METVIEW NEWS

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Summary: This paper talks about the current developments going on with Metview. Several features mentioned here were demonstrated successfully in the Workshop, on a workstation running the latest development version of Metview.

1. INTRODUCTION

Metview is a powerful and versatile meteorological computing and visualisation tool, developed at ECMWF, together with INPE/CPTEC and MeteoFrance (*Daabeck & al*, 1995). Metview is a mature product, used at ECMWF since 1993. Metview was released for Member States in 1995, and since that Metview has been installed at some 24 sites. Currently Metview is undergoing some big changes.

2. METVIEW NEWS

I had my first Metview talk in this same workshop 4 years ago, just after Metview was officially released for Member States *(Karhila,* 1995). Here are the most important changes since then.

2.1 Manuals

Four years ago Metview was distributed with hardly no manuals. Today Metview comes with a rich set of manuals, both in PostScript format for printing, and in HTML format for browsing through WEB. Metview manuals are browsable, at ECMWF WEB site, also for remote Member State users.

2.2 3-D Visualisation

Every now and then we have been asked if Metview can do 3-D visualisation. Four years ago I finished my talk telling that Metview was a pure 2-D application, but due to Metview's open architecture and configurability it is quite possible to add a 3-D graphics engine into Metview.

Now this has been done. In 1998 Bill Hibbard, from the University of Wisconsin, visited ECMWF for

a couple of months and his Vis5D was integrated with Metview. Integration is based on Tcl[1] scripts, which Metview sends to Vis5D.

Metview-Vis5D integration provides easy data conversions from the standard GRIB format into the proprietary Vis5D format. The huge MARS archive can easily be visualised in 3-D. Integrated Vis5D accepts also Metview icons i.e. users can create Metview icons and macros for frequent Vis5D tasks.

2.3 Y2K

We believe (and this has turned out to be true) the latest Metview 2.0 is Y2K compatible. The older versions do pose some problems.

3. NEW FEATURES

Currently Metview is going through a big evolution, switching from MAGICS 5 with S-GKS based graphics engine to MAGICS 6 with OpenGL based engine. Also Metview user interfaces will change dramatically, both for the main user interface and for plot windows, and a new output format will be introduced for WEB publishing. Following is a description of the coming new features.

3.1 New User Interface

Main user interface usability has been increased, e.g. by introducing new interactive editor for page design, tabbed selections, enhanced drag-and-drop (now also into a closed folder icon), plus some other minor requested features.

The main user interface has been totally rewritten to make the code more robust, more extendible, and more maintainable. Standard C++, with STL (Standard Template Library), has been used all through the coding process.

3.2 New Plot Module

The old visualising module, VisMod, has some severe restrictions, e.g. screen plots are not WYSIWYG and some enhanced page formatting options are available only for PostScript output via macros.

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[1]Note for Metview installers: "off-the-shelf" Vis5D will not co-operate with Metview! You have to build your Vis5D with full external Tcl library!

New PlotMod is WYSIWYG and there are no differences between screen and paper plotting (except the animation, of course). In a way, with the introduction of the new PlotMod module Metview could be called a "MDTP[2] tool".

PlotMod is "view driven". Each page has a view which defines how data is to be visualised. If a user drops an icon representing temperature fields on several levels, to a Map View page, then this data is visualised, one field at a time, with isolines. If the same data is dropped into Cross Section View, then a cross section will be computed and visualised.

New PlotMod is based on Magics 6, and thus is based on OpenGL/Mesa graphics environment. PlotMod module can also produce PostScript and Portable Network Graphics files. More about these graphics issues follow.

3.3   New Graphics Possibilities

OpenGL/Mesa provide modern graphics subsystem for fast plotting. Portable Network Graphics format is a new free software (non-commercial) standard for graphics images.

3.3.1   OpenGL

OpenGL is a package for high performance graphics. OpenGL is capable to access the underlying graphics hardware directly. In general this provides faster drawing, but on the other hand may not work with X-terminals or low level graphical workstations.

OpenGL is commercial. This means that normally you have to pay for it (although on some workstations OpenGL is bundled as part of the basic workstation software). For institutes with low computing budget there is an attractive alternative: public domain Mesa library.

3.3.2   Mesa

Mesa is a public domain OpenGL clone. Mesa has the same API (Application Program Interface) as OpenGL, and indeed libraries are interchangeable.

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[2] MDTP stands for "Meteorological Desk Top Publishing"

Originally Mesa was written on top of X11 interface. Externally it provided an OpenGL compatible programming interface, but internally it used a slow, but everywhere available lower level X11 interface. It follows that OpenGL programs, when linked with Mesa, can be run also on X-terminals.

Latest Mesa implementations are capable to access directly some graphics hardware, and with such hardware Mesa is also fast.

From the Metview point of view the only problem with Mesa is that for tessellation Metview requires GLU (GL Utilities library) version 1.2, and this version is still missing from Mesa (when this paper is being printed GLU 1.2 may already exist). Also some commercial OpenGL implementations currently still come with GLU 1.1, not with the required 1.2!

3.3.3   *Portable Network Graphics Form (PNG)*

For some time there has been requests for Metview to produce images that can be shown on WEB pages. So far Metview has been able to produce PostScript files only, and WEB images have been produced by converting PostScript to some more WEB friendly format.

GIF format used to be the de-facto standard for storing and transmitting high quality images, but unfortunately the GIF compression method (LZW) is not free software, but needs to be licensed from Unisys. Portable Network Graphics (PNG) is a counter attack from free software world. It is still quite young standard, but the number of software that supports PNG is growing fast. All the popular WEB browsers, at least their latest versions, are able to display PNG images.

Magics 6.1 already has a PNG driver and thus the next release of Metview will be able to produce PNG images directly, without time consuming transformations.

3.4   New Metview Modules

New PlotMod is "view oriented". Each view type defines its own visualisation area and/or axis etc. This makes the requirements for some computing modules easier, as they can ignore all features that the view takes care of, and only compute the required data.

Some of the old modules that used to produce also visualisation info, have been redesigned and rewritten to provide the data only. There are rewritten modules for Cross Section, Average, Vertical

Profile and the Tephigram family.

All the views require metadata to tell what the real data is, e.g. date/time, meteorological parameter, level etc. The basic meteorological data formats, GRIB and BUFR, carry within the required metadata. Unfortunately not all data fits into these formats, e.g. Cross Section data values could be coded as a GRIB field, but there is no metadata reserved for cross section line in GRIB headers. To provide the required metadata from the computing module to the view, a new, but already well established data format was introduced into Metview: Network Common Data Form, or NetCDF for short.

3.5　Network Common Data Form

Network Common Data Form (NetCDF) is a flexible way to store data and metadata, and it fulfils all the requirements for passing computed data to views in PlotMod.

NetCDF is very popular form and we have already been asked if Metview will be able to input NetCDF data. The answer is "Not yet!" as currently NetCDF is used only as an internal data format. We do have plans to provide a module that will be able to import some data, in NetCDF format, into Metview.

4.　OLD FEATURES NEWS

New PlotMod module will take over the visualisation and the old VisMod module will be phased out. This brings some problems, as PlotMod uses totally different set of icons for defining plot windows and views. What should be done with all old existing VisMod icons?

This situation becomes even worse when we think of the macros that are used for the production of all the required daily meteorological plots at ECMWF and at several Member States. Must all these macros be rewritten?

4.1　Migration News

Luckily Metview is highly configurable. Inside Metview "Everything is a Request". Modules communicate by sending Metview requests to each other. It would not be too difficult to catch all requests that are addressed to old VisMod and pass them instead to some kind of a Request Translator that will transform them and then send the transformed requests to PlotMod.

We are currently finishing such a translator. Our plan is to keep most of the old icons and macros still running strong.

5 PORTABILITY NEWS

Metview was originally designed for Unix environment, and within this environment Metview is quite portable. The latest port is to Linux[3]/GNU environment.

A relatively cheap Linux PC, with accelerated graphics hardware supported by Mesa, provides quite a powerful graphical environment for Metview.

Porting Metview to a non-Unix platforms (e.g. NT), if required, will not be such an easy task. Such a port could be done by using an intermediate commercial layer that provides Posix and X11 API. Porting Metview to e.g. native NT environment, without intermediate Posix and X11 layers, is considered a real hard job, and currently there are no plans to port Metview onto NT platforms.

6. CONCLUSIONS

Metview is a mature visualisation tool that is undergoing a major user interface change. The underlying graphics system is also changed. New Metview will be able to produce PNG images for the ever growing WEB usage needs. Porting to Linux will provide Metview users more economical but still very powerful visualisation platforms.

References:

Daabeck, J., B. Norris and B. Raoult, 1995: Metview - Interactive Access, Manipulation and Visualisation of Meteorological Data on Unix Workstations. ECMWF Newsletter, 68, 9-28.

Karhila, V.E., 1995: Metview in a Member State: a Dream or a Reality. In Workshop Proceedings of Fifth Workshop on Meteorological Operational Systems, ECMWF, 172-174.

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[3]A note on pronunciation: Linus Torvalds, who gave his name to Linux, comes from Finland (from the same honourable Helsinki University as I do), and *i* in Finnish name *Linus* is pronounced as *i* in *list*, not as *i* in *lie*. From this it follows, as *Linux* is a derivative of *Linus*, also *i* in *Linux* should be pronounced as *i* in *list*!