A new framework to handle ODB in Metview 4

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The ODB (Observational DataBase) is bespoke software developed at ECMWF to manage very large volumes of observational data. It uses SQL (Structured Query Language) to enable fast and flexible post-processing of observational data produced during the data assimilation system runs of the Integrated Forecasting System (IFS).

The main motivation behind the developments presented in this article was to provide users with a comprehensive framework for working with ODBs. There was a need for a system that could operate both in interactive and batch mode and enable users to retrieve, filter and visualise ODB data and perform computations on it. As a design goal the visualisation had to be flexible enough to be able to generate a wide range of graphical products out of ODB such as map-based plots, histograms, scatter plots and graphs. In addition, the capability of overlaying displays of ODB content with other data types, especially with numerical model fields was an important requirement.

All these goals were achieved within the Metview meteorological workstation whose latest version (4.1) includes a redesigned ODB interface. This article gives an overview of the new interface and highlights how users can benefit from working with ODB in Metview 4.

Data access, inspection and filtering

The basis of all the ODB-related operations in Metview 4 is the *ODB Database* icon (Figure 1a), which represents an ODB database residing on the file system. Analysts and researchers can inspect an ODB by right clicking on its icon and selecting 'examine' from the context menu. The ODB examiner will appear, as illustrated in Figure 2, to show both the meta-data and the data values of the database. A command line version of the ODB examiner is also available by typing: metview4 -e odb *database-path*.

One of the most commonly used and popular features of Metview is its interface to the MARS archive. The *MARS Client* in Metview 4 is now ODB-enabled so users can retrieve ODB data from MARS in a similar way to that used for GRIB or BUFR, but of course an ODB-specific set of MARS parameters has to be used to define the request.
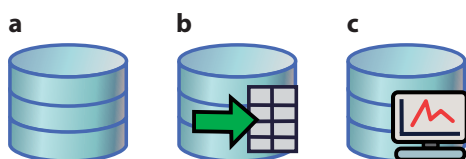

Figure 1 The icons representing the ODB Database, ODB Filter and ODB Visualiser in Metview 4.

Figure 2 The ODB examiner in Metview 4 offers a powerful way to inspect both the meta-data and data values of ODBs.

To run ODB/SQL queries Metview 4 offers the *ODB Filter* module, whose icon is shown in Figure 1b. The output of ODB Filter is a new ODB database storing only the selected subset of the original data. The main goal of using ODB Filter is to provide a smaller subset of ODB data better suited for visualisation and further data processing in Metview 4.

Visualisation

Metview 4 introduced the concept of *visualisers* to allow the quick and easy visualisation of particular data types in various ways. The ODB Visualiser, whose icon can be seen in Figure 1c, provides a high-level interface for selecting a subset of ODB data and visualising it in the desired plot type. With this icon Metview users can easily generate maps with symbol or wind plotting. Also scatter plots and graphs can be produced.

Both symbol and wind plotting in Metview 4 now benefit from the improved functionalities of Magics. Probably the most important feature is that the colour palette can be automatically generated for the plots, just like it has been available for the *Contouring* icon. Another exciting novelty is that the legend can contain a colour-coded histogram showing the distribution of the visualised data values as illustrated in Figure 3.

The control area on the right of the Display Window was also renewed. Here the Layer Data tab was added to display statistics and a histogram complemented with a data count table. In addition, the Cursor Data tool, which shows data values at the cursor position in the plot, has been redesigned to be able to display ODB data values as well. Figure 3 illustrates both these features. Note that ODB data can be overlaid with any other data types in Metview as shown in Figure 4.
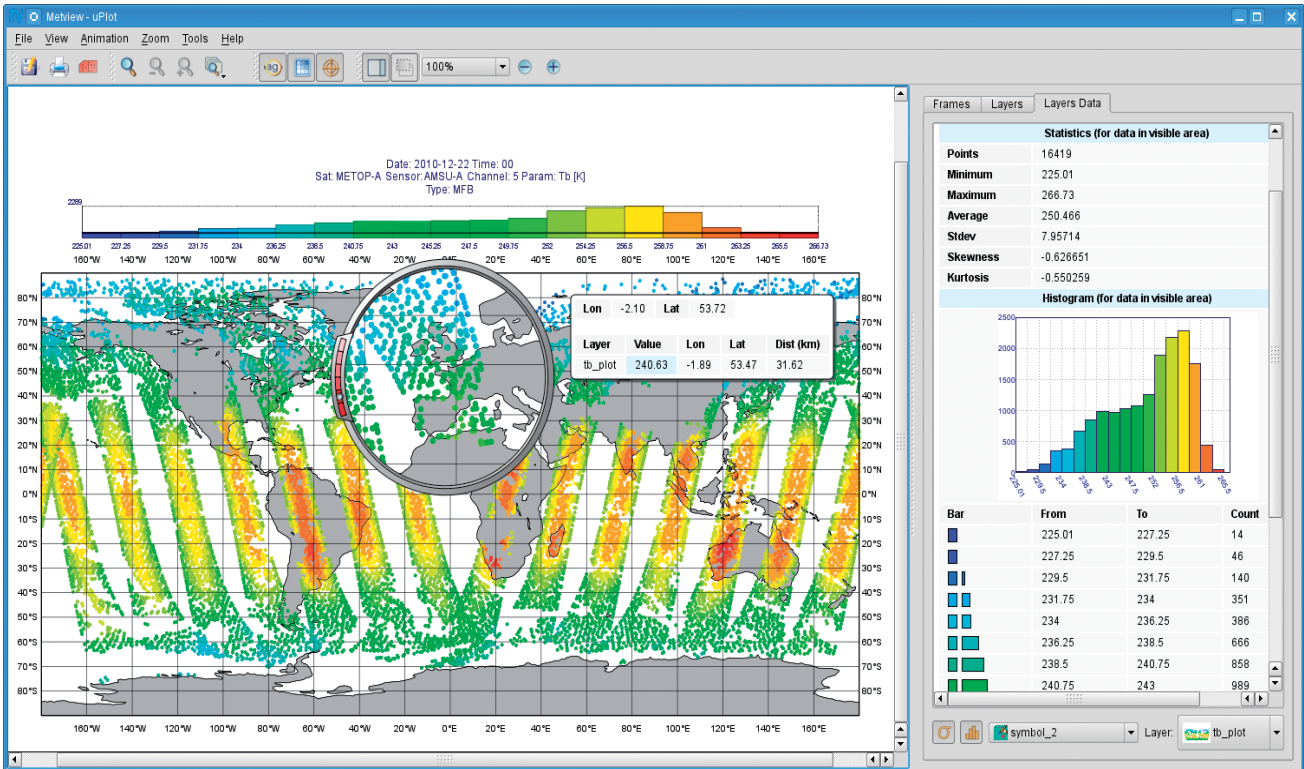
Figure 3 Brightness temperature values from an ODB visualised using an automatically-generated colour palette. Another interesting feature is the cursor data (next to the magnifier) showing the ODB values nearest to the current cursor position in the plot. The legend features a histogram showing the data distribution within the visualised value range. The sidebar on the right-hand side of the window displays detailed statistics about the visualised data together with a histogram.
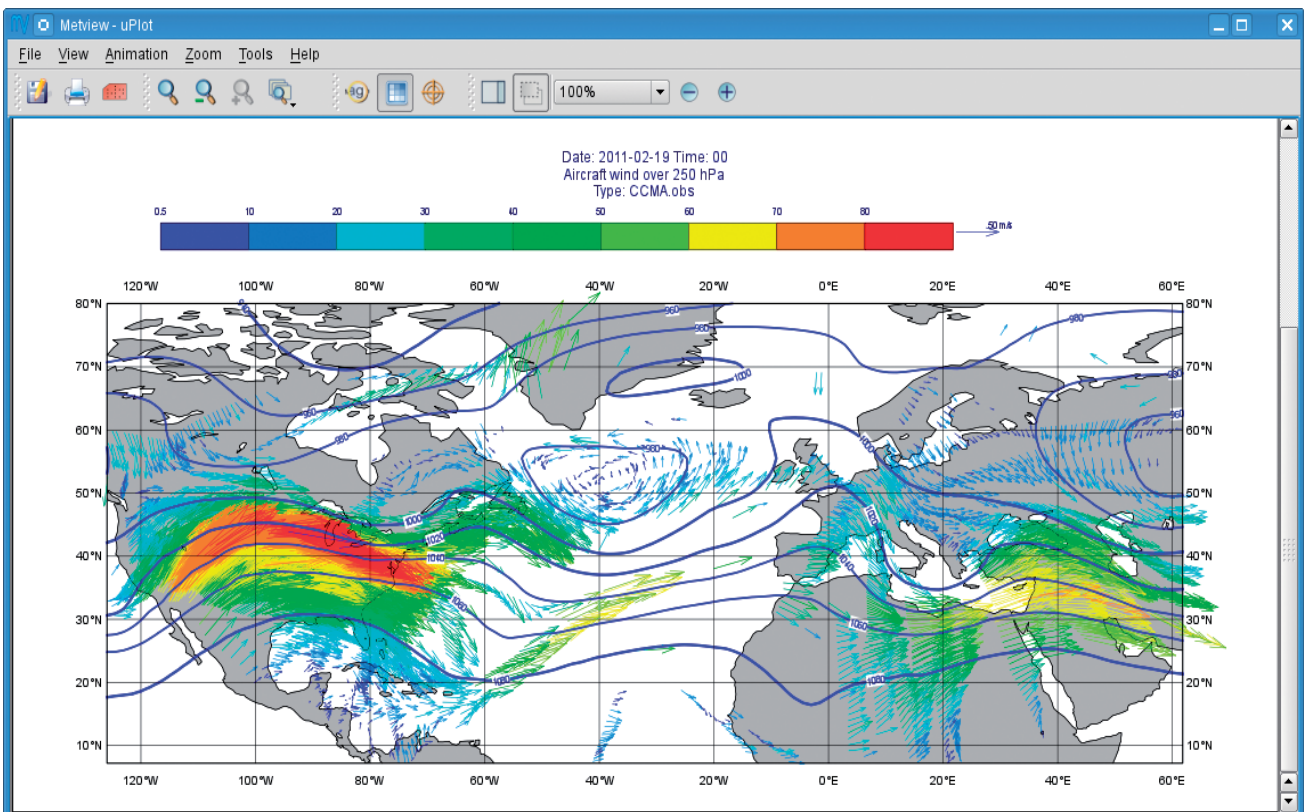

Figure 4 Wind data from an ODB overlaid with isolines of geopotential from GRIB data.

Figure 5 illustrates the ability of Metview 4 to generate scatter plots for ODB data.

Metview Macro

Metview's macro scripting language offers a powerful framework for incorporating all the functionality provided by the ODB icons. The usage of the **values()** macro function is particularly useful because it can read ODB data into a built-in **vector** data structure. Vectors are optimised to store a large number of numerical values and it is easy to derive new datasets and generate new plots out of ODB data stored in vectors.

More information

Metview users will find a tutorial that goes into more detail about how to use the ODB interface on the Metview documentation web page at:

● www.ecmwf.int/publications/manuals/metview/
documentation.html

User feedback is important for improving Metview, and users are encouraged to send their suggestions by e-mail to:
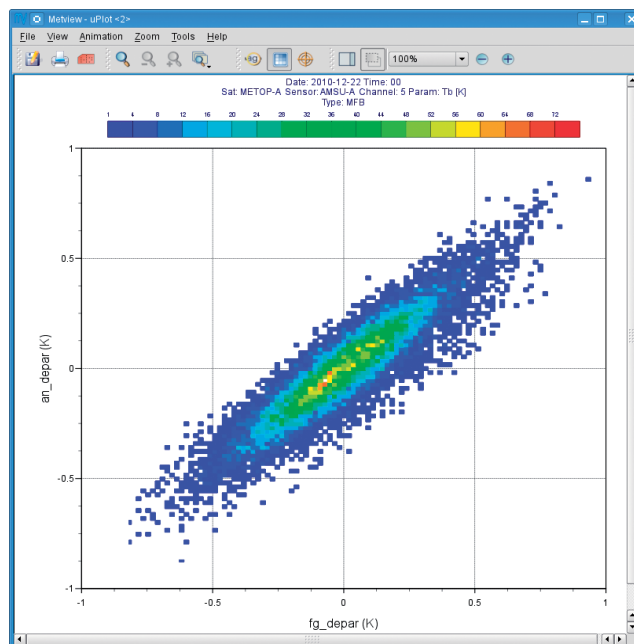
● metview@ecmwf.int.

Figure 5 Scatter plot for the first-guess and analysis departures read from an ODB.

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