Metview 4 – Answering the challenges of increasing volumes of data

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Introduction

Metview is a meteorological workstation designed to be a complete working environment for both the operational and research meteorologist. Its capabilities include powerful data access, processing and visualisation. In recent years we have seen the need for researchers to analyse larger amounts of data and information. The main reasons for this lie in higher model resolutions, larger ensemble sets and the increasing amount of satellite observations. These challenges were an essential driving force in the development of Metview 4. With Metview 4 new facilities will be provided to analyse standard data formats (GRIB, NetCDF, BUFR), monitor observation data (ODB) and allow powerful on screen analysis of data and forecasts through new zooming, magnification and data query facilities.

Metview

Metview is an interactive meteorological application designed to access, manipulate and visualise meteorological data on UNIX workstations. It was developed as part of a co-operation between ECMWF, INPE/CPTEC (Brazilian National Institute for Space Research / Centre for Weather Forecasts and Climate Studies), with assistance from Météo-France.

Metview was conceived as having a modular Service Oriented Architecture, where modules can be run on different machines. Modules can be seen as 'mini applications' which sit on top of Metview's kernel, adding both essential and optional functionality to the system.

Standard software libraries such as OpenGL and Motif are used within Metview 3, easing its portability within the UNIX world. Metview has been installed on UNIX systems such as IBM's AIX and various Linux distributions such as SuSE, RedHat and Ubuntu.

General features of Metview 4

The major focus of the recent work on Metview has been the development of the next generation version of the system called Metview 4. The main motivation behind these developments was to offer enhanced tools for:

- post-processing & visualisation of model analysis and forecasts
- observation monitoring
- development of web products
- logging & debugging for operations
- model verification

Metview 4 still uses the underlying modular architecture of Metview but offers a lot of new features that make it radically different to the current operational version (version 3). The most important general features are summarised below:

- Metview 4 fully relies on the advanced Magics++ graphics library (Metview 3 used its predecessor, MAGICS 6). Magics++ enables Metview to use a new variety of output drivers and plot types. With Magics++ it is now possible to build a completely 64-bit version of Metview, allowing access to far greater amounts of memory.
- The original Metview user interface, written in Motif, is gradually replaced by Qt in Metview 4. This is quite a significant change since it will not only provide users with a modern user interface but even enables the development of completely new applications which were simply not possible with Motif. So far the experience with Qt has been absolutely positive.
- The installation process has been made significantly easier in Metview 4: the original custom build process was changed to the use of the GNU Autotools.

New Display Window

The Display Window was completely redesigned in Metview 4 and now it is fully based on Magics++ and Qt taking the advantage of both systems (Figure 1). All the animation steps can be seen in a list, which can be used to navigate through the data steps.
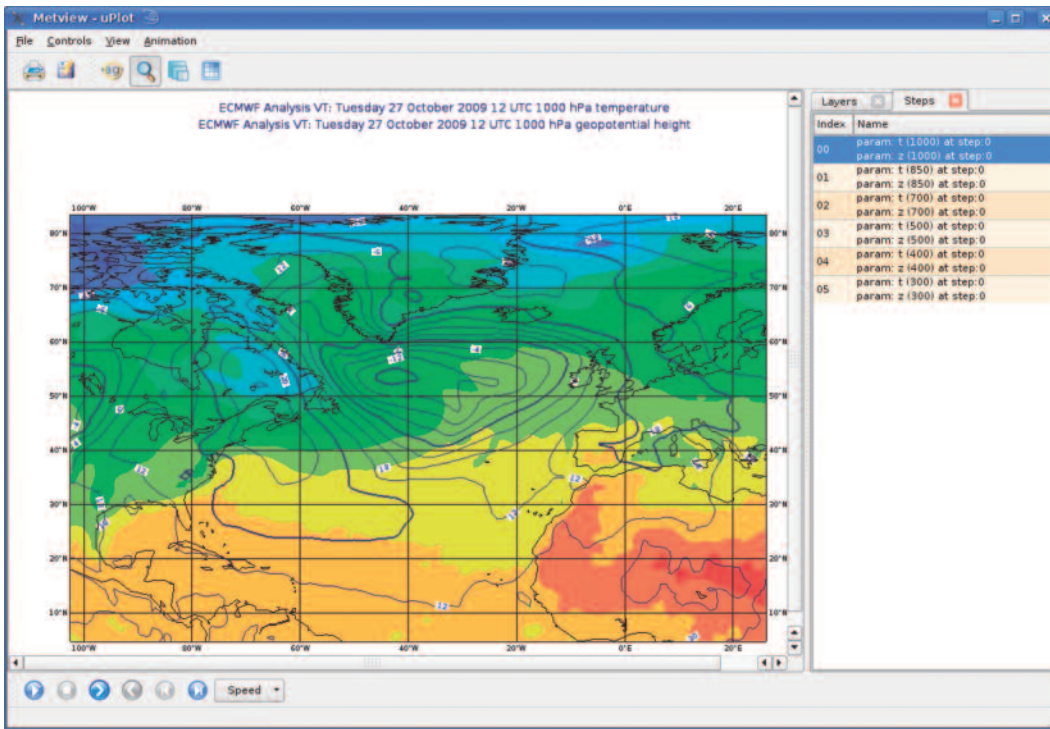
Fig. 1 The Display Window of Metview 4 showing an overlay of two different fields. The animation step list can be seen on the right.

A completely new feature is the addition of the layer management pane. This contains a list of the graphical layers in the plot; these can be toggled on or off, and can have their transparency changed.

Magnification now takes the form of an interactive magnifying glass. In Magnification mode it can be used to enlarge fine text in the plot (e.g. contour labels). However, in Data Inspection mode users will see grid values displayed within the glass. The higher the magnification power, the more values are displayed.
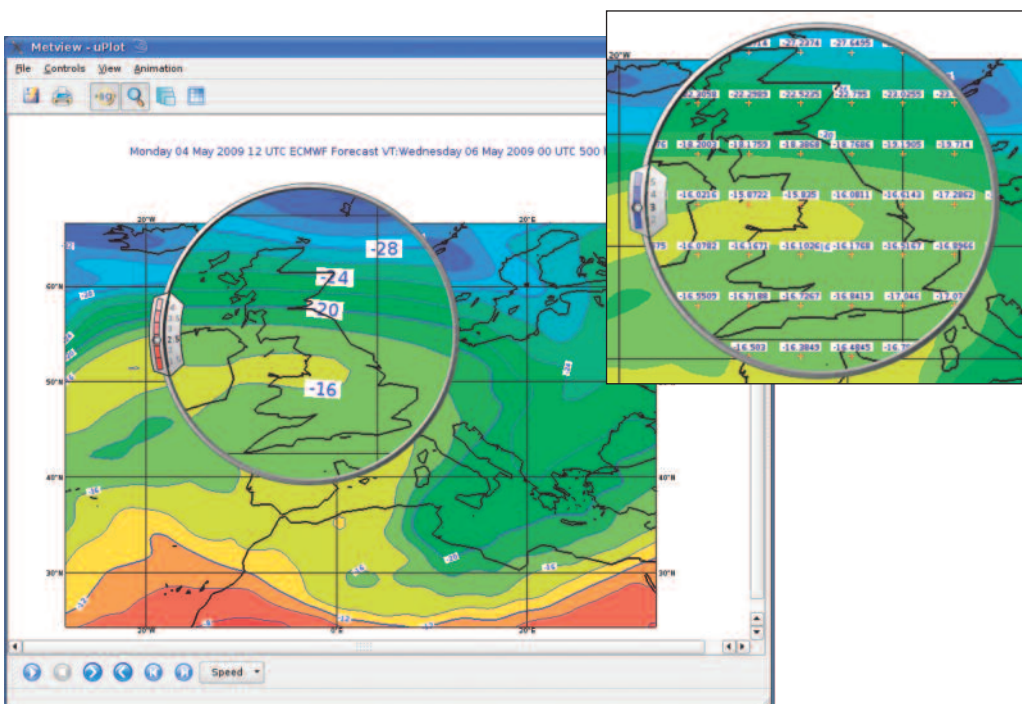
Fig. 2 The magnifying glass at work in two different modes: Magnification mode (on the left) and Data Inspection mode (on the right)

New Data Examiners

Metview 4 contains a set of powerful data examiners. The first prototype is the GRIB Examiner which was written entirely in Qt and uses GRIB API for the GRIB file handling (Figure 3). This tool includes a detailed message list showing the values of a user defined set of GRIB API keys for each message. The full meta data contents of the messages can be examined as well. Similar tools are planned to be developed for other data formats handled by Metview (BUFR, NetCDF, ODB).
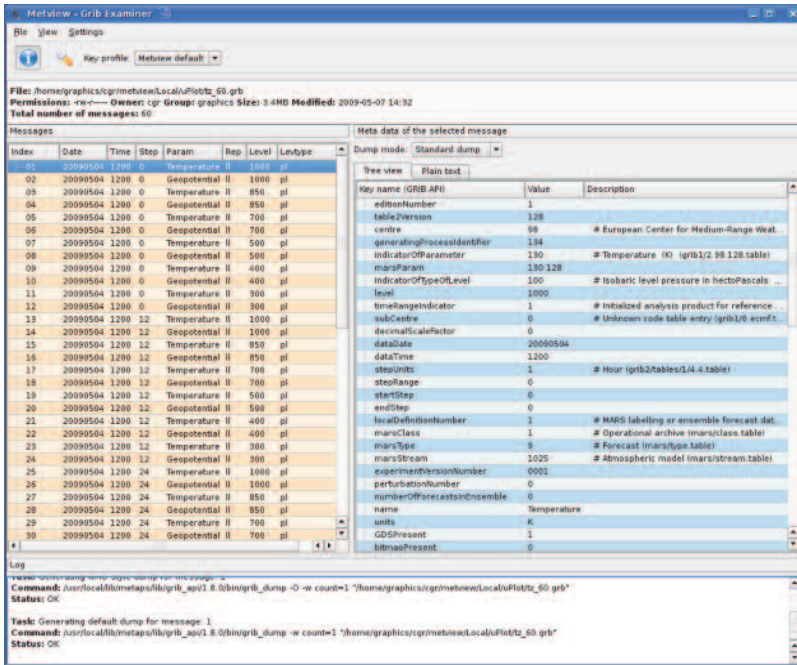
An extension of the data examiner concept is the data tool concept. A data tool is basically an extended data examiner that can both visualise the examined data and run Metview macros on them to derive and visualise new products within the same interface. The first implementation of the tool concept is the GRIB Tool which was developed to cope with the GRIB files containing a great number of different gridded statistics produced by the observation monitoring system at ECMWF. Just like in the case of data examiners the data tools will be developed for the other data formats as well.

Fig. 3 The GRIB Examiner tool

Working with OGC standards

ECMWF is committed to investigating the use of OGC standards and (web) services and Metview can play an important role in this activity.

Metview 4 currently has a WMS client enabling users to incorporate maps from other providers into the Metview environment. This client can perform a GetCapabilites request and builds its user interface dynamically according to the retrieved information. Then users can interactively build the GetMap request. After that the downloaded WMS images can be easily overlaid with any other data in the Display Window (Figure 4). Further developments in implementing clients for other OGC services (WCS and WFS) are being considered.
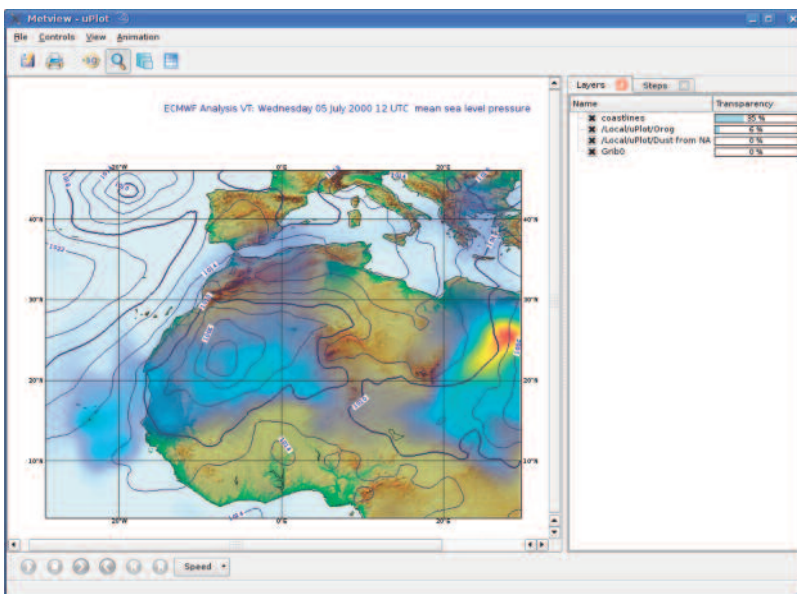

Fig. 4 Overlay of WMS layers with other data in Metview 4. This plot contains four layers: orography and dust data from WMS services, coastlines from a built-in data set, and isolines from a GRIB field