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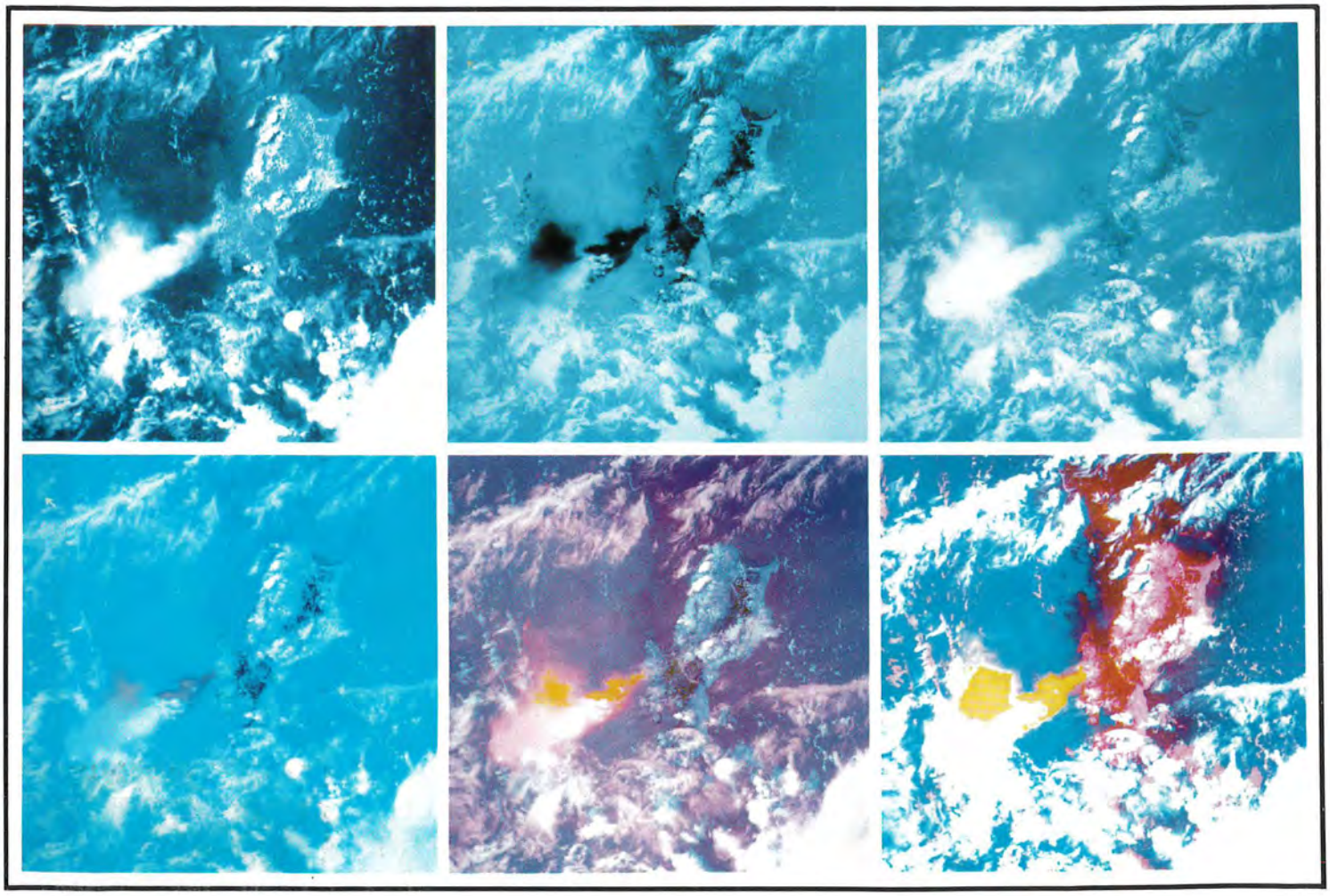

AMERICAN METEOROLOGICAL SOCIETY

METVIEW/ws - WORKSTATION APPLICATION FOR VISUALIZATION OF METEOROLOGICAL DATA AT ECMWF AND INPE/CPTEC

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1. INTRODUCTION

METVIEW/ws provides tools for users to visualise meteorological data in a workstation environment, with a Motif-based window interface for interactive work and an equivalent command-line interface for batch.

METVIEW/ ws is an interactive meteorological workstation. It enables operational and research meteorologists to access, manipulate and visualise meteorological and climatological data on Unix workstations. Fields can be combined with satellite data and observations can be added. The concept of specific applications is used to provide cross-sections, tephigrams, meteograms, display of verification scores etc. (see figure 1).

METVIEW/ws is implemented as a distributed and expandable system, allowing additional functionality to be implemented.

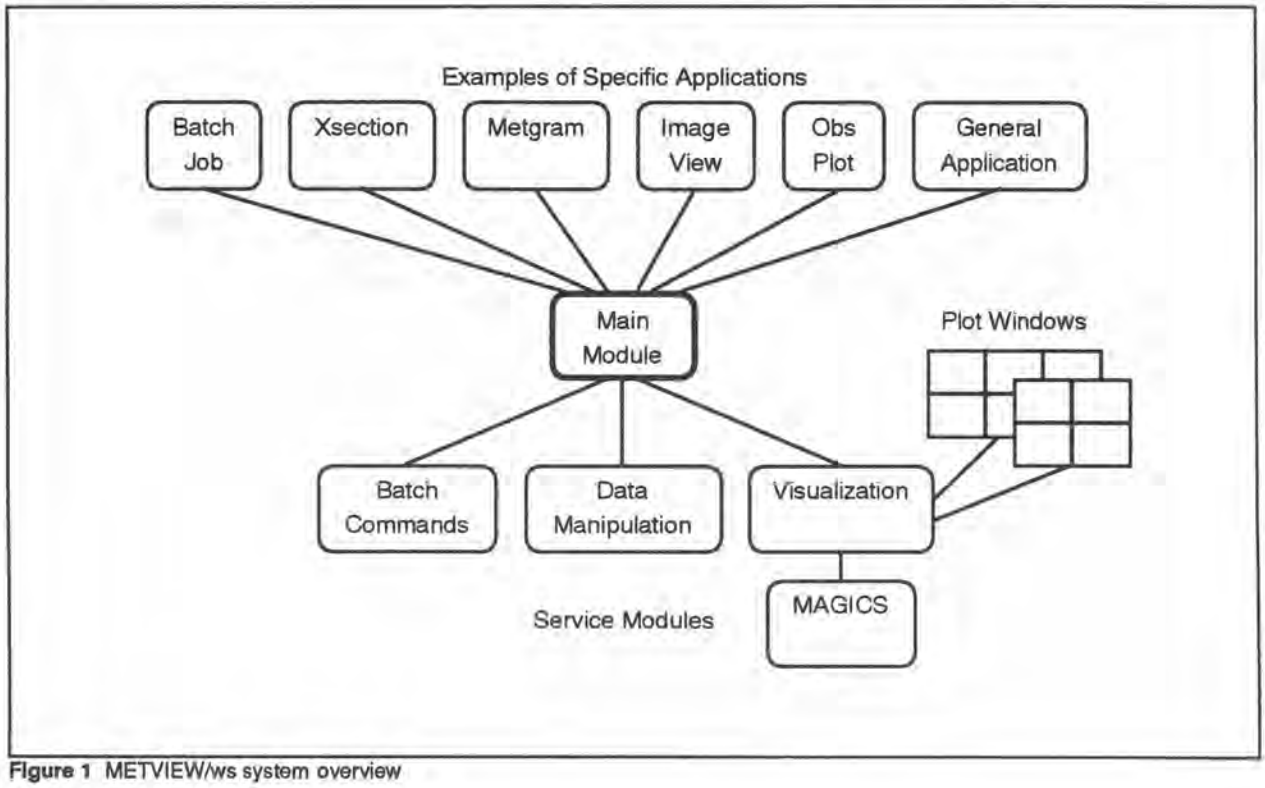

Figure 1 METVIEW/ws system overview

This presentation will report on the progress since the METVIEW/ws concept was introduced at the AMS conference in 1991 (Câmara and Daabeck 1991).

2. THE METEOROLOGICAL WORKSTATION

METVIEW/ws gives the user interactive, conversational access to data and functions via graphics workstation hardware. Interactive data access allows the user to perform the normal functions needed by an operational or research meteorologist in an interactive mode.

User needs evolve over time and one cannot implement all user requirements at once. Hence METVIEW/ws is an expandable system, allowing additional functionality to be implemented. There is a core of basic needs (accessing data, manipulating data, drawing charts), around which one can customise meteorological and climatological applications.

Users may also create their own data outside METVIEW/ws, subsequently visualising them using METVIEW/ws. METVIEW/ws allows loose control over such applications as a preparatory step to visualisation.

3. REQUIREMENTS

METVIEW/ws presents meteorological concepts and solutions to meteorological users. Users interact with a collection of meteorological applications. METVIEW/ws is mainly an interactive system, but incorporates equivalent functionality in batch.

METVIEW/ws allows the user to manipulate and view meteorological data. To accomplish this, a set of common functionality requirements are laid down and implemented as a set of common services available to all applications in METVIEW/ws. Application developers can implement new applications by using the common modules through a well-defined application library.

METVIEW/ws is designed to be easy-to-use, by using an X Windows based graphical user interface, specifically designed to minimise input requirements. The user can also save global definitions, such as data manipulation formulae, drawing attributes, screen layouts, so that he can make new drawings with a minimum of effort. It provides many services, such as full help facilities and custom configurability.

To implement METVIEW/ws, a workstation environment is needed, preferably with powerful servers, and a well-performing network in order to distribute the data and processing load of the system.

METVIEW/ws is, in its entirety, a very large system and it is not desirable nor feasible to aim at the implementation of the complete system at once. Therefore, METVIEW/ws is designed as a modular, extendible system, allowing new functionality to be added without rewriting existing code. For example, new meteorological applications and data manipulation functions can be added to METVIEW/ws.

METVIEW/ws is based on the ECMWF MAGICS package (Daabeck et al 1989) and uses image processing functions from MicroMAGICS (Daabeck 1990). Data representation formats include GRIB (fields, images) and BUFR (observations). It is compatible with the data archival and data access environments of ECMWF i.e. MARS (Hennessy 1986, Gibson 1992) and INPE/CPTEC. It will also include modules from other ECMWF applications.

Because of the project size, modern software productivity tools are being used. This includes X Windows with Motif and C++ programming, an X-based GKS and a window based debugger.

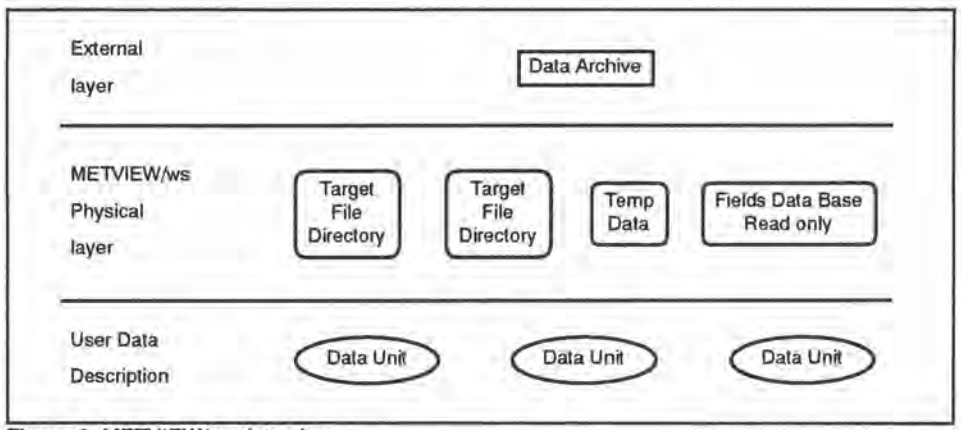

Figure 2 METVIEW/ws data view

4. VISUALIZATION

METVIEW/ws has three primary defined units: the Data Unit, the Visdef (visual definitions) and Plot Window/Plot Subwindow (location of plots).

A **Data Unit** is a user defined name with a symbolic data description in meteorological terms, describing meteorological data types, i.e. fields, images and observations (see figure 2). The symbolic description will at run time be translated to physical file specifications. Furthermore, Data Sequences are multiple Data Units that can be operated on as a single item.

A **Visdef** describes a series of visual attributes (e.g. contour line style, colours etc.). A visdef is not bound to any Data Unit, but is merely a description of the visual look of a chart, should the Visdef be applied with some data and displayed.

A **Plot Window** is a rectangular container for multiple plot areas. The individual plot areas are called **Plot Subwindows** and can be organized in a row/column layout.

Soft visualization is implemented. By binding any arbitrary combination of a Visdef and a Data Unit a chart is produced. This allows for flexibility in changing attributes and plot location with minimal effort. In addition, by allowing the Data Unit and Plot Subwindow components to be sequences, multiple drawings can be made with a single selection.

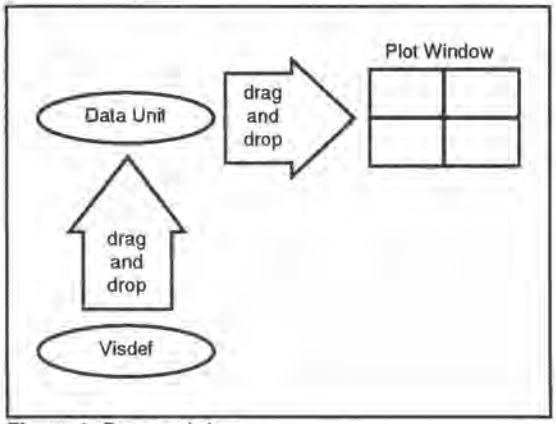

Figure 3 Drag and drop

4.1 Drag and drop

A drag and drop user interface has been implemented in Motif to simplify the user interface, e.g. to visualize a Data Unit (see figure 3):

- A Visdef icon can be dragged and dropped onto the Data Unit if a replacement of the default Visdef is required.
- The Data Unit can be dragged and dropped into a Plot Subwindow.

4.2 Select input values for application

The user will often make the next visualization request based on previous charts, i.e. some of the Plot Subwindows might contain useful information to build the next visualization request. In an application, the user can select input values for an application by pointing at an existing chart in a Plot Subwindow and then, optionally, modify them before realizing the visualization request (see figure 4).

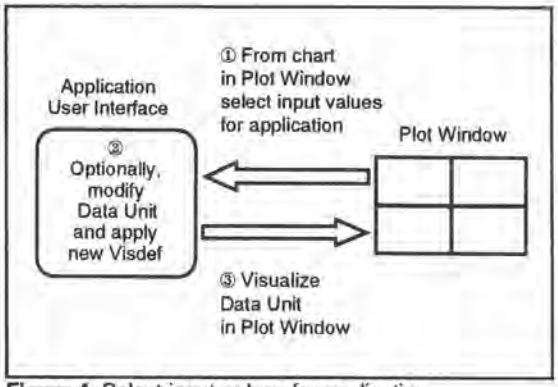

Figure 4 Select input values for application

5. DISTRIBUTED PROCESSING

METVIEW/ws is a distributed system. Application processing and certain CPU demanding services (e.g. data manipulation and visualization) are separate load modules networked to METVIEW/ws. This is all transparent to the user, who should merely experience higher efficiency of processing. To implement this NFS and RPC programming techniques have been used.

6. THE METVIEW/ws PROJECT

METVIEW/ws is a cooperative project between ECMWF and INPE/CPTEC, Brazil. Currently, ECMWF is also assisted by a staff member from Météo France. Preceding the project, some interactive, X Windows based pilot systems were developed, such as *xsection* (cross sections) and *metbatch* (interactive edition and execution of METVIEW/batch job scripts). Based on the *Spring* development, INPE/CPTEC finalised the version 0.1 prototype of METVIEW/ws in October 1991, forming the basis for further development.

Currently, the development teams consist of K.Petersen, E.Nishimura and S.Thépaut at ECMWF and R.Cartaxo, U.Freitas, J.R.Oliveira and A.Battaiola at INPE/CPTEC.

ACKNOWLEDGEMENTS

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