Graphics on Workstations

A Jørgensen, S Lamy-Thépaut, E Nishimura, K Petersen.

ECMWF
Shinfield Park
Reading, Berkshire
U.K

Introduction

This paper is an introduction to the current activities at ECMWF to move graphics applications into a workstation environment.

Four products are introduced :

1. **MAGICS** is a general FORTRAN subroutine library for visualizing meteorological data.

2. **MicroMAGICS/SUN** is a utility based on MAGICS for visualizing meteorological data on SUN. It has an interactive user interface based on concepts similar to MicroMAGICS/PC.

3. **Xsection** is an X Window application using MAGICS to visualize vertical cross sections of meteorological parameters.

4. **Metbatch** is an X Window application using Sun Xview/Guide to allow the user to create and submit METVIEW/batch jobs to CRAY/UNICOS.

1. MAGICS

MAGICS (Meteorological Applications Graphics Integrated Colour System) is a subroutine library that permits the plotting of:

- contouring
- streamlines
- windfields
- observations
- coastlines
- axis/curves/symbols/bars/text/legends

MAGICS is integrated into many meteorological applications on a number of different platforms at ECMWF and Member States. MAGICS has achieved a high degree of portability using:

- WMO GRIB and BUFR
- ISO GKS and FORTRAN 77

Complete versions of MAGICS have been implemented on Sun/Sparc and DECstation with the exception of BUFR which will be added shortly. The only requirements to run MAGICS are:

SUN/Sparc
- SunOS   version 4.1.1
- SunGKS version 3.0
- SunView

DECstation 5000
- DEC GKS3D version 1.1
- ULTRIX   version 4.2
- DECwindows

Moving MAGICS to other platforms with UNIX and GKS should be straight forward.

2. MicroMAGICS/SUN

MicroMAGICS/SUN is an interactive system based on MAGICS/SUN for visualizing meteorological fields. The graphics interface is GKS based and the user interaction is implemented using GKS input functions with the same functionality as MicroMAGICS/PC 1.1. The application runs on SUN workstations.

Input

Input data for MicroMAGICS/SUN are fields in GRIB format. Both GRIB edition 0 and 1 are accepted. MicroMAGICS/SUN shows the list of available fields, displaying for each field its name, originating centre and date.

All fields with the same forecast reference date, parameter code and level are presented as a single entry in order to facilitate the creation of a time ordered sequence of charts. Charts are MAGICS pages that are created in an internal format and displayed from there using GKS functions only.

Visualisation Tools

The system has facilities to zoom in and out and pan over charts. When a chart sequence contains more than one page (each page representing one time step of a forecast), the user can browse through the pages.

Output

The screen is the default output device for a chart. The chart is saved in an internal format to enable subsequent visualisation without recreating the chart. The user can create charts in PostScript format or as GKS metafiles.

Spec Groups

Graphical and geographical attributes are defined by MAGICS parameters. There are 3 different sets of attributes (called **spec groups**):

- CONT   containing all the contour parameters
- WIND   containing all the wind parameters
- MAP   all parameters related to geographical
            area, coastlines, grid and projection.

There is a default **spec group** for each of these sets of attributes. **spec groups** can be manipulated by the user.

Batch language

The system is designed to create charts interactively but they can also be produced using a command language. MicroMAGICS/SUN batch command language is useful in an operational environment where, frequently, the same series of charts have to be generated on a daily basis.

3. Xsection

The Cross section application gives the user facilities to select, calculate and display a vertical cross section of one or more meteorological parameters. Figure 1 shows the window in which the cross section line is selected.

The interface is an X Window based graphical user interface and has been developed with the Sun toolkit Xview.

Most input parameters have default values. Thus, the user has only a few buttons to press in order to define a Cross section. All default values are easily changed and the changes can be saved in a "Setup file" for the next application. Figure 2 shows the window interface to change visualization attributes. The user can thereby configurate the system with visualization attributes for specific cross section applications.

Vertical interpolation is performed on the model level fields and the logarithm of the surface pressure. This data must be in GRIB format. The meteorological parameters presently known by the application are:

- temperature
- potential temperature
- divergence,
- vorticity
- vertical velocity
- wind

Others parameters can easily be added.

Figure 3 shows an example of a cross section plotting vorticity.

The output is based on MAGICS(ECMWF) and GKX(INPE/CPTEC). The application runs on a standalone SUN workstation and needs 1 to 2 minutes to read all the model level fields, do the interpolation and display the cross section.

4. Metbatch

METVIEW/batch is a standard package within ECMWF for retrieving, processing and visualising meteorological data. The user interface is a type of command language consisting of a series of control statements and directives. **metbatch** is a XWindows based application assisting users in building and executing batch scripts using the METVIEW/batch language.

The **metbatch** user almost completely avoids the error-prone methods of typing commands, by selecting preset values or typing just the command value. A significant amount of error checking is done to further assure an error-free command script. The output is a complete batch job for CRAY UNICOS complete with QSUB directives and METVIEW/batch commands. The METVIEW/batch language is based on MARS and MAGICS syntax and most of the METVIEW/batch commands have been implemented.

After the job has been built, the user can store his jobs in a library of jobs and these jobs can be edited at any time in the future. Jobs can be submitted directly from **metbatch**, their progress can be monitored and they can be deleted on the user's request.

Users can set up their own configuration of **metbatch** by defining standard batch job templates, default job library and a file of default MARS/MAGICS command values. The latter enables the user to customize the values of commands that he uses often, thereby further minimizing input requirements.

metbatch was implemented using Sun Xview/Guide and was programmed in the C language. It only runs on Sun workstations.
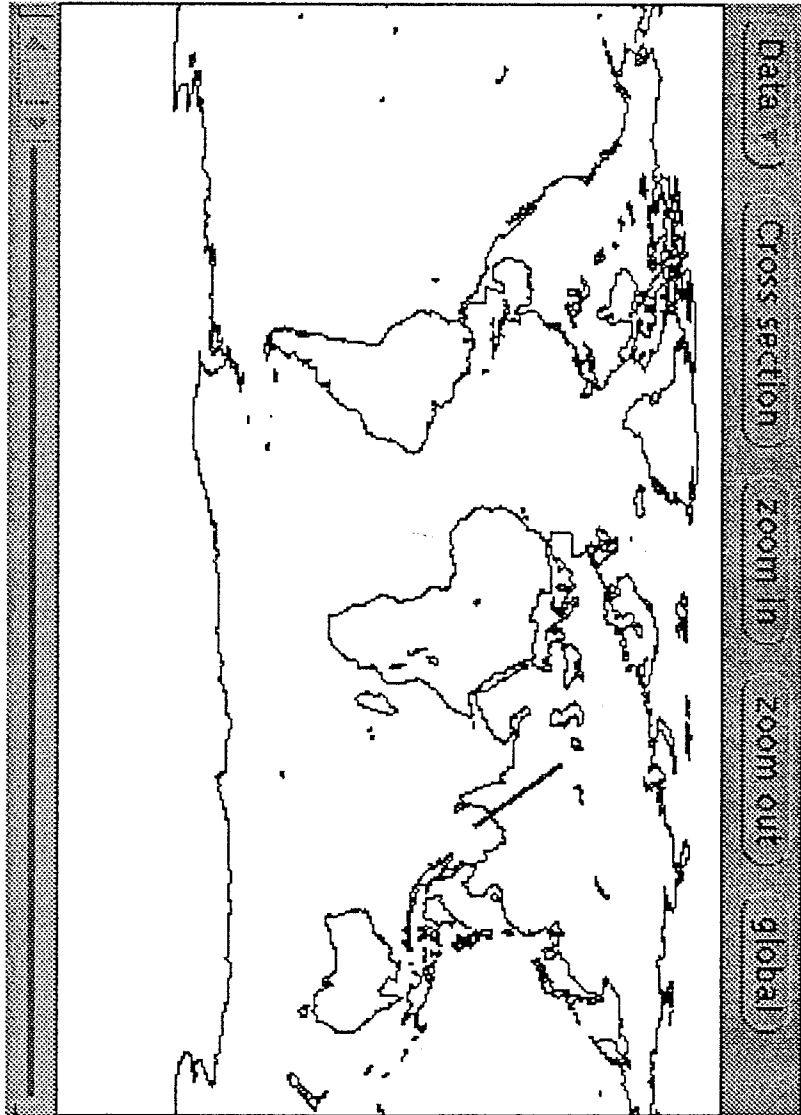
Figure 1: Main Window.
This window allows the user to select the
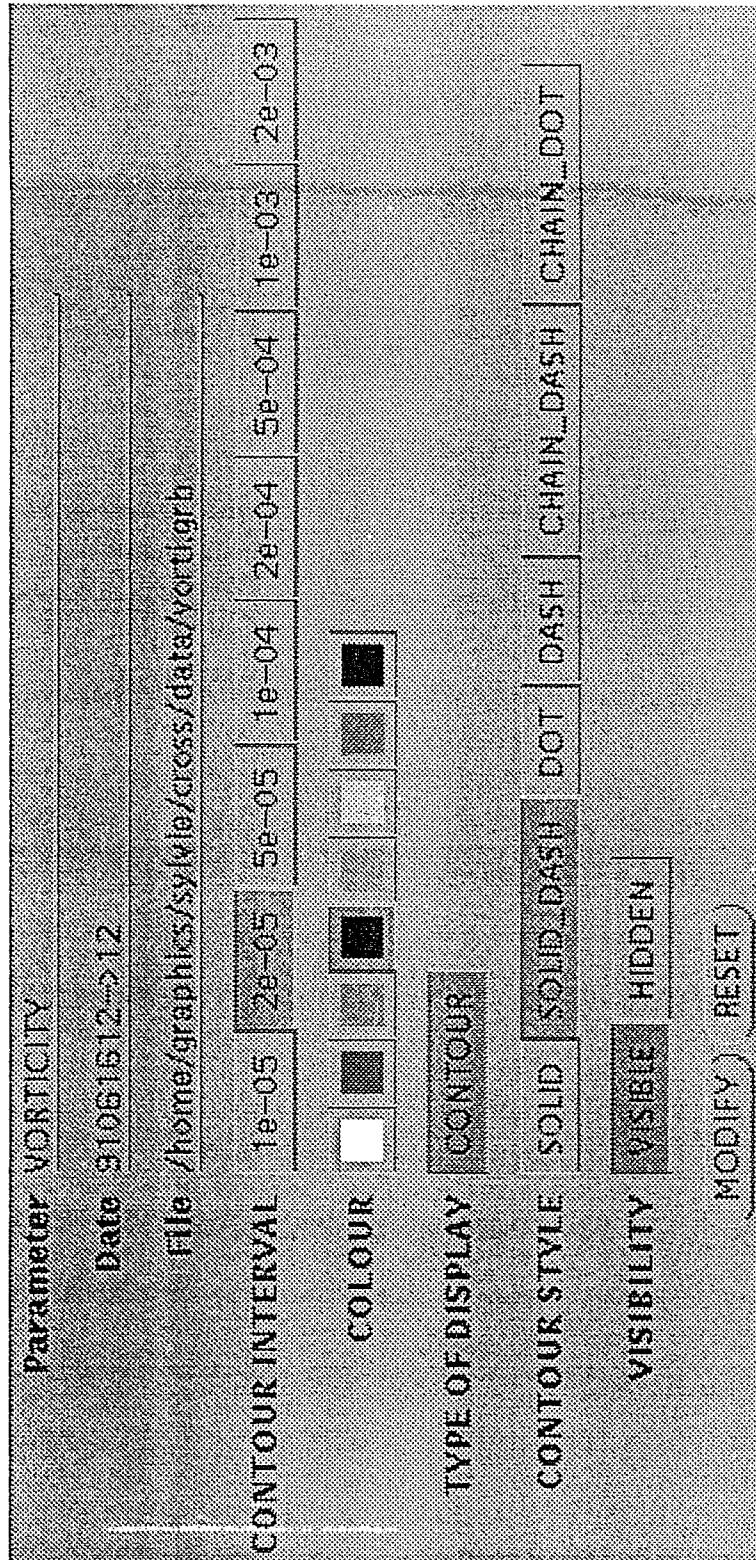Cross Section Line.

Figure 2: Visualisation Attributes Interface.
Using the mouse, the user can easily change the
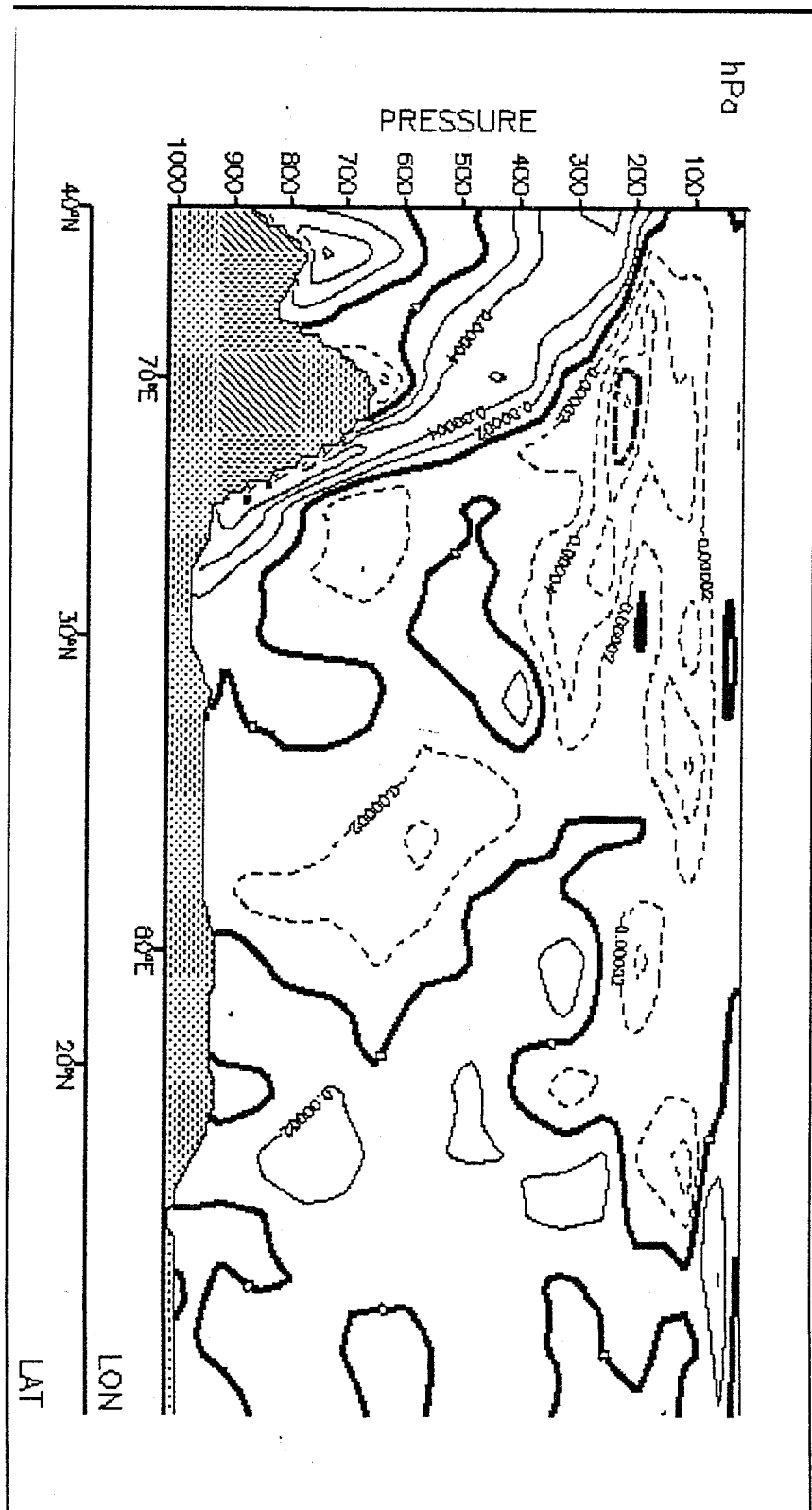visualisation attributes of a Cross Section.

Figure 3: Vorticity Vertical Cross Section.
Output window: Graphics based on Magics (ECMWF)
and GKX (INPE/CPTEC).