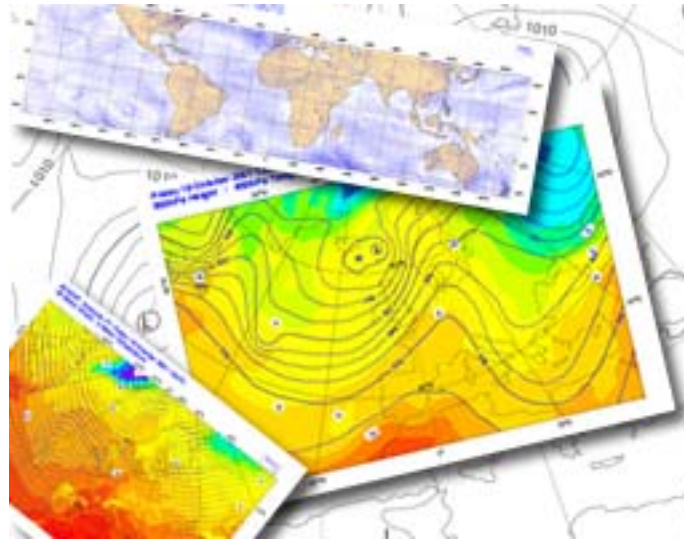


# Metview 4

## Answering new challenges of increasing volumes of data



**Sándor Kertész**

*Graphics Section*

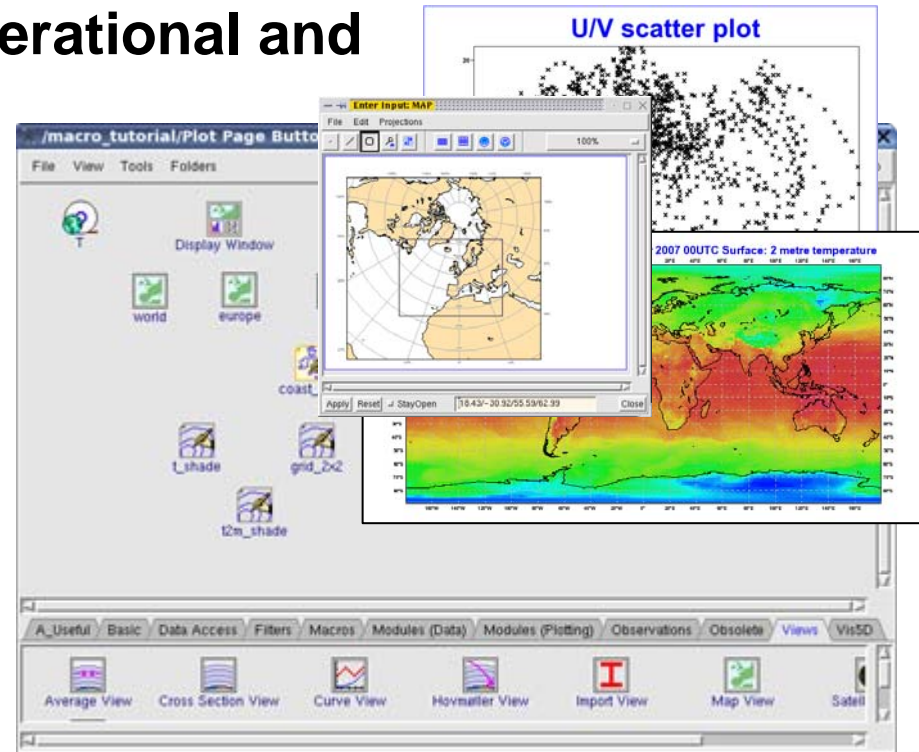
*ECMWF*

# Metview

- Working environment for Operational and Research Meteorologists

- Co-operative project:

- *ECMWF*
- *INPE/CPTEC (Brazil)*
- *Météo France*



- The main focus is now on Metview 4
  - Significant changes, a lot of new features

# Metview in the age of web services?

Now that there is the ability of powerful web services, is there still room for meteorological workstations like Metview? Our answer is: Yes!

- The ever increasing data volume still requires processing speed best achieved by an optimised software
- Workstations can offer more tools to analyse and work with data itself
- The tool, once installed, is always available and independent of network and other services
- We also still need a tool to design the products for the web in the first place!!!

# Metview 4 - Motivations

- Offer enhanced tools for:

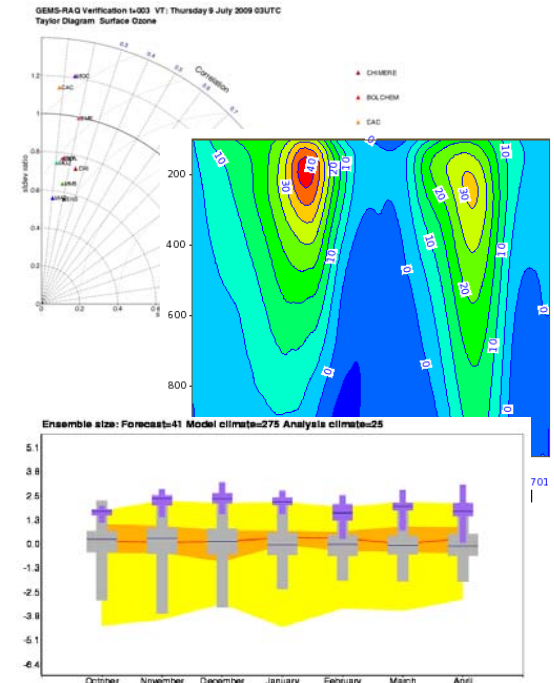
- post-processing & visualisation of model analysis and forecasts
- observation monitoring
- development of web products
- logging & debugging for operations
- model verification

- Better interaction with:

- other libraries (MARS, GRIB API, ODB)
- tools (OBSTAT)
- GIS systems (TerraLib)

- Replacement of MAGICS with **Magics++**

- Offers all features of Magics++
- Enables 64 bit version



# Metview 4 - Development choices

- Metview **Macro** language has been reviewed and it was decided not to change its current implementation
  - Keep possibilities open for adding new features
- Replacement of Motif with **Qt**
  - New user interface
  - New applications
- Use **Autotools** to make installation easier
- More functionality to handle **netCDF**
- Implement clients for **OGC** web services

```
# Compute the coriolis parameter
omega = 2 * 3.14 / 86400.
coriolis = 2 * omega * sinlat(grad[1])

# Bitmap the tropics in the gradient field
trop_mask=mask(grad[1], [15, 0, -15, 360])
trop_mask=bitmap(trop_mask, 1)

for i=1 to count(grad) do
    grad[i]=bitmap(grad[i], trop_mask)
end for
```

# The challenge of increasing data volume

**In recent years the amount of data to be handled has increased significantly**

- **Large increase in satellite data**
  - More channels, better resolution
- **High-resolution NWP models**
  - ECMWF (IFS): increase from T799 to T1279 meant data volume increase by factor of 2.5. In total: **2,140,704** grid points!
- **Complex data structures**
  - 1000s of messages in GRIBs, table hierarchy in ODBs
- **More and more data needed from non-meteorological sources**

# The challenge of increasing data volume (2)

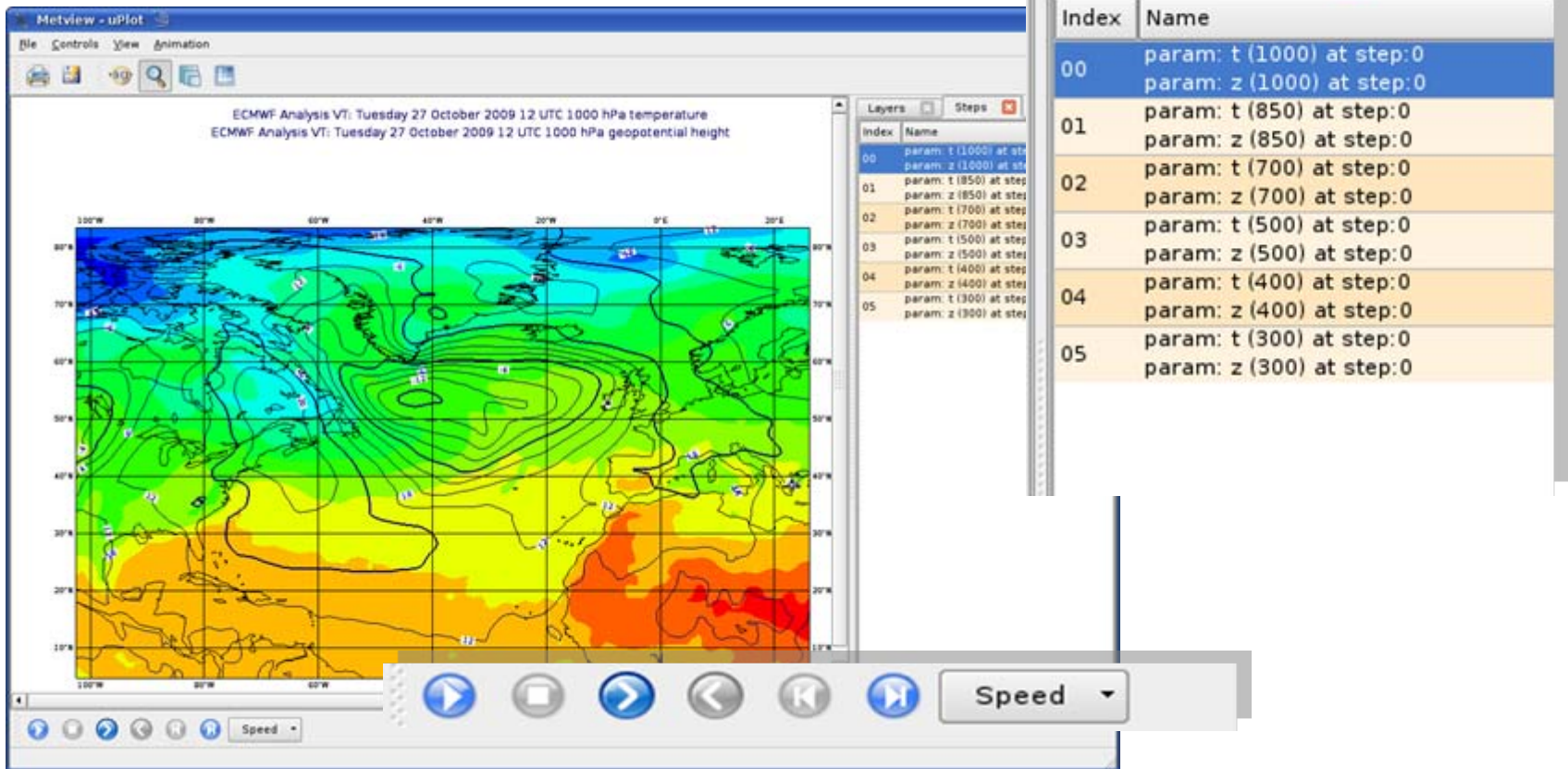
## What we can do?

- Revise how we handle data to make it more efficient (GRIB API, ODB)
- Offer tools to quickly comprehend the data and its structure (→ **data examiners**)
- Find ways to visualise data in its complexity (→ **layers**)
- Make more use of various dimensions (→ **animations**)
- Constantly working on optimising batch performance (→ **Metview Macro**)



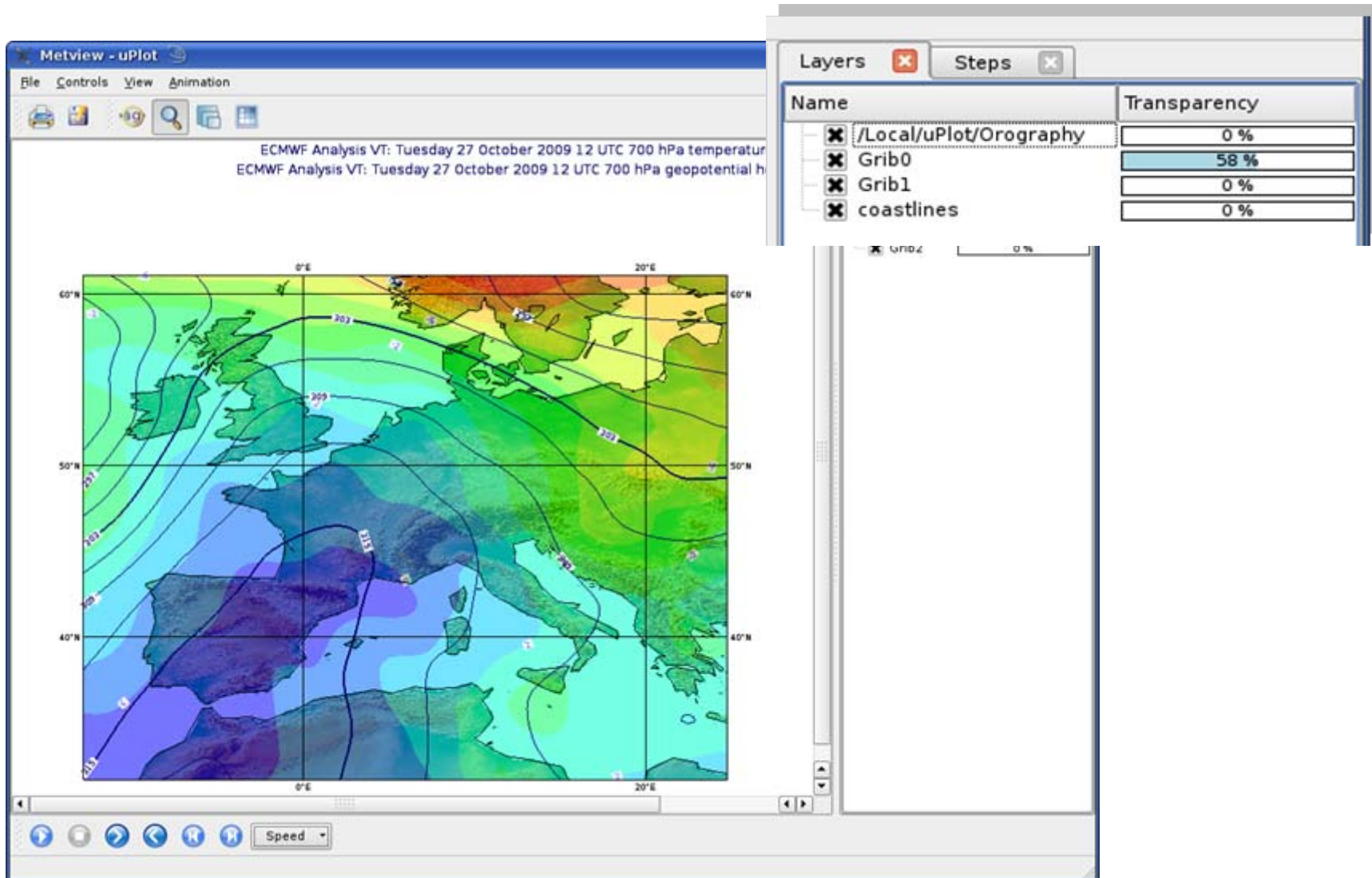
# Metview 4 - Redesigned display module

- Takes advantage of both Magics++ and Qt
- New animation control



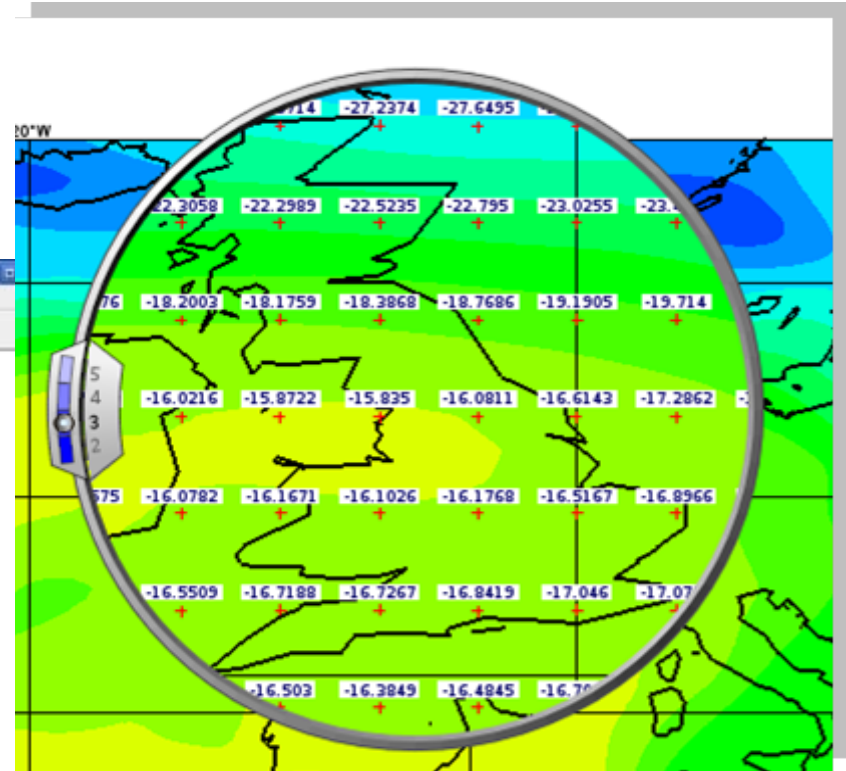
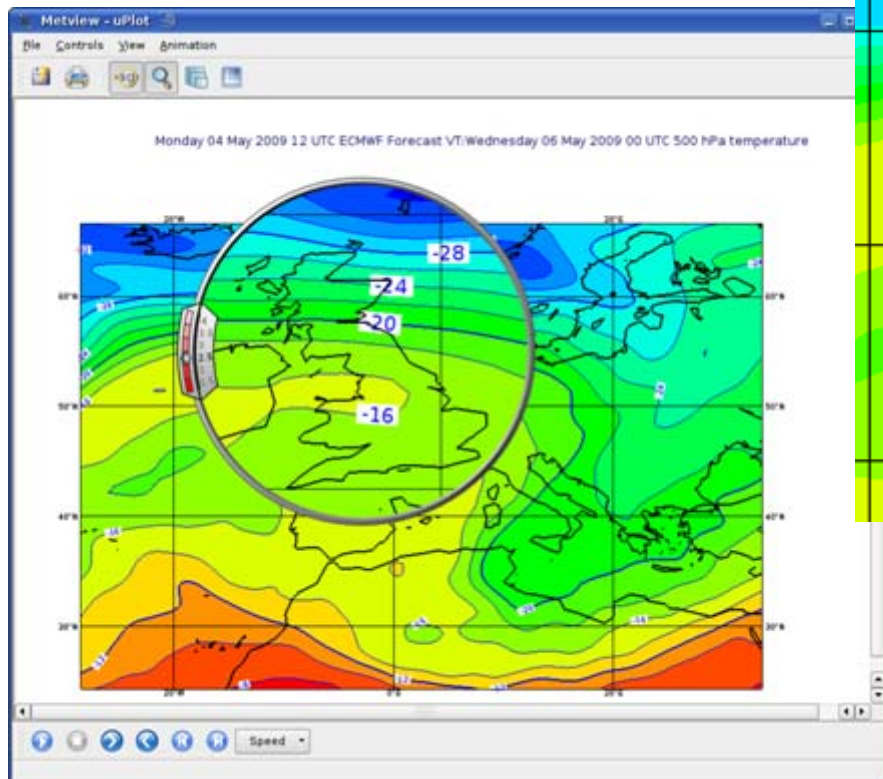


# Display module - Layers



# Display module - Magnifier

- **Two modes:**
  - **Text magnification**
  - **Grid point values**



# New GRIB Examiner (using GRIB API)

File information

File: /home/graphics/cgr/metview/Local/uPlot/tz\_60.grb  
Permissions: -rw-r----- Owner: cgr Group: graphics Size: 3.4MB Modified: 2009-05-07 14:32  
Total number of messages: 60

Index	Date	Time	Step	Param	Rep	Level	Levtype
01	20090504	1200	0	Temperature	II	1000	pl
02	20090504	1200	0	Geopotential	II	1000	pl
03	20090504	1200	0	Temperature	II	850	pl
04	20090504	1200	0	Geopotential	II	850	pl
05	20090504	1200	0	Temperature	II	700	pl
06	20090504	1200	0	Geopotential	II	700	pl
07	20090504	1200	0	Temperature	II	500	pl
08	20090504	1200	0	Geopotential	II	500	pl
09	20090504	1200	0	Temperature	II	400	pl
10	20090504	1200	0	Geopotential	II	400	pl
11	20090504	1200	0	Temperature	II	300	pl
12	20090504	1200	0	Geopotential	II	300	pl
13	20090504	1200	12	Temperature	II	1000	pl
14	20090504	1200	12	Geopotential	II	1000	pl
15	20090504	1200	12	Temperature	II	850	pl
16	20090504	1200	12	Geopotential	II	850	pl
17	20090504	1200	12	Temperature	II	700	pl
18	20090504	1200	12	Geopotential	II	700	pl
19	20090504	1200	12	Temperature	II	500	pl
20	20090504	1200	12	Geopotential	II	500	pl
21	20090504	1200	12	Temperature	II	400	pl
22	20090504	1200	12	Geopotential	II	400	pl
23	20090504	1200	12	Temperature	II	300	pl
24	20090504	1200	12	Geopotential	II	300	pl
25	20090504	1200	24	Temperature	II	1000	pl
26	20090504	1200	24	Geopotential	II	1000	pl
27	20090504	1200	24	Temperature	II	850	pl
28	20090504	1200	24	Geopotential	II	850	pl
29	20090504	1200	24	Temperature	II	700	pl
30	20090504	1200	24	Geopotential	II	700	pl

Meta data of the selected message

Dump mode: Standard dump

Key name (GRIB API)	Value	Description
editionNumber	1	
table2Version	128	
centre	98	# European Center for Medium-Range Weat...
generatingProcessIdentifier	134	
indicatorOfParameter	130	# Temperature (K) (grib1/2_98_128.table)
marsParam	130_128	
indicatorOfTypeOfLevel	100	# Isobaric level pressure in hectoPascals
level	1000	
timeRangeIndicator	1	# Initialized analysis product for referenc...
subCentre	0	# Unknown code table entry (grib1/0.ecmf.t...
decimalScaleFactor	0	
dataDate	20090504	
dataTime	1200	
stepUnits	1	# Hour (grib2/tables/1/4_4.table)
stepRange	0	
startStep	0	
endStep	0	
localDefinitionNumber	1	# MARS labelling or ensemble forecast dat...
marsClass	1	# Operational archive (mars/class.table)
marsType	9	# Forecast (mars/type.table)
marsStream	1025	# Atmospheric model (mars/stream.table)
experimentVersionNumber	0001	
perturbationNumber	0	
numberOfForecastsInEnsemble	0	
name	Temperature	
units	K	
GDSPresent	1	
bitmapPresent	0	

Log

```
Command: /usr/local/lib/metaps/lib/grib_api/1.8.0/bin/grib_dump -O -w count=1 ~/home/graphics/cgr/metview/Local/uPlot/tz_60.grb  
Status: OK  
  
Task: Generating default dump for message: 1  
Command: /usr/local/lib/metaps/lib/grib_api/1.8.0/bin/grib_dump -w count=1 ~/home/graphics/cgr/metview/Local/uPlot/tz_60.grb  
Status: OK
```

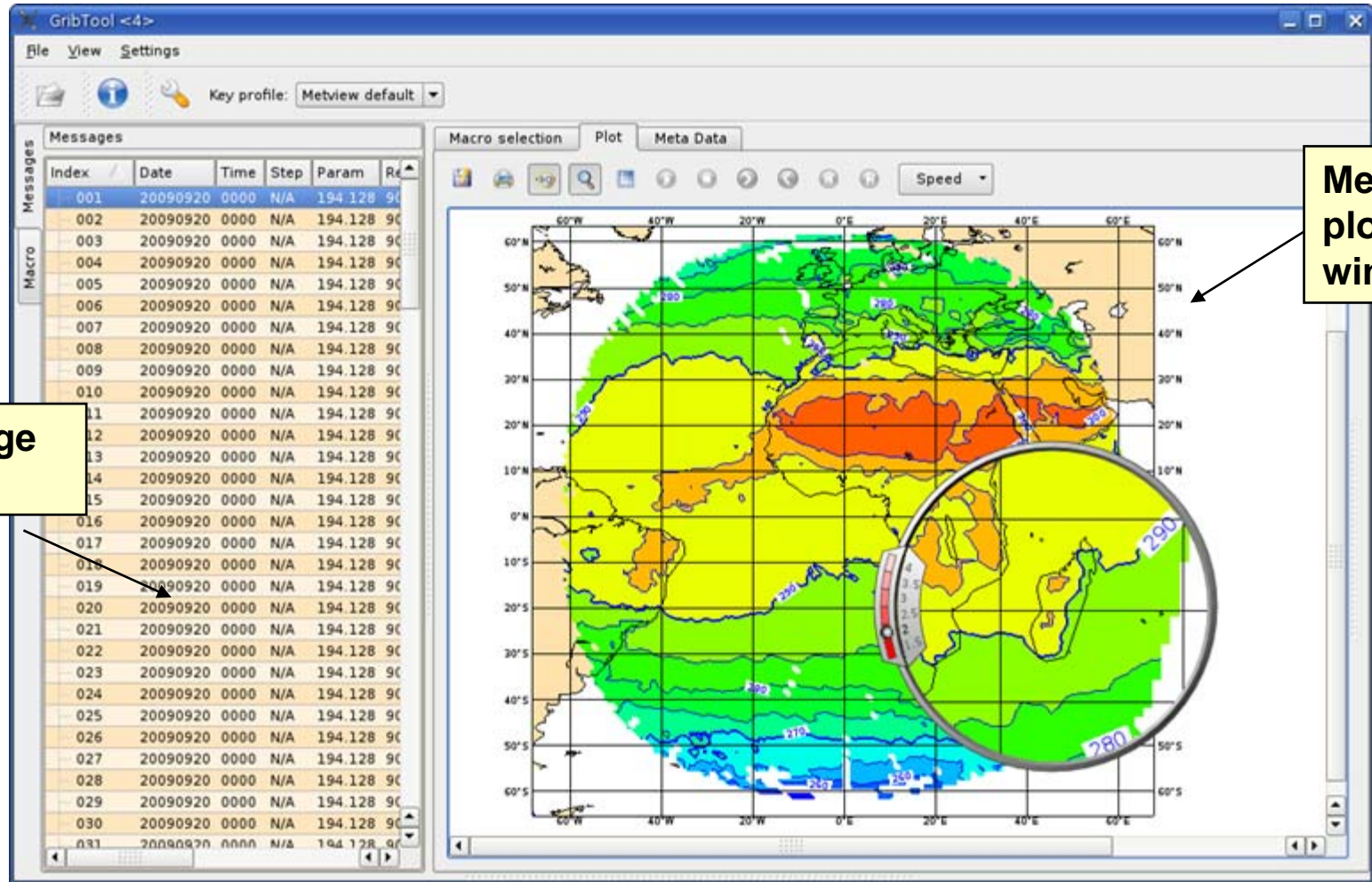
# GRIBTool – A new framework

**The main motivation is to support observation monitoring at ECMWF**

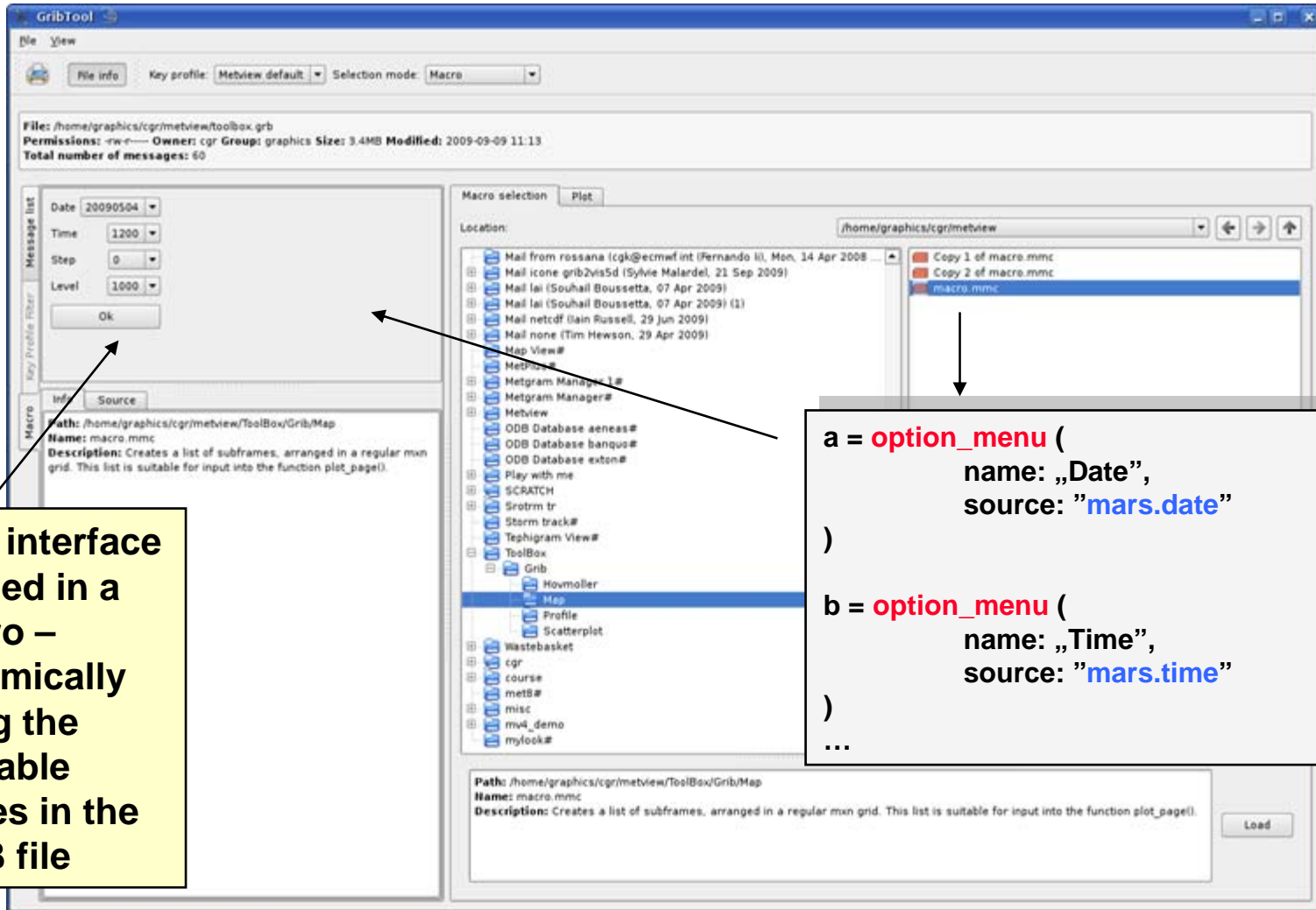
- **OBSTAT at ECMWF produces GRIB outputs with 1000s of messages containing grid based statistics**
- **Users want to quickly:**
  - analyse file contents
  - select and visualize a subset of the messages
  - generate and visualize custom products: profiles, histograms, cross sections, etc.
- **GRIBTool is the newly developed integrated environment in Metview 4 to implement these features**



# GRIBTool: Message list



# GRIBTool: Macro based GUI

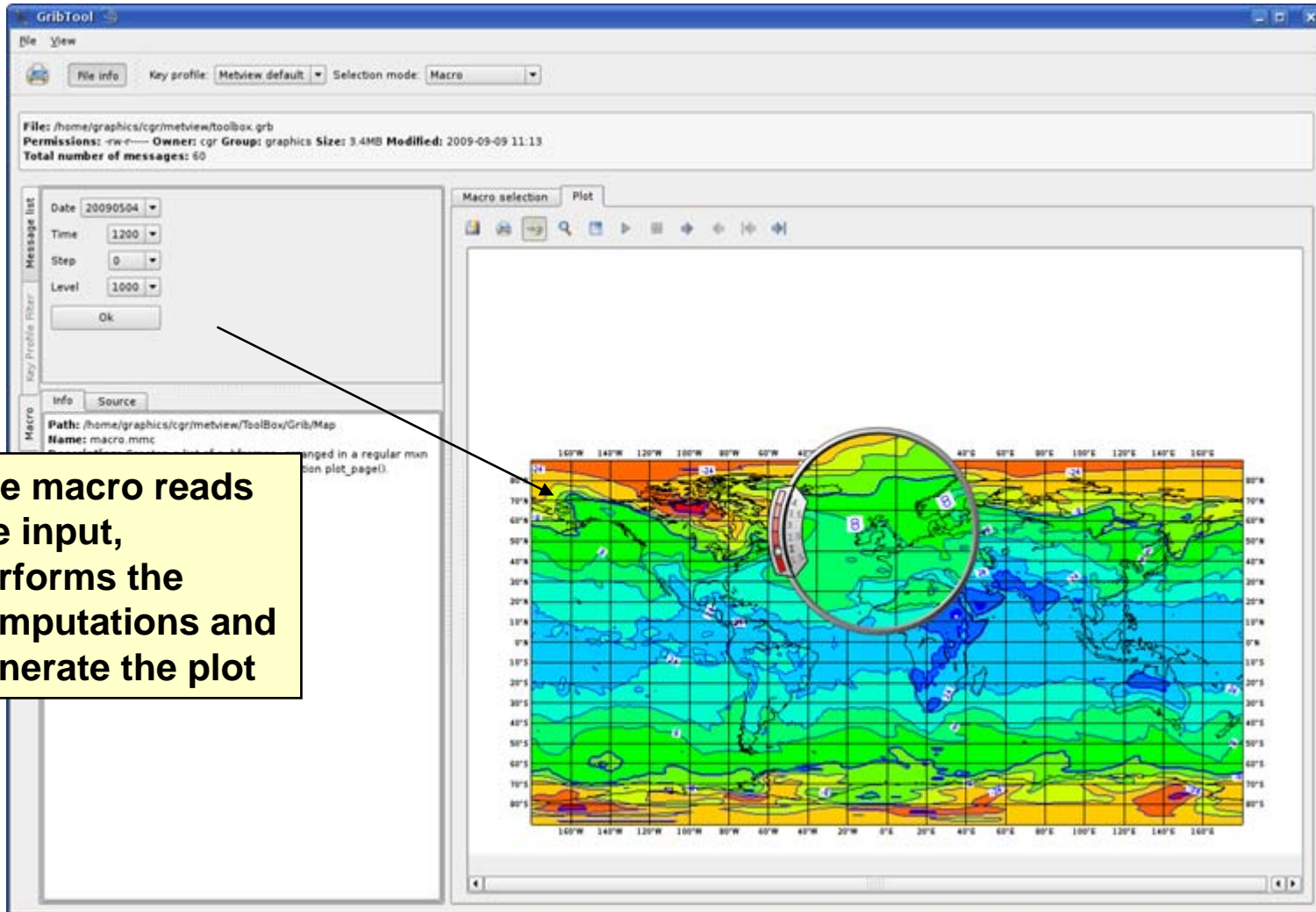


User interface defined in a macro – dynamically using the available values in the GRIB file

```
a = option_menu (
    name: „Date”,
    source: "mars.date"
)

b = option_menu (
    name: „Time”,
    source: "mars.time"
)
...
```

# GRIBTool: Macro based GUI (2)



**The macro reads the input, performs the computations and generate the plot**



# GRIBTool

- It can be used for arbitrary GRIB files (not limited to OBSTAT output)
- It is built from reusable software components:
  - Shares embedded features from the Display module, GRIB Examiner, Macro module, etc.
  - It will ease the development of similar tools
- Similar tools will be developed for all the other formats supported by Metview (BUFR, ODB, netCDF etc.)

# ODB related developments

- ODB: Observational DataBase (developed at ECMWF)
- A basic ODB interface (interactive and batch) is available in Metview3/Metview4
- Currently only available internally
- The ODB interface comprises two new icons:
  - ODB Database icon



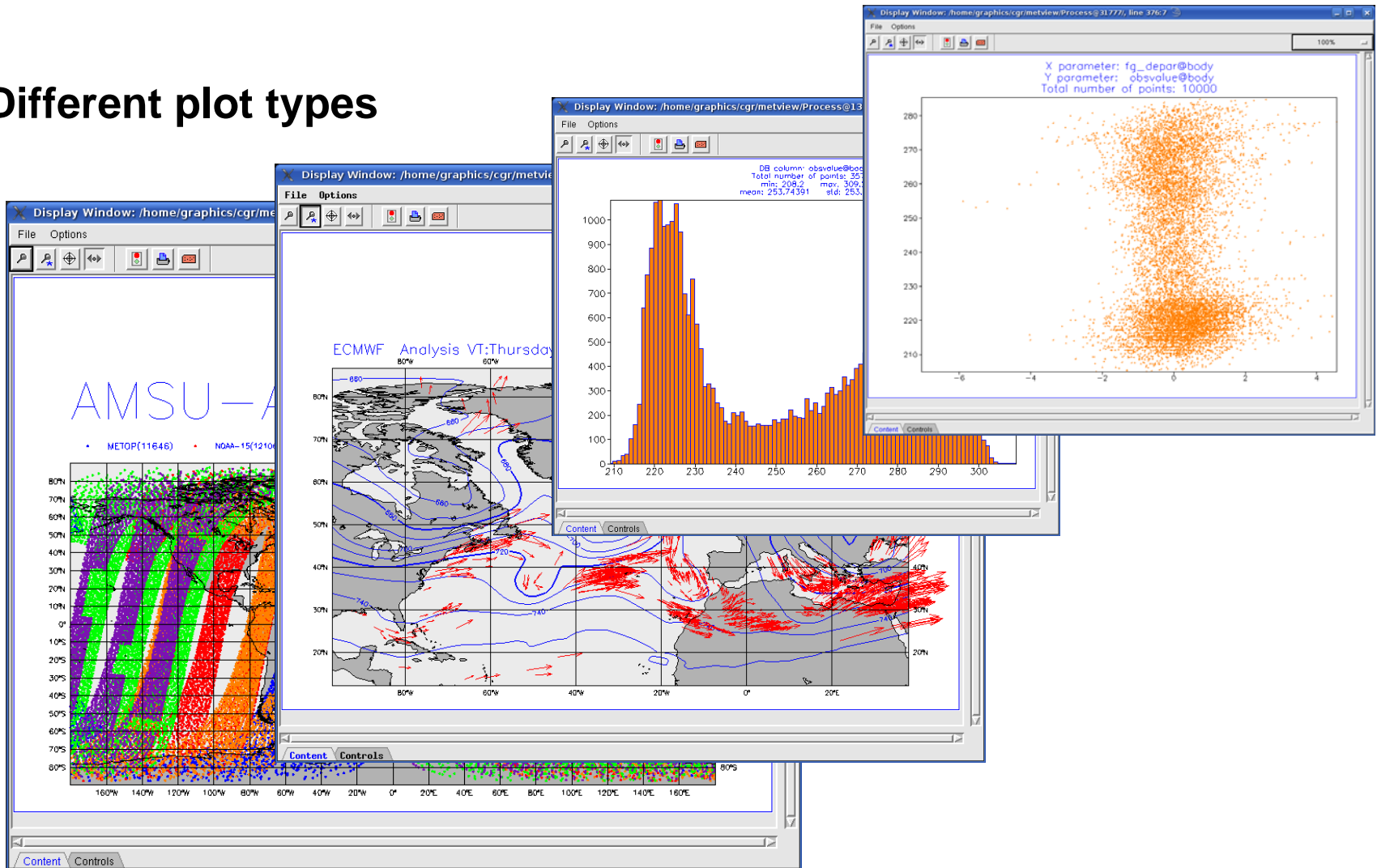
- ODB Access icon (defines the ODB/SQL query)



```
SELECT lat, lon, obsvalue
FROM hdr, body
WHERE
  obstype = $AIREP and
  status.active@hdr = 1 and
  varno = $t
```

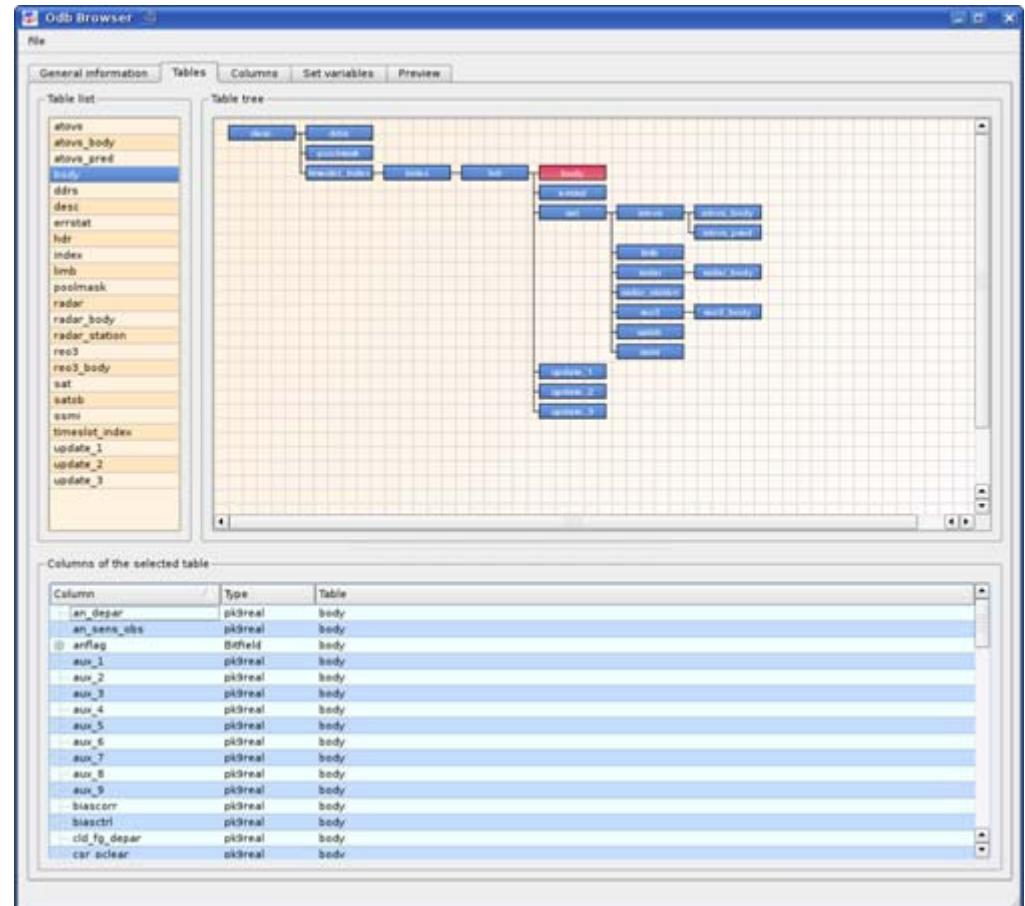
# ODB visualisation in Metview

- Different plot types



# ODB tools in Metview

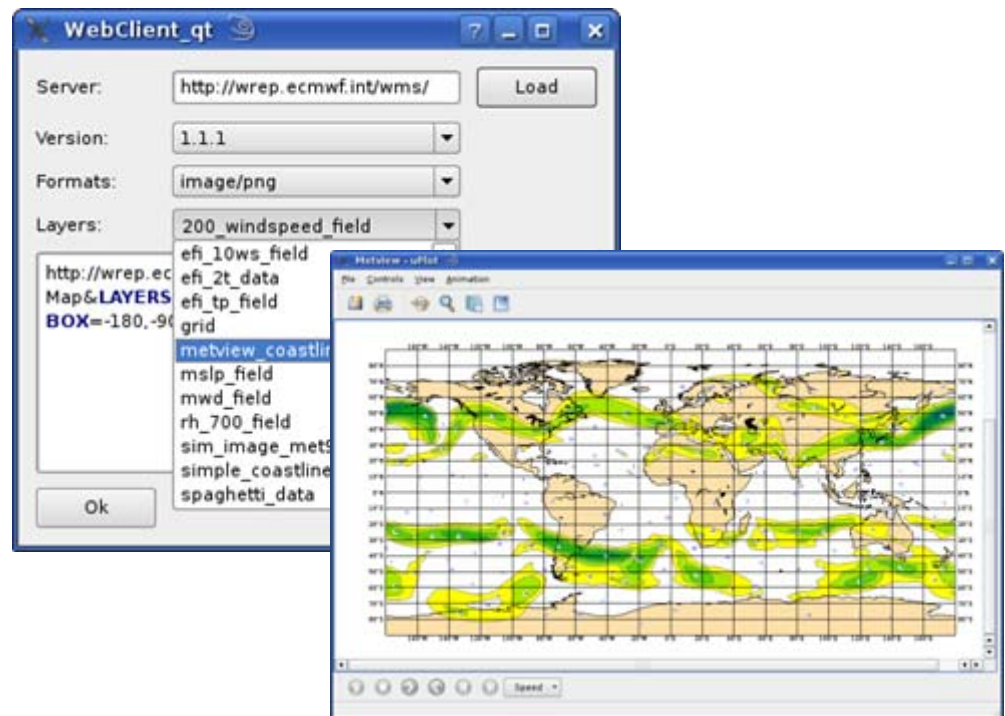
- **The ODB Examiner** allows the fast analysis of the metadata contents of an ODB
  - Data structure is shown graphically
- **ODBTool** (similar to GRIBTool) is being developed



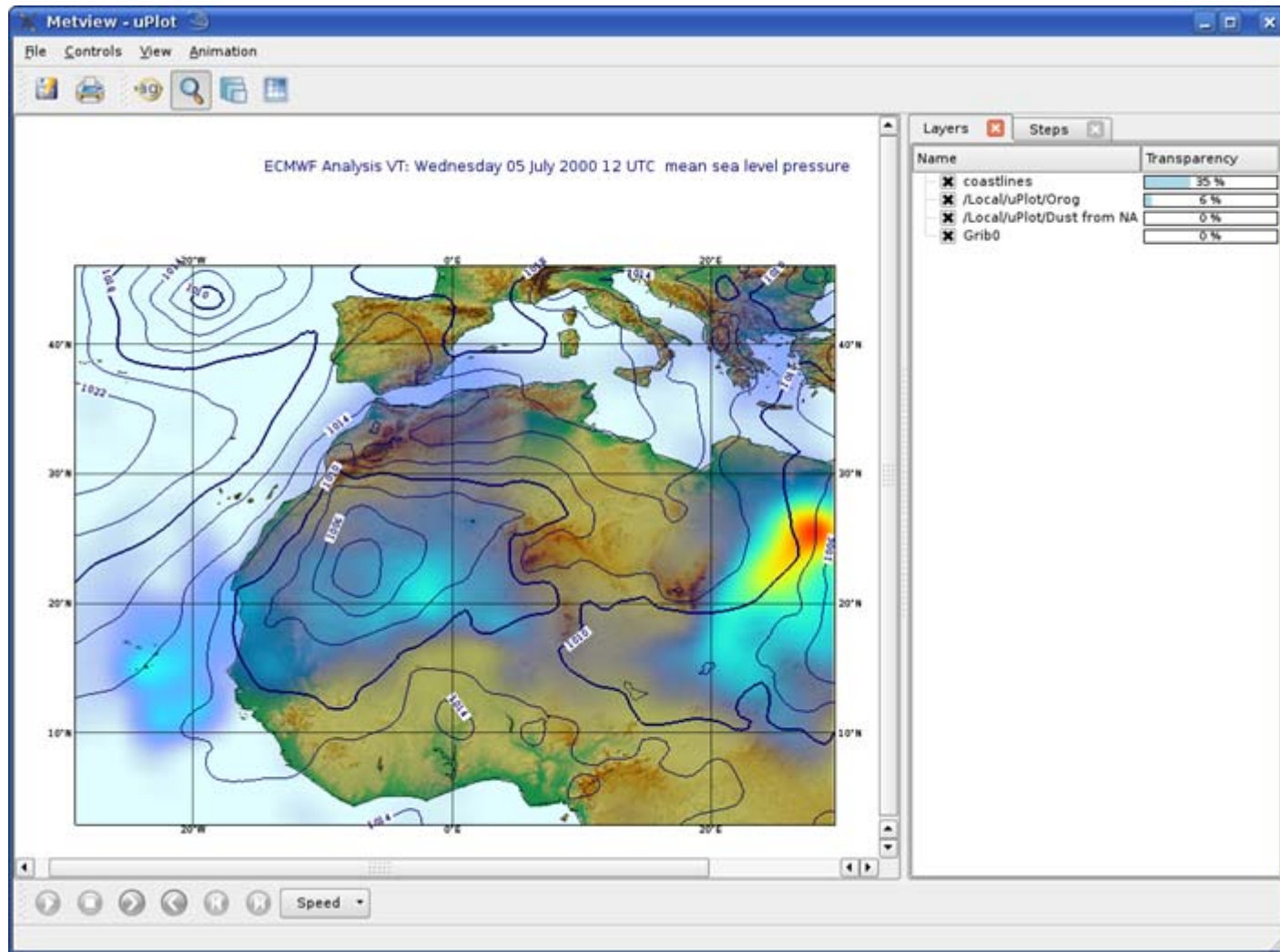
# OGC standards in Metview

- ECMWF is committed to investigating the use of OGC standards and (web) services
- Metview 4 supports **KML/KMZ** as output format
- Current developments concentrates on **WMS**

- Metview 4 as client enables users to integrate maps from other providers
- New user interface is developed to build the **GetMap** request dynamically (using the information from the **GetCapabilities** request)



# OGC WMS client in Metview

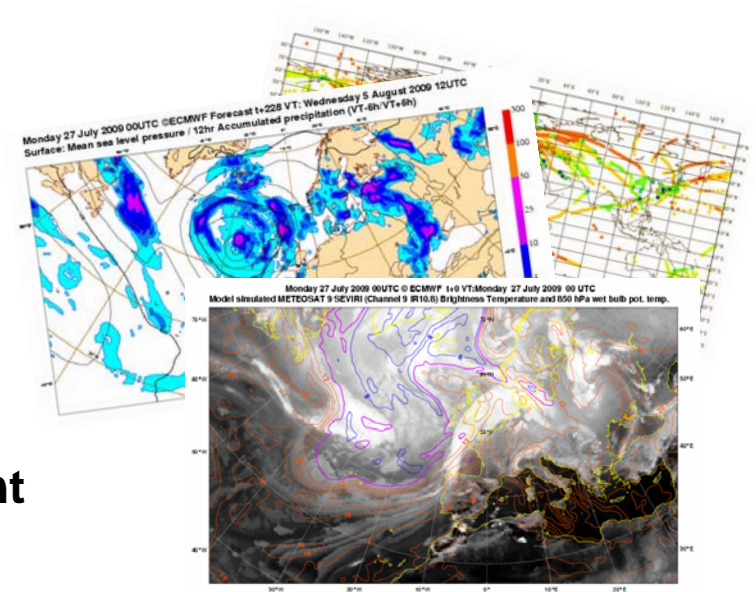




# The Last Slide

- **Contact details:**

- **Metview:**        `metview@ecmwf.int`
- **Magics++:**     `magicsplus@ecmwf.int`



- ☞ <http://www.ecmwf.int/publications/manuals/metview/>

- ☞ <http://www.ecmwf.int/publications/manuals/magics/magplus/>

- **See us at the exhibition**

- **Thursday, 5:00 pm**
- **Meeting room 1 near the atrium in the new building**