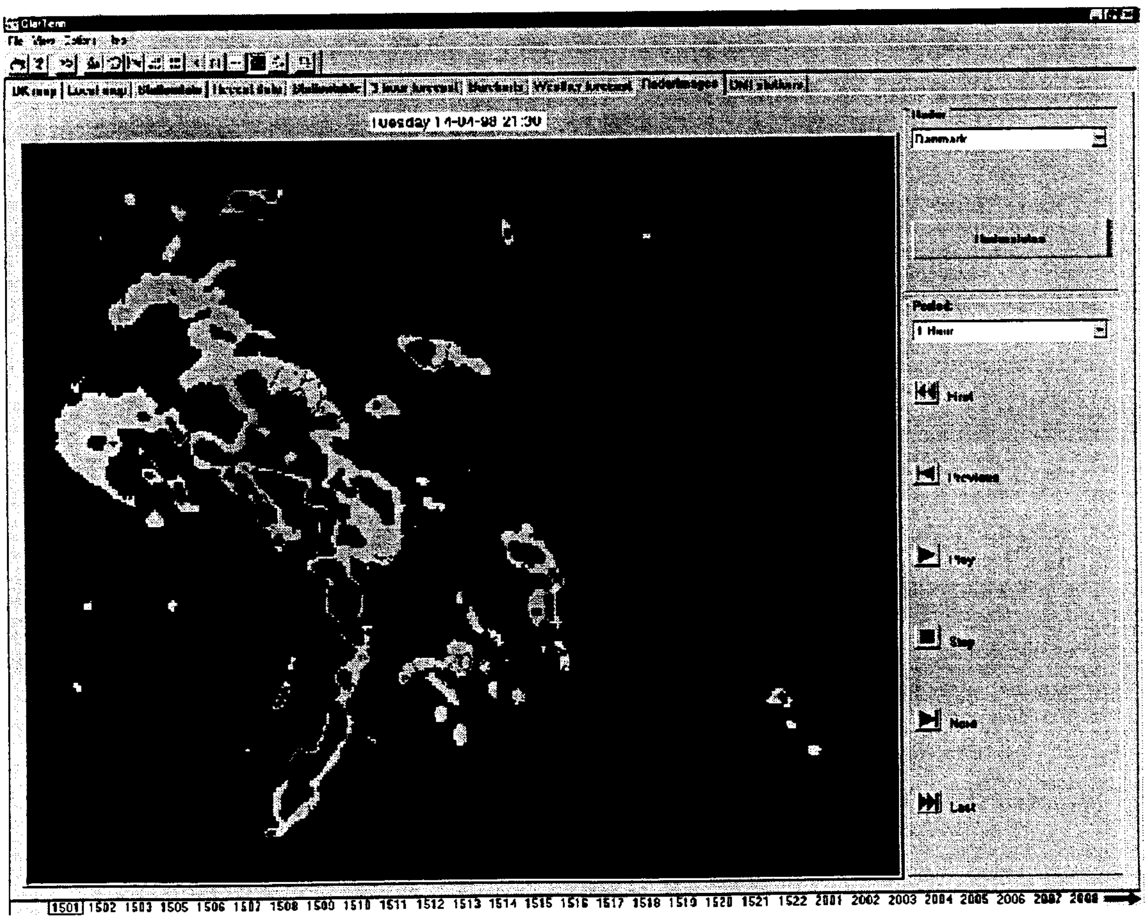


Figure 10 Radarimages

CONCLUSION AND FUTURE DEVELOPMENTS

The development of the system has in many ways been a bit different from our usual developments for the Unix-platforms. In this case there has been a lot of interaction with external customers, we have developed a server-like program, demanding high stability, for the Windows platform and we have had a lot of contact with external users.
Some of the major problems were the stability of the kernel and the TCP/IP communication. In the end applying patches to the operating systems solved all these problems. The users have responded with great satisfaction to the intuitiveness of the terminal part, while there have been some complaints about stability and complexity from persons in the counties, responsible for system maintenance.
The customers have ordered some enhancements to the system. These enhancements will be implemented in the summer of 1998 and includes the following:

- Implementing special wind- and iceforecast, model and presentation, primarily for bridge warning purposes.
- Improving the graphical presentation of data in the system. More flexible and with the possibility to display all parameters graphically.
- Roads and county-borders will be displayed on the maps.
- Extended configurable sound-alarm system.
- Automatic phonecalls on specified alarms to specified persons.
-
-
-
-
-

*H*ungari*a*n Meteorological *Work*station (*HAWK*) Project

Akos Horvath
Hungarian Meteorological Service

The Hungarian Meteorological Service, collaborating with Forecast System Laboratory of NOAA, runs a project to develop a UNIX based meteorological workstation. The result of the project would be a highly interactive system designed for Mid-European environment. This system would allow meteorologists of Hungarian Meteorological Service to use much more and higher quality of meteorological information. Primary usage is planned in short range forecasting, but the system should be able to operate on wide scale of meteorological fields, like pollution transportation, aerology, climatology, etc. The full operative usage are planned in 1997, but some parts of the system are already used in operative practice.

Main requirements

Main requirements from meteorologist users are follows:

1. Fast display capability of chosen information:

meteorological maps
diagrams
images
tables
characters etc.

2. Space and time synchronizing of different data.

The system has to find the optimal map projection and place different products to this common map. The user may modify it.

The system also offers an optimal time resolution of different products which can be modified.

3. Run as many applications as possible "on the fly" way.

This concept helps increase the flexibility of the system, and there are some tasks, like cross sections, time sections, where this is the only way of solution. The price for it is the slower speed of displaying.

4. Full data handling.

All data preprocessing and encoding, decoding procedure run in background.

5. High level interactive connection between the user and the system.

6. Open system for special (and new) applications

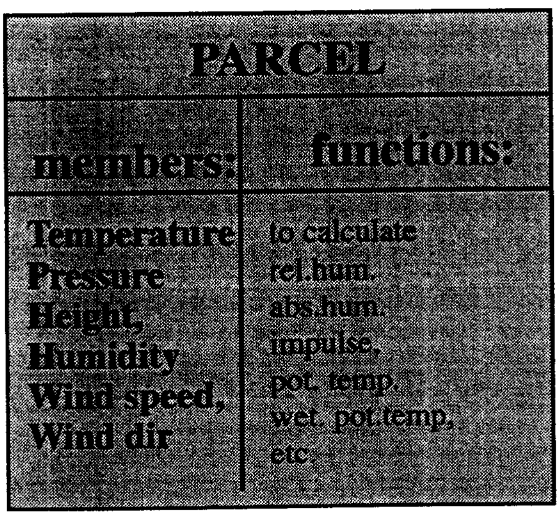
Used Software Devices

HP-UNIX operation system is used.
All graphic tasks are written in **X, Xt and Motif**.
For data storage **netCDF** format is applied.
Programming languages are :
Fortran-77 for meteorological tasks,
ANSI C for data handling.
C++ is the backbone language of the HAWK system, all other languages are called from C++.
The system is based on object oriented programming technique.

Object oriented "plug in" programming technique

Object oriented programming technique is used. Two kinds of objects are defined: data objects and application objects. Data objects are for data storing and manipulating. These are:

Parcel which contains the basic parameters like temperature, height, humidity, pressure, wind speed and wind direction (Fig. 1).



Example to get potential temperature and temperature of a parcel

```
{
Parcel pc;
.:
:
float poT = pc.getPot();
float temperature = pc.getT();
}
```

Figure 1.

Grid, which contains Parcels at grid points.

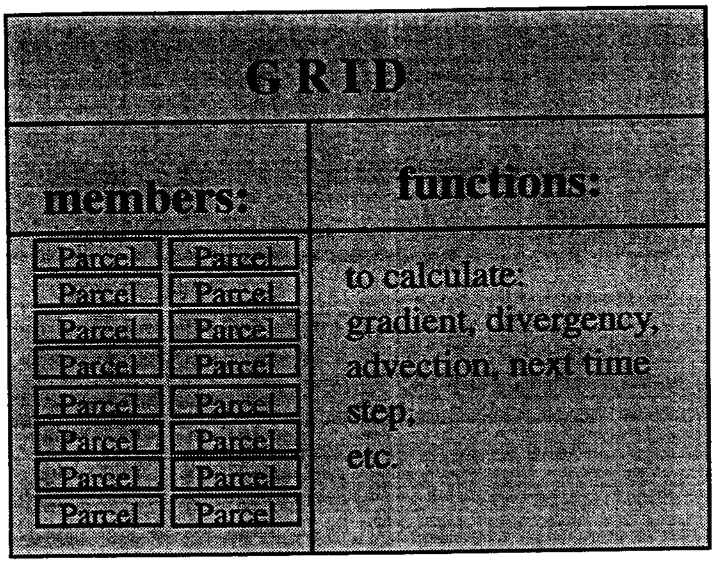


Figure 4.

And several other objects like above mentioned can be defined(Fig.4).

Application objects are objects which are able to display data objects. For example: plugging a Temp class variable into an Emagram class we can get a sounding diagram, or plugging a Grid class variable into a Map we can display contours of a meteorological field (Fig.5).
This "plug in" technique are preferred in HAWK processes.

Using application classes and data classes at "plug in" technique"

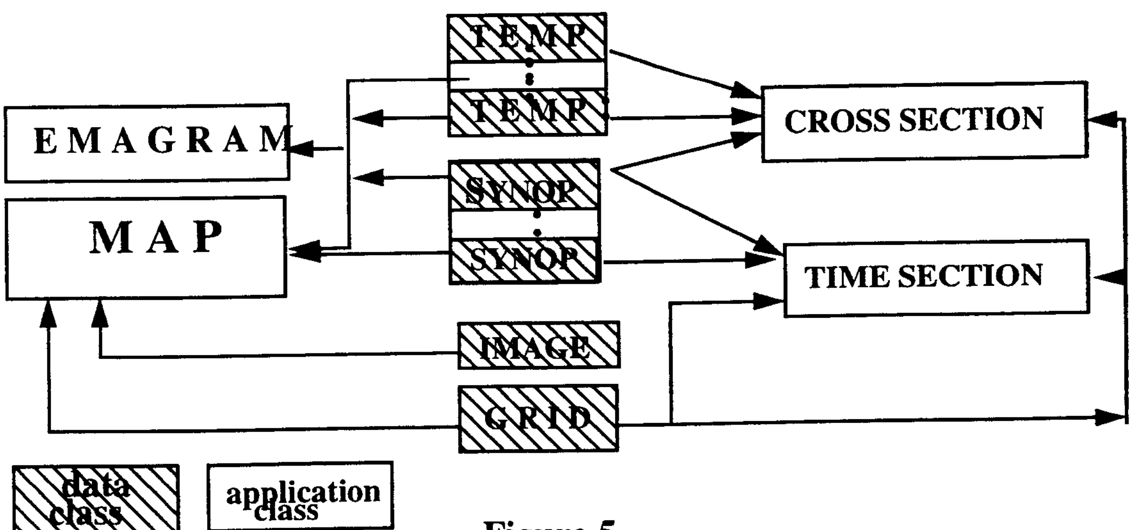
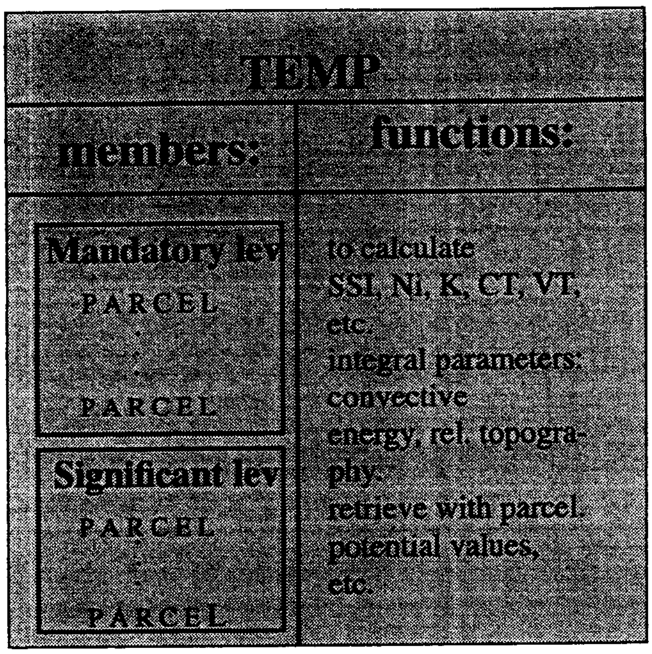


Figure 5.

Temp, which contains vertical columns of Parcels of mandatory and significant levels, and some other special parameters (Fig 2).

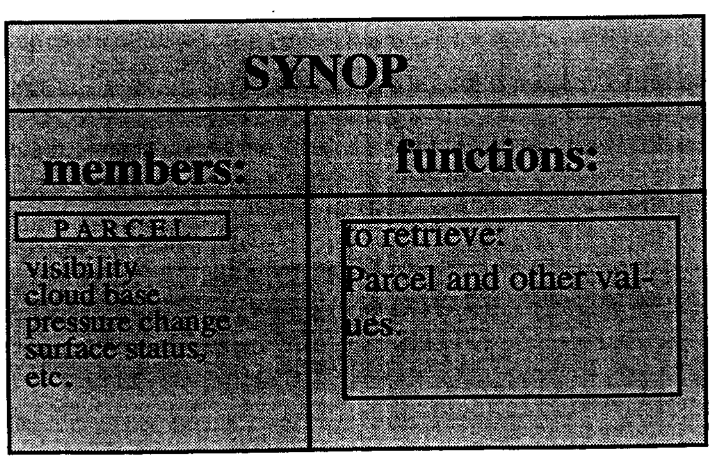


Examples to get Showalter index (ssi), temperature of 850 hPa level, and temperature at 1550 m.

```
float ssi, T850;
Parcel pc850;
Temp tp;
:
:
ssi = tp.getSSI();
T850 = tp.getPressLev(850.0).getT();
T= tp.getHeight(1550.0).getT();
;
```

Figure 2.

Synop, which contains synop information (Fig. 3),



Figures 3.

Server oriented process organizing

Different processes running on the workstation are organized under three servers (Figure 6).

The **Data Server** responsible to collect information, and keep the connection with the outside world. This server runs decoding and encoding processes, data inventory processes and informs other servers about the existing or new information. When a new information arrives, data server take care with placing it to the appropriate place, and sends a message to **Local Product Generator** (**LPG**) server asking it to do the necessary manipulations or preprocessing with given data. When LPG has done the preprocessing the Data Server stores the processed information and informs the Display Server about the existence of given data.

The **LPG** server responsible for running preprocessing programs, like map transformations, or calculations of derived meteorological fields. It receives raw data from Data Server and sends back processed data for Data Server. Most of meteorological programs run under this server.

Display servers display preprocessed or raw data required by the user and keep connection with users via Graphical User Interfaces. Display Servers turn for information to Data Server, but some applications use services of LPG servers, too. (Especially "on the fly" applications like vertical cross sections, where users set up the direction of a cross section and the system has to calculate field at once.)

Processes inside a server use unix-pipes for inter process communication. Between servers RPC are used for communication.

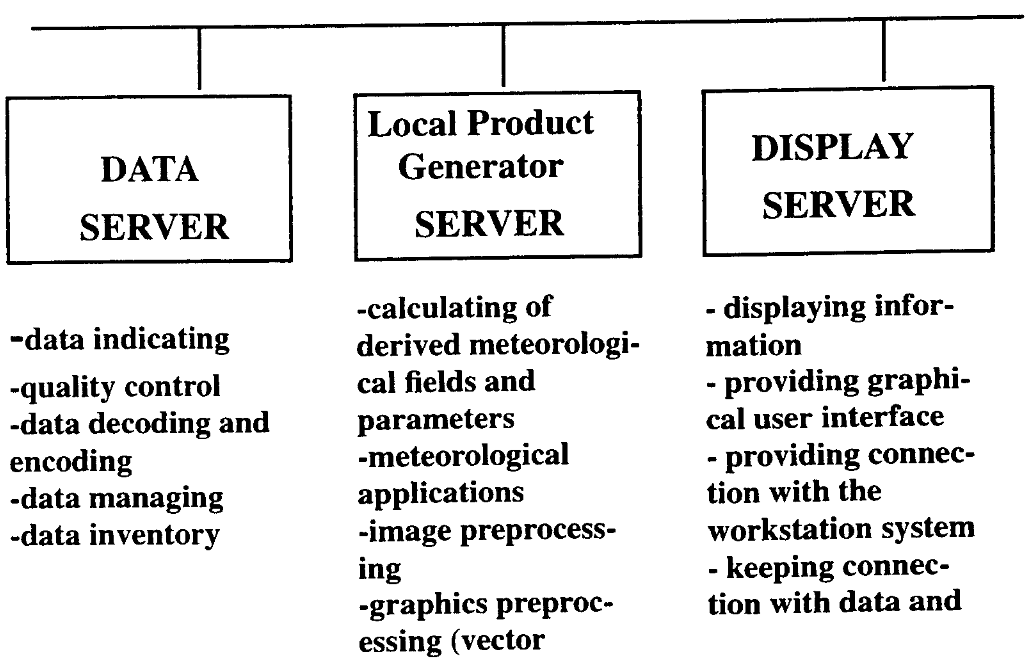


Figure 6

Some data storage forms for display access

1. "Value level" storage at SYNOP, TEMP, METAR etc.

Preprocessing:
- decoding from carrier format (BUFR, SYNOP) into netCDF

2. "Spherical level" storage at "isoline" information (analysed fields from grided data).

Isolines are stored as function of VALUE, LATITUDE, LONGITUDE.

Preprocessing:
- decoding from GRIB or GRID into netCDF
- creating and storing isolines in netCDF

3. Image level storage at RADAR, SATELLITE information.

Pixel values are stored. Calibrations of pixel values are given in parameter files.

Preprocessing:
- decoding from original format into netCDF and transforming values (for example radiation temperature) into pixel value.

Storage mode:

1. images are transformed to fixed map projections.
   advantages: quick display.
   disadvantages: it needs large disk place, and rigid access.
2. Images are stored in a general projection and projected "on the fly" at arbitrary map projection.
   advantages: more flexible.
   disadvantage: slower...

Available input data for HAWK

- point data: TEMP, SYNOP, METAR
-
- grided data (analyses and forecast: ECMWF, ALADIN, GTS GRIDS)
-
- image data METEOSAT and RADAR from National Radar Network
-
- special information: lightning, cameras

Hardware configuration of HAWK

From hardware point of view, HAWK workstation consists of three HP workstations. An HP 755 responsible for data server and LPG server functions, and there are two HP-715 where display programs are running. GTS informations for HAWK comes from a NETSYS telecommunication computer, from ECMWF via ftp. Radar and satellite centre supports digital radar and satellite information (Fig.7).

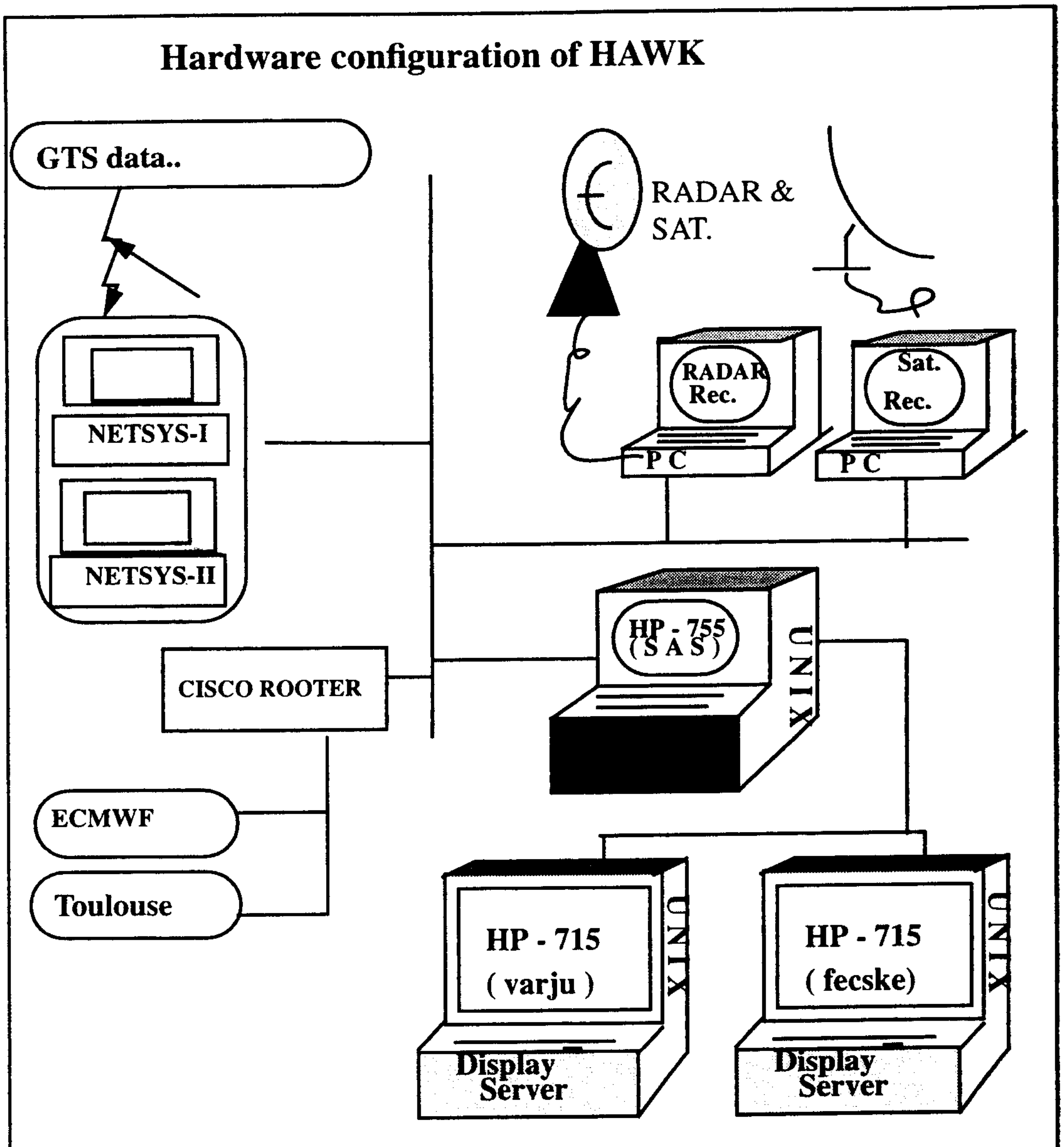


Figure 7.

Session 2 - Recent Developments/ Visualization

Deutscher Wetterdienst
VM EA Potsdam
MAP-Gruppe

MAP Version 98.3

1. Introduction

Mr. Pogoda, former head of the MAP group, left DWD in 1997. Nevertheless the remaining team of three developers managed to produce the planned MAP Version 98.3 in time. There is still a lot of tasks for the remaining MAP team.
The number of installations now exceeds 200. There are some new fields of activity using the MAP.
MAP will be used to support the developement of the next generation numerical weather prediction system.
Until now MAP only monitors dangerous weather situations. A system to produce nowcasting warnings automatically will be integrated into MAP. This system will support the verification of the warnings both for real time and non real time use.

2. Data Base

In addition to MAP Version 97.4 there are the following new data:

- TAF Guidance
- EMOS
- Trajektories
- Nowcasting
- Toptherm
- Cross Sections delivered by VISUAL
- GRIB1 to assist the developement of the new models

3. Data Supply

AFD (Automatic File Distributor) is now responsible for delivery of data, using WiN and FAXE.

4. New features

4.1 TAF-Guidance

TAF-Guidances are MOS forcasts for a special set of elements, using the EM, observations and data of about 100 stations collected for more than four successive years.
Predictants are the elements to be forecast in TAF, such as wind, temperature, visbility, significant weather and clouds.

4.2 EMOS

EMOS is a MOS system with predictants of general interest. Standard elements are forecast with two special features:
MOS forecasts are Kalman-filtered and MOS forecast errors are predicted.
Forcasts are given for about both 100 German and 100 European stations.

4.3 TOPTHERM

TOPTHERM is a forecast of thermal, rise velocity, height of cloud top and cloud cover for all GAFOR regions on the basis of DM. TOPTHERM is useful especially for sail-planes.

4.4 NOWCASTING

For METEOSAT displacement vectors are derived on the basis of the last two consecutive images. Extrapolated satellite images according to these displacement vectors we presented in MAP Version 97.4 already. Now there is an additional prediction of thunderstorm and hail for two and a half hour in steps of 30 minutes. IR and VIS METEOSAT images and RADAR images must exist for the actual termin.

4.5 Trajektories

Trajectories are produced using three-dimensional wind fields of the NWP system (GM, EM, DM) of the DWD. About 50 forward trajectories, starting at nuclear power stations and about 60 backward trajectories, ending at observatories or stations measuring radio-activity are available for a number of heights.

4.6 Cross Sections delivered by VISUAL

A couple of fixed Cross Sections will be delivered by VISUAL as a first approach.
The possibility to chose any Cross Section interactively will be the next step using remote procedure call. A powerful VISUAL server in Offenbach will respond to remote requests.

5. Handling

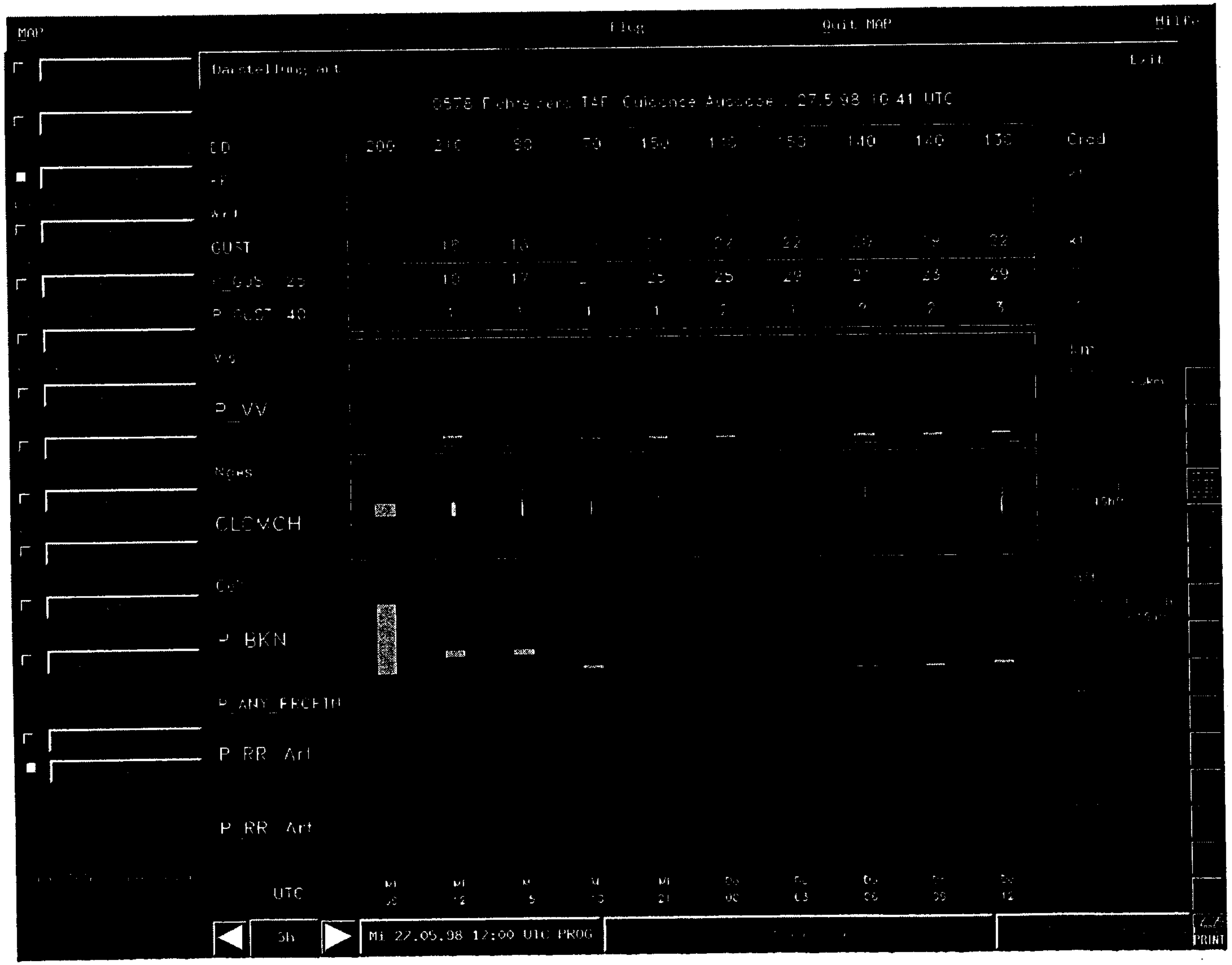
5.1 Choice of date/time is improved

With time intervalls of 3 hours, 6 hours or more changing the termin leads to main termins (0 UTC, 3 UTC, ...) automatically.
It is therefore possible to switch from 18 UTC to 18 UTC at the next day (but not from 19 UTC to 19 UTC).

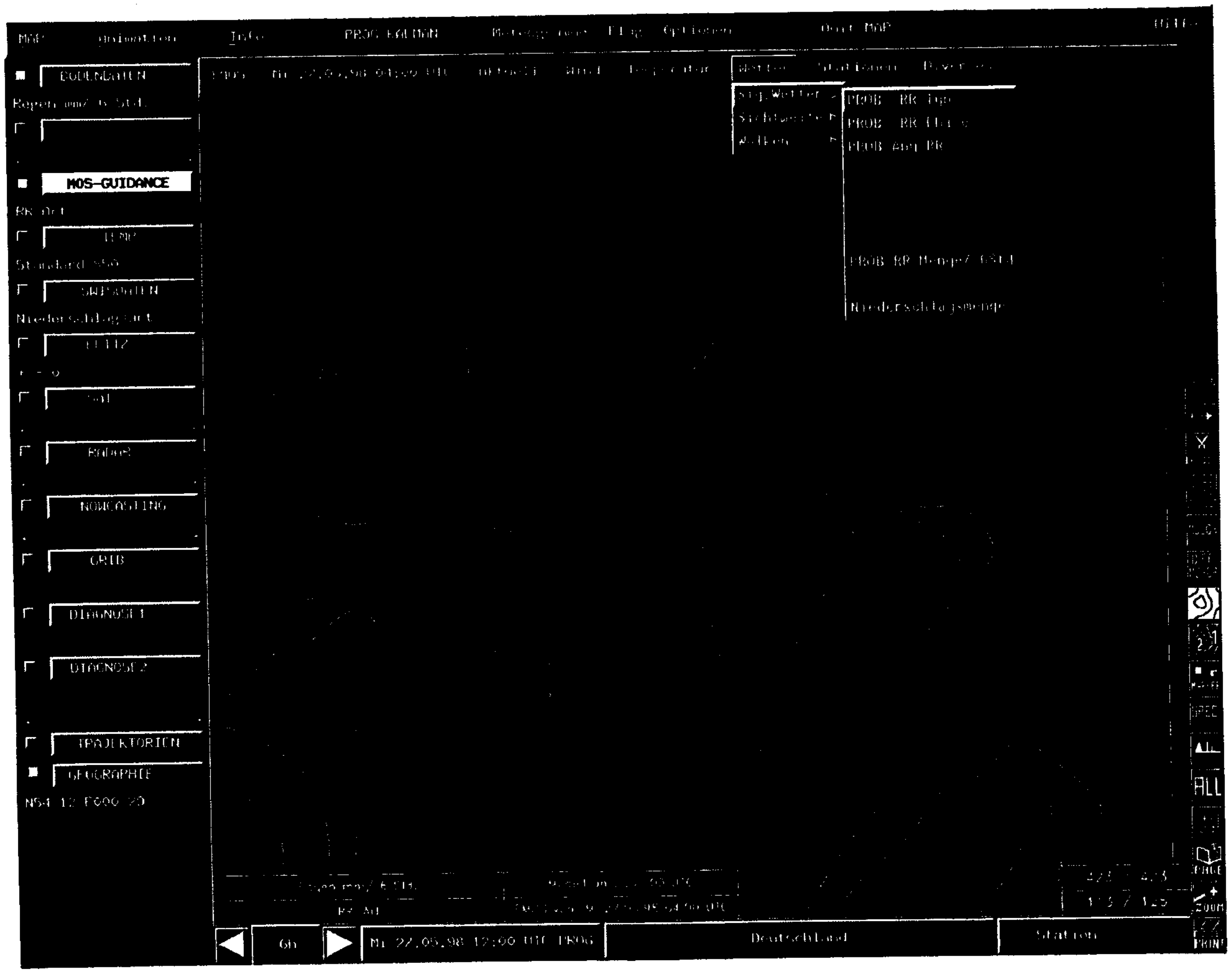
5.2 Choice of Diagnose and GRIB is improved

- Elements are arranged according to a given priority.
- The level must not be chosen for elements with only one level, e. g. pressure.
- Dropping the chosen element includes dropping of the level.
- Repeated choice resumes with the state of the last choice.
- Main principle is to reduce the number of clicks while remaining as flexible as possible.

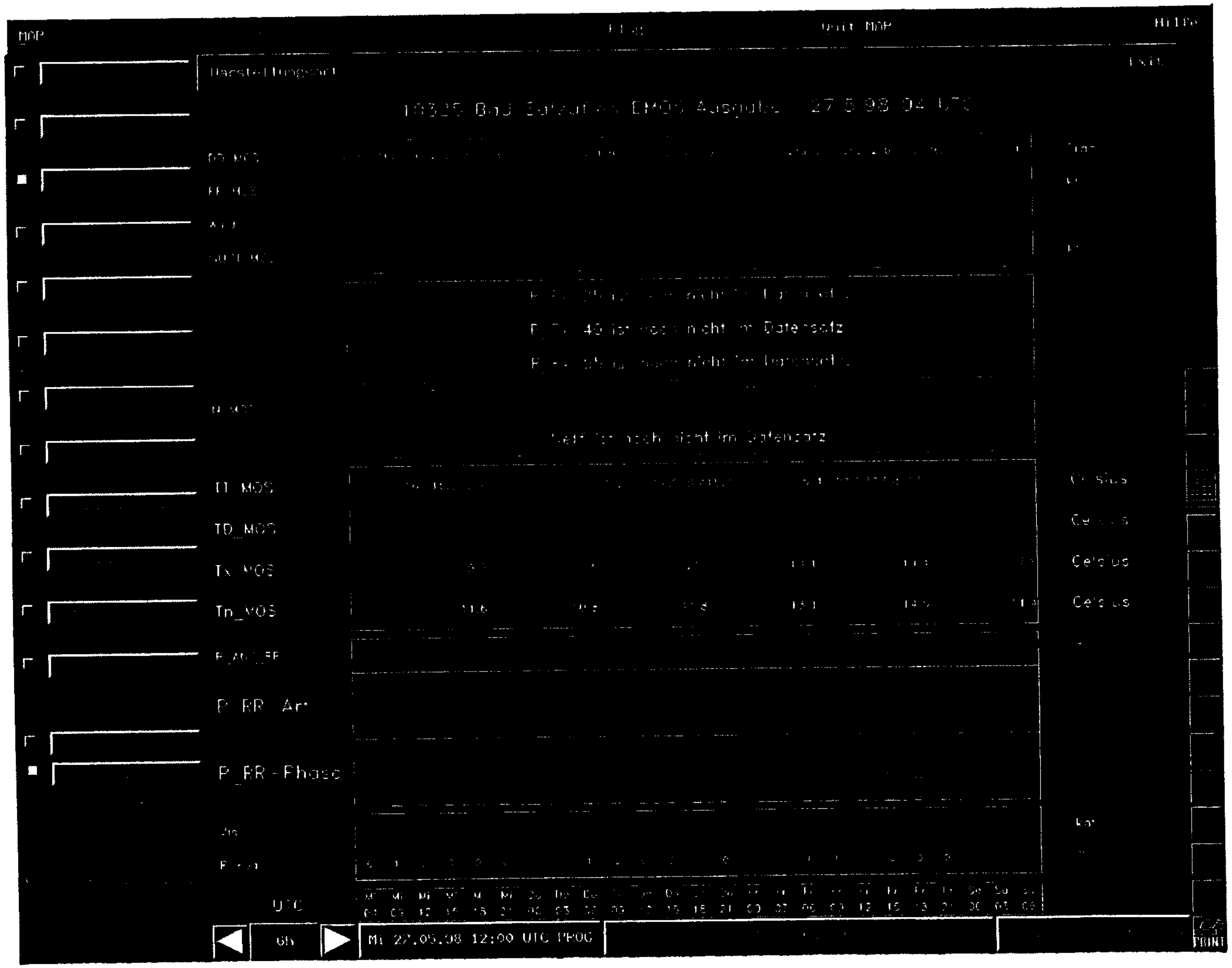
TAF Guidance



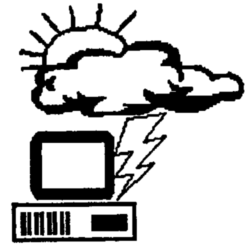
Precipitation, OBS and EMOS

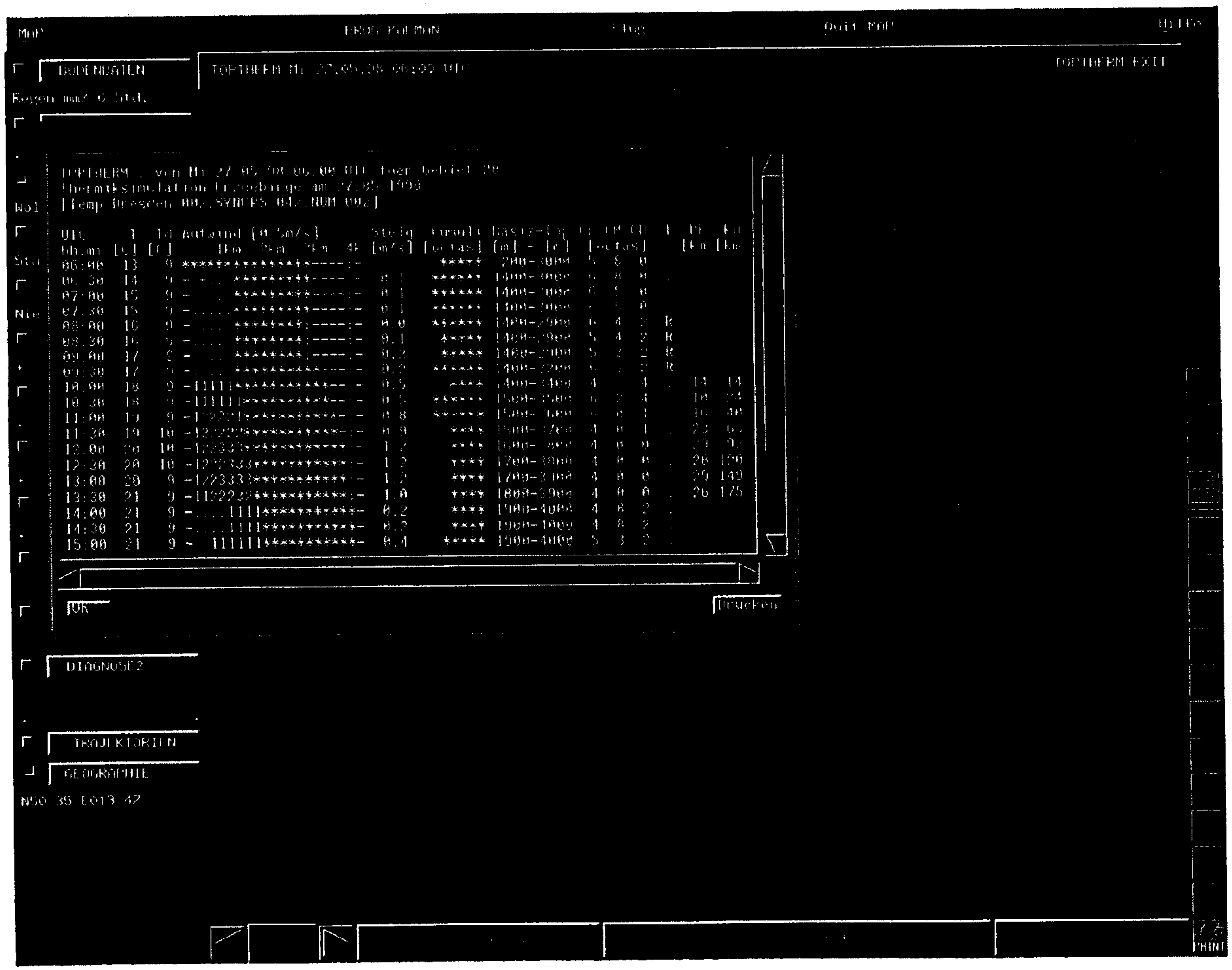


EMOS - time series

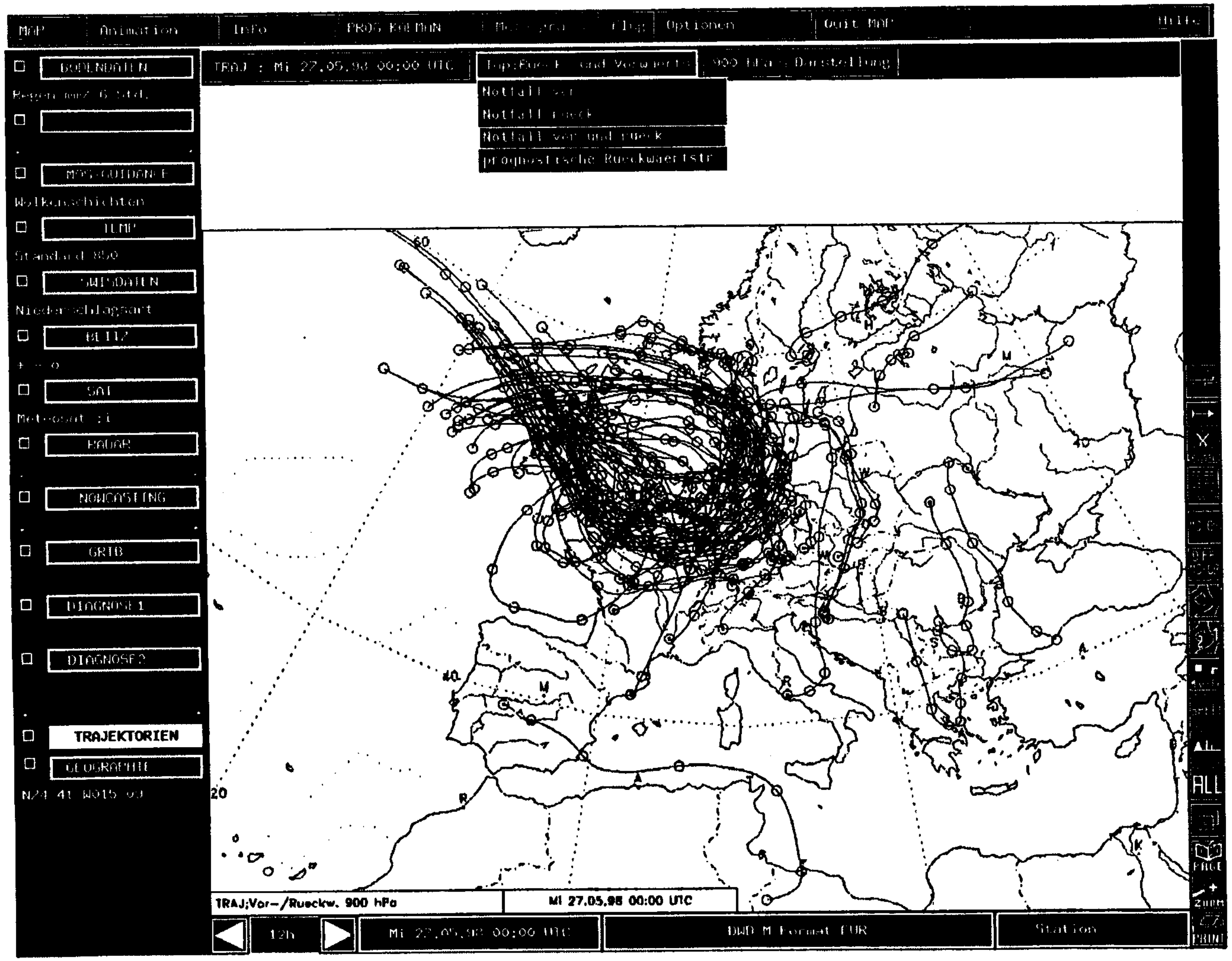


TOPTHERM
thermal simulation





Trajectories



Zentralanstalt fuer Meteorologie und Geodynamik (ZAMG), Vienna

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"New operational visualization tools in weather forecasting"

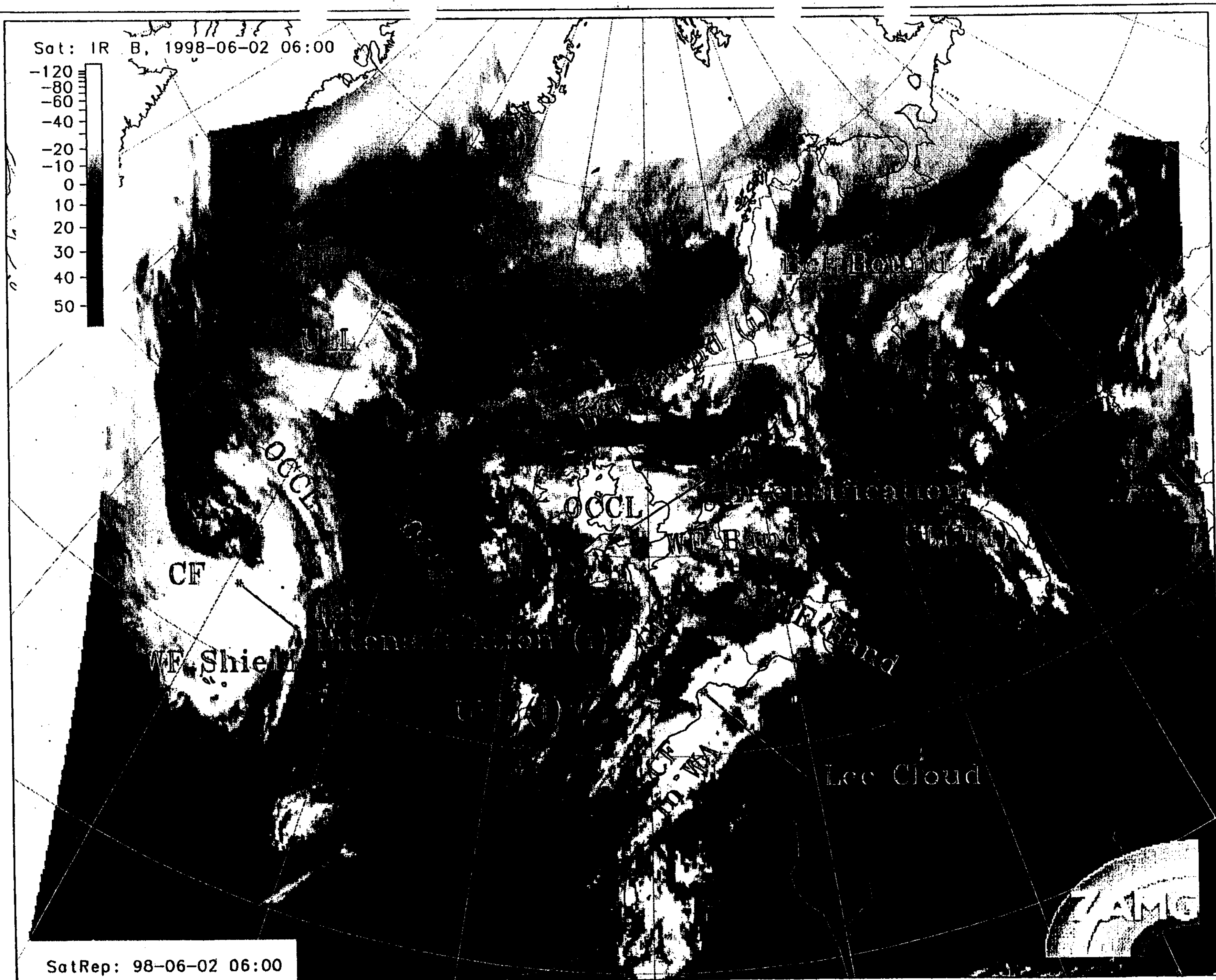
Short overview about existing tools

New tools in diagnosis and forecast of satellite images:

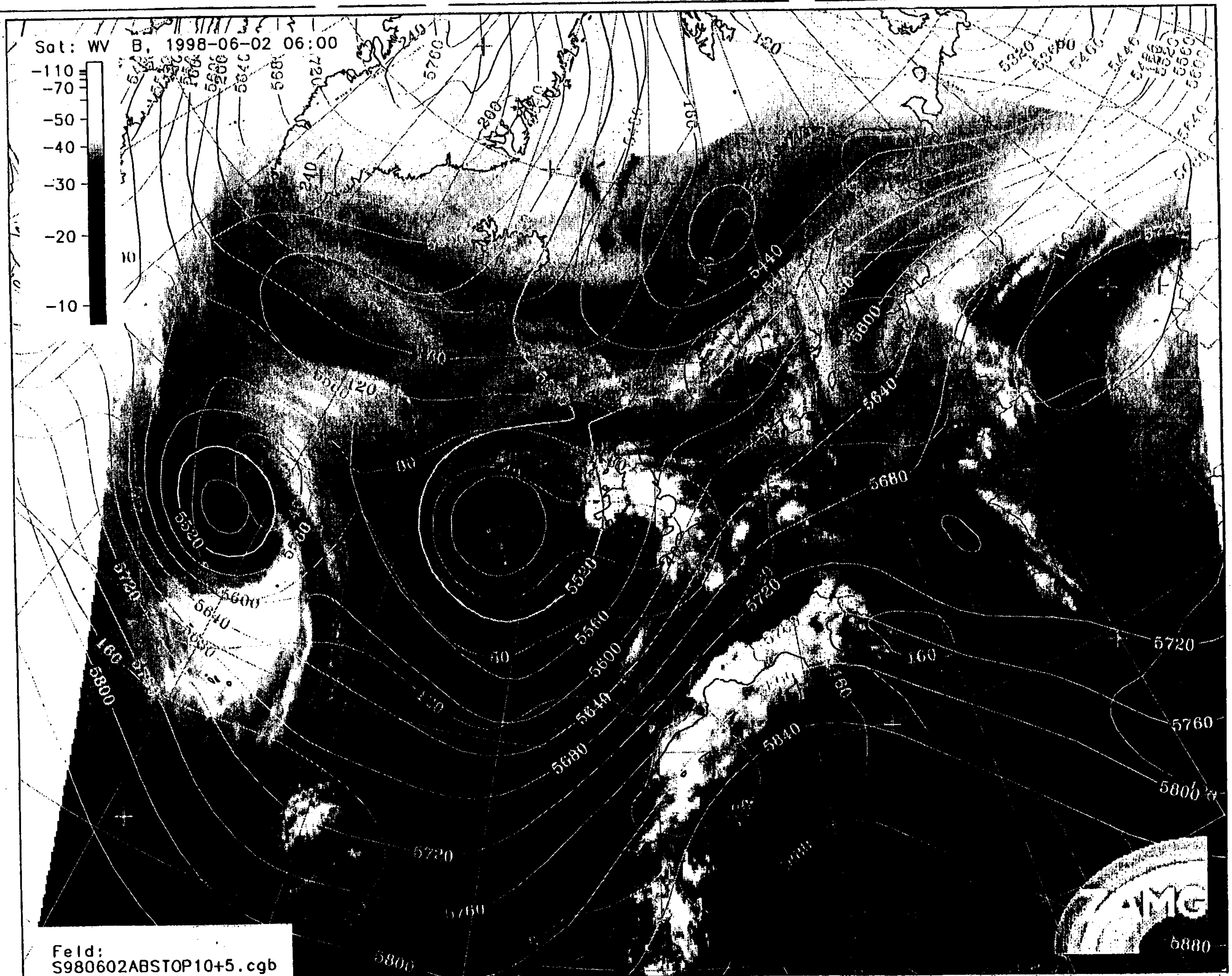
- Satellite report
- Use of derived quantities
- Atmospheric motion vectors
- Nowcasting
- Pointcasts
- Forecast images
- Verification of model output
- Vertical cross-sections

Fig. 1
Basic forecaster information of the satellite report (satrep)

Fig. 2
WV image overlapped by the fields of 1000 hPa and 500 hPa



MAVIS V0.7 Plot-Datum: 1998-06-02 05:48



MAVIS V0.7 Plot-Datum: 1998-06-02 07:06

This is a short memo of my presentation at the EGOWs-98 conference held in Norrköping.

By Tomas Vävargård SMHI Sweden

Automatic generation by the natural language method.

Background and motivation.

Meteorology have lately gained a lot in quality when it coms to predict weather parameters in time and space. We are now capable of automatic production of rather detailed weather information, this increases the demands of rational production methods for dissemination and presentation of the DMO post proceeded results.

Sometimes we tend to forget the particular advantages of the use of a natural language to present weather-forecasts. It is much easier to produce pictures and tables than fluent text and this might be the reason why we use very simple text or no text at all to fullfill the needs of our consumers.

But when we look back a few years we can notice that the products at the time did contain more fluent text then the products that are fabricated to day are. A study of the forecast-text reveals a rich information in a rather available and compact form. The problem is that it is too expensive to produce manmade text in the weather service today.

Attempt to a solution

We are now trying to solve this problem by producing fluent text automatically.
The approach can be described as follows:

First we have to plan the text. Then we convert the material to a interlingvistic representation. At the final part of the method we interpret the interlingvistical represented facts to certain languages and to certain styles of vocabularies. As a final touch to top it off we can connect the automatically produced text to speech-machines that can create a spoken representation of the information.

A more detailed description of the method.

The problem of fabricating fluent text can be split into three main subproblems:

What to say?
In what order to say it?
How to say it?
The first two questions are a part that is taking care of the planning of the text. The last question is a text-generator.

Planner.

The text-planner takes care of the problems what to say and in what order to say it.
To do this we use an expert system that match the actual weather situation and forecast to the demands of a certain customer. This results in a row of objects. The objects could be Wind, Temperature etc. The following part of the planner structures an order in-between the chosen objects and connects some objects to others, for instance a front can bring rain.

Converter.

The converter converts the result from the planner to an interface to a lingvistical representation. The step from C++ or delfi is made to prolog.

Text generator.

The text generator interpret the information to a machine-language information. This information includes all the grammatical and morfological information needed so that the text generator could match the information to most languages.

Results.

We have a system running where we use the text generator described above.
The system is called S2 and it delivers English and Swedish fluent textual aviation forecasts.
The forecast contains a weather overview as well as a surface and 3D detailed information that concerns VFR and IFR pilots planning to use the air space up to 4000 meters or 12500ft.
The information is used frequently by pilots and can be accessed both in a written version as well as in a spoken one.
The automatic text planner is not fully implemented in this system. It is working more as a semiautomatic text planner.
We first convert the NWP data to objects adequate to fullfill the need of the aviation customer. We are not yet able to produce all the needed objects fully automatically so with the means of a graphical interface the meteorologist can complete the set of objects.
The rest of the production cycle is done fully automatically as described above.

The METPRO Advantage

Marjan Sandev

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Czech Hydrometeorological Institute

EGOWS-98, Norrköping

8-12 June 1998

MD-325C 17

INTRODUCTION

In 1996, Czech Hydrometeorological Institute decided to buy a powerful meteorological data analyses and display system. The METPRO meteorological workstation provides a comprehensive set of programmes to analyse satellite and conventional data for both operational and research meteorology. The application programmes of the workstation analyse and integrate the data to create final weather satellite images and graphical maps and diagrams. These products can be customised to meet the needs of the particular site at which METPRO is installed.

The METPRO meteorological workstation is the result of the General Sciences Corporation's (GSC) extensive research and development efforts and of many years of software development in co-operation with the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA) in the United States of America. METPRO incorporates proved techniques and algorithms from the world's leading universities and research centres.

The METPRO is installed in several countries around the world, mainly in South America and Asia. The Czech Republic is the first state in Europe and now only one that disposes of this system.

UNIX WORKSTATION BASED SYSTEM

The minimum hardware requirements for the current version of METPRO are:

- IRIX workstation
- Console monitor (1024 x 1280)
- 32 megabytes memory and approximately 150 megabytes disk space (METPRO only)
- 24-bit color and Z buffer
- Graphics option
- Keyboard and mouse

The basic information about software installed on Silicon Graphics workstation are bellow.

- X Windows
- UNIX CGM/GKS graphics file format
- TCP/IP
- 95% of code hardware independent
- Modular design
- Applications/algorithms easily added/modified
- Distributed processing capability
- Structured language (C, FORTRAN 77, C++)
- On-Line Help Facility

MODES OF OPERATION

The METPRO workstation has three modes of operation to accommodate the requirements of operational and research environments and the user's level of expertise.

- The automated mode is the simplest mode of operation. In this mode products are automatically generated by the system immediately after input and transferred to the workstation data base. This mode is the most suitable to the operational environment where the user might have time to display pre-generated products only.
- The semi-automated mode allows the user to generate his/her own set of products in a relatively quick way. In this mode, the user operates his/her own METPRO script file to create a product. The product can be stored in the user's data base for future access.
- The interactive mode allows the user to generate products or their components by running applications interactively. The interactive mode provides two different interfaces.
  - The Advanced Interface which provides expert users a high degree of control over the product generation.
  - The Operational Interface which provides all users simply using access to complex of all METPRO tasks.

METPRO SYSTEM DATA FLOW

The data flow for a complete METPRO system is illustrated in the next figure.

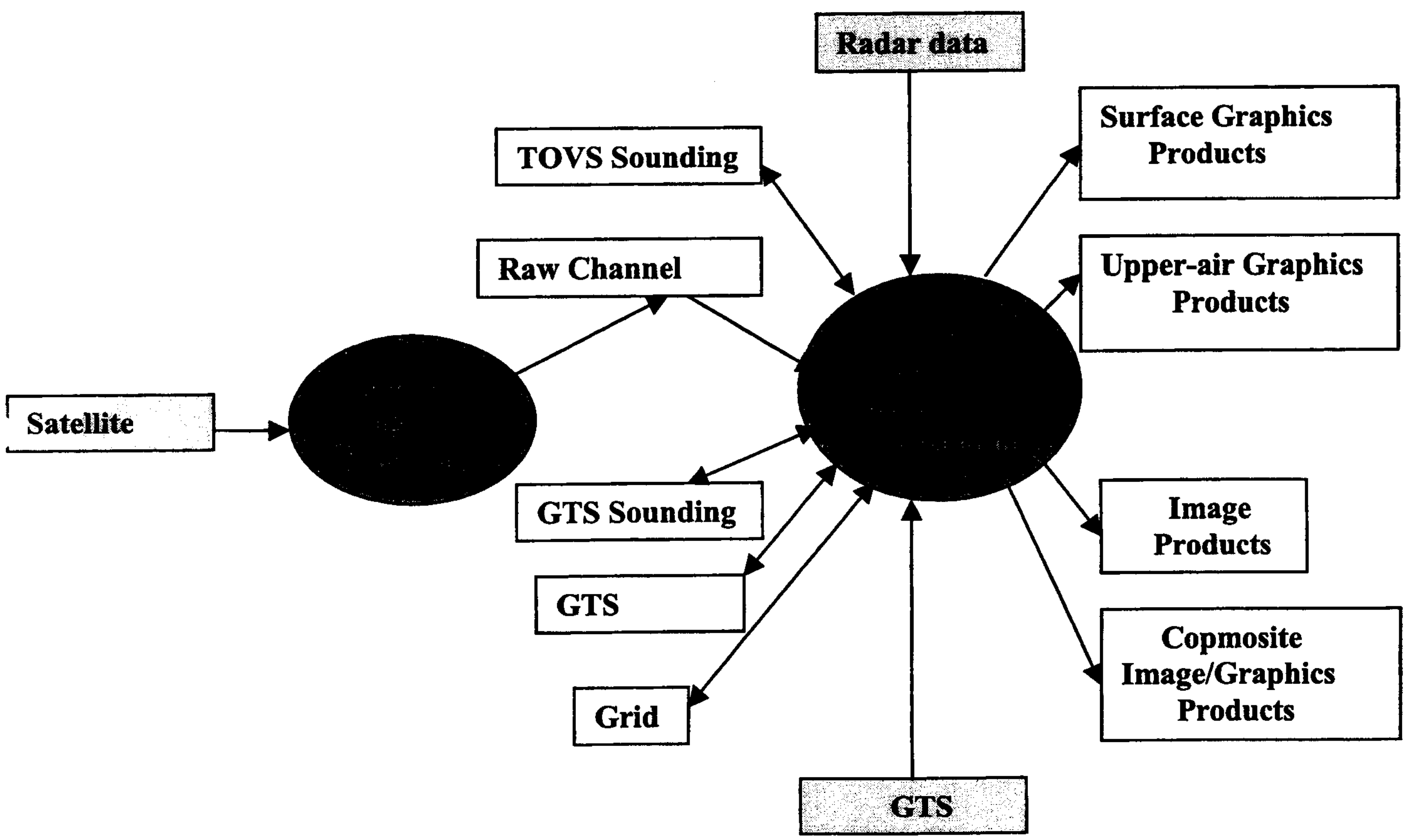


Fig.1 METPRO system data flow

GENERAL FUNCTIONS

The general functions allow to work with pages. These programme create, load, save toggle, print, delete, and loop METPRO pages and their components. The general function pulldown menu provides a quick access to some frequently used applications, as well as an access to some general products and file manipulation applications. In the METPRO workstation we can meet with the following general functions:

- Load Page/graphics
- Create New page
- View pages
- Zoom/Pan
- Loop pages
- Save graphics/images/PC product
- Toggle area of interest/graphics/image
- Delete area of interest/graphics/image
- Print product

OBSERVATIONS DATA BASE

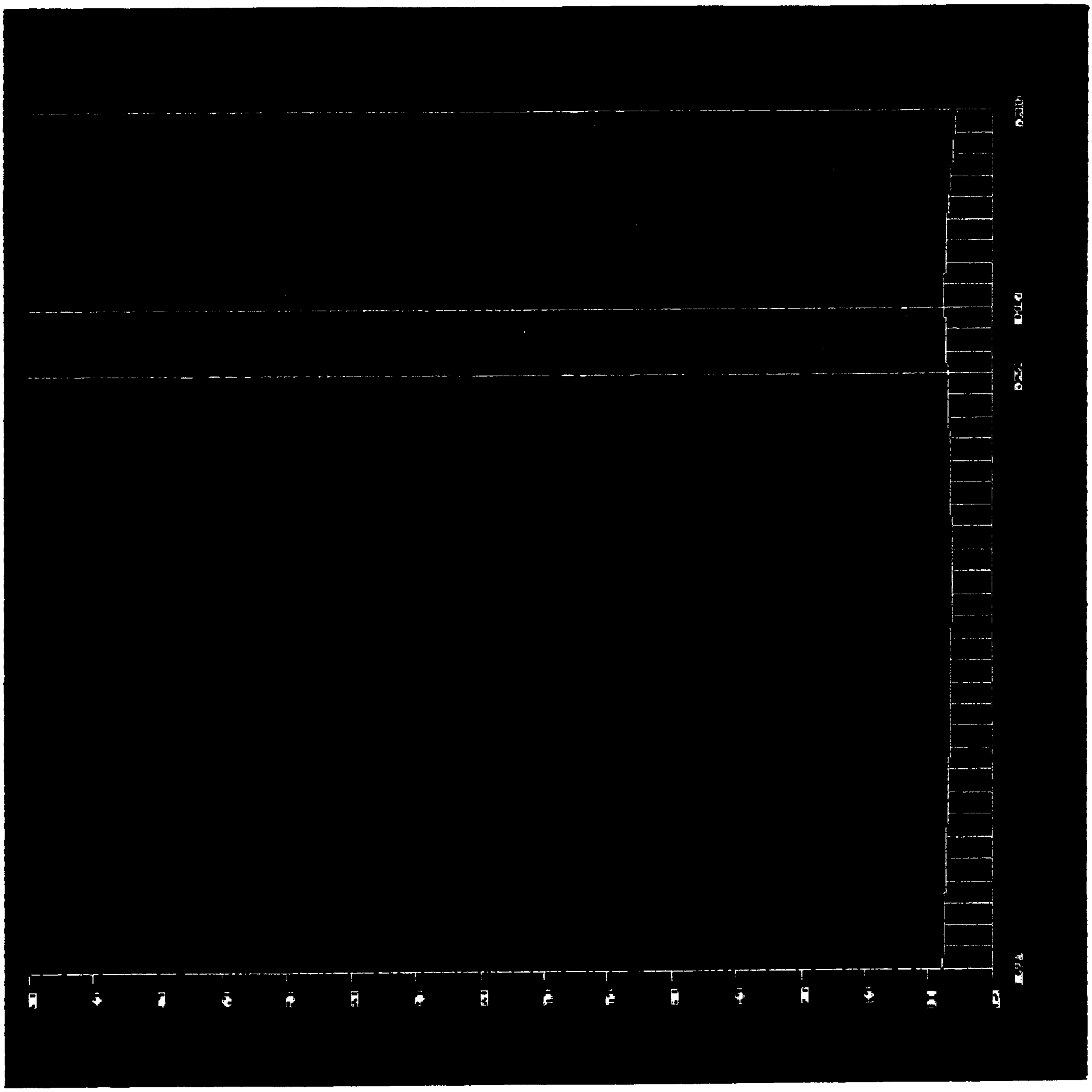
The Metpro GTS data system is a set of programmes designed to collect and decode meteorological data provided by the WMO GTS data circuit. The data are then converted into the format for a convenient manipulation and display on the METPRO workstation. METPRO image files and conventional data files are stored in a common area so that all users can access them. When new data becomes available on the real-time ingest system, the software automatically copies the data to special data directory on the workstation. Data in this directory follow a specific directory structure. Subdirectories are created according to the data ingest date, time, instrument and sector.

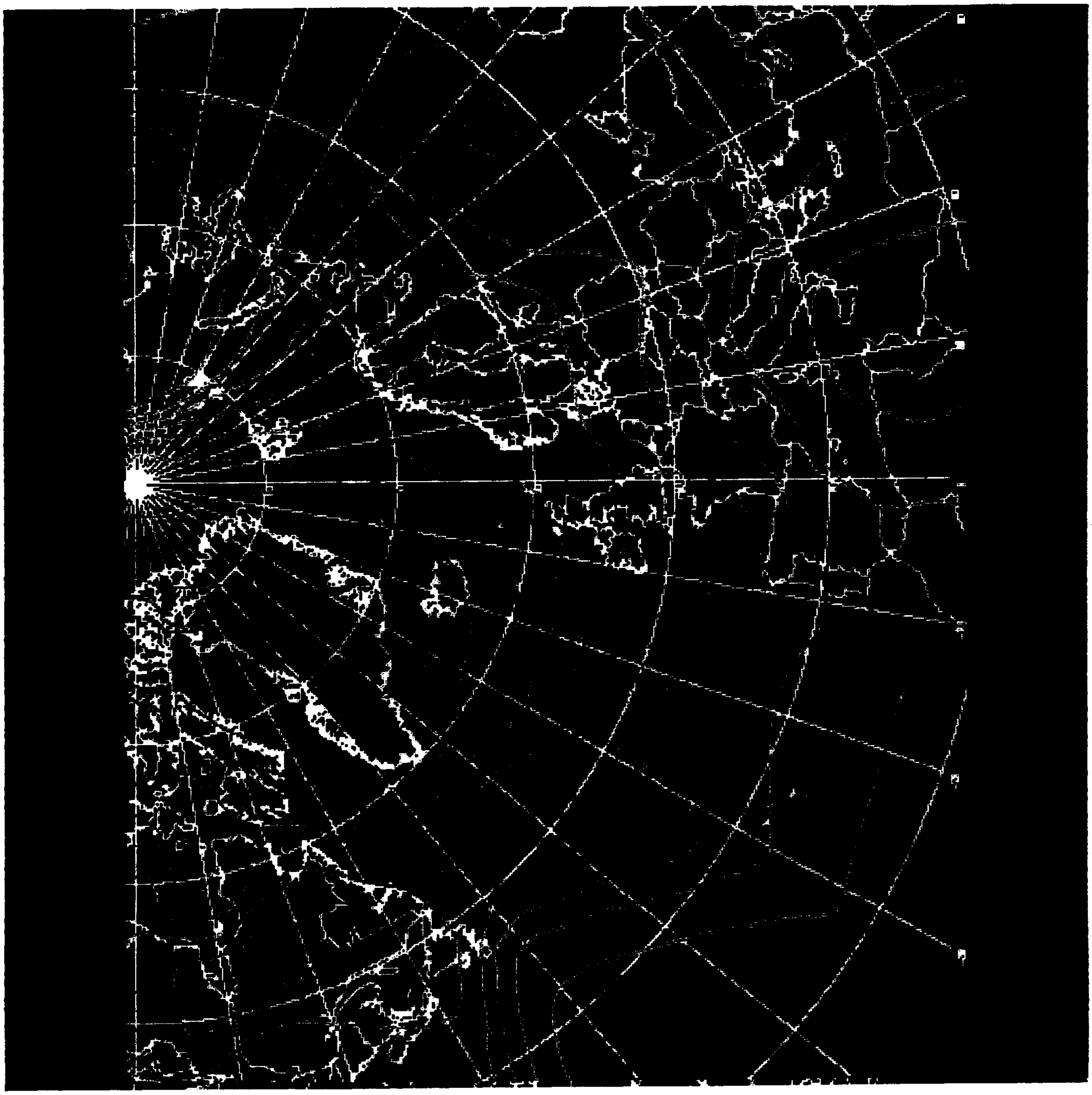
The observation data base programmes list, edit and delete alphanumeric data stored in the METPRO data base. The alphanumerical data in the METPRO data base include GTS surface (synoptic, meter, ship, drifting bouys, and airep data), sounding, grid, and text data as well as alphanumeric data from non-GTS sources for example lightning data.

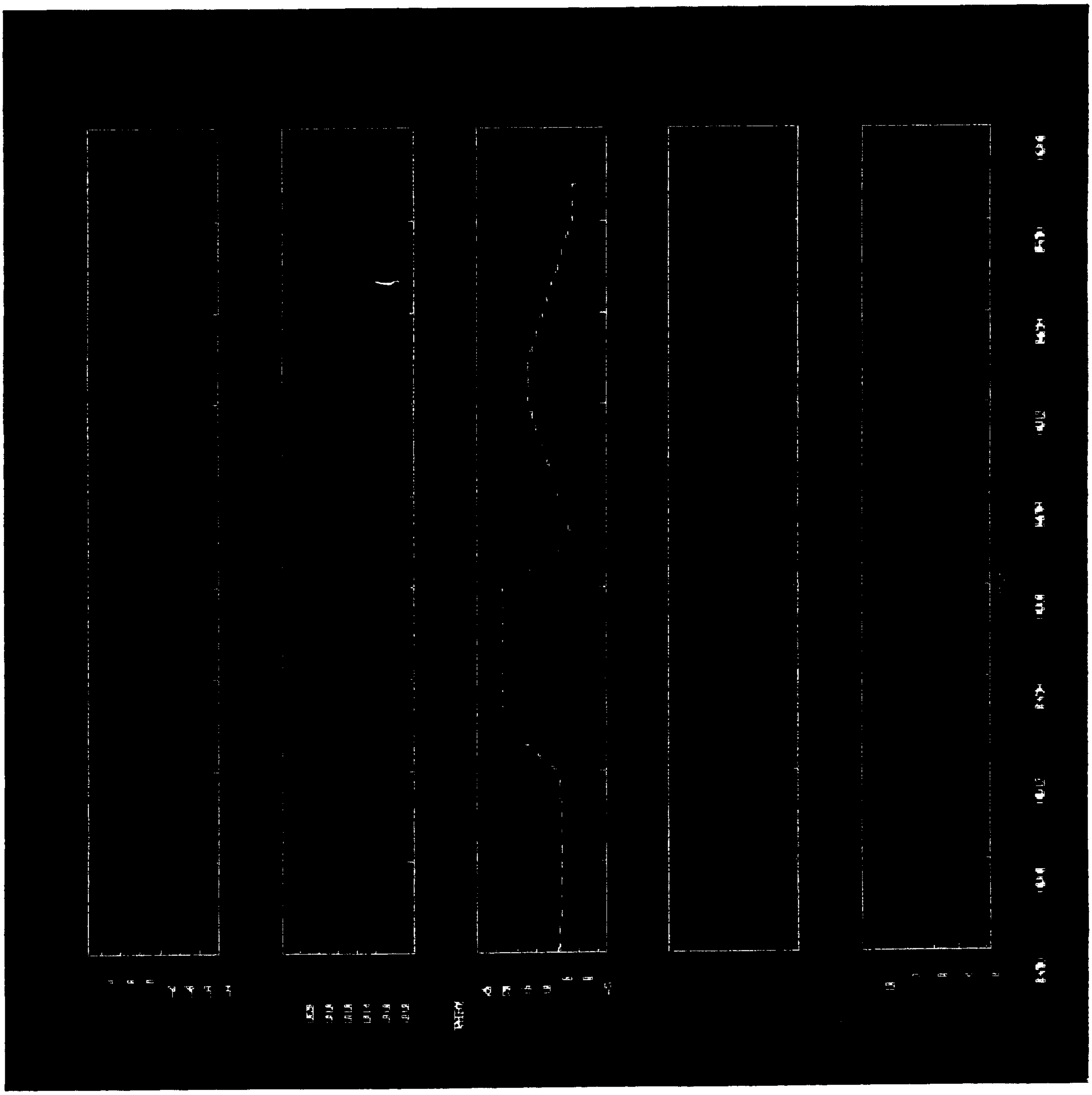
GRAPHICS FUNCTIONS

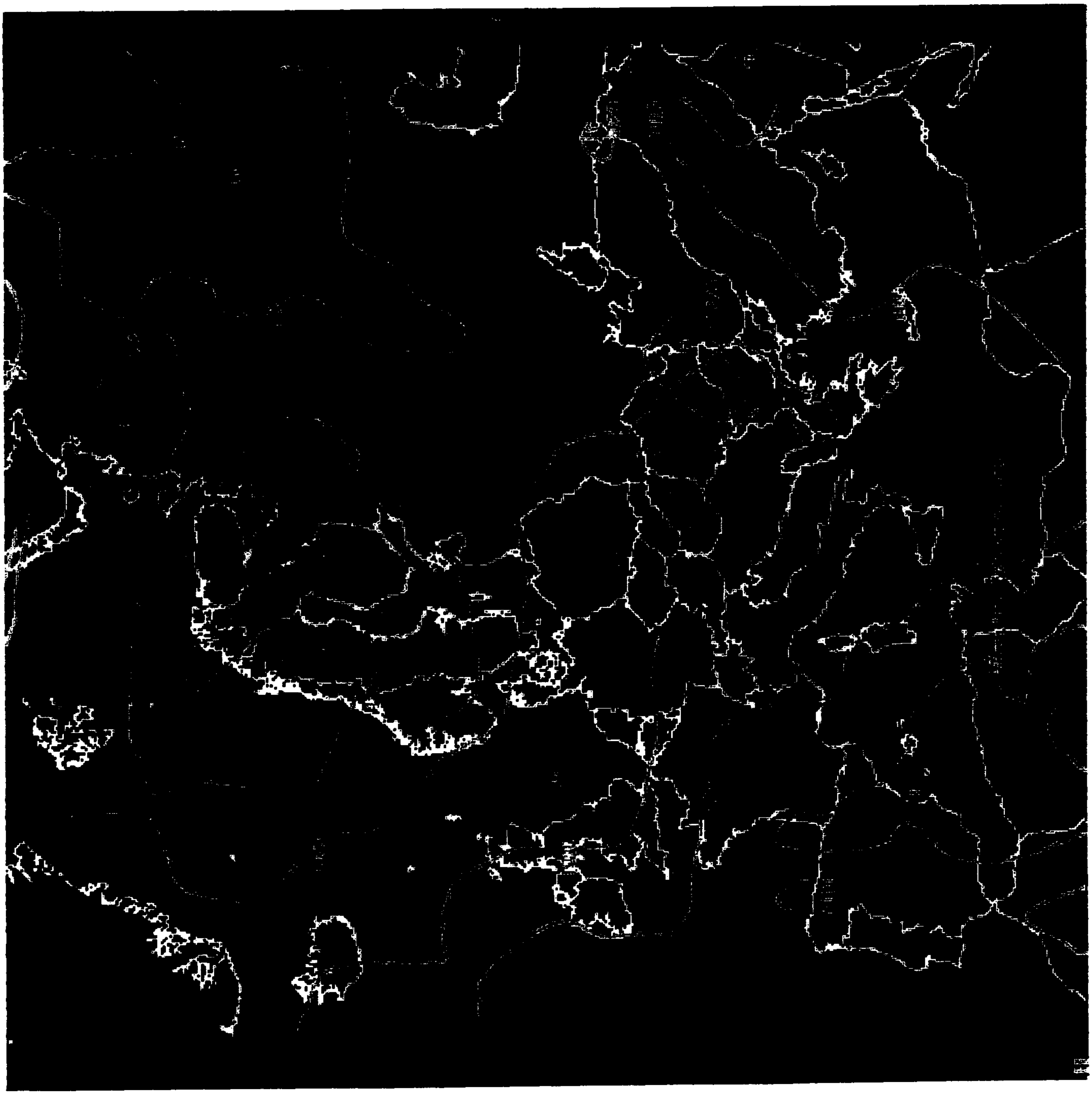
The graphics product programmes create surface and sounding maps, and plot sounding diagrams, cross sections and time series. This programmes plot observational and forecast data, draw contours or streamlines, political and latitude/longitude maps on navigable pages. They also include graphics editing tools which enable a user to draw customised graphics on pre-existing product. The basic function of the graphics editing program are:

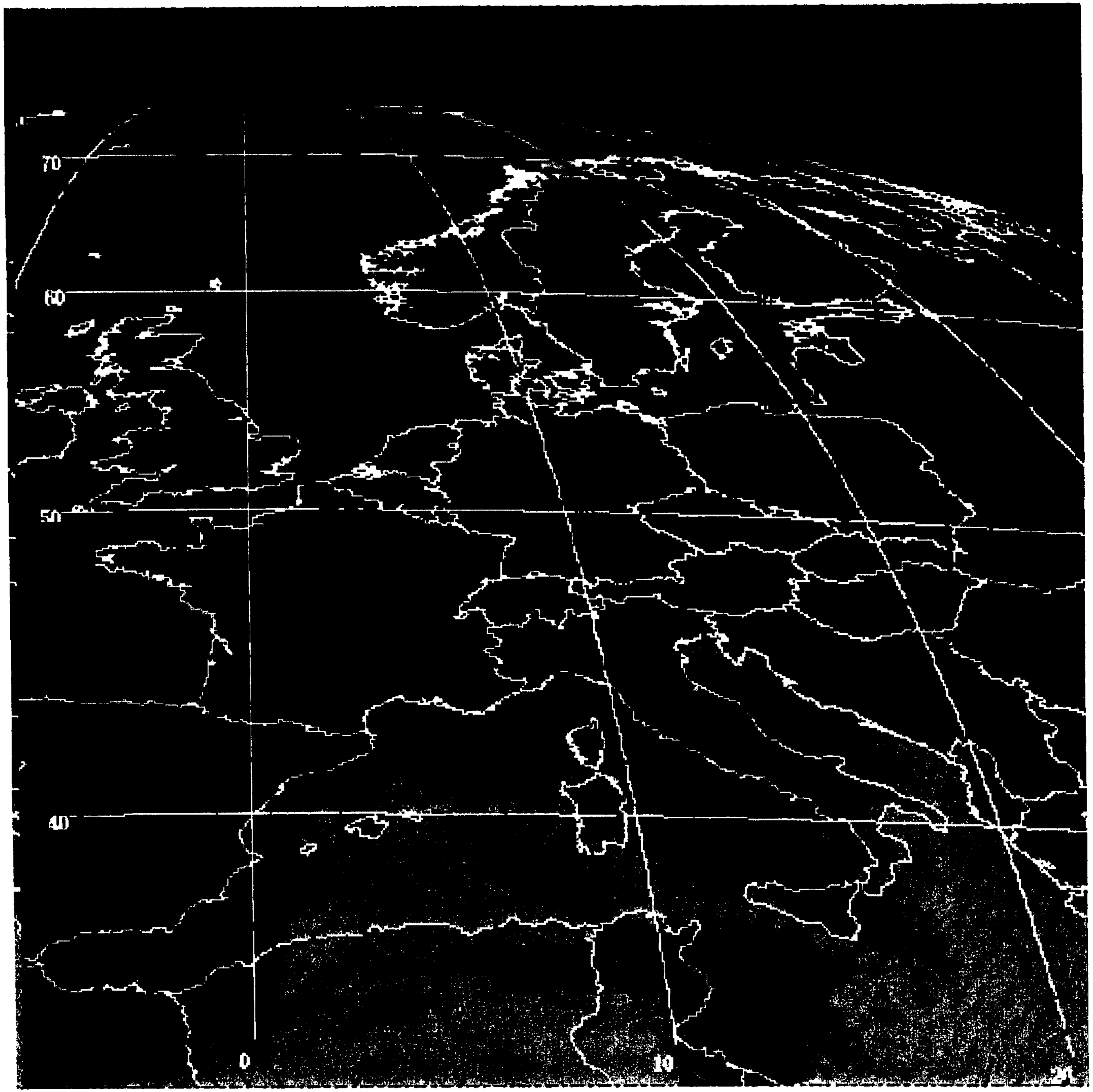
- Plot text
- Plot weather symbols
- Draw freehand
- Draw filled polygon
- Draw weather fronts
- Shift graphics
- Engrave graphics










70
60
50
40
0
10
20

The Graphic Tools for visualisation NWP data at CFO

Oldřich Španiel
Slovak Hydrometeorological Institute

NCAR & VIS5D

9th EGOWS Meeting, Norrkoping, 08-11 June 1998

NCAR Graphic package

History of NCAR Graphics

NCAR Graphics is a registered trademark of the University Corporation for Atmospheric Research.

1960 - The NCAR Graphics package has been evolving since its inception in the early 1960s as a collection of low-level FORTRAN routines for drawing simple graphical elements on the output devices of that era.

1970 - In the 1970s, NCAR scientists and Scientific Computing Division staff developed higher-level graphics utilities which were integrated into a package that could be distributed throughout the scientific community. Portability was enhanced as the utilities generated an output metafile to achieve device independence.

1980 - In the 1980s, still more functionality was added, and the whole package was brought into conformance with the graphics and programming language standards that emerged at that time. In late 1986, the updated set of the NCAR Graphics utilities was converted to FORTRAN 77, the metafile was based upon a private encoding of the Computer Graphics Metafile (CGM) standard instead of the early home-grown metafile format, and the utilities were moved to the Graphical Kernel System (GKS) standard. This standards-conforming package has been distributed to about 1000 sites worldwide.

1990 - In the 1990s, the functionality of NCAR Graphics has been growing, both from the expanded power provided by GKS and from the addition of new utilities. With the release of NCAR Graphics Version 3.2 in 1993, a second programmatic interface was added: C program bindings were included for all calls to all utilities. NCAR Graphics is widely viewed as a mature two-dimensional visualisation package.

New interfaces for the future

The traditional FORTRAN interface to NCAR Graphics can be difficult to use.

The various utilities were developed by numerous people through many years.

The NCAR Graphics Group is now focusing its efforts on improving the user interface.
The three new interfaces are being developed:

- ***High Level Utilities (HLUs)***
- ***NCAR Command Language (NCL)***
- ***Graphical User Interface (GUI)***

The significant difference is that two new interfaces are partially implemented for a subset of the NCAR Graphics functionality. The High Level Utilities (HLUs) and the NCAR Command Language (NCL) are the beginnings of a consistent visualisation model for all of NCAR Graphics.
The Graphical User Interface (GUI) is being released as an unsupported prototype at Version 4.0.
In future releases, all NCAR Graphics functionality will be accessible through all three new interfaces.
There will be included functions as viewing and editing metafiles, creating animations, converting between raster formats, resizing and compressing raster images, and zooming on images.

NCAR Graphics produces output files - ***PostScript*** and ***Computer Graphics Metafile*** (CGM).

List of supported UNIX platforms

Architecture	Operating System
Cray Y-MP/J90*	UNICOS 8.0
Digital Equipment Alpha	Digital Unix 3.2
Digital Equipment DECstation	Ultrix 4.4
HP9000 Series 700	HP-UX 10.01
IBM RISC System/6000	AIX 4.1
Silicon Graphics R4 systems	IRIX 5.3
Sun-4 series	Solaris 2.4/2.5
Sun-4 series	SunOS 4.1 (using Version 3.x of Sun's Fortran and ANSI C compilers)

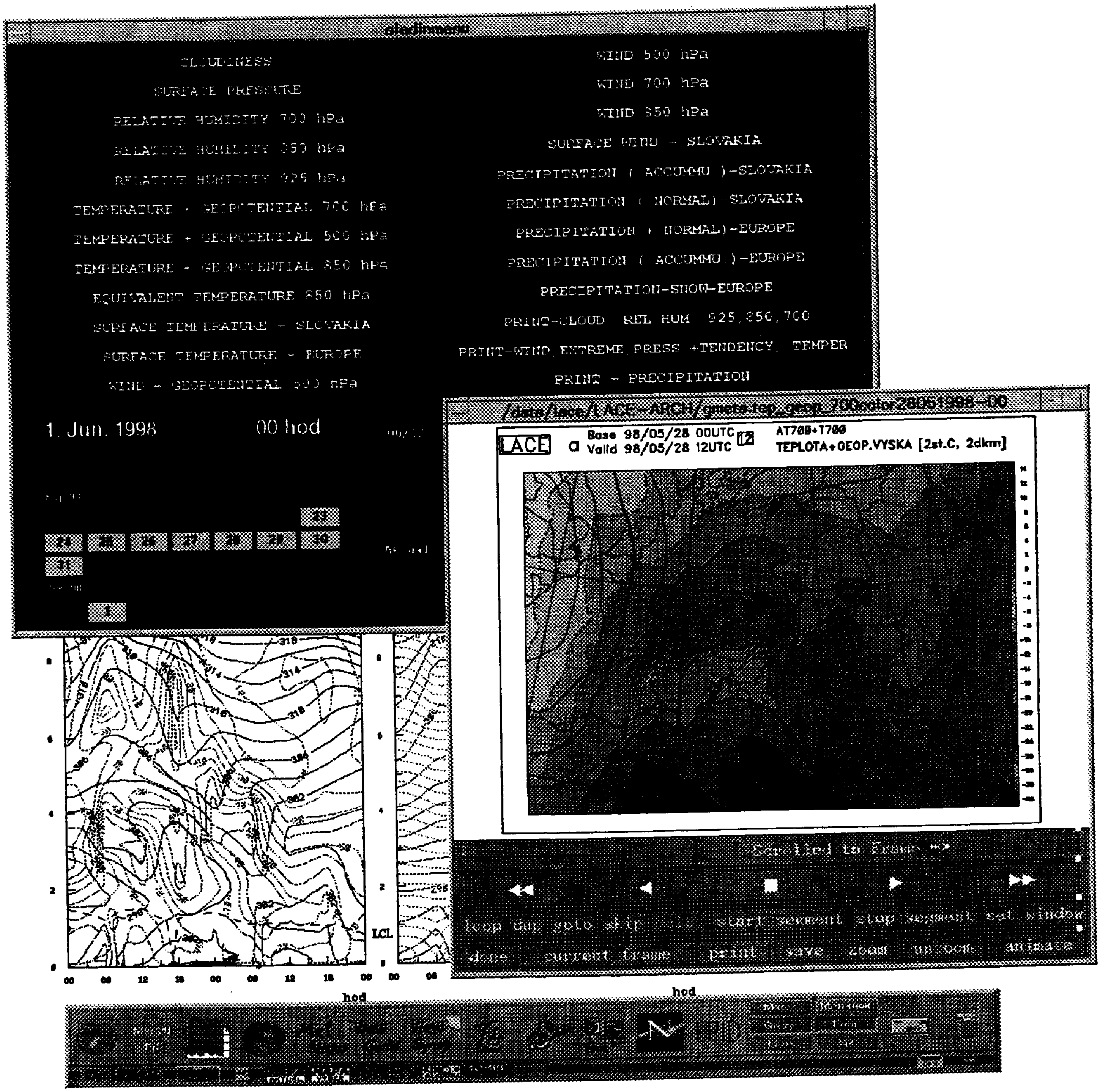
At framework ALADIN/LACE - visualisation environment based on NCAR graphic package for visualisation numerical prediction fields.

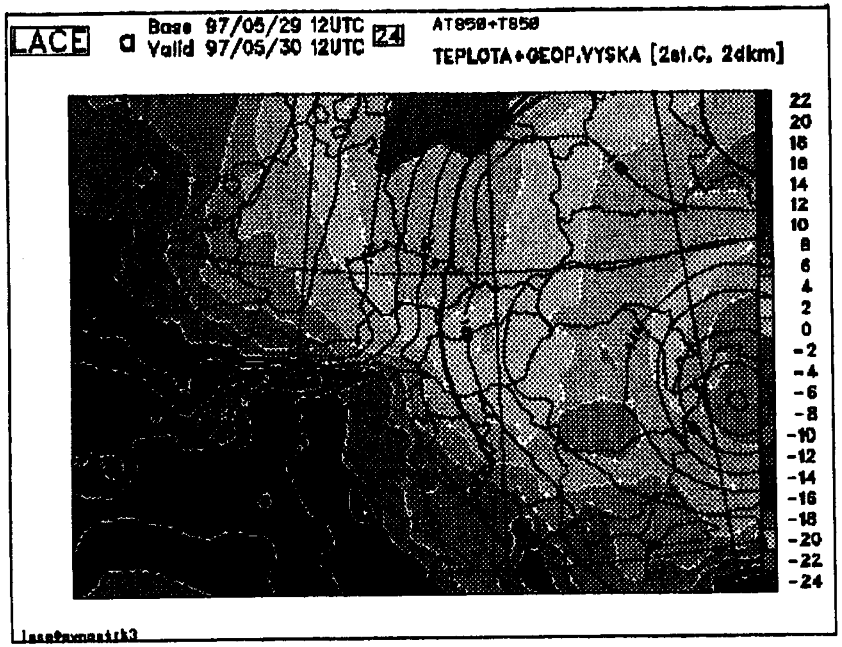
ALADIN/LACE model - grib files

visualisation on screen

charts for printing

NCAR - output data from NWP model




LACE
Base 97/05/29 12UTC
Valid 97/05/30 12UTC
24
AT850+T850
TEPLOTA+GEOP.VYSKA [2st.C, 2dkm]
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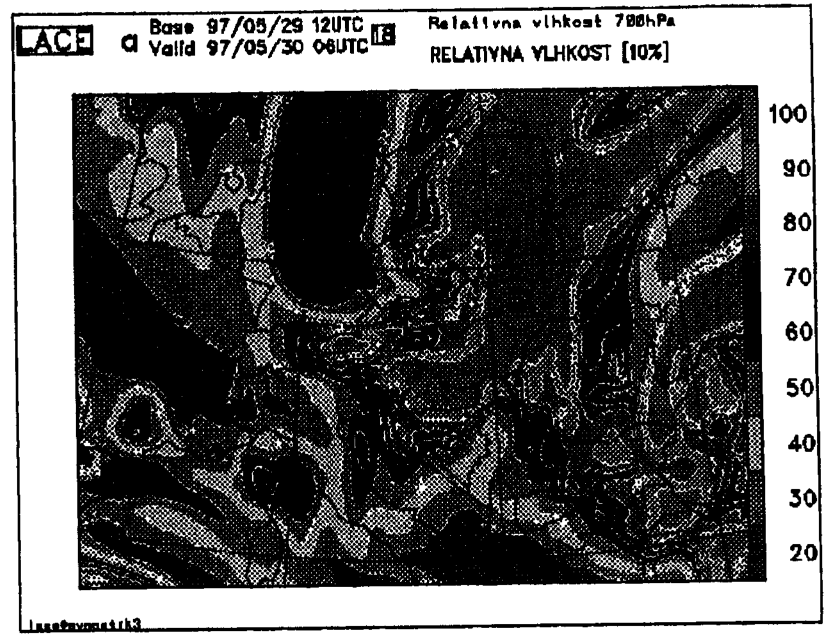
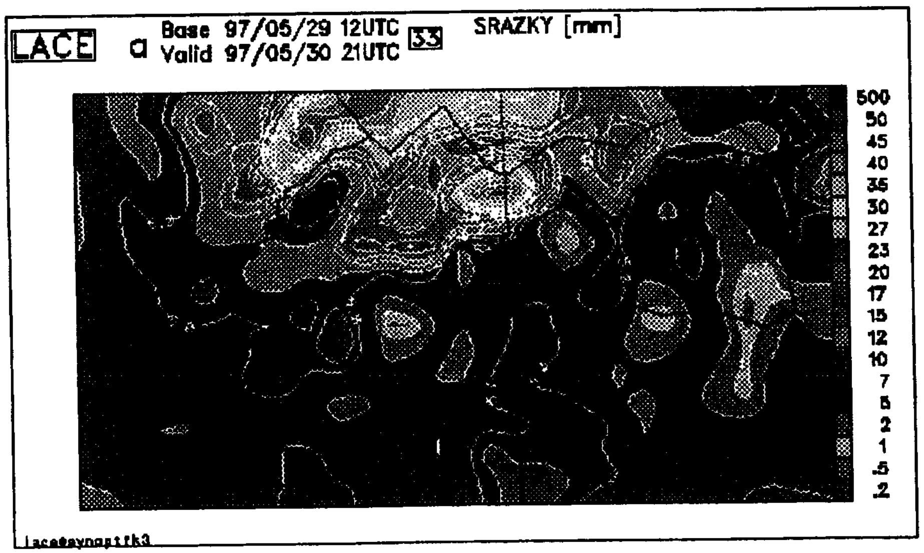
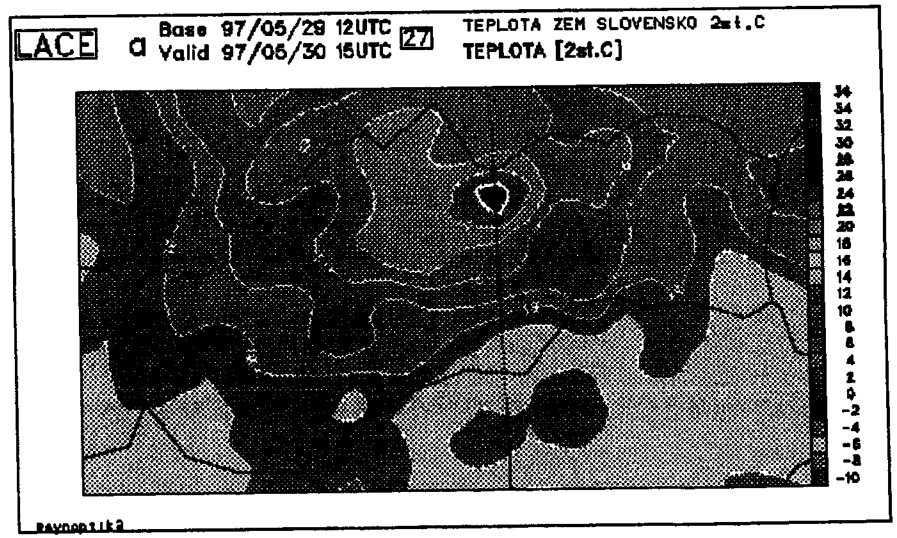
lace@synoptik3


LACE
Base 97/05/29 12UTC
Valid 97/05/30 06UTC
18
Relativna vlhkost 700hPa
RELATIVNA VLHKOST [10%]
100 90 80 70 60 50 40 30 20
lace@synoptik3


LACE
Base 97/05/29 12UTC
Valid 97/05/30 21UTC
33
SRAZKY [mm]
500 50 45 40 35 30 27 23 20 17 15 12 10 7 5 2 1 .5 .2
lace@synoptik3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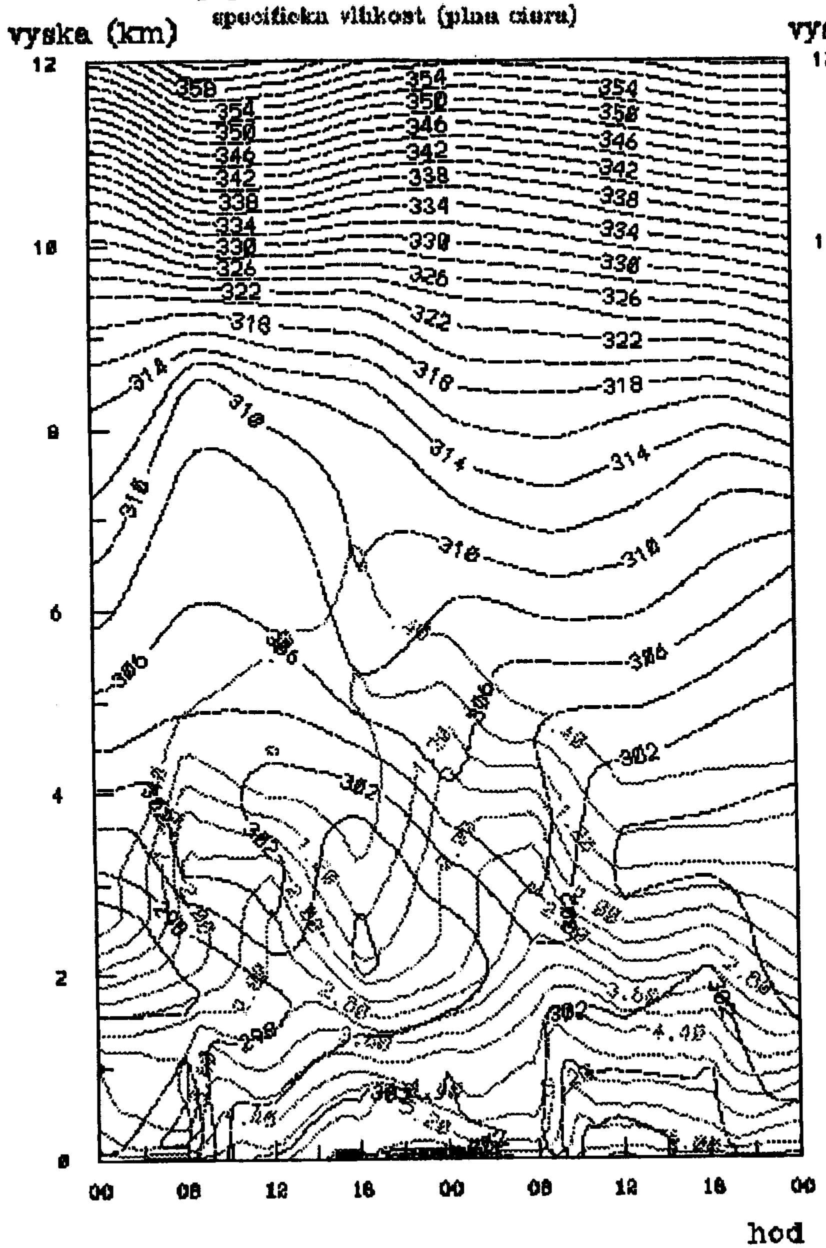
Base 97/05/29 12UTC
Valid 97/05/30 15UTC
27
TEPLOTA ZEM SLOVENSKO 2st.C
TEPLOTA [2st.C]
synoptik3

HRID COMPOSITE TIME CROSS-SECTION

Bratislava 26 May 1997 00 UTC+48

Forecast ALADIN

equipotencialna teplota (ciarkovane)
specificka vlhkost (plna ciara)

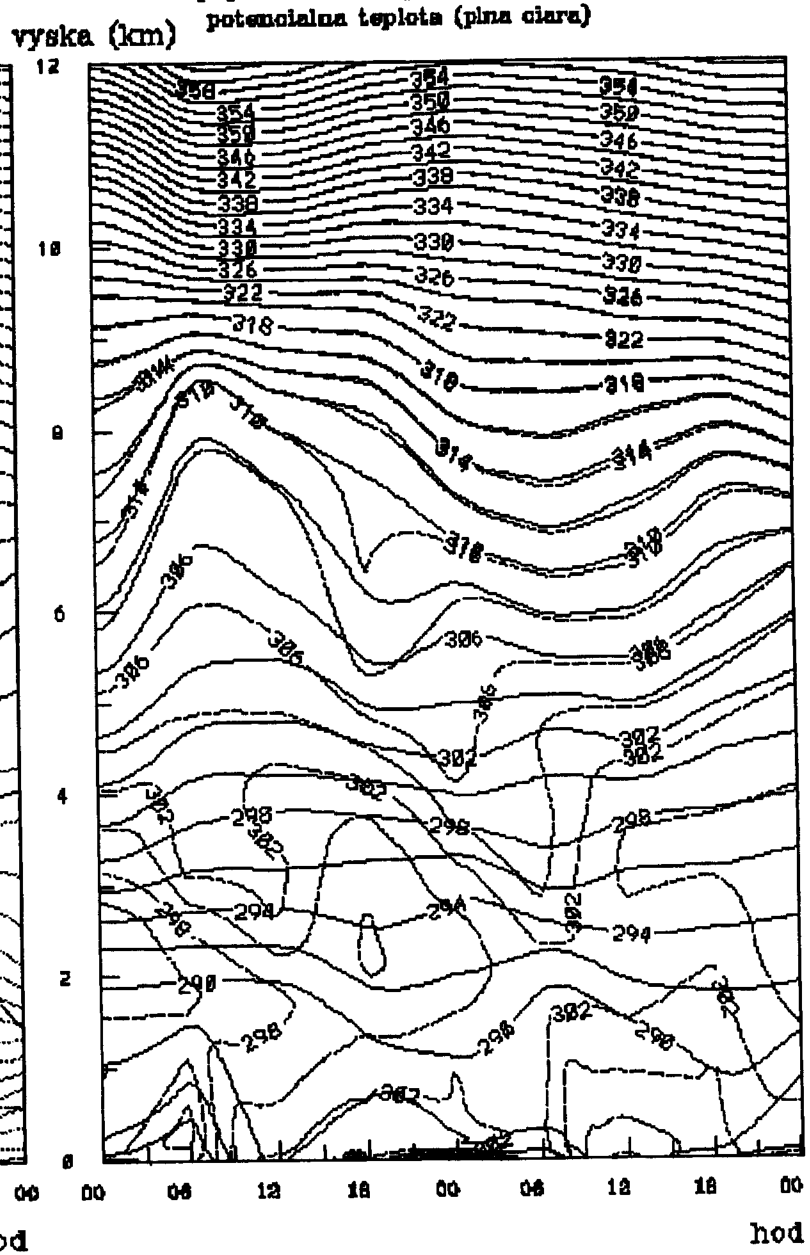


HRID COMPOSITE TIME CROSS-SECTION

Bratislava 26 May 1997 00 UTC+48

Forecast ALADIN

equipotencialna teplota (ciarkovane)
potencialna teplota (plna ciara)



VIS5D

Vis5D is a system for interactive visualisation of large 5-D gridded data sets such as those produced by numerical weather models.

isosurfaces
contour line slices
coloured slices
volume renderings

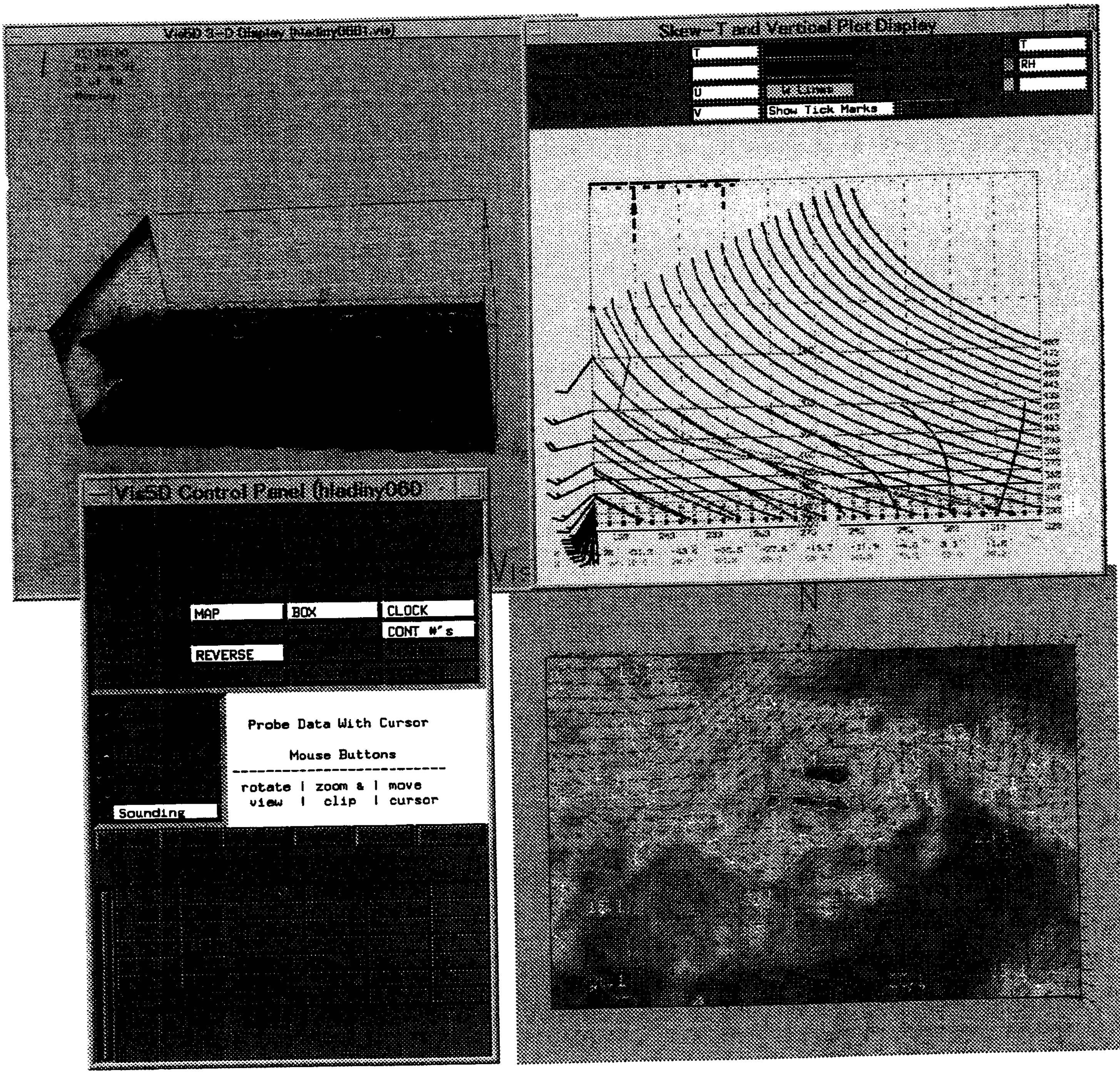
rotate and animate the images in real time

wind trajectory tracing
sounding
text annotations for publications,
support for interactive data analysis

„The Visualisation Project at the Space Science and Engineering Centre (SSEC) of the University of Wisconsin-Madison focuses on making advanced visualisation techniques useful to scientists in their daily work. They accomplish this goal by making two scientific visualisation systems, named Vis5D and VisAD, freely available over the Internet, and by using these systems as testbeds for exploring and evaluating new techniques.
The Vis5D system is very widely used by scientists to visualise the output of their numerical simulations of the Earth's atmosphere and oceans. „

ALADIN/LACE products from Toulouse in grib form
LBC
ALADIN/LACE - resolution about 15 km
WS version ALADIN/LACE - 7 km
VIS5D for interactive visualisation of model output

VIS5D - output data from NWP model



Session 3 - Recent Developments/End User Production

RiPP – Forecast production system at SMHI

Håkan Carlsson

This is a short overview describing the prerequisites of the project and the resulting system design. The prerequisites consist of the guiding vision for the new production flow and some technical requirements. The system is described by its main building blocks and the underlying technical ideas.

Vision

The current meteorological production at SMHI is divided between the central forecasting office and the end user production units. The central forecasting office supervises the weather development and issue hand made forecast based on NWP, radar, satellite's etc. The end user production is mainly manual and based on the central forecasts and the same sources as the central forecasters use. Obviously forecasters in different positions do and redo the same work for most products.

RiPP is based on the belief that the numerical forecasts can be used for more or less automatic end user production. In those cases when the numerical forecasts aren't good enough they should be corrected centrally to avoid the same work being done more then once.

There will still be a need for two different positions for forecasters, Central Production and End User Production. The central forecaster will interact directly with the numerical information and the end production forecaster will correct details that the central forecaster miss and add information that can't be generated automatically from numerical information.

Technical requirements

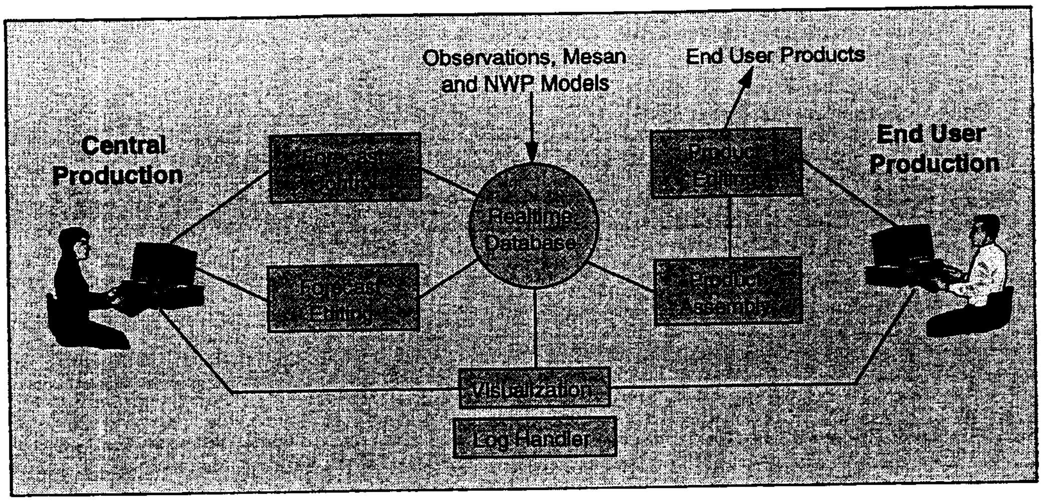
Besides the vision there are a number of technical requirements and functional requirements with technical implication that has influenced the system design.

- SMHI is geographically divided. The system will be used from different geographical locations. It is impossible to tell where a certain task will be performed and it must be easy to move production to another location.
- SMHI is trying to keep the connection between a system and its platform as loos as possible.
- SMHI has and will continue to have different platforms in parallel use. The systems must be able to operate over mixed platforms.
- SMHI is trying to use standard components as far as possible.
- It must be easy to define products.

The system

The system is designed as a number of subsystems with clearly defined purposes. All subsystems are centred around a database containing all NWP models and all observations. The database is not a part of the RiPP project/system but is a separate project.

The system is built around the two types of meteorological positions. Central Production and End User Production. Each position is supported by appropriate RiPP subsystems. Central Production is mainly supported by two subsystems, Forecast Control and Forecast Editing. Forecast Control is used to select information from the numerical models into RiPP forecast database, which is a separate part of the central database where the information is kept in grid format. Product Editing is used to graphically correct information in the forecast database. End User Production is also supported by two subsystems, Product Assembly and Product Editing. Product Assembly automatically generates end user products from the information in the forecast database. Product Editing is used to edit the actual products. A fifth subsystem, Visualisation, is available from both positions.



The flow through the system is as follows:

- Information from the numerical models and observations are continuously loaded into the central database.
- Forecasters in the Central Production position selects and combines information from the models and load it into the RiPP forecast database. If needed the information is edited.
- End user products are then generated automatically from the forecast database.
- Forecasters in the End User Production position supervise and edit the products before they are sent to the users.

Technical Architecture

Here the main architectural decisions are summarised.

- The system is a n-tire client/server system with thin clients based on intranet and Corba. All computing power is centralized and thin Java clients are downloaded to the individual workstations (PC or whatever). The clients request services from the central system components. By separating the clients from the servers the geographical limitations are overcome. At the same time all maintenance is centralized.
- The system is built with distributed platform "independent" components. Products based on the Corba standard makes it possible to distribute components over the whole runtime environment practically without limitations in harware or operating systems. This gives possibilities to mix platforms within the system and and also balance the load between available hardware.
- The system is as far as possible built with object oriented languages and methods. This modernization of the development enhances the possibilities to build platform independent code. The possibility to to use standard components increase not least in the intranet area.
- Products are defined in ordinary HTML where all meteorological values are replaced with active corba components that at runtime communicate with the system and fill in temperatures, texts, symbols etc.

1 ▢ Workstation Systems at DWD

Dirk Heizenreder

EGOWS 08.-11.06.1998

2 ▢ Introduction

3 ▢ History

- 1987 Start of development
- 1990 IGS
- 1993 TriVis
- 1995 MAP
- 1997 Improvements (AGS, MOTIF)

4 ▢ IGS - recent developments

- Integration of MAP functionalities
- GUI redesign
  - Object oriented
  - Experience of the last years
- Integration of new work contents
  - Concept of nowcasting production
    - Interactive Production of warnings
    - Interactive editing of automated TAFs

5 ▢ TriVis - recent developments

- **New visualization techniques**
  - **3D high resolution terrain data with LoD**
  - **2D masks,smooth overlay of pixmaps**
  - **Cloud classification**
  - **Improved usability (faster rendering, GUI)**
- **Weather on demand (WxoD (R))**
  - **Interactive TriVis prepared for the Web**
  - **GUI WxoD**

6 ▢ Outlook

- GUI redesign
  - IGS
  - TriVis
- New model chain
  - LM (2...8 km)
  - GME (50 km)
- VISUAL

Recent Development of Forecasting and Production Tools in metAP (Swiss MWS)

P.Ambrosetti[1], D.Matter[2], S. Huber[2]

Swiss Meteorological Institute
[1]CH-6605 Locarno-Monti
[2]CH-8044 Zurich

EGOWS '98 Norrköping
Project metAP

Summary

In the last years all meteorological services saw a dramatic increase of the amount of data, both of observations and numerical model outputs, and the number of forecast products. Today weather services are able to forecast more parameters with increased time and space resolution for longer periods. Our customers require specially tailored products as cheap as possible (because of the competition with private forecast services). The bottleneck is the forecaster: He gets more and more data and he must produce more and more products , increasing the forecast quality at the same time.

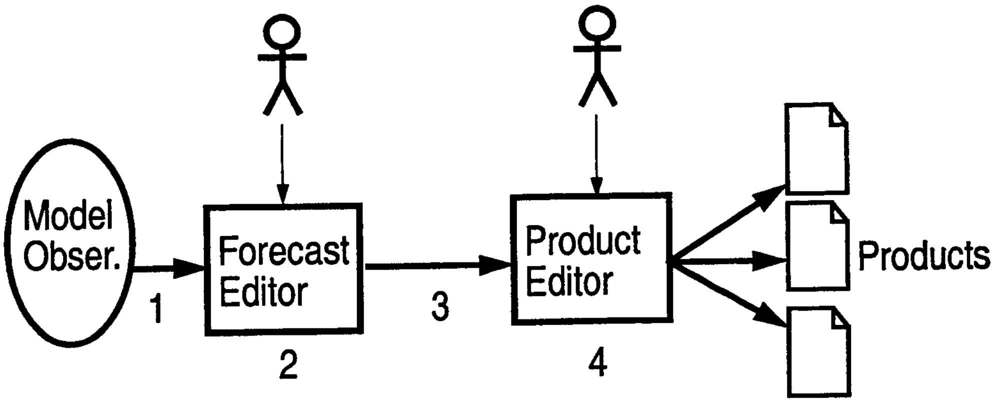
One first step towards a solution is to separate the forecasting step from the production step itself. IIn the forecasting step the forecaster uses a Forecast Editor to produce and modify weather elements which are stored in a database (Forecast DB). These elements will then be used during the production step. Going this way the same forecast can be used for several products avoiding a lot of repetitive work and assuring consistency among different products. This concept frees forecasters from preparing routine products and allows them to concentrate on studying the large amount of input data. Also the forecaster will be able to better issue severe weather warnings. A monitoring application on the Forecast DB may then compare the incoming weather observations to the current forecast. If they differ significantly an alert may be presented to the forecaster. Moreover the Forecast DB will support enhanced verification procedures.

Several weather services (both public and private) developed different approaches to fill Forecast DBs with data. We developed a "hybrid" approach, more suitable to our way of producing forecasts and using the large experience of our forecasters, who have detailled knowledge of the regional meteorological peculiarities.

The software was written in JAVA: we give here a brief description of our developing environmnet and of our experience with JAVA.

/proj/MAZ/metAP/doc/Work/Miscellaneous/Folien/98_Norrkoping/report_pam.doc
14.8.98

Forecast and Production Process



Steps:
1 Initialization of Forecast Data (Data Preprocessing)
2 Forecasting
3 Import Forecast Data (Postprocessing)
4 Production (Automatic/Manual)

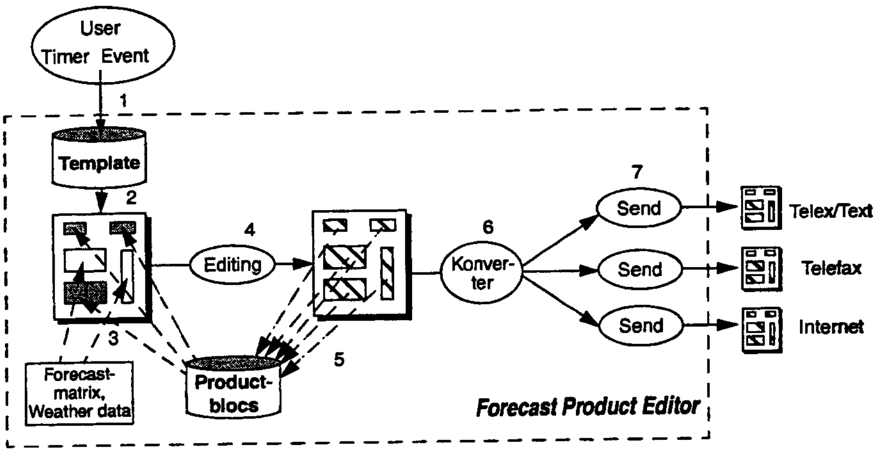
Forecast Product Editor features

- Workplan (direct choice of products)
- Template and Product Editor
- Text, Tables and Graphics Editor
- "Reusability" of forecast components (blocs)
- Direct link to Forecast DB
- Choice of Output Formats

Draw functionalities (Version 1.1)

- Layers capability
- Free movement of components (text and graphics)
- Front drawing
- Graphic editing
- Import/export of vector format files (dxf)
- Export of gif files (via ppm) with JDK 1.2 jpg

Forecast Product Editor functionality



Experiences

Internal "problems"

- requires powerful Workstation (SUN UltraSparc 2)
- time consuming for customer retrieval
- cost transparency (for commercial products)
- cost control (reduction of governement spending)
- production cost reduction (competition from private companies)

Trasmission Complexity

- New transmission formats (not just telex)
- New file format (-> HTML)
- Trasmission chain quit long
  (not all under control by the project team)

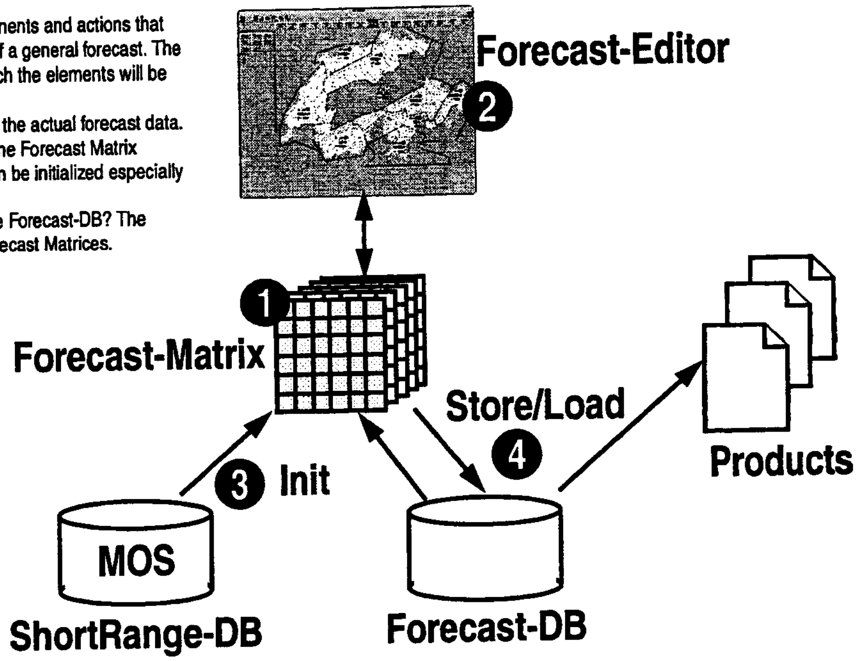
Custom oriented

- many customers are not flexible - > we have to be

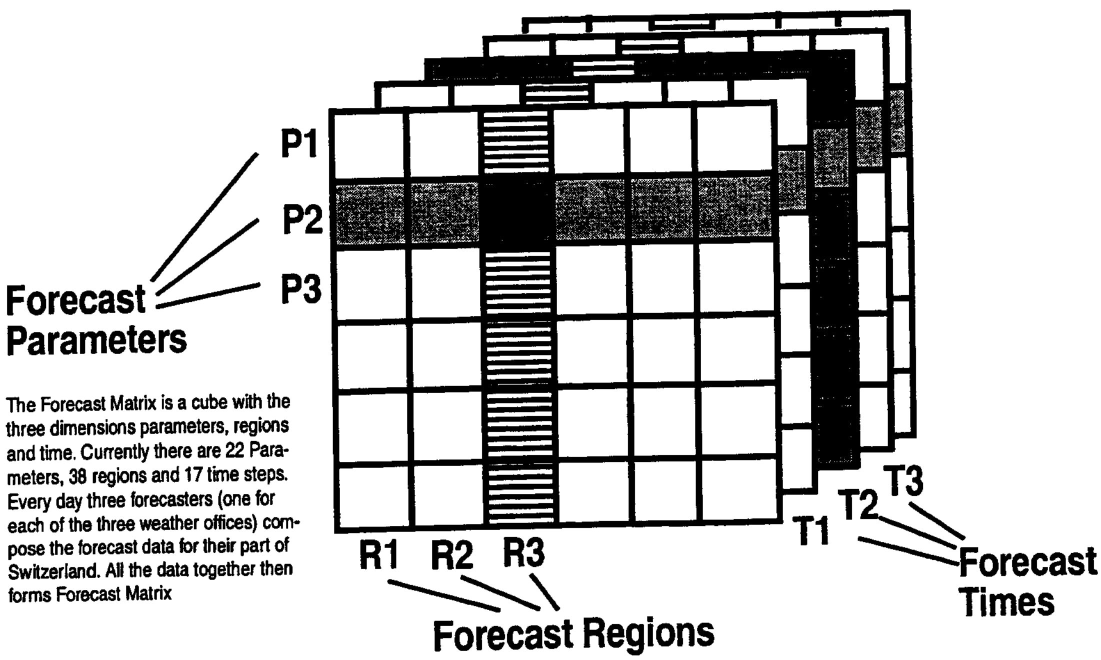
The Forecasting Environment

This diagram shows the components and actions that are involved in the generating of a general forecast. The numbers show the order in which the elements will be discussed on the next pages.

1 The Forecast Matrix contains the actual forecast data.
2 The Tool to edit the fields of the Forecast Matrix
3 Describes, how the Matrix can be initialized especially with MOS-Data
4 Who can store the data to the Forecast-DB? The managment of the different Forecast Matrices.



The Forecast Matrix



The Forecast Matrix is a cube with the three dimensions parameters, regions and time. Currently there are 22 Parameters, 38 regions and 17 time steps. Every day three forecasters (one for each of the three weather offices) compose the forecast data for their part of Switzerland. All the data together then forms Forecast Matrix

Forecast Parameters

Weather Parameter	Unit	Type
[illegible] at any altitude	[illegible]	one edit-able value for each region
[illegible] in the mountains	[illegible]	
Cloudiness	Classes	
Precipitation	Classes	
Probability of Precipitation	%	
Wind Direction	Sektors	
Wind Speed	Classes	
Significant Weather	Classes	
Lower limit of snow fall	m	
Upper limit of fog	**m**	**editable value for a group of regions**
Free air temperature (at 1, 2 ,3 ,4000m)	**°C**	
Free air wind direction (at 1, 2 ,3 ,4000m)	**Sektors**	
Free air wind speed (at 1, 2 ,3 ,4000m)	**Classes**	

Each weather office is responsible for the forecast for one part (or area) of the country. Each area contains several regions. Some parameters values may individually be assigned to the regions (to upper ones). The others may only be assigned once for the whole area i.e. for all regions.

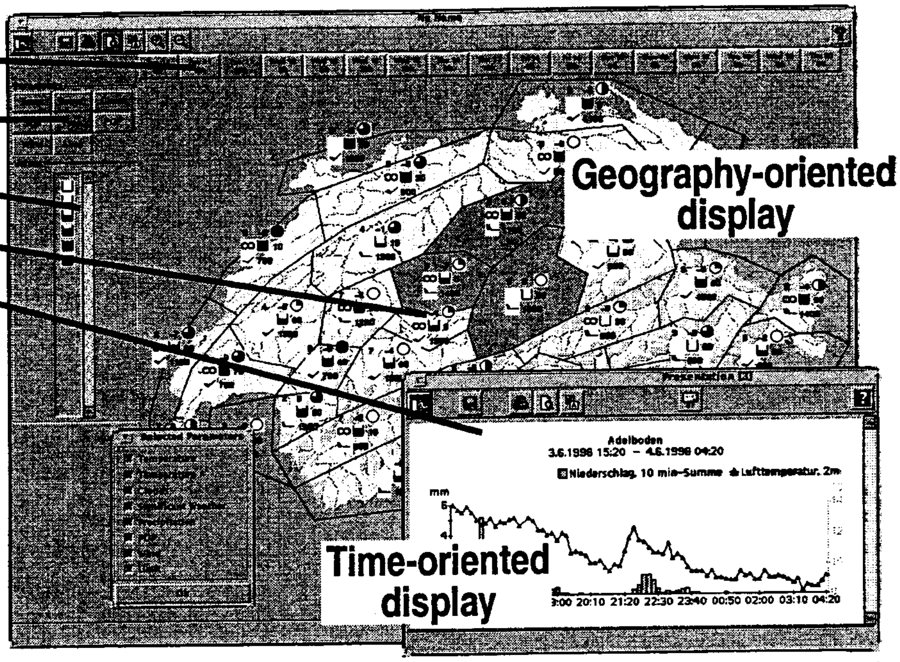
Regions and Times

Times (in hours)

Regions			[illegible]						medium range				extended medium range				
			6	12				48	60	72	84	96	120	144	168	192	216
Regions	East	E1															
		E2															
		E3															
		E4															
		E5															
		E6															
		E7															
		E8															
	West	W1															
		W2															

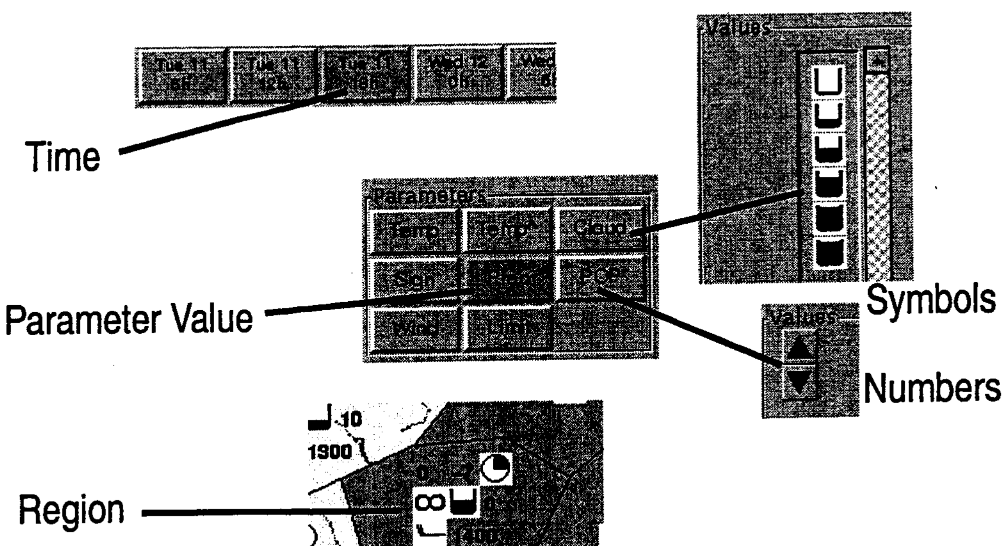
The resolution in time and space (i.e. regions) is reduced step by step from short range to medium and extended medium range because the predictability isn't the same for the whole time span..

Forecast Editor



Time Steps: by clicking a time button, the forecast values of the selected time step are shown
Parameters/Values: If a parameter is selected, the symbols belonging to that parameter type are displayed in the values section. If a parameter is has a number type then an up/down arrow button pair appears. Only the values of the selected parameter are changed by selecting values.
Regions: Only regions "belonging" to the own weather office are selecteable
Meteogram: Data of one or several regions and parameters may be displayed as meteograms over the whole time span.

Editable Fields



Description of these elements: see last page

Initialize Forecast Data

Times

There are many options in choosing the fields to be initialized: All three dimensions time, region and parameter are freely chooseable.

- actual timestep
- ranges (short 6-48, middle 60-96, extended middle 120-216)

Parameters and Regions

- selected, multiple/all

Sources

There are three possibilites for choosing a source:
1. the data of an old forecast matrix can be imported into the actual matrix
2. If a forecaster thinks the weather is going to stay the same like now, then observation data may be included
3. In most cases MOS data will be used for initializing

- Old Forecast Matrix (automatical)
- Persistence (i.e. observation)
- MOS (short range: SM, middle range: ECMWF)

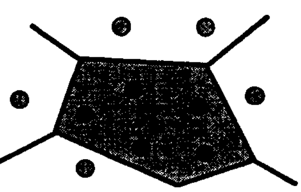
Initialize Forecast Data with MOS

Available Data

To check the quality of MOS data, in Switzerland the MOS is computed for the location of our meteo stations.

- 72 meteo stations with different locations
- MOS computes values for those 72 locations
  --> Problem: n stations in one forecast region

Several station, several values. Question: Which value which station should we take as reference for a region?



Reference Stations

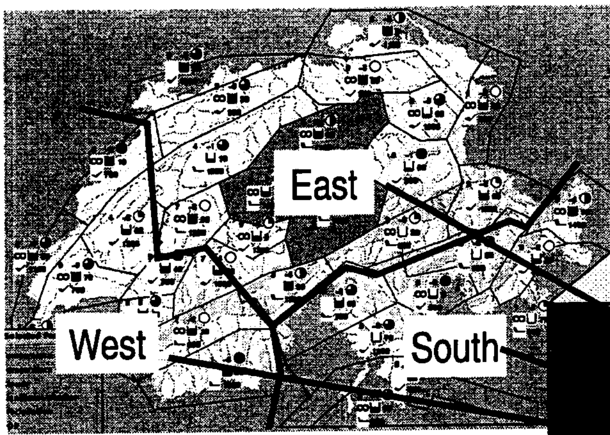
- define reference stations for each {region, parameter, time range}

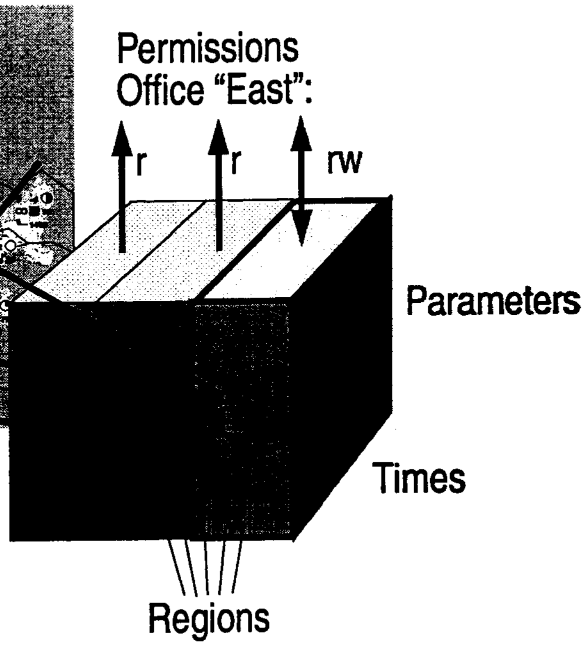
  example: short range

Region	Temp	Temp^	Cloud
W1	gve		gve
W2	puy		puy
W3	alg	mls	alg

A reference station is defined for each region, parameter and time step. So the values are consistent. Another profit is that later their quality may be checked by comparing the forecast value by the observered value.

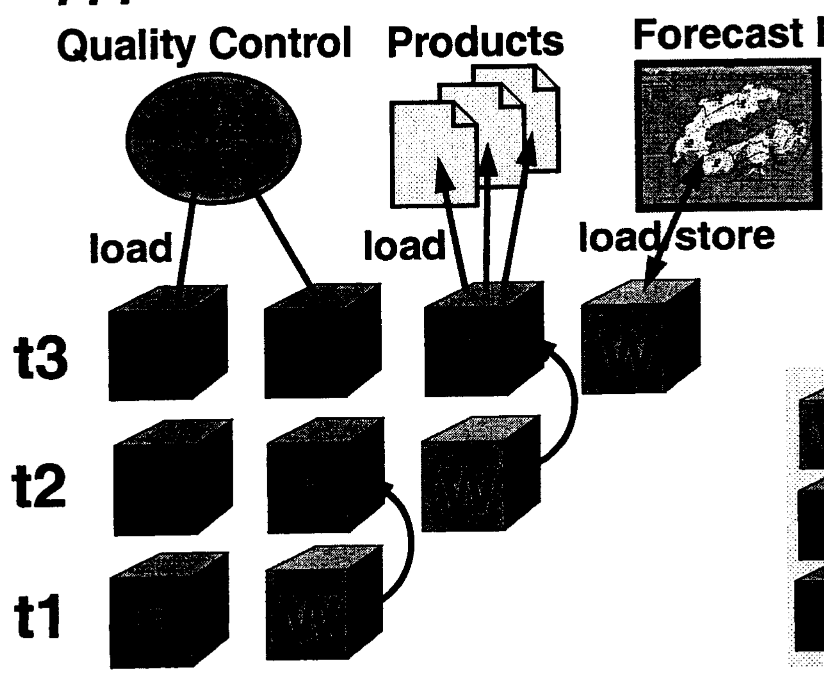
Editing Permissions on Matrix





Each weather office may only edit the values of their own regions. Regions belonging to another part of Switzerland may only be viewed but not changed.

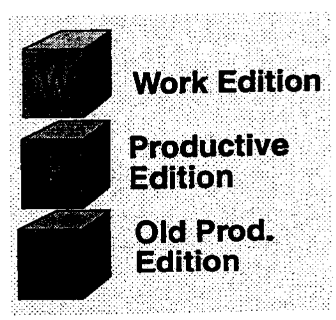
Appplication of the Forecast Matrix



There are two types of forecast matrices:

Work Edition: This is the actually processed version of the Forecast. It is only visible for the forecasters who work with the forecast editor. They may read and write into it.

Productive Edition: If a Work Edition is said to be released it is indicated as a Productive Edition. A productive Edition may not be edited again. It is used to compile products. Older versions are still stored to check the quality of the forecast.



Object oriented technologies

Object oriented Analysis and Design

Use Case Workshops
- specification of requirements whith the user or/and of systems
- goal: users and programers have the same vision of the application

- class diagrams shows the application's context

Object oriented Implementation

- metAP : implementation in Java
- programming environement: SNiFF+, laborious to set up a share project with SNiff+, but then comfortable use for different users

EGOWS '98 Norrköping
Project metAP

Important features in SNiFF+

Project and code management for teams

- Sharing of files, decoupling between users

Build management

- Concept of project and working environment.The single user only works in his private working environment (PWE). By checking out a file from the Shared Source Working Environemnet (SSWE, only readable files), a copy is written to (PWE), and the file is editable.

Code comprehension and browsing, version and configuration management

- Browsing and cross referencing features
- All file of any file type can be managed with SNiFF+, whether source code or documentation

/proj/MAZ/metAP/doc/Work/Miscellaneous/Folien/98_Norrkoping/tech_0a.doc
10.8.98

Technical experiences with Java

Advantages

- Reuse of software components, e.g database access, utilities classes
- Fast market development, " the day you finish a class, you can buy it"
- Swing as a Component library replaces the AWT (Abstract Windowing Toolkit),
- Look-and-Feel allover the same
- Version 0.99 of Java 2D now available, final version will be released with JDK 1.2

Problems

- Inconveniences Solaris - java
- Increase of performance, need of fast machines

Session 4 - Joint session COST-78/EGOWS
Graphical Interaction/End User Production

COST-78

Dick Blaauboer, KNMI, Norrköping, June 1998

1. Introduction

Graphical interaction is the linking pin between the EGOWS and COST-78, a European cooperation action on nowcasting. Within COST-78 a working group on Graphical Interaction is existing since March 1996. Both the EGOWS and the COST-78 working group are rather informal. While COST is more research driven, EGOWS is perhaps a little bit more driven by technology. In this contribution a overview is given of the COST-78 working group recent activities.

2. Terms of Reference

At the COST-78 Management Committee Meeting (MCM) in Bologna, March 1996, the Terms of Reference (ToR) of the Working Group on Tools for Graphical Interaction, initiated by Jens Sunde, Norway, have been adopted. According to this ToR the working group should proceed along the following lines (systems to be interpreted as systems for graphical interaction):

- Common definitions of requirements and specifications for European systems.
- Cooperation between European institutions that want to invest in the development of a new system. Computer specialists from potential participating countries in Europe should be brought together to establish development plans for the different modules.
- Coordination between European institutions that have procured or in near future want to procure systems for graphical interaction based on existing commercial software. Establishment of European contact networks and user groups.

Currently 13 countries participate in the working group: Finland, France, Germany, Greece, Italy, Netherlands, Norway, Slovakia, Slovenia, Spain, Sweden, Switzerland and UK.

4. Letter of Recommendation

After an inventory phase the working group had a first meeting in Toulouse, June 1997. During this meeting, which was organized jointly with the EGOWS the possibilities of cooperation on the subject of graphical interaction have been discussed. During the meeting 7 potential sub-fields of cooperation have been distinguished:

1. Extrapolation methods
2. Interaction with analysis by modification of observations; quality control
3. Interaction with gridded fields and interactive match of models
4. Automatic pre/post-processing for interactive production
5. Generation of products including text generation
6. Interaction with model timeseries including TAF
7. Patterns for handling meteorological problems

After the meeting for each of these sub-fields a coordinator gathered information from the countries that attended the meeting on interest for future cooperation. This work resulted in the first version of this Letter of Recommendation (LoR) in which statements are made on the preparedness of countries to cooperate for each of the sub-fields separately. The first sub-field is missing in the LoR because of insufficient response.

After endorsement of this first version of the LoR by the MCM it has been used by all members that are interested, to further define the scope of cooperation on each of the sub-fields. The working group members were responsible for the discussion of the LoR at their own institute. During the ECAM-97 in Lindau the work of the wg has been mentioned by the chairman of COST-78, Erik Liljas. Also he introduced the possible cooperation activities on the Eumetnet platform. During the conference a lot of information have been exchanged and more persons showed interest to join the wg. So the number of participating countries increased to 13.

The second version of the LoR was the result of the second meeting of the working group held at Reading (UK), November 21st 1997. All amendments that have come forth since the first version of September 22nd has been incorporated in order to make the scope of cooperation more concrete.

This third version contains the amendments that have been made between November 1997 and the third meeting of the working group during the COST-78 workshop in Dresden, March 3rd 1998. The final LoR is available with the working group members and the COST-78 secretariate.

4. Results from Dresden workshop and future actions

Except from the final LoR the following results from the Dresden workshop should be mentioned.

- TIPS project: a proposal for a project for the development of an TAF Interactive Production System has been worked out during and shortly after the workshop. This project proposal has been based on activities in subfield 6 of the LoR. The project has been subdevided in 5 main tasks: TAF-encoding, forecaster interaction, consistency + syntax check, monitoring, verification. Nine countries showed their interest sofar. The proposal has been discussed during the EUMETNET council meeting in April 1998. A final decision is expected in September 1998. Sofar Norway is chairing this activity.
- GI on gridded fields (LoR subfield 3): a request has been done to UK MetOffice to make available for the COST-cummunity software that has been developped by Eddy Carroll to modify gridded fields from NWP models. Pilots in this field are going on in a few countries. During a next meeting in Norrköping joint with the European Group on Operational Meteorological WorkStations (EGOWS) feedback will be gathered from the operational pilots and possible ways of cooperation will be discussed, including a project proposal by the Netherlands.
- Text generation (LoR subfield 5): a project proposal for this subfield formulated by Slovenia has been suspended, waiting for result from the European Multi Meteo project, where a few countries are already involved.
- Pre/post processing for GI: an action based on subfield 4 of the LoR. A list of items available for bilateral exchange is comprised in chapter 4 of the LoR. (see also the COST-78 website: http://www.knmi.nl/samenw/cost78 under documents of the wg on GI). Most of the available products are GRIB fields derived from NWP models. As a next step a proposal for the cooperative development of BUFR objects from GRIBs has been initiated. Activities within this subfield are coordinated by France.
- Meteorological design patterns: though this is an interesting field (LoR subfield 7), too few countries are involved in concrete plans at the moment. Further actions are suspended. Switzerland is in charge in this field.

A few miscellaneous results should be mentioned as well:

- In general future projects in the field of Graphical Interaction could be brought under the EUMETNET umbrella. Preparations still can be done within the COST-78 framework until March 1999, when COST-78 will end.
- The wg on Dissemination Systems and Warnings has been merged with the wg GI. Further activities are related to the demonstration of systems during the ECAM-99 conference in Norrköping, September 1999. Chairing country for dissemination systems: Slovenia.
- Cooperation with EGOWS: apart from the joint meetings in 1997 and 1998 it has been suggested that the activities of EGOWS and the COST-78 wg GI could merge after March 1999. The new "working group" could be the platform where projects on visualization and graphical interaction could be prepared. This could be done during annual meetings and preparational communication using mailing lists (already existing) or news groups on the Internet.

Graphical Interaction at KNMI

Dick Blaauboer, KNMI, Norrköping, June 1998

1. Introduction

In the past six years a meteorological workstation, MWS, has been introduced and integrated in the operational service of KNMI. During this time the system has been extended and customized in order to fulfil as much as possible the needs of the operational user. Also in parallel a production system has been set up to generate standard products that are used in end user products. The KNMI Meteorological Workstation System (MWS) has been developed in close cooperation with the software provider Spatial Software Solutions Inc. (3SI), Marlton NJ, USA. The developped software, Metlab has been written in C and X-windows. It is running on DEC-Alpha workstations.

Currently our production process is in a phase of redefinition, the HOPWA-project: the process will be automated as much as possible while the role of the forecaster is reconsidered. The future role of the process oriented forecaster will be a monitoring one and, if needed, he will intervene. To be well equipped for this task he needs new tools for interaction with NWP modeloutput. The meteorological workstation will remain the vital system where this interaction takes place. Graphical Interaction is linking pin between the HOPWA-project and the MWS.

2. MWS

2.1 News

During summer and autumn 1998 the hardware of the MWS is being replaced (DEC Alpha DPW 600a), the old systems being 4 to 5 years in use. Current software developments include:

- object oriented redesign: the system will be rebuilt in C++
- higher degree of modularity
- standard interfaces to external software
- new features: a set of new functionality

2.2 New features

New functionality is being developped right now and will become available later this year or beginning next year.

- alert-function on observations (extendable to models): thresholds can be set on a variety of parameters of observations within a predefined area above or below which forecasters will be alerted;
- configurable detailed background maps: topographical details, height-isopleths, shadings etc. will be added;
- integration of lightning data: both location and density maps;
- combined Station-Contour source: analysis of various parameters directly on the map with station plots;
- advanced crosssection features: all available model parameters and derived parameters can be used on all model levels, grey-scales of satellite data can be displayed in the same graph;
- integration of windprofiler data: processing of the BUFR messages and display of both wind and temperature data;
- integration of AMDAR profiles (aircraft measurements): the ascending and descending parts are displayed on a profile diagram;

- overlays of vertical profiles: all kinds of vertical profiles (TEMP, AMDAR, windprofiler data, model profiles) can be overlayed;
- multi-windowing with mouse-mirroring: synchronous actions in different windows;
- a variety of smaller enhancements

3. HOPWA

3.1 Objectives

In 1996 KNMI started a project called HOPWA which is dealing with the reorganization of the whole production process. For this reason also the future role of the forecaster and the future use of an interactive workstation have been discussed. The main objectives of HOPWA include:

- rationalization of the production process;
- efficiency improvement: work should not be duplicated; products should be generated as efficiently as possible;
- automation: processes should be automated as far as automation is cost effective;
- avoid inconsistencies: forecast for different customers and with a different scope should be consistent with respect to their overlapping parts;
- modularity, flexibility, standardization etc.

3.2 Schedule

The time schedule for the HOPWA-project is as follows:

- 1996: orientation-phase
- 1997: definition of the whole process boiling down to the definition of concrete projects
- 1998: design and implementation of these projects
- 1999: operationalization-phase

Most projects that have been defined have been started now and are in a design-phase. Implementation will start later this year and run into 1999.

3.3 Projects

Below an overview is given of the main projects of HOPWA:

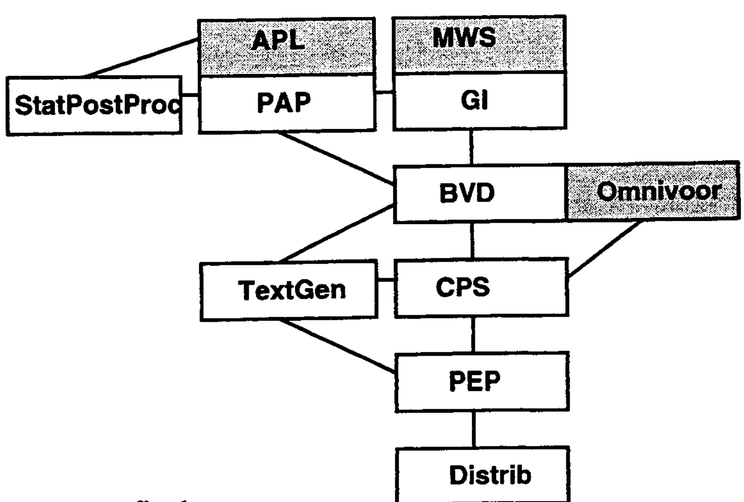


fig. 1

The grey parts are already existing (development before HOPWA):

- APL: the Automatic Production Line: the suite of numerical weather and wave models;
- MWS: the Meteorological Workstation System: the main interface of the forecaster;
- Omnivoor: the central databases of KNMI

The white projects are part of HOPWA (some of the names are borrowed from the Swedish RiPP project):

- StatPostProc: Statistical Postprocessing of numerical weather output on gridded fields
- PAP: Product Assembley Parameters: a set of gridded fields which contains all parameters that are needed for the end products (closely related to APL);
- GI: Graphical Interaction: the forecaster's interaction with model fields (closely related to MWS);
- BVD: Forecast Database: one of the central databases containing the basic forecaster's output (closely related to Omnivoor);
- TextGen: automatic text generation module;
- CPS: Central Production Shell: a counter through which all data from the central databases is available for internal and external users;
- PEP: Product Enhancement Platform: a set of user tailored production systems;
- Distrib: Distribution to end users.

3.4 Forecast Database

Four different datatypes are contained in the Forecast Database:

- (modified) model fields
- graphical products (surface charts, significant weather charts etc.)
- timeseries derived from modified fields
- texts derived from timeseries

Model fields are put in the Forecast Database by the NWP models. Graphical interaction is taking place as much as possible directly on these fields. Timeseries are derived automatically from the (modified) fields. Some parameters will be modified on this level. Finally texts are as much as possible automatically derived from the timeseries. A text editor is still needed for final adjustments and generation of more complicated texts.

Below all grey parts are part of the Forecas Database project (BVD), whereas the white parts are dealt with in related HOPWA- projects.

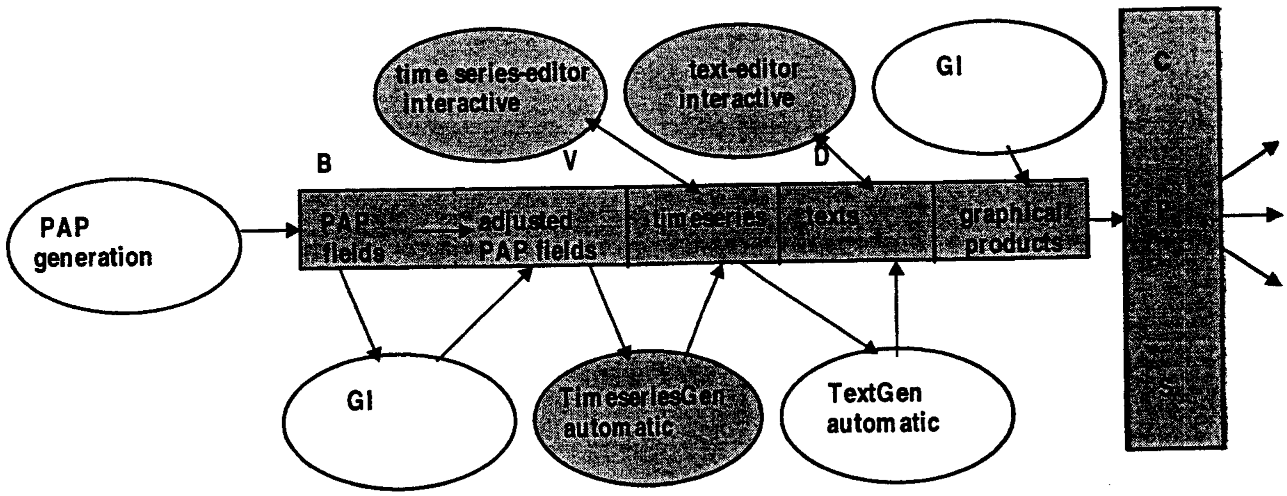


fig. 2

3.5 Graphical Interaction

Graphical Interaction is taking place within the Meteorological Workstation. Interaction is mainly done on modelfields. Different tools are needed for different time-scales: for now-casting time constraints are predominant whereas for longer timescales higher requirements are put on meteorological correctness.

At KNMI a pilot has been started to produce wind-temperature charts for aviation (short time-scale). In this pilot first experience will be gained on the interactive process to modify model fields. Later this year from this pilot the requirements will be derived to design the final system.

Graphical products like surface charts and significant weather charts are produced still manually on the MWS. Later these products possibly will be generated from BUFR-objects, that can be produced from GRIB-products.

THE LATEST DEVELOPMENTS OF METEOROLOGICAL WORKSTATIONS AT FMI

Juha Kilpinen* and Pertti Kukkonen
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1. INTRODUCTION

A new meteorological information and visualization system is under development at Finnish Meteorological Institute (FMI). The purpose is to built a new workstation environment for weather service including features for data editing and generation of different end products. One of these new applications is a workstation software for aviation forecasters, especially for those who take care of TAFs (Terminal Aerodrome Forecast). The system is able to help forecasters in their actual work, not just in visualization of different data. Some attention has also been given to briefing features for pilots.

Other application are also under development. Among these applications are graphical editor for forecast data in data base. Several new production tools have also been developed. All the new applications use the common new data base. Among the production tools are a software for producing graphics for newspapers (EPS), World Wide Web (.gif) etc.

2. THE INTERFACE TO DATA BASES

An object interface for the data base has been developed. The same kind of functions can be used to request different kind of data. This makes it easier to built new applications. The data base includes at the moment NWP data and surface observations. The next data type in the data base will be radar data.

3. THE AVIATION WORKSTATION

The most important features of the system are the display of METARs, TAFs and AutoTAFs and the editor with message checking (Kilpinen and Pietarinen, 1998). Special attention has also been given to the reliability of telecommunication.

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The present version can display the status of METARs, TAFs and AutoTAFs on a map. The coverage area of data on map display is Europe and user can zoom in and out. Also individual decoded METARs and TAFs are displayed on time/vertical cross-section diagram in the same window (Figure 1.). The message window is able to display the data in ASCII format and this window is synchronized with other display windows.

The messages are checked against syntax errors and feasibility errors. TAFs are checked also against METARs and SPECIs in real time. If a TAF is not valid with the METAR or SPECI observations, the particular aerodrome is colored on the map display and the corresponding elements are highlighted on message display. A short declaration about the error is also included. Also syntax errors are highlighted in the same way but with different colors (Figure 2.).

These monitoring features include also the check of syntax and feasibility errors in METAR and SPECI messages.

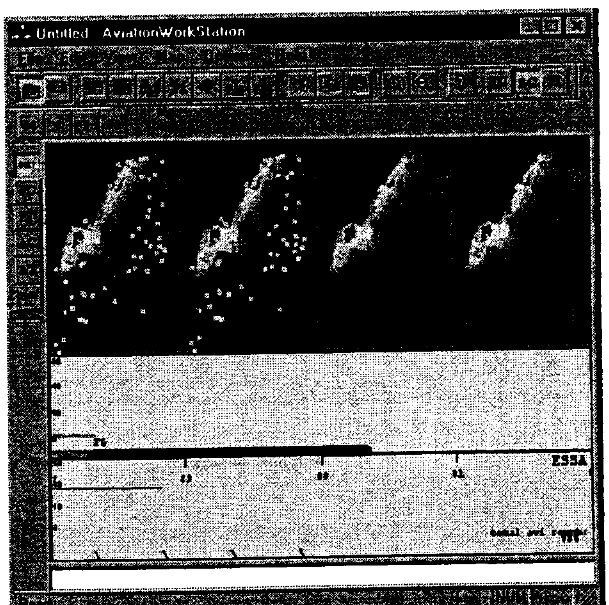

Figure 1. The main window of AviationWorkStation. The system has a map view and a parameter view for TAF's and METAR's. The status of observations and

forecasts is highlighted with different colors. The different windows are synchronized in time.

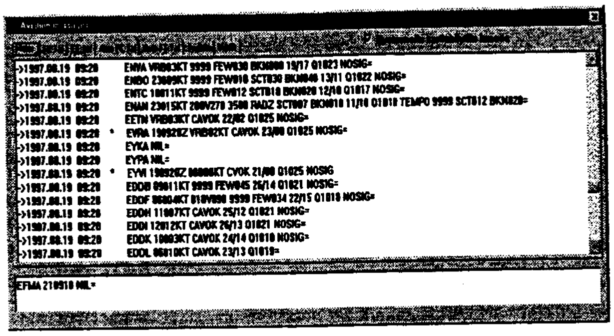

Figure 2. The outlook of message display window. The user can choose between different observations, forecasts and the task list.

The system keeps record of the task lists and time tables of all local offices. So a warning is given for the forecaster when he has to do his next TAFs. In the editor the user can choose between first guess TAFs. These possibilities are the previous TAF, AutoTAF (computer generated TAF) or a TAF based on latest METAR observation.

If the editor finds a syntax error or a conflict between the TAF and the ICAO regulations, the particular erroneous string is highlighted and a short description of the error is given. After the correction of the message, it can be send out to AFTN network.

4. OTHER APPLICATIONS

A prototype of a graphical forecast editor in under development at FMI. The idea is to built a tool for data editing and it should make the work of forecasters easier than it is now.

The following figure gives some idea of the editor. The present outlook given in Figure 3. will not be the final one. Several new ideas will be tested and even fundamental changes will be expected.

Before the graphical editor is ready for operational work at FMI a text editor and a web browser based editor will use used. An example of a WWW based editor is in Figure4.

The software is written in C++ language and the software is running on Windows95/NT platform. The first version of software will include spatial editing features for variables like temperature on pressure.

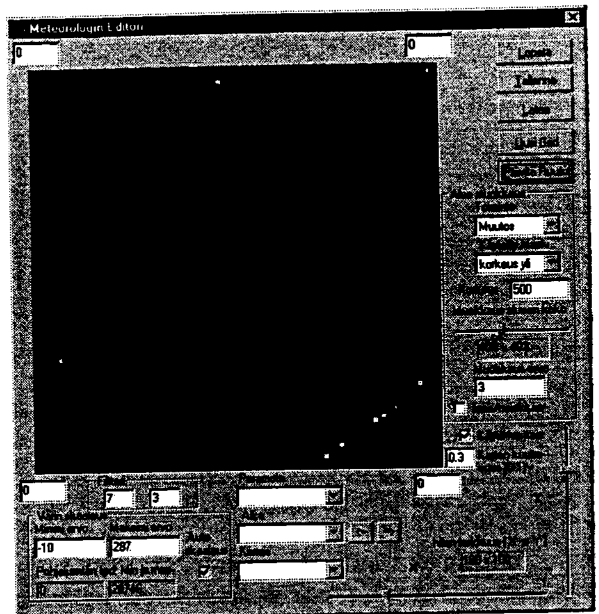

Figure 3. A prototype of graphical editor at FMI.

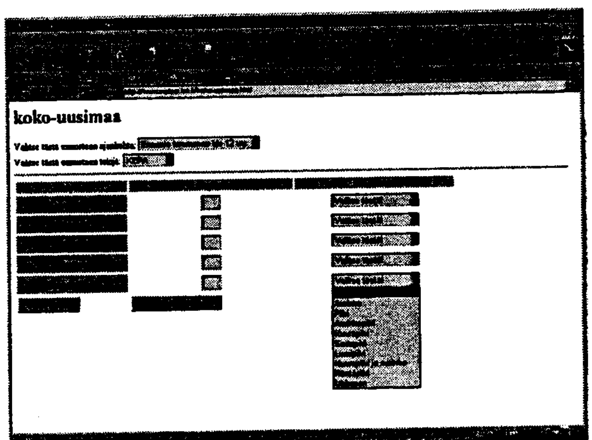

Figure 4. A simple forecast editor at FMI.

Several application which produce end product for customers are already using the real time data base described earlier. Among these products are graphics for newspapers, transportation, industry and commerce.

5. REFERENCES

Kilpinen J., and M. Pietarinen, 1998: The New Workstation Software for Aviation Forecaster. 14th International Conference on Interactive Information and Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology, 11-16 January, 1998, Phoenix, Arizona, pp 445-446.

Graphical editing at SMHI

by Lars Häggmark, SMHI, Sweden

A prototype for doing graphical editing of gridded data has been developed at SMHI. An operational application is under development within the RIPP project, and will be based on web technology.

The basic features in the application is to let the user

* set a point value with a given influence area
* add an increment to the original point value with an influence area
* to assign the same value to all grid-points within an area

The editing can optionally take into account information of physiography, and thereby create and maintain sharp gradients in coastal and mountain areas.

The methods used is based on ideas from the mesoscale analysis system MESAN developed at SMHI.

METEOROLOGICAL OBJECTS MANAGEMENT AT CNMCA

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CNMCA - IMS
Roma, Italy

During the last year the National Operative Centre (CNMCA) of the Italian Meteorological Service (IMS) has carried out a system for the extraction of frontal and jet streams lines from the gridded fields and for graphical interaction. The extraction is based on software developed in FORTRAN and running on Unix workstations, while the graphical interaction rely on software developed in JAVA and running on PC with Microsoft Windows NT operating system.

1. INTRODUCTION

The use of NWP' s output in the operational forecasting environment is traditionally based on a set of procedure that we can call *grid points approach.* The basic steps of this approach are:

- data presentation using maps or meteograms;
- weather analysis carried out by forecaster that identifies and locates, starting from the scratch and taking into account various plotted field, the driving meteorological elements (frontal lines, trough, ridge, jet streams, ...) ;
- end - user weather elements located by forecaster on the basis of the driving meteorological elements. By comparison with automatically predicted weather elements (DMO or post-processing) the forecaster can sharpen his weather analysis and modify his previous end-user forecast;

The graphical interaction software needed, in this approach, by forecaster must have all the standard facilities to easily prepare the weather charts and the end-user maps. Graphic files of this maps are needed in order to manage transmission and archiving. The forecast database is composed by gridded field (GRIB format) and by graphic files (any compressed format - GIF, JPEG, ...).

A new way to employ the NWP' s output is the *meteorological objects approach* where we have, as very first step, to define as more complete as possible the various met objects that are relevant in the operational forecasting environment . After that we have to physical describe this objects in order to make it possible to identify them starting from the gridded NWP fields. The extraction of the collection of data that define the met object is the last process of this automatic procedure.

The forecaster can use this automatically extracted objects as first guess during both the weather analysis step or the end-user weather elements description step. He needs a graphical interaction software that can easily manage this met objects . A pure Objects Oriented Programming language seems to be the right choice for this kind of software.

Furthermore the use of met objects allow a more efficient way to transmit and archive the weather maps. The forecast database is composed by gridded field (GRIB format) and by collection of met objects coded in a binary format (BUFR, GRIB,...).

In order to evaluate the advantages of the meteorological objects approach at CNMCA we have carried out in the last year a system for the extraction of frontal and jet streams lines from the gridded fields and for their graphical management. We have used JAVA as programming language for the graphical interaction software in order to assess its use in our operational environment.

2. EXAMPLE OF MET OBJECTS' EXTRACTION : FRONTAL LINES AND JET STREAMS

Object Definition	frontal lines: identification code, number of points, arrays of latitude and longitude coordinates of the points jet streams: identification code, number of points, arrays of latitude and longitude coordinates of the points, array of geopotential height, array of max wind speed.
Physical Description	frontal lines: according T. D. Hewson work (Objective fronts. *JCMM Internal Report No 57*; Department of Meteorology, University of Reading); jet streams: first derivative of the maximum wind along the distance perpendicular to wind direction = 0.
Object Extraction	Fortran code : ESTRAI (linear interpolation)

3. THE GRAPHICAL INTERACTION SOFTWARE: DRAWMETEO

This software has been written in JAVA using JDK 1.1. on Win NT/95 Cpu.

DRAWMETEO makes it possible to:

- load the met objects file generated by ESTRAI;
- modify the met objects displayed on the basis of single object selection;
- visualise meteorological maps as background;
- generate new objects;
- save the displayed met objects in a file;
- print the background map plus the displayed met objects.

DRAWMETEO is composed by the main classes briefly described in table 1.
The graphical user interface and an example of printed output is showed in figure 1 and 2 respectively.

4. CONCLUSIONS

According a few tests we have performed at CNMCA the automatic computed frontal lines and jet stream lines are useful for the operational activities. Simple graphical methods to generate or modify met objects, as that provided by DRAWMETEO, are well accepted by forecaster.
JAVA requires a fast CPU but has proved to be a language improving the programmer's productivity. In a short period of time (roughly 2 months) a Fortran and Visual Basic medium level programmer has learnt the basic features of JAVA and has written DRAWMETEO.

name and description	data	methods
drawmeteo (extends frame) It is the main class and define the graphical user interface		all the methods to perform the basic operations (files loading and saving , choice of background maps ......)
drawmeteopanel (extends ScrollPanel) It is the class that allow the graphical interaction by the user with the met objects		all the methods linked to graphical interaction events generated by mouse (with or not modification key pressed)
fronte. It is the class that define the frontal lines as object	*type,* identification string *npoints,* number of points *xp[ ], yp[ ],* array of pixel coordinate	*addpoint,* adds new point in xp, yp array; *traccia,* draws the polyline having as node the xp,yp points; *traccia_spline,* as *traccia* but draws a B spline; *sposta,* move the object; *setX, setY,* to modify the coordinate of a point; *getX,getY* *getNpoint*
getto. It is the class that define the jet stream lines as object	the same data as fronte plus the array *zp[ ]* (array of geopotential height) and the array *wp[ ]* (array of the maximum wind speed)	the same methods as fronte plus the methods *setZ* , *getZ, setW, getW* and *printZ*
metobj It is a class that contains all the met objects (fronte and getto) the software is managing	*metobjects,* a vector of objects	*carica,* load in metobjects the fronte or getto objects from a file selected by the user; *salva,* save in a file selected by the user all the met objects; *stampa,* print the background map plus all the met objects; *addmetobj,* *setmetobj,* *getmetobj,* *cancellametobj,*

table 1

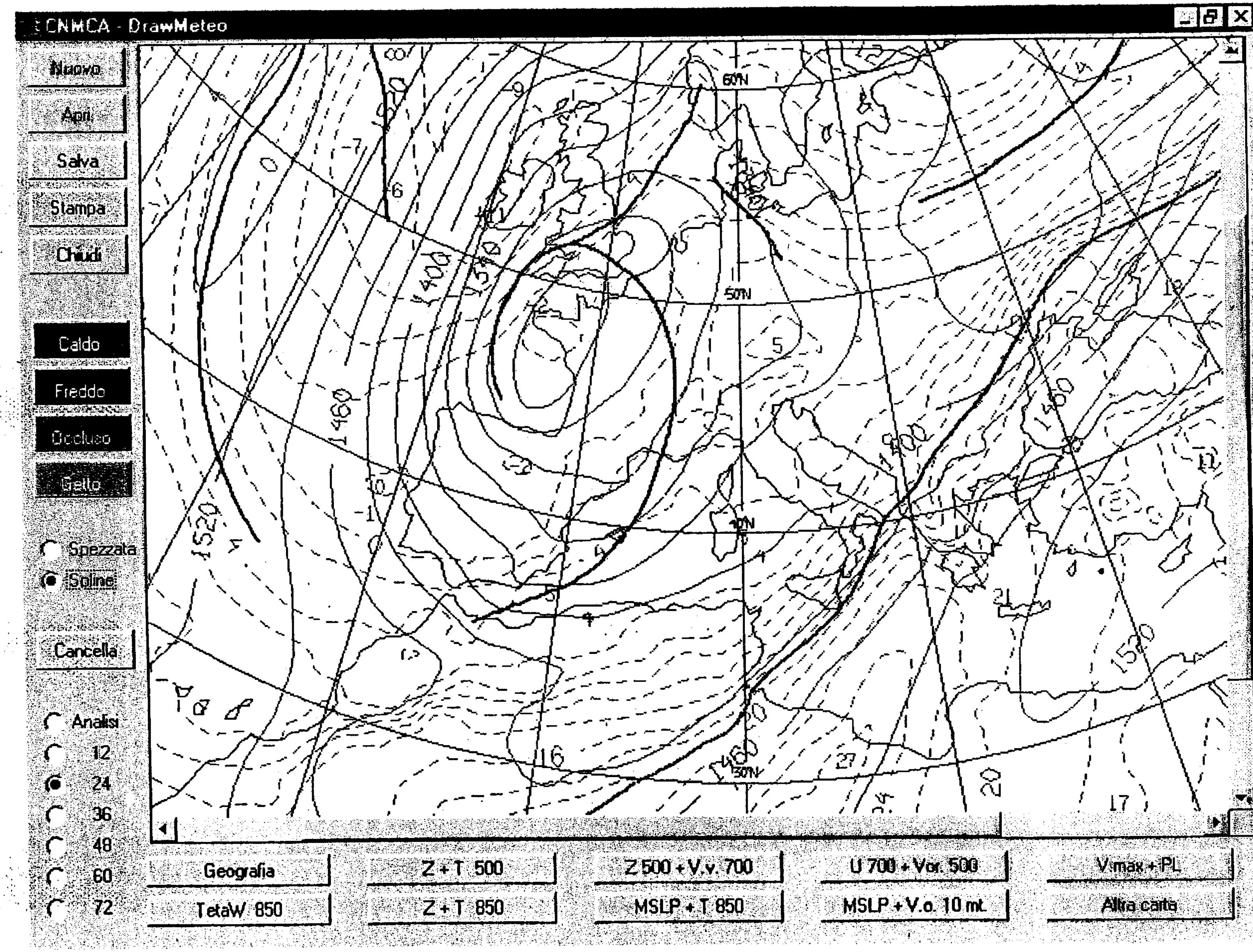

CNMCA - DrawMeteo
Nuovo
Apri
Salva
Stampa
Chiudi
Caldo
Freddo
Occluso
Getto
Spezzata
Isoline
Cancella
Analisi
12
24
36
48
60
72
Geografia
TetaW 850
Z + T 500
Z + T 850
Z 500 + V.v. 700
MSLP + T 850
U 700 + Vor. 500
MSLP + V.o. 10 mt.
Vmax + PL
Altra carta
60N
50N
40N
30N
1520
1400
1460
1340
16
20
27
17
5

Figure 1

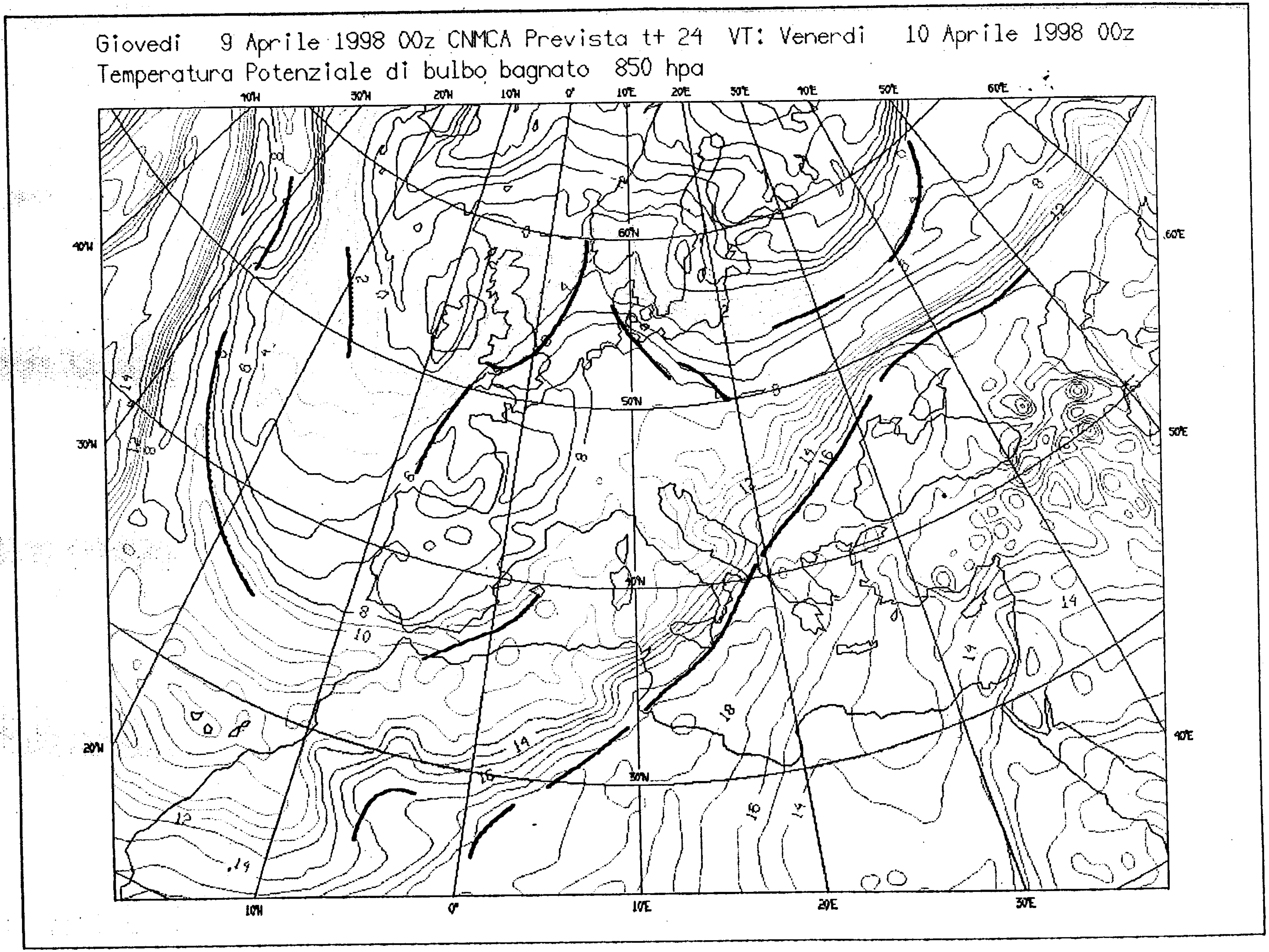

Giovedi 9 Aprile 1998 00z CNMCA Prevista t+ 24 VT: Venerdi 10 Aprile 1998 00z
Temperatura Potenziale di bulbo bagnato 850 hpa
40W
30W
20W
10W
0°
10E
20E
30E
40E
50E
60E
60N
50N
40N
30N
40N
30N
20N
60E
50E
40E
10W
0°
10E
20E
30E

Figure 2

EGOWS98, Norrköping, Sweden, Jun08-11, 1998

Météo-France experience in Graphical Interaction on the SYNERGIE Workstations

Patrick Bénichou

METEO FRANCE

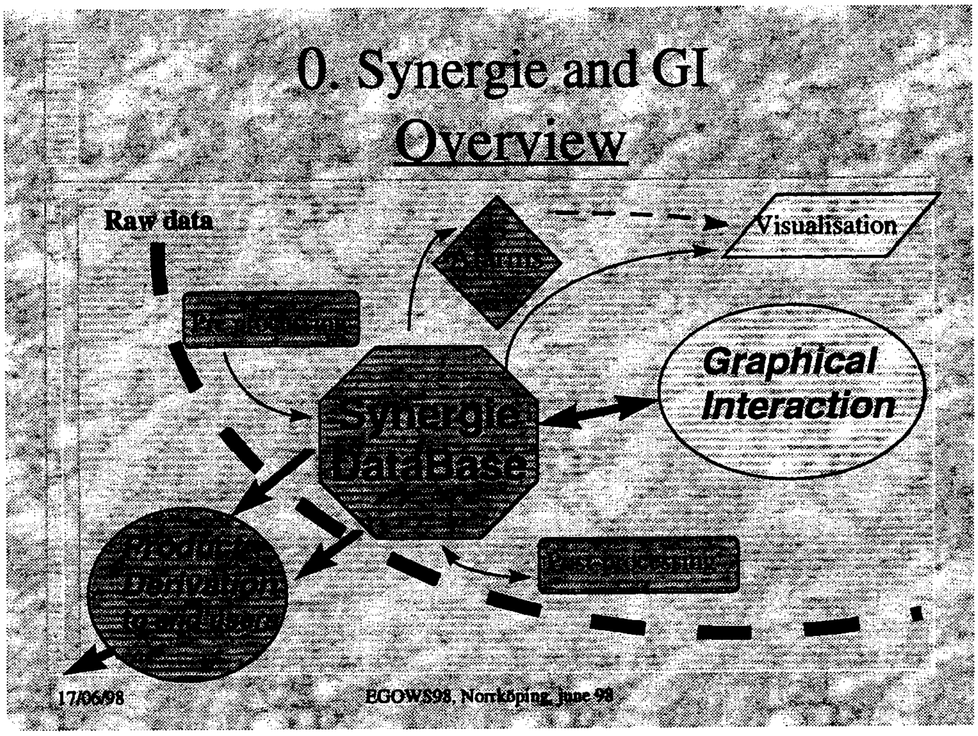
EGOWS98 **Synergie**

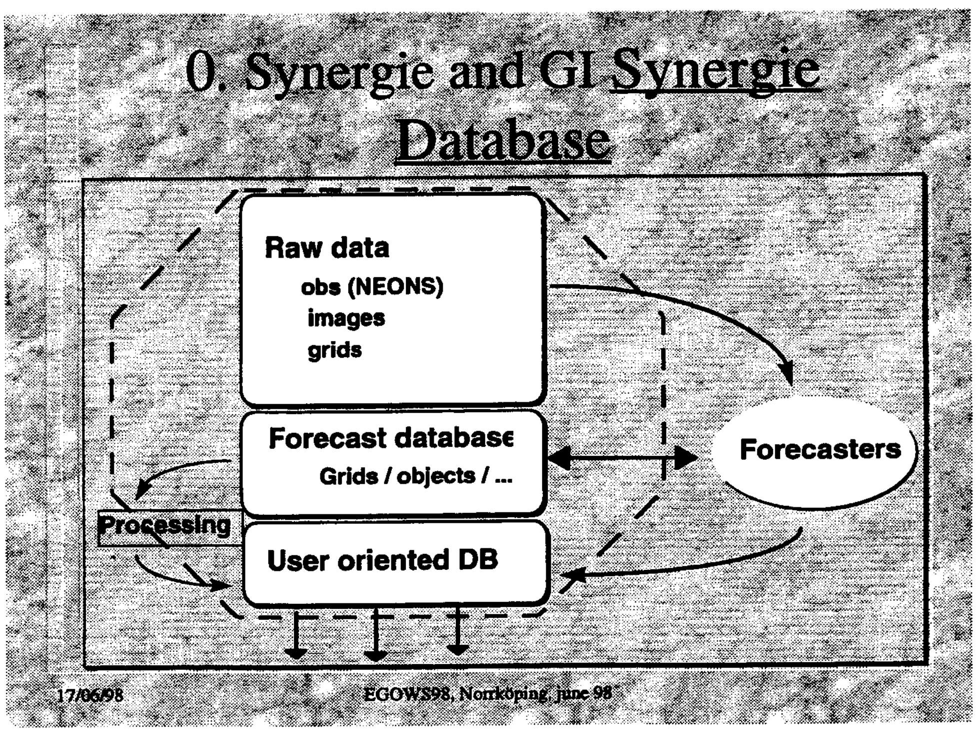
❶ Latest features in Graphical Interaction (Synergie_3.1 & 3.2)

❷ Feed-back on 3 «object-oriented» Synergie sub-applications

❸ Next GI features for next years

❹ Lessons learned


0. Synergie and GI
Overview
Raw data
Visualisation
Synergie
DataBase
Graphical
Interaction
17/06/98
EGOWS98, Norrköping, june 98


0. Synergie and GI Synergie
Database
Raw data
obs (NEONS)
images
grids
Forecast database
Grids / objects / ...
Forecasters
Processing
User oriented DB
17/06/98
EGOWS98, Norrköping, june 98

1. Latest GI features on Synergie

- Object edition
  - Scrolled window
  - Object edition : re-written
  - Annotations : consolidation
  - UNDO : 20 levels
  - Commentaries on objects and documents
  - Info «bubble» fitted to objects
  - Rotation of objects (JETS)
  - Overlaying obj + obj & initialisation from background
  - Time management & interpolation of objects
  - Exchange of objects between sites

1'. Latest GI features on Synergie

- On screen Analysis
  - Rewritten! (performances / ergonomics)
  - Computation optimisation / work on subdomains
  - Ability to alternate on screen analysis and field modif.
  - Visualisation of the obs. status after analysis or modif.
  - Possibility of creating observations (from guess field)

17/06/98 EGOWS98, Norrköping, june 98

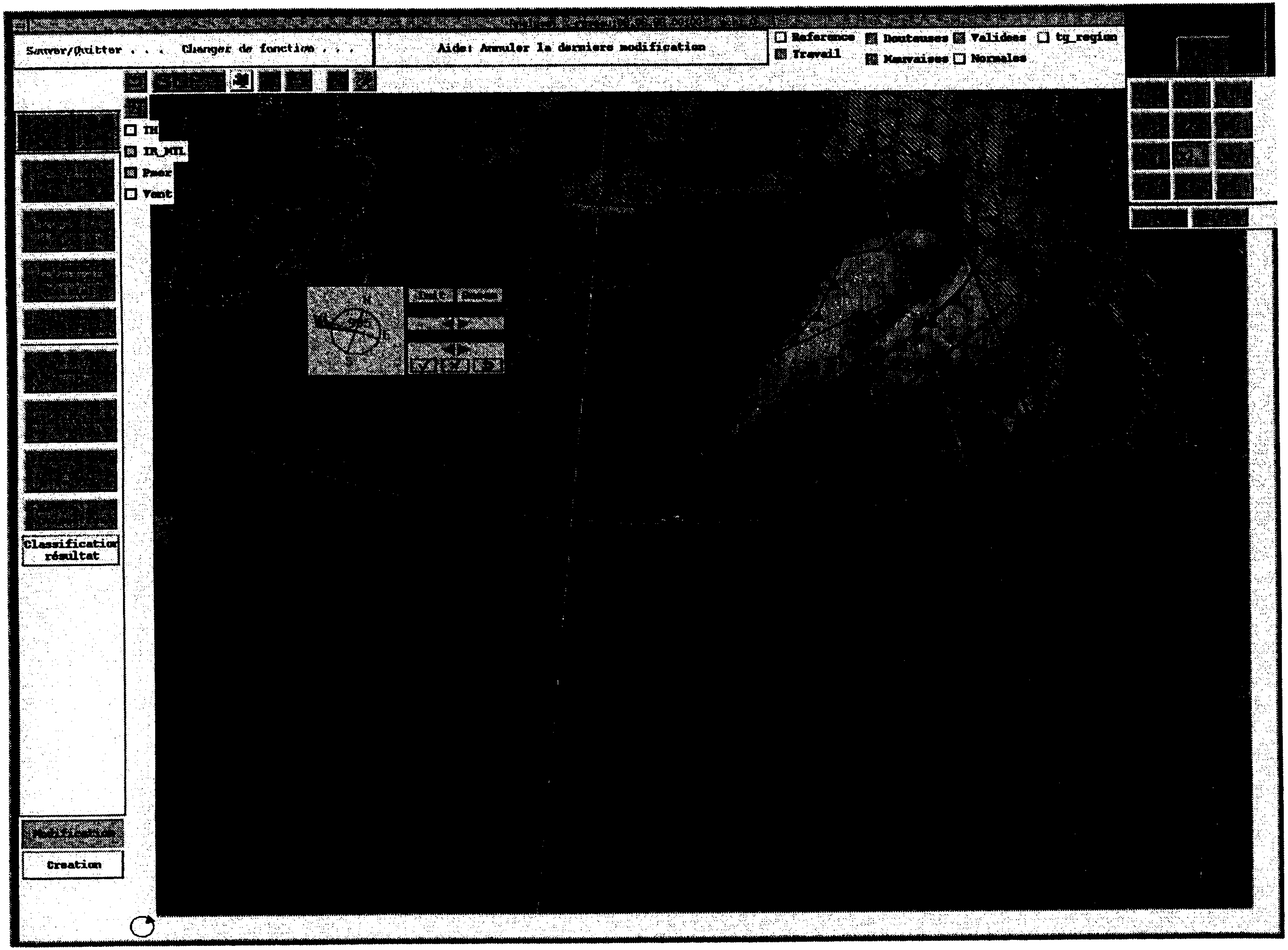


Figure 1. On screen analysis on Synergie

2. Feed-back from users : SIGWX

- Tested since oct. 97
- a) 1h training then copy of existing SIGWX
  - mean time 90' (50->120') : too long; test = few weeks
- b) Simulation of real duty : < 3h, lack of confidence
- Annotations : not enough training yet.
- Ergonomics : OK
- Strong need for WYSIWYG
- Final chart output : OK
- Tbd : final training + work in //,
  more initialisation, 2 screens!
- In operation **before end 98**

2'. Feed-back on synoptic SIGWX

- History :
  - Concept of object : not accepted before 94-95
  - object edition : end 94
  - field modification : mid 95
  - Fastex experiment end 96
  - on screen analysis : end 97
- Ergonomics :
  - few blocking pbs at first (response time)
  - mouse pb (96) -> ergonomics/soft
  - large domains -> scrolled window
- Tbd : training on object edition & field modif.
  validation/training on analysis (bild 3.2)
- In Operations **before end 98**

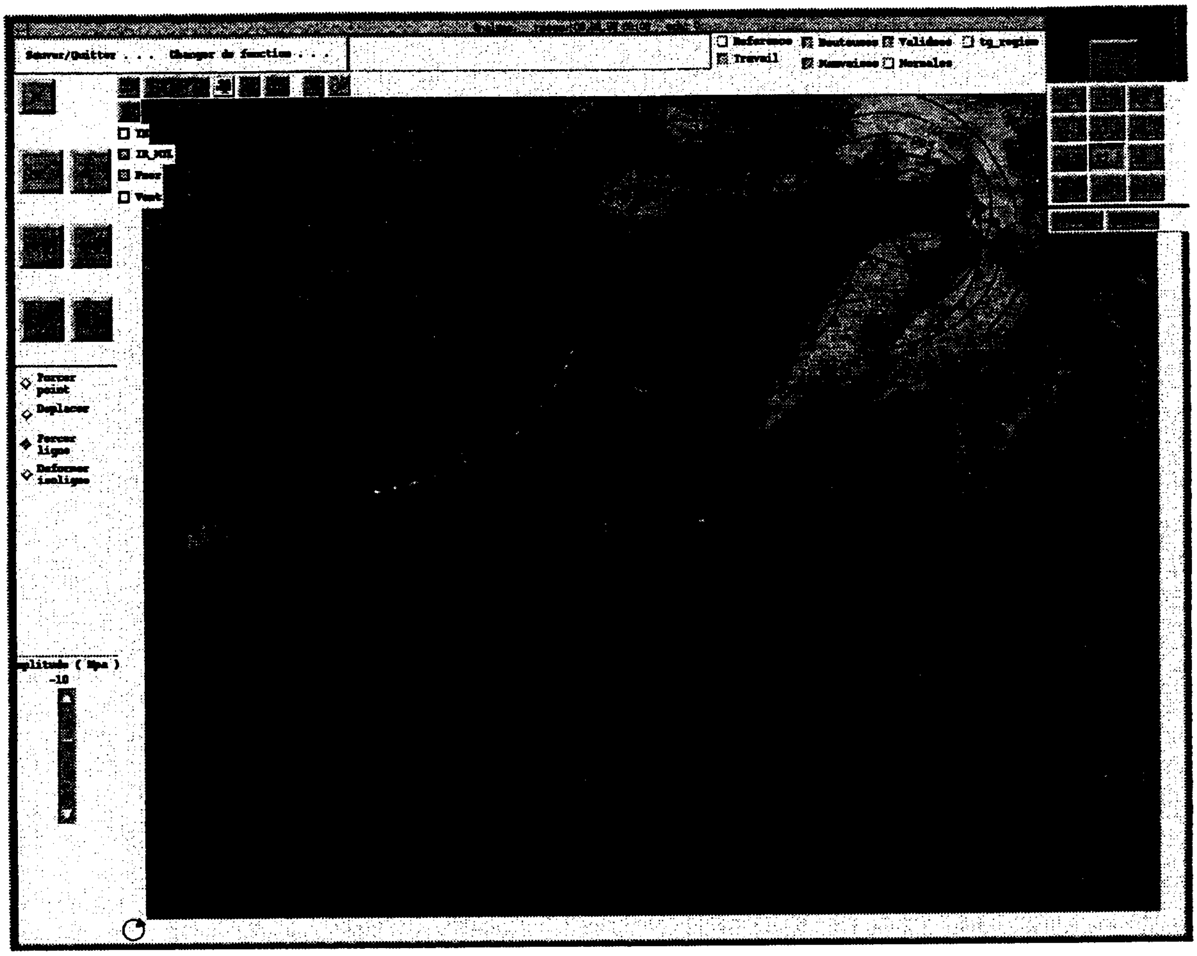


Figure 2. Linear MSLP modification (request)

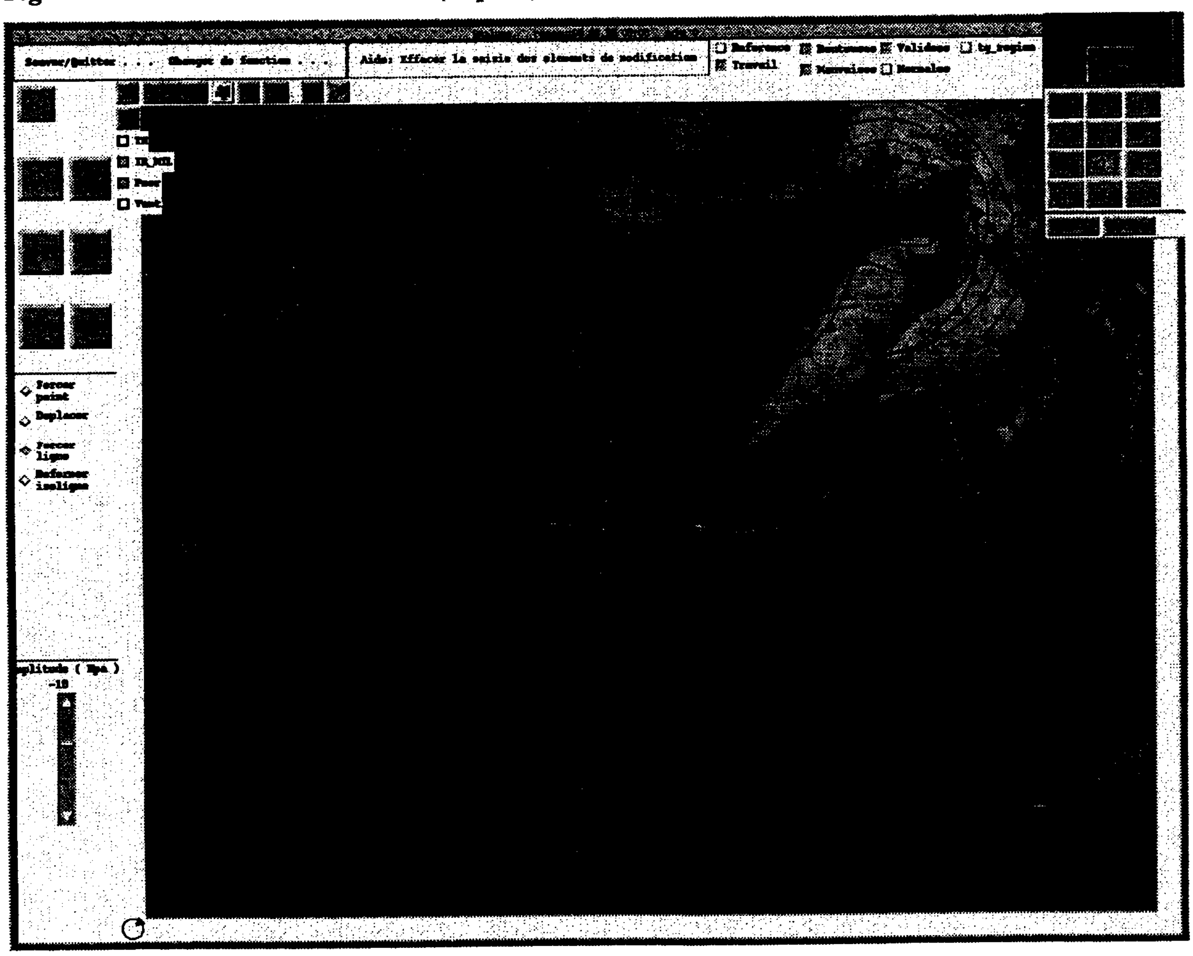


Figure 3. Linear MSLP modification (result)

2''. Feed-back on PRESYG

- History
  - Concept 93
  - Module mid 96
  - Fastex test end 96
  - evolutions 97
- Methodology
  - specific Synergie macros for GI and for visu.
- Tbd :
  - Initialisation : choice between SUP and Initialization
  - training :
    central forecasters (GI);
    regional/local forecasters (Visu/interp.) : long!
- In operations **before end 99**

17/06/98 EGOWS98, Norrköping, june 98

3. Next GI features using objects

- Meteorama
  - Objects for Medias (TV, Internet,...)
  - Initialisation from PRESYG, SIGWX,...
  - over any domain(s)
- Marine sub-application
  - Connected to the synoptic SIGWX appl.
  - Marine weather elements
  - Coupling with wave model, text generator
- Symposium II (after Symposium I)
  - object exchange
  - concept of intervention rights
  - ...
  - in operation before 2003?

17/06/98 EGOWS98, Norrköping, june 98

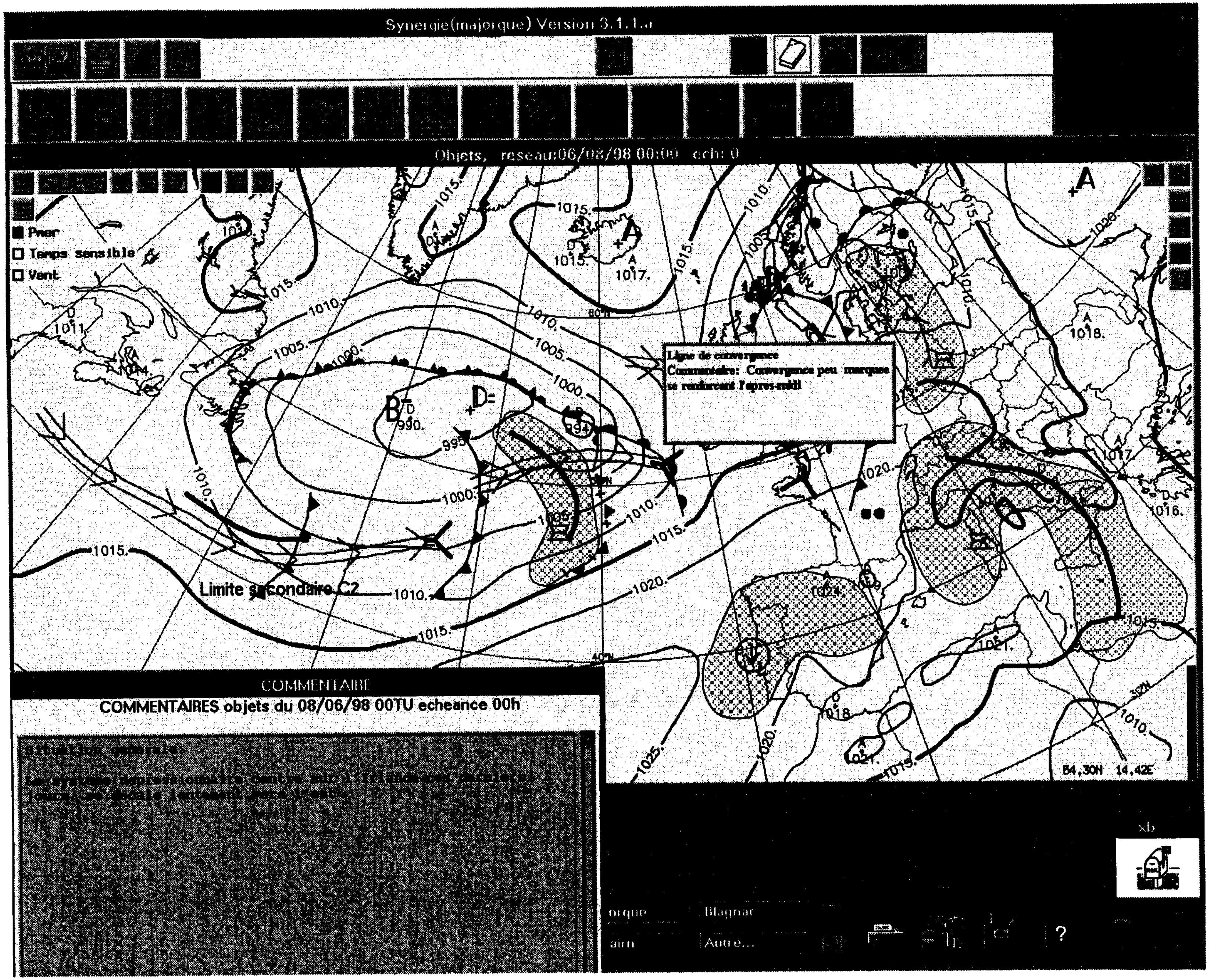


Figure 4. New PRESYG guidance and comments

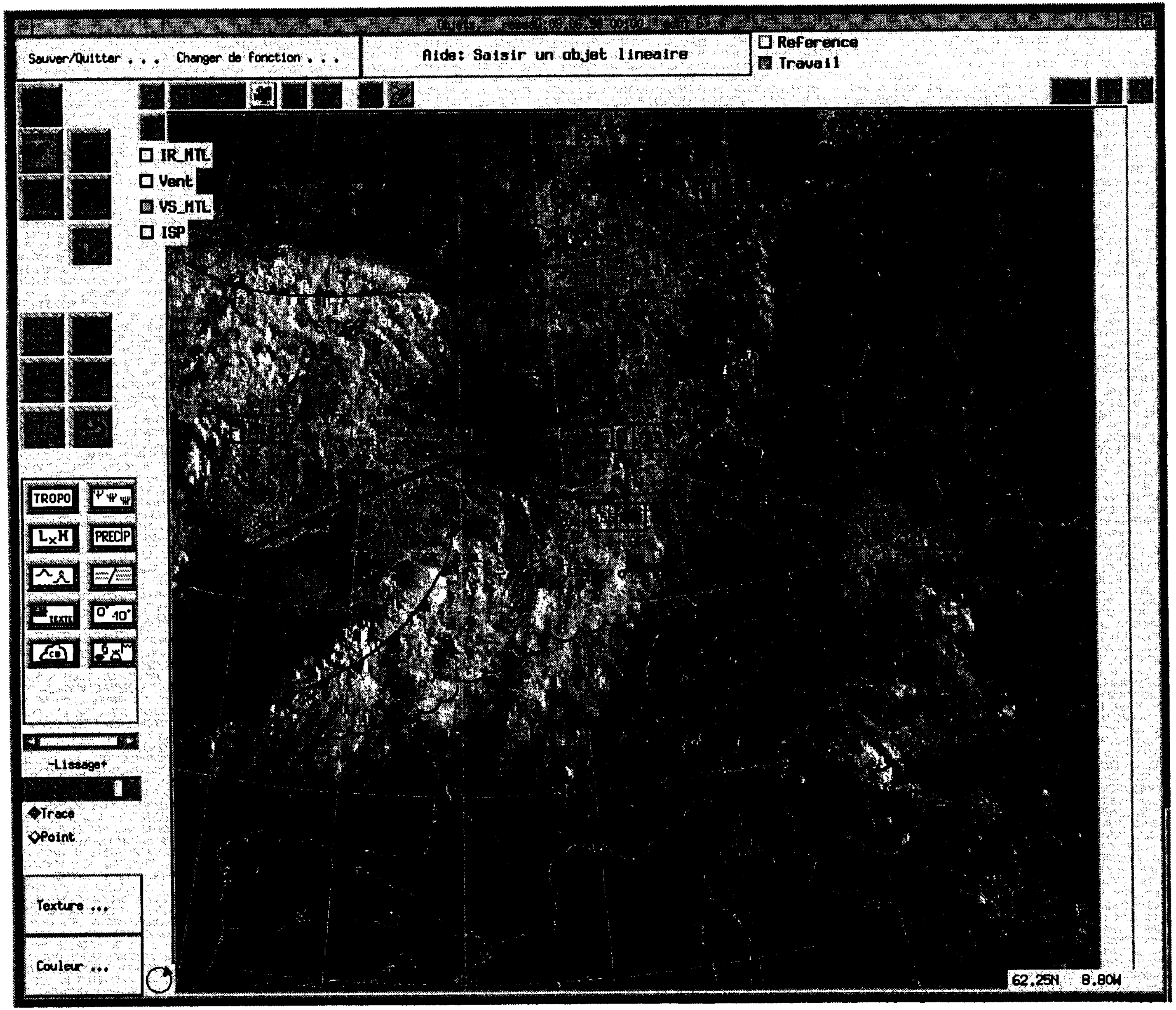


Figure 5. Aviation SigWx GI window

4. Lessons learned

- Capitalization on a single package
- Ergonomics
  - permanent interaction with forecasters
  - appropriation step WITH developers
  - well accepted now
- Integration within Synergie : relevant
- Methodology : overlaying, macros, annotations
- Initialization : to generalize
- Risks : 3 forecasting levels
- Objects are not the only solution to GI

UKMO Horace System
Production Facilities

In January 1997 the UKMO and in particular the National Meteorological Centre (NMC) at Bracknell decided that they needed to be able to produce products and disseminate them in a more efficient way than they were currently doing.

In 1996 a study (Forecast Rationalisation) had been carried out, this looked at all the forecasting offices in the UKMO and the forecasts they produced. The conclusion of the study was that a lot of duplication takes place in various locations around the country.

The study helped to identify the tasks that could quickly and easily be reorganised to produce business benefits to the UKMO. It was decided that the first products to be changed would be the aviation charts. The aviation work being done at Head Quarters Strike Command (HQSTC) on paper would be transferred to the NMC and be done on screen. The UKMO SigWx package, which is accessed from Horace, was the most obvious way to do some of these charts. However some of the charts involved a combination of both text and graphics. Some software would have to be developed as part of the Horace system to create these products.

At the time of the study products in the NMC were created by the forecaster drawing isobars onto a large map covering the North Atlantic area. The support staff would trace various parts of the chart onto a blank product form. Various further annotations would be added by a forecaster. Some products have text associated with them, which is written by a forecaster. All the pieces would go to the support staff who would get out the glue and scissors and create the product. The final stage in production would involve reducing the product on the photocopier to an appropriate size and passing the photocopy to the telecommunications staff for onwards transmission. As anyone can see this is quite a labour intensive procedure.

The Horace system software was developed to give the forecaster the right kind of tools to create the product on screen and then disseminate to one or more customers in a number of formats. This would reduce the amount of time required to create the current NMC products and therefore allow for the HQSTC products to be inserted into the NMC schedule.

Our first challenge was that all this new functionality had to be proven and available in the NMC on 27th October 1997. This date was a fixed deadline, Forecast Rationalisation would go ahead with or without us. The NMC would go live on that day, they would take over the responsibilities for producing aviation charts done at HQSTC. This would subsequently free HQSTC to take on more work for military customers. Up until this time Horace had only visualised data, the only production facilities we had were the SigWx package, which is a project on its own that uses Horace as its platform.

We made a decision straight away to try and identify a commercial software package that could take an on screen image and combine it with scales, labels and text to produce a final products, thus dispensing with the glue and scissors. A number of desk top publishing packages were looked at. These were great for assembling the product on the screen but we wanted a package that could do all the work behind the scenes. The forecaster would not have time to save all the components and create the product on screen from these bits. We finally found the product we required, it was used extensively in the oil industry and by geologists to create maps and plot data in combined presentations.

The ZEH package is powerful and can be run using scripts, the scripts take the CGMs of the text, screen, scales etc. and combine then into a template to create the final product. The next hurdle to overcome was our own use of CGMs. It would appear that for years we had been using the wrong type, well certainly the wrong type to use with ZEH. The package requires the attributes for line styles etc. to be included in the CGM. The CGM packages used by the UKMO expect the attribute information to be stored in bundles that the drawing software accesses in a lookup table. We asked our GKS suppliers if they could help and provide us with any software to convert between the types, they provide us with CGView.

We now had all the basic components to produce a product from CGMs. We just needed to write the software to create the CGMs in the first place. The scales and titles were the obvious place to start as they were mostly static and reasonably straight forward. We created the scale CGMs using some UKMO software that creates geostrophic scales for hardcopy charts. We captured the scales and saved them as static CGMs that could be placed within our ZEH templates. The titles had to be done slightly differently as they incorporate dates and times. The same software that was used for the scales was also used for the titles but is run when a title is required, the CGM output is placed in the correct part of the template.

So far we had managed to use third party and existing UKMO software to create the basic products. The text has been produced from the Horace text editor for a number of years, we had to take it and convert to CGM which was quite straightforward. One of the products did present us with a problem as the text contained imbedded WMO symbols. We solved this by pre-processing the text and converting key words, from a pre-defined list, to a symbol number. When the ASCII to CGM conversion took place the numbers were translated into appropriate WMO symbols - Figure 1.

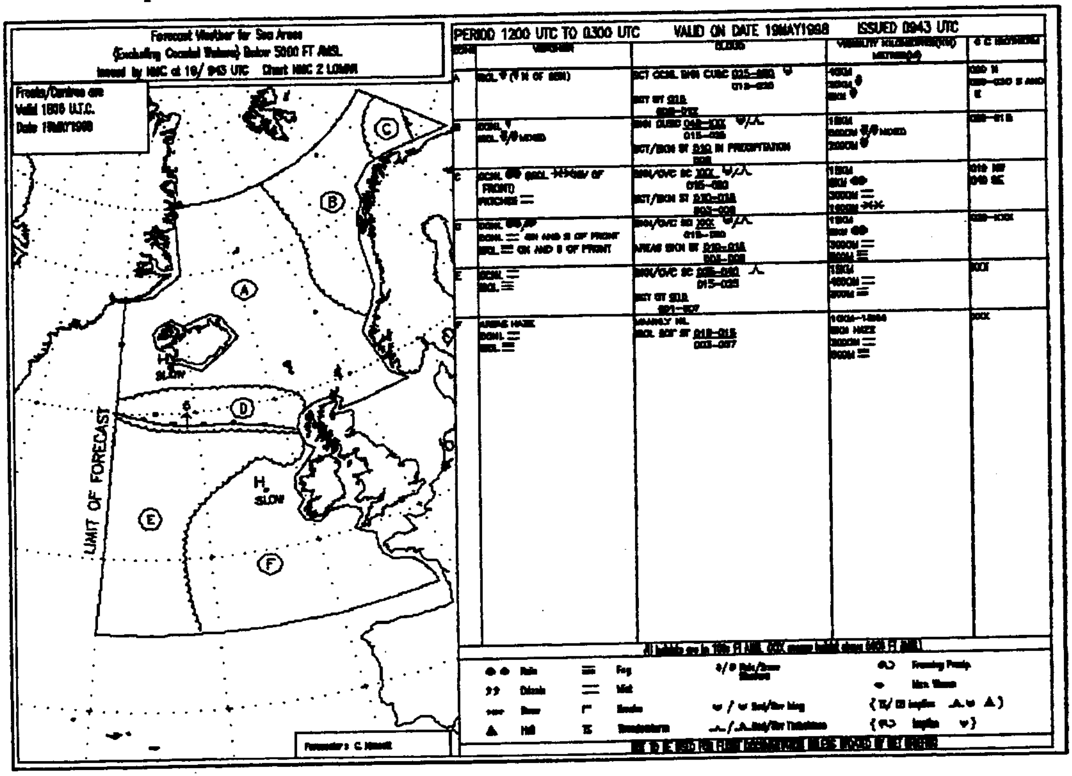


Figure 1 : Text with imbedded WMO Symbols

The main task now had to be tackled which would be providing the forecaster with the editing tools to create products on screen. We had to get the on-screen image and covert it to a CGM for use in our ZEH template. As the existing Horace Graphical Visualiser (GV) contained the data types that the forecaster would need to produce the final product it was decided to add the editing tools to the GV.

The editing tools consists of a GUI which is an interface to the UKMO centrally supported WMO symbol and line drawing package. The GUI gives the forecaster the necessary functionality to draw all front types, add text, draw lines and add WMO symbols. When the on-screen drawing has been completed the product is saved, the objects that have been drawn on the screen go into an object database and can be retrieved later - Figure 2 On Screen Product.

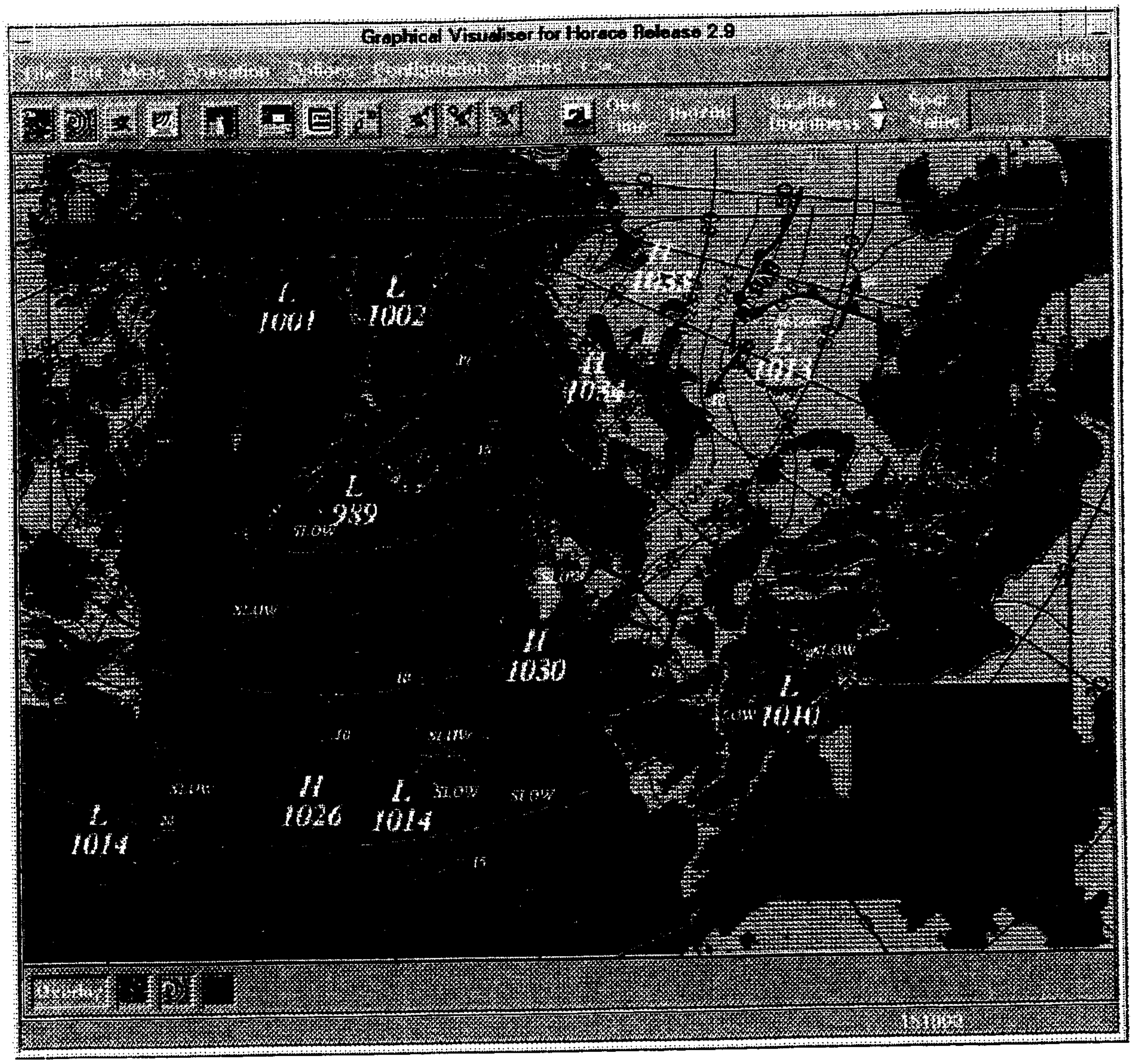


Figure 2 - FSXX on Graphical Visualiser

To create the CGM from what is on screen we effectively redraw the screen into a blank CGM. When the product was saved information like the map area and contour drawn is also saved. This information along with the object database is used to recreate the screen in the CGM.

All the parts have been created, the final product is assembled and shown to the forecaster. When satisfied the forecaster will send the product electronically. This is done by converting the CGM to T4 fax format, adding bulletin information and sending the bulletin the UKMO communications centre for outwards dispatch to customers - Figure 3 Final Product.

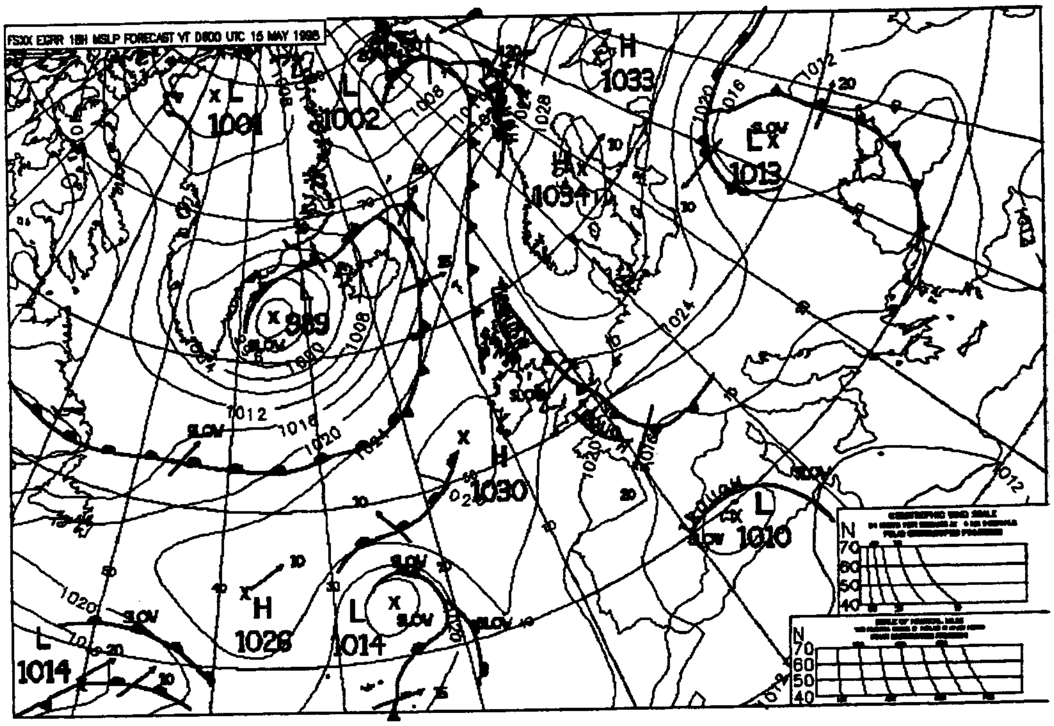


Figure 3 - FSXX as disseminated to customers

Interactive Production Facilities at UKMO

Alan Radford

(UKMO)

1. Introduction

In this talk I will concentrate on four main areas of interactive production in the UK Met. Office:

¥ Significant Weather chart production
¥ Horatio project
¥ Semi-automatic TAF production
¥ Other miscellaneous semi-automatic production facilities

2. Significant Weather Charts

The UK Met. Office is one of two World Area Forecast Centres (WAFCs) within the World Area Forecast System (WAFS) of the International Civil Aviation Organisation (ICAO). One of its responsibilities is to produce and disseminate charts of high-level significant weather (above flight level 240) every six hours for a number of different areas around the globe. There is also a growing requirement for the production of medium-level significant weather (between flight levels 100 and 450).

A semi-automatic facility has been developed over the last few years that enables the forecaster to carry out this work in the time available. On the screen he is presented with 'first guess' fields of the various significant weather parameters, such as clear air turbulence (CAT), jet streams, embedded Cb cloud and tropopause heights. He can also underlay raw model fields, such as isotachs and temperatures. He can then either accept the first guess features, or use them as guidance to draw his own.

The significant weather features on the chart can be represented in BUFR code. This makes it easier to disseminate the information, as the recipients are then able to decode the data and display it using their own software on any area they choose. A trial is currently underway between the two WAFCs at Bracknell and Washington to test out this procedure. Currently the BUFR code can only handle high level significant weather objects. However, there are plans (through the COST-78 Working Group on Graphical Interaction) to generalise the specification so that many more meteorological objects can be coded, including medium level significant weather.

3. Horatio project

The Horatio project is a subproject of Horace to develop advanced visualisation and interactive production facilities for the Royal Navy, particularly relating to ocean observations and models.

OSFM - On-Screen Field Modification

The OSFM software, now being used routinely within NMC Bracknell to produce forecast charts of surface pressure, is being extended to work on fields from the UKMO's ocean model (FOAM). In the first release the software will use simple dynamical algorithms to modify fields of temperature, salinity and current. However, a feasibility study has indicated that the potential vorticity method can also be applied to ocean fields, so work to implement this will start soon.

OSA - On-Screen Analysis

The OSA software, which will soon be used routinely within NMC Bracknell to produce analysed charts, has been extended to analyse certain ocean observations such as BATHY temperatures at standard depths and significant wave height.

Automatic text generation

One of the prime requirements is the facility to automatically produce text for shipping area forecasts, gale warnings and ship route forecasts. We are investigating the use of the PROLOG language, particularly for the production of the shipping area forecast.

Visualisation

We are developing certain advanced visualisation facilities specifically for the requirements of the Navy. As well as being able to display raw fields from FOAM, derived fields (such as the speed of sound under water) can also be calculated and displayed. The standard Horace tephigram display has been modified to allow the plotting of BATHY profiles of temperature, sound speed and salinity. Work will also soon begin on developing software to display cross sections of ocean fields.

CAnal - Coded analysis

There is still the need to be able to disseminate an analysed chart of mean sea level pressure in standard alphanumeric code. To aid this process we are developing software to digitise the chart automatically. Each isobar will be defined by a number of latitude-longitude pairs (depending on the curvature and pressure gradient). The location of fronts and pressure centres will also be included.

Graphical product generation

There will be a set of tools to enable the forecaster to produce standard and customised products from the fusion of various sources of gridded and satellite data. It will be possible to add graphical objects (e.g. fronts), and to integrate graphics and text from other sources.

4. TAF Automation

We have recently started on a project to semi-automate the production of TAFs. We plan to combine the output from MOS and the UKMO's site-specific forecast model (a 1D version of the Unified Model) and ingest this into the encoding software. We have bought the AUTOTAF encoding software from the German company Meteo Service, and are currently evaluating it using test data.

We are also involved in the EUMETNET project called TIPS (TAF Interactive Production System) and are taking the lead in the task to produce a common set of TAF monitoring software.

5. Miscellaneous facilities

Forecast QNH

A particular routine (hourly) task within NMC Bracknell is to produce a short-term forecast of minimum QNH (pressure) for 22 regions covering the UK. This is now being semi-automated. An algorithm calculates a first guess, based on pressure tendency and other factors, which the forecaster can then change if he wishes before dissemination. There is a verification scheme incorporated into the software to measure how much improvement the forecaster makes.

NWP sequence

An existing Horace application, to display a sequence of observations in a grid on the screen, has been used as the basis for a similar facility to display a sequence of NWP forecasts. The user is able to select a station location and a particular model forecast, and the software will display the forecast in the form of a sequence of METAR plots at given intervals.

6. Future

The OSFM software is currently used to produce forecast charts, but the modified fields are not used elsewhere in the production process. Therefore, the main thrust over the coming year will be to make use of these modified fields, in both fully automated and semi-automated production.

9th EGOWS Meeting, Norrköping 1998

Joint session with

COST-78 Working Group for Graphical Interaction Tools

Interaction with model time-series

Lars Brusletto Sveen
Audun Christoffersen,
DNMI, Research and Development Division

1. Introduction

One of the fields of interest for the Working Group for Graphical Interaction Tools is "interaction with model time-series, including TAFs".

This paper gives a brief introduction to the work done on graphical interaction with model time-series at DNMI, and includes a presentation of a project called TIPS – *TAF Interactive Production System* – a proposed EUMETNET programme for computer assisted TAF production.

2. The need for graphical interaction

Software for visualisation and manipulation of fields, time-series etc. has existed for some time at DNMI, but there have been no facilities for graphical interaction. The Maritime Forecast Centre expressed a wish for the rationalisation of production of off-shore forecasts. These off-shore forecasts are

- point forecasts for oil rigs, ships etc
- tailor-made for each user
- subject to strict quality control and monitoring

The preferred solution for the rationalisation was that forecasts should be produced by graphical editing of time-series

2.1 Phase 1: Visualisation

For the time-series interaction project it was necessary to develop new routines for visualisation. The focus was set on flexibility: presenting arbitrary data sets according to user-defined styles of visualisation. A sample time-series diagram is shown in figure 1.

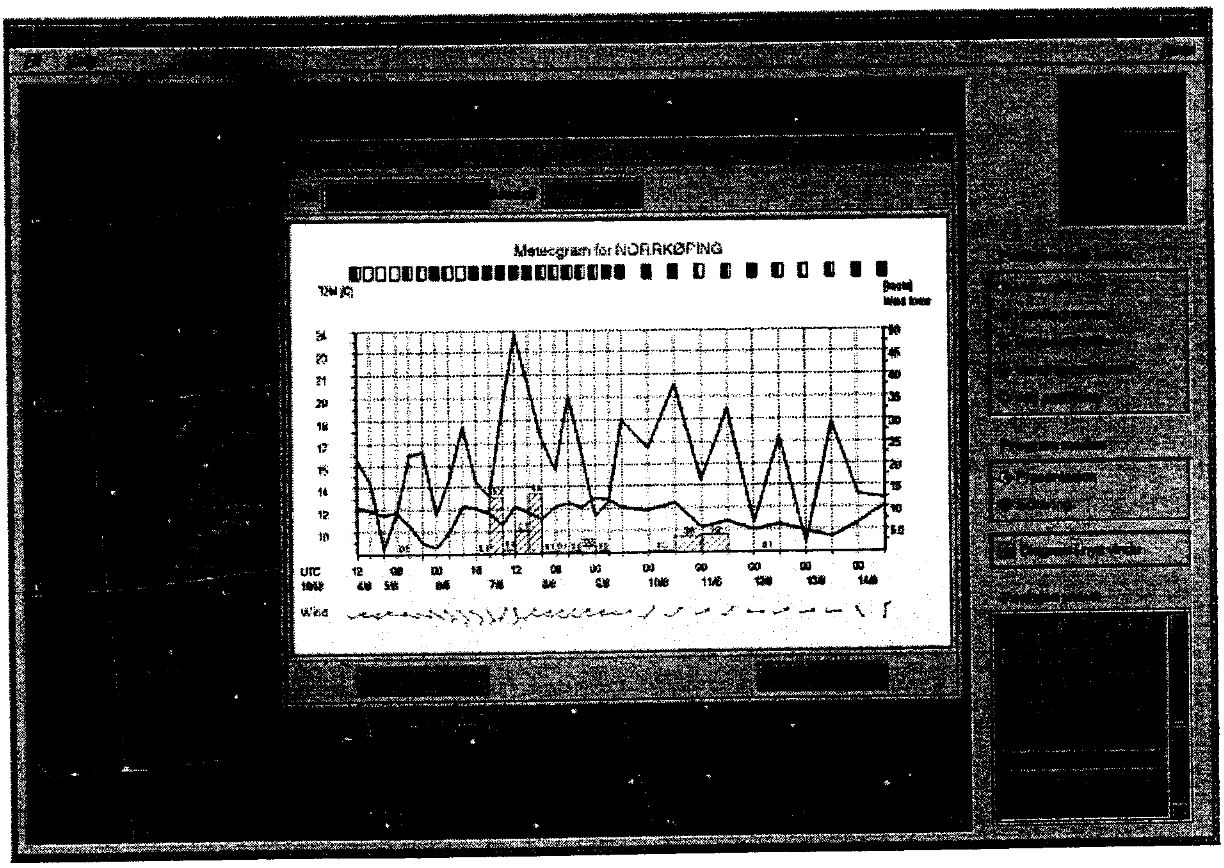


Figure 1: User interface with sample diagram from the new time-series visualisation tool

2.2 Phase 2: Editing timeseries

Graphical pointer-based methods of interaction are both intuitive and efficient. They provide easy manipulation of entire time-series, and immediate visualisation of derived data sets is achieved.

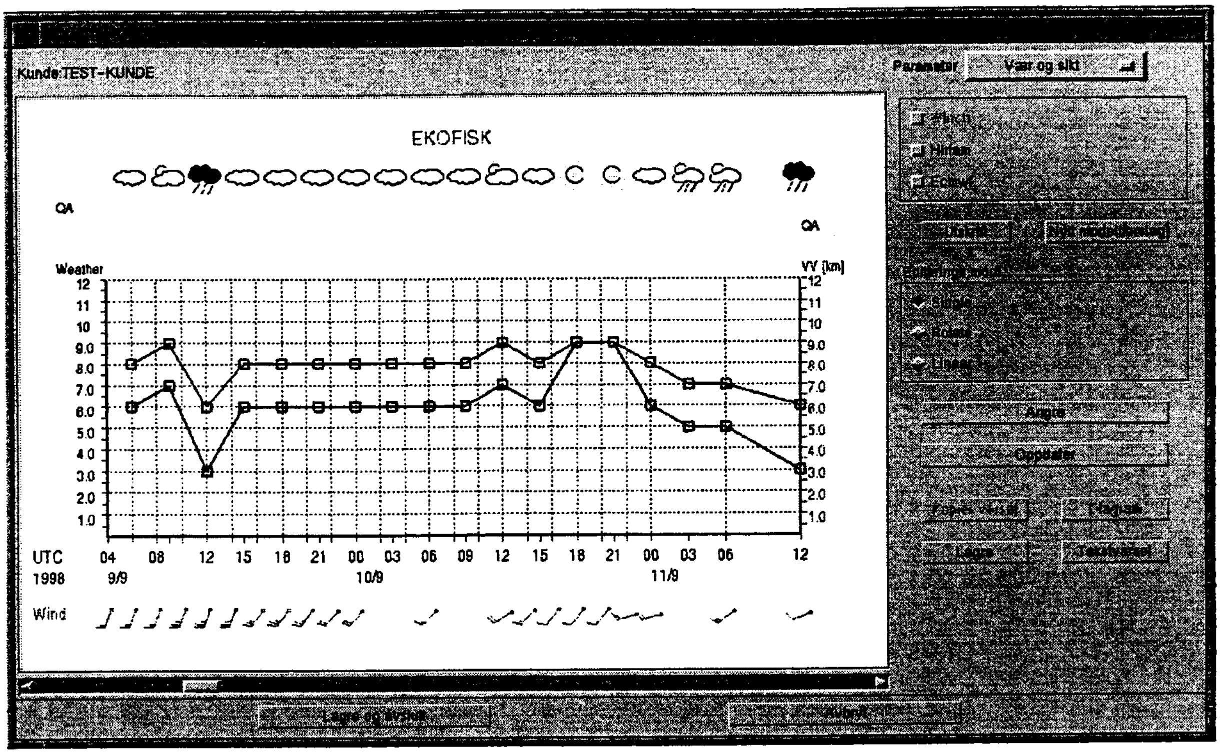


Figure 2: Sample diagram for time-series editing

Visualisation and interaction tools are collected in a library for shared use across applications.

2.3 Technical niceties

- Object-oriented programming (in C++)
- Flexible data structures based on NCSA's HDF file format
- Graphics with OpenGL (on SGIs) but not without problems:
    - Batch production – solved by using an off-screen rendering area (X pixmap)
    - Printing – not yet satisfactorlily solved; several libraries using the OpenGL feedback mechanism tested
- User interface in Motif

2.4 Further applications

The visualisation and interaction tools will be used in a series of planned applications:

- Maritime and off-shore forecasting
- Aviation forecasting in connection with DNMI's implementation of the results from TIPS.
- EPS products
- Regional forecasting

3. TIPS – *TAF Interactive Production System*

TIPS is a proposed EUMETNET programme originating from the COST-78 Working Group for Graphical Interaction Tools. A EUMETNET programme is proposed because

- The COST-78 action ends in March 1999
- A framework for international cooperation is desirable

The EUMETNET Council responded positively to the first draft of the proposal, and the final decision on whether TIPS is to be accepted as a EUMETNET programme will be made in September 1998.

Participants so far are Austro-Control, DNMI, DWD, FMI, HMS, IMS, KNMI, Météo-France, SMA, SMHI, UKMO, and DNMI will act as the responsible institute for the programme.

3.1 Objectives and system design

The main objectives of TIPS are

- to deliver operational tools for computer assisted TAF production
- to increase international standardisation of aviation forecasting

The TAF production chain is imagined to follow this pattern:

NWP output
↓
post-processing
↓
human interaction on numerical data
↓
automatic TAF generation
↓
human interaction on TAF text
↓
basic quality control
↓
distribution
↓
monitoring
.
TAF and TREND verification

Areas suitable for co-operation are marked here in bold type.

3.2 Tasks, deliverables, and task managers

1. Derivation of parameters from model output
- **Deliverable**: List of existing algorithms and software
- **Responsible**: Météo-France

2. TAF encoding
- **Deliverable:** Software for TAF production from NWP output
- **Responsible:** SMHI

3. Forecaster interaction
- **Deliverable:** Evaluation of interaction methods
- **Responsible:** KNMI

4. Basic quality control of man-made TAFs
- **Deliverable:** Software for performing basic control of syntax and consistency

- **Responsible:** DNMI

5. TAF monitoring
- **Deliverable:** Software for monitoring TAFs
- **Responsible:** UKMO

6. Verification
- **Deliverable:** TAF verification method and software
- **Responsible:** DWD

The project started in June 1998 and is scheduled to be completed by April 2000.

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