

GRAPHICS FACILITIES AT ECMWF

J. Daabeck

European Centre for Medium-Range Weather Forecasts

Reading, U.K.

1. INTRODUCTION

Operational and research work at the Centre relies heavily on computer-generated graphics. It is used routinely as a basis for monitoring observational data, which is used as input to the Centre's model, as well as for plotting model output. Graphics is also used to generate charts for the Centre's publications and verification work.

The first hardware and software graphics systems at the Centre were developed nearly twelve years ago and have proven to be excellent tools for the Centre's staff. In the meantime, the requirements for graphics have changed, due mainly to the developments in graphics hardware and software. On the hardware side many new devices have become available with improved resolution and enhanced intelligence, which means that more information can be presented in a better way. As colour is now available as a standard for terminals, further improvements in presentation can be achieved, even though colour hard copy devices are still rather slow compared to black and white. The improved colour quality and resolution is now up to a suitable standard to allow direct use for publication work. Because of the various types of graphics devices available, device independence on the software side, becomes a necessary attribute of a new graphics system. An easy to use, flexible user interface to the graphics systems was also seen as an important requirement. Furthermore, the functionality and flexibility of a new system should be enhanced, so that more complex presentations become easier.

It was envisaged that to design and implement a second generation graphics system, special effort would be needed and a Graphics Project Group was established at the beginning of 1984. The main duties of the group have been to develop graphics systems and to take care of many of the ongoing tasks within graphics.

The major achievements of the Graphics Project Group have been the Meteogram system, design and implementation of the new graphics system MAGICS, and participation in the selection and installation of graphics hardware.

2. THE COMPUTING COMPLEX

The present computing facility (Fig. 1) comprises a Cray X-MP/48, a CDC Cyber 855 and a CDC Cyber 835, a Telecommunications System based on four VAX 11/750, a VAX 8200 for graphical applications and an IBM 3090-150 running a Meteorological Archival and Retrieval System (MARS). All computers are interconnected via a high-speed local area network. The computer facility provides a continuous service, 24 hours per day, 365 days a year.

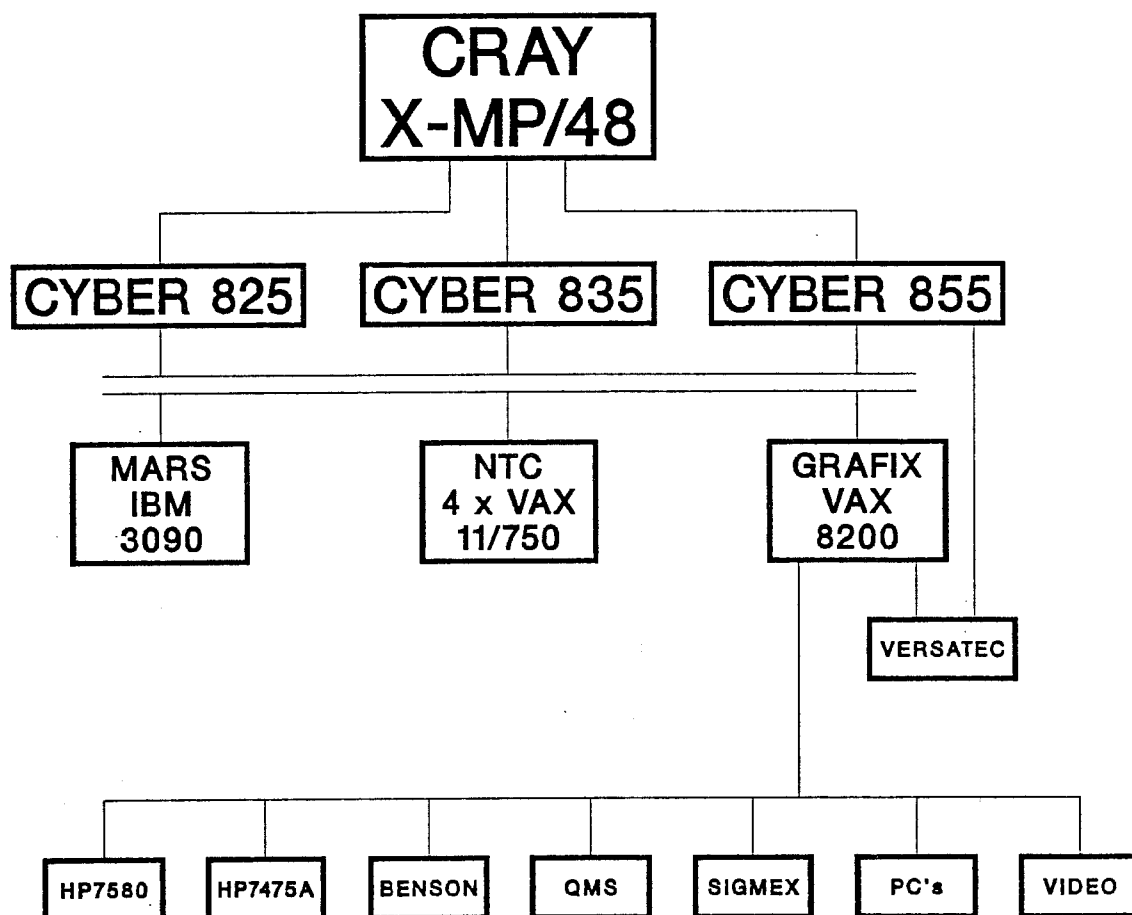


Fig. 1: Computing Facilities

3. THE METEOGRAM SYSTEM

The first development project to be completed was the Meteogram system. With this system, meteograms (Fig. 2) based on on-line data or data from the ECMWF archives can easily be plotted. The meteograms can be generated for any place on the globe and will display, for a 10-day forecast in black and white or colour, the cloud amount, 850 hectopascal relative humidity, temperature at 2 m and 850 hectopascal, precipitation, mean sea level pressure and 10 m wind.

With the interactive command driven processor METGRAM, users at the Centre can very easily generate a batch job sequence to retrieve the data for the meteograms and plot them. The data retrieval, data manipulation and post-processing of the graphics output is performed on the Cybers, whereas the generation of the meteograms is done by a DISSPLA based Cray job.

The usage of this interactive command driven system has so far ranged from being a tool for testing changes in the forecast model to visualisation of the forecast, e.g. a daily colour display of meteograms for selected places.

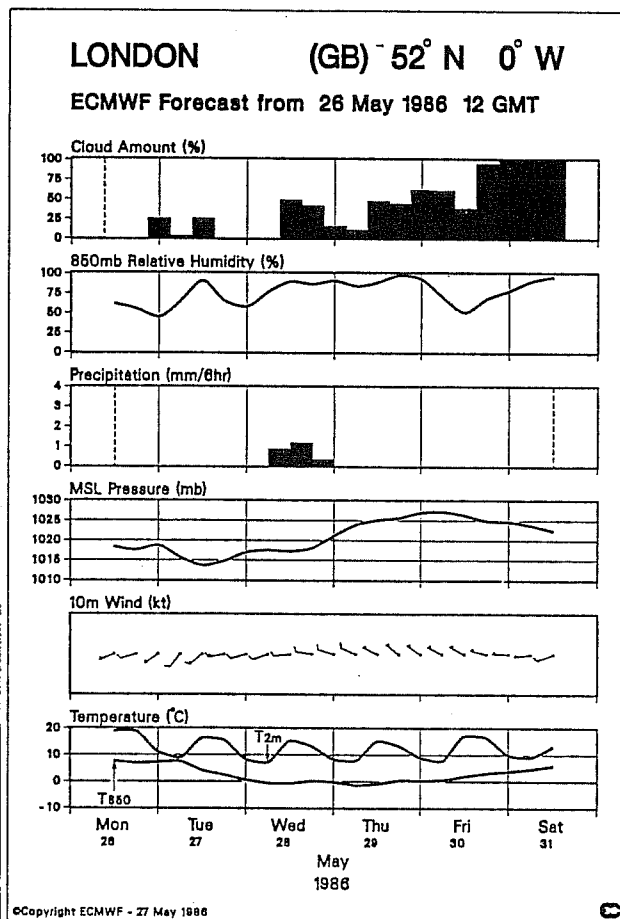


Fig. 2: ECMWF Meteogram

4. MAGICS

The Meteorological Applications Graphics Integrated Colour System (MAGICS) is a software system that currently permits contouring, wind field plotting, observation plotting, streamline plotting, isotach plotting and text plotting.

MAGICS contains some powerful features.

1. Comprehensive list of simple English language parameters
2. Extensive use of colour
3. Flexible user interface
4. Matrix and GRIB code data input
5. Selection of geographical area and direct projection of data (Fig. 3)
6. High quality contouring based on CONICON (Fig. 3)
7. Shading between contour lines (Fig. 3)
8. Wind fields directly projected, as arrows or WMO flags
9. Device independence (metafiles)
10. Storage of program context (specification groups)
11. Advanced legend plotting
12. Streamline and isotach plotting.

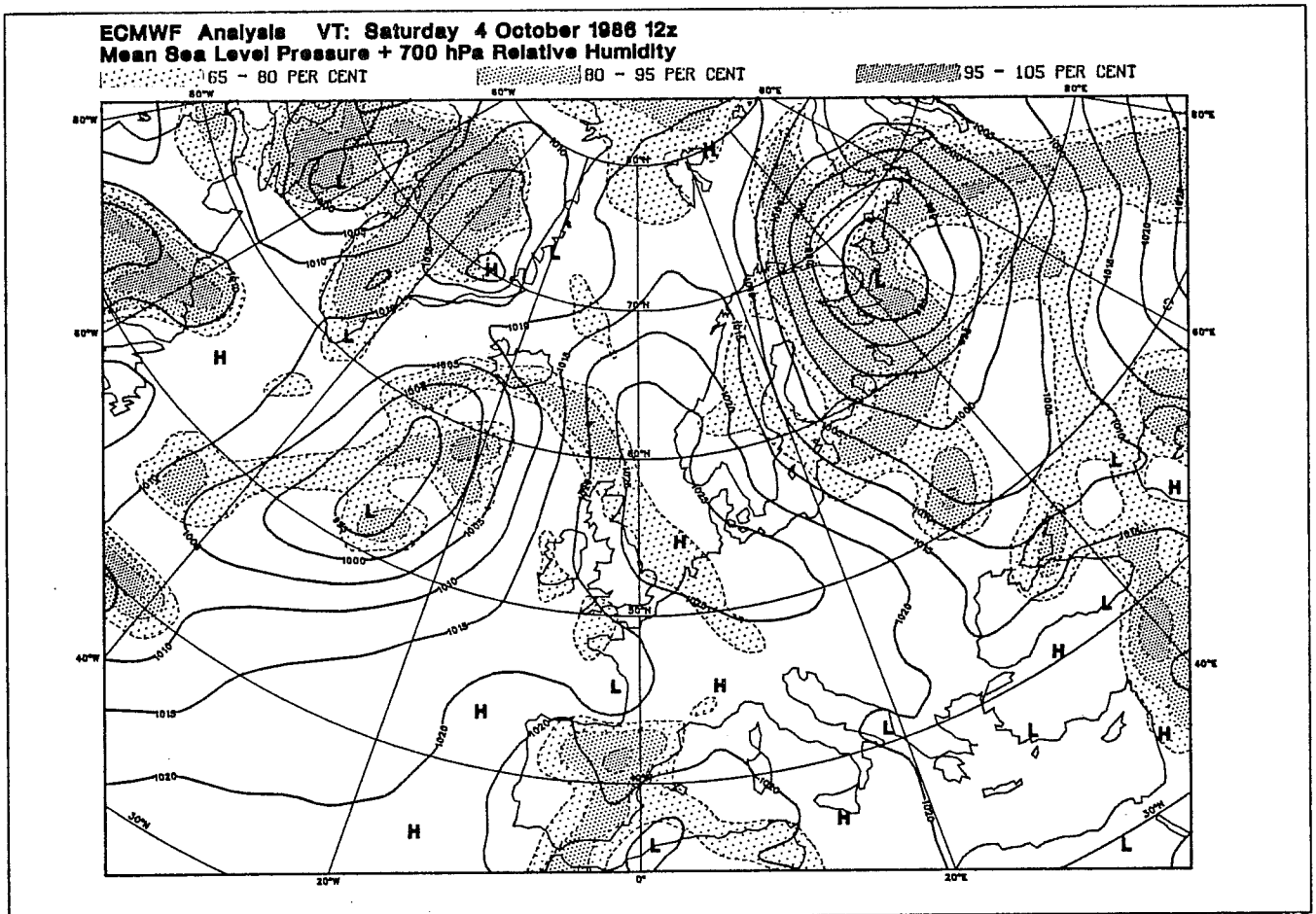


Fig. 3: MSL and Relative Humidity Map

For further details please see the presentation on "Meteorological Applications Graphics Integrated Colour System (MAGICS/GKS)".

5. METAFILES AND THE DISPLOT UTILITY

The graphics output generated by MAGICS is normally in the form of a graphics metafile. The metafile contains a device independent description of the graphics information.

DISPLOT is a utility program to send metafiles between the Centre's computers and to activate post-processors to produce plots from metafiles on the various plotting devices available at the Centre (Fig. 1).

The following hard copy devices are supported directly by DISPLOT:

Versatec 8122 electrostatic plotter
QMS Lasergraphics 2400 laser printer/plotter
Benson Colourscan 800 ink jet plotter
Dowty video system.

To produce output on any of the Centre's Graphics terminals/PCs or on the HP7475/HP7580 pen plotters, a metafile should be sent to a user directory on the system to which the device is connected and the appropriate post-processor used.

The metafile currently used is based on DISSPLA but a change to the ISO Computer Graphics Metafile (CGM) standard is planned next year. Distribution to the Member States of maps in CGM format, using Character Encoding via the telecommunications system, is planned as soon as implementation of CGM becomes available.

6. GRAPHICS HARDWARE

A3 sized QMS 2400 laser plotters have been chosen as the future main output devices for black and white graphics at the Centre. The main advantage of the laser plotters are that they will produce high resolution plots on standard paper and that the resource-demanding vector-to-raster (VRC) is built into the devices.

For colour hard copy output, an A3 sized Benson Colourscan 800 high resolution graphics colour ink jet plotter has been chosen so that colour plots, including maps with shaded areas, can be produced.

High resolution Sigmex 6000 graphics colour terminals have been selected to be used for an operational plot display system, based on MAGICS. The segment storage of the terminals gives very fast access to locally stored pictures. This can be used for switching rapidly between different combinations of fields or showing an animated sequence of time steps for the same fields.

Many staff members have recently got access to AES 286 PC's (AT compatible with EGA graphics cards). Future plans include better support of graphics on PC's, e.g. transfer of CGM files to/from mainframes and PC's. Also the possibility of a PC based MAGICS is being examined.

In-house facilities for video tape production have been installed recently. The system is based on a frame buffer connected to a VAX UNIBUS. Recordings are made on a SONY 5850P in the PAL U-MATIC Low Band format. For further details, please see the presentation on "ECMWF model output on video".