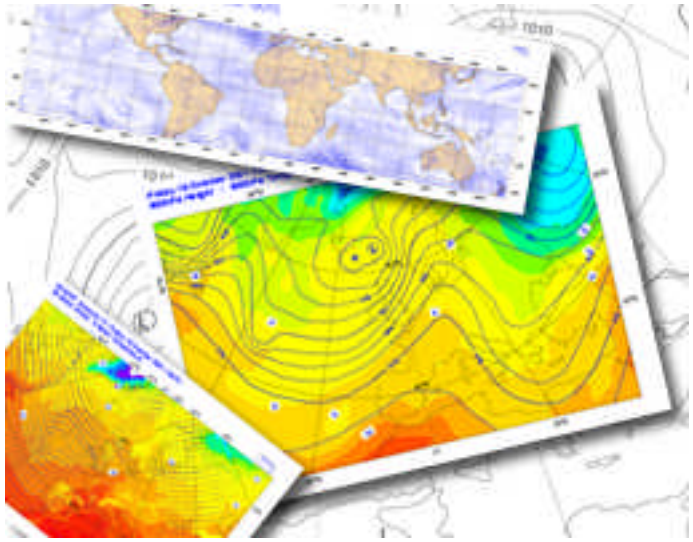
Meeting the challenges of the next generation of user interfaces



Iain Russell, Sylvie Lamy-Thépaut

Graphics Section

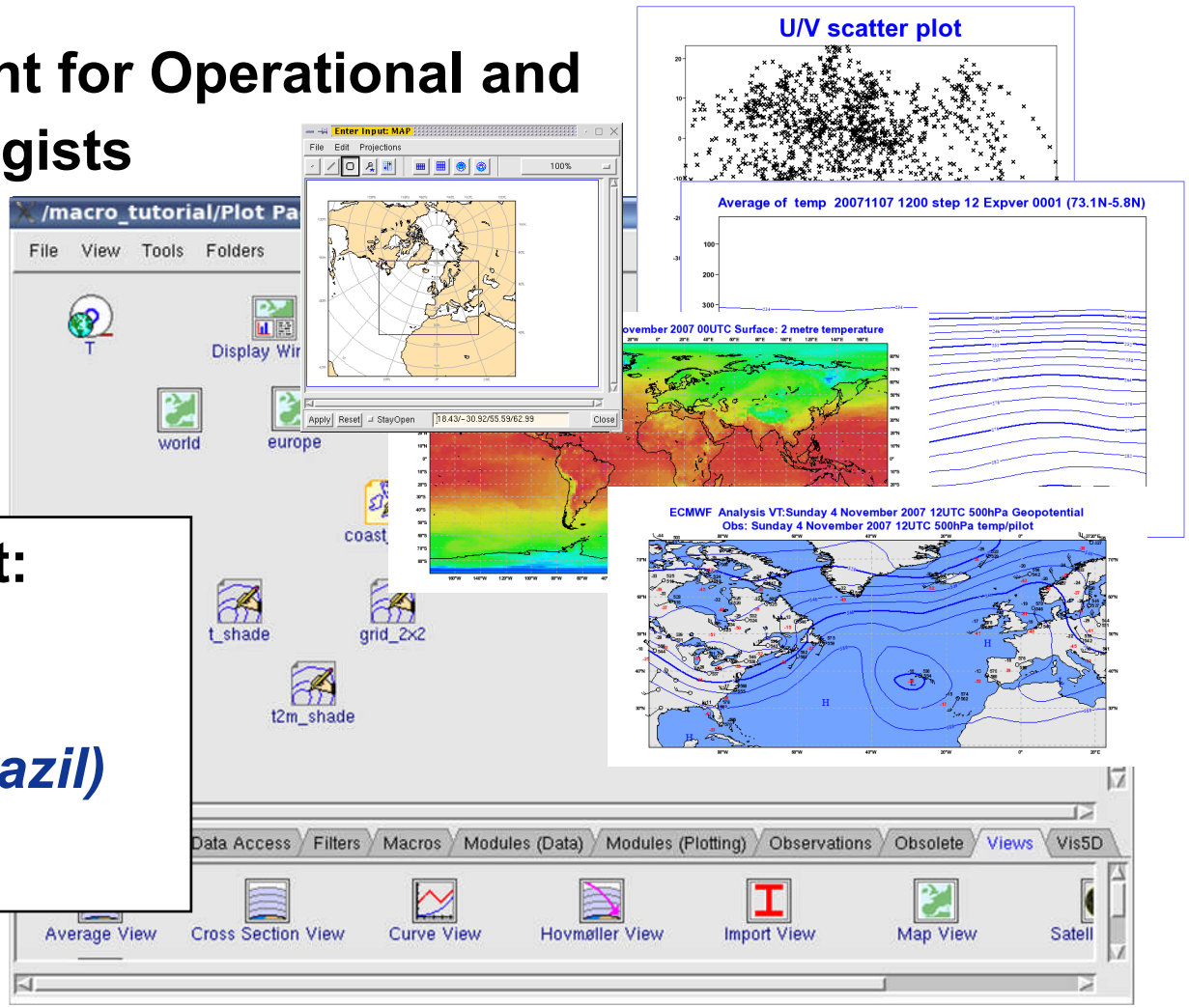
ECMWF

Overview

- Metview
  - → a meteorological workstation
- The next generation of user interfaces
  - → challenges and solutions
- Magics++
  - → a meteorological graphics plotting library

Metview

- Working environment for Operational and Research Meteorologists



- Co-operative project:
  - ➔ *ECMWF*
  - ➔ *INPE/CPTEC (Brazil)*
  - ➔ *Meteo-France*

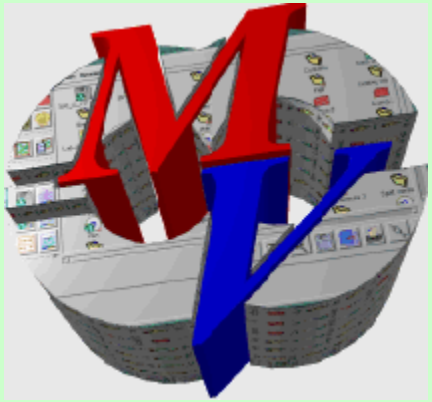
Metview - Design

- **Open and portable design**

Modules, e.g. **MARS**, **Vis5D**, **Hovmöller**

- straightforward to add more

Standard software libraries,
e.g. **OpenGL**, **Motif**, **PNG**



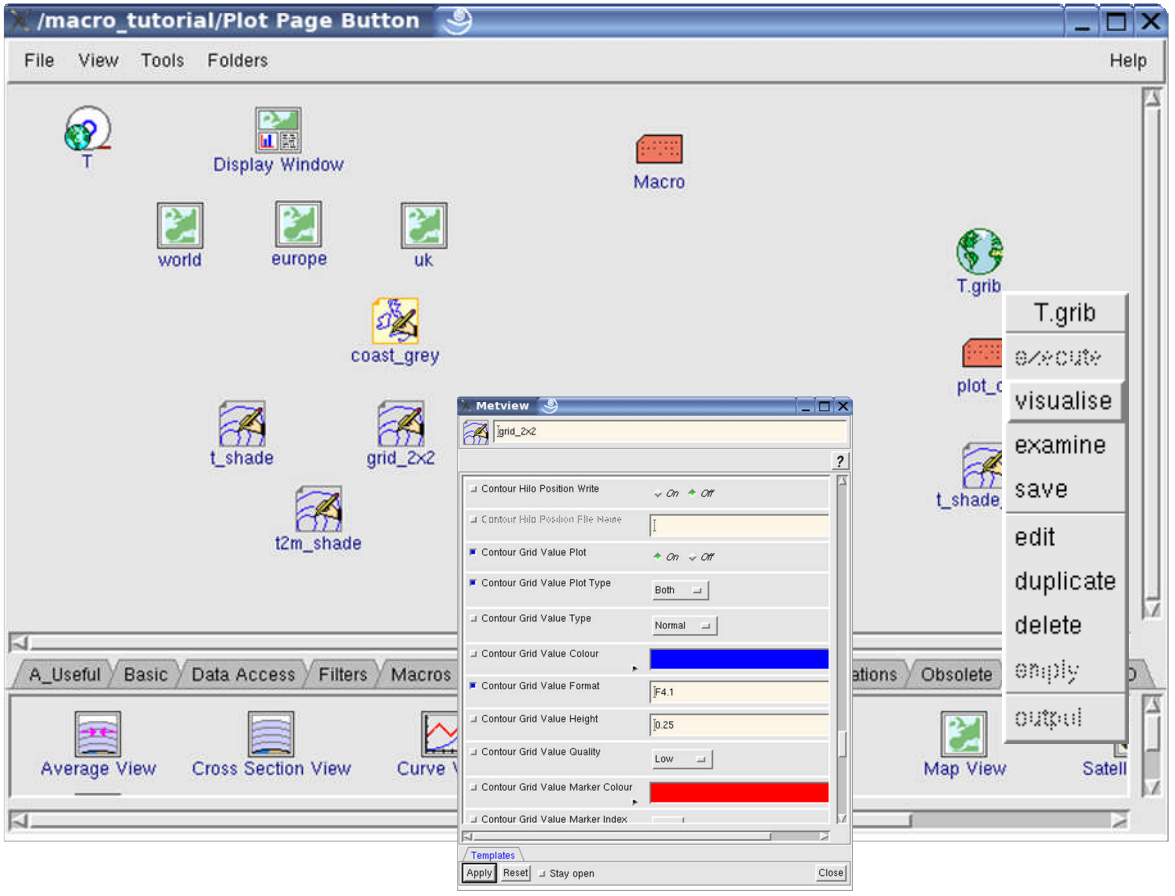
Platforms:
Linux,IBM,SGI,HP,SUN

Metview - Interactive

- Icon-based interface (drag and drop)

- Icons represent everything in Metview

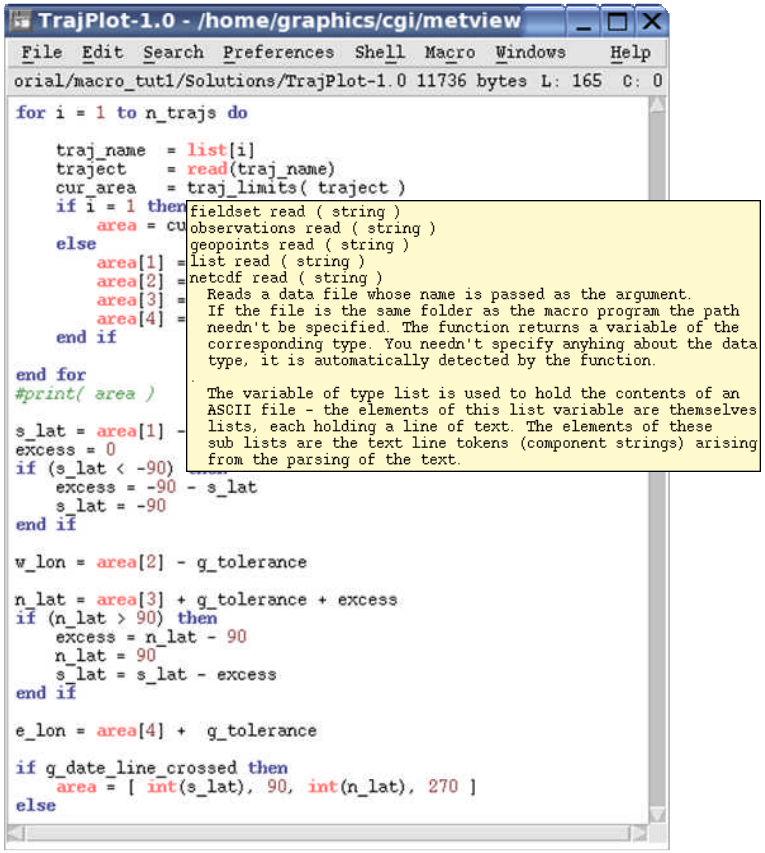
- Data, visual definitions, macros



Metview – Macro Language

- **Macro language**

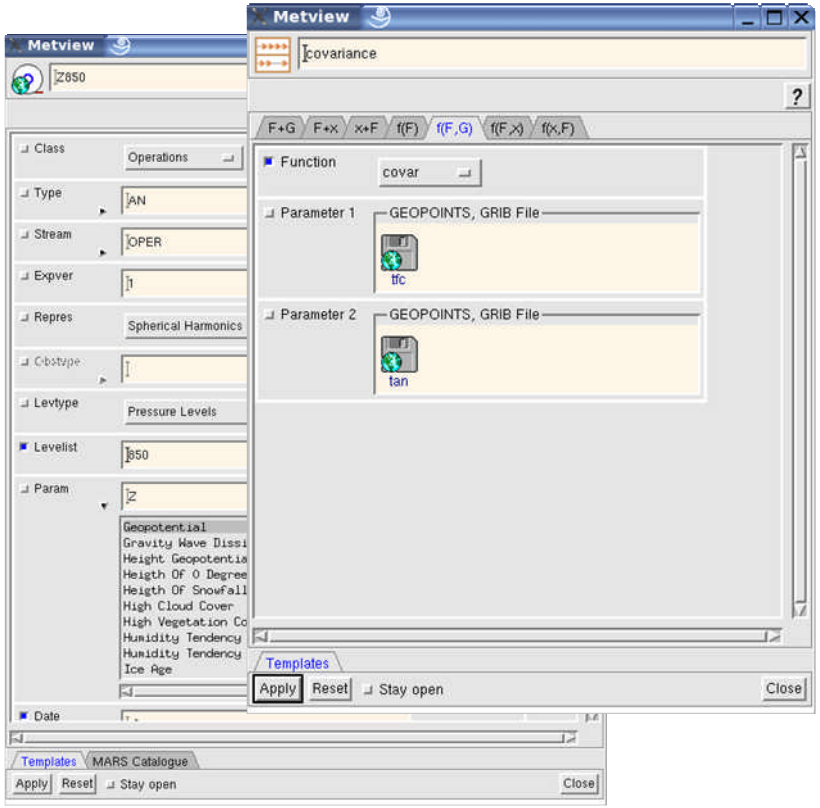
  ➔**powerful meteorologically oriented language**

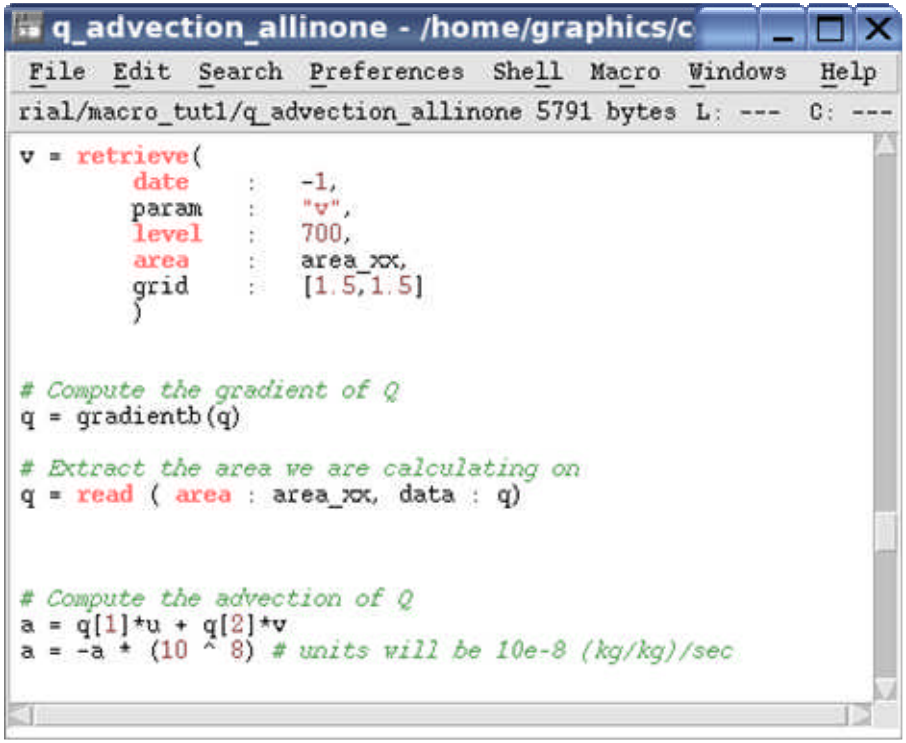


- ✓Simple, modern script language
- ✓Extensive list of operators/functions
- ✓Macro programs: interactive or batch mode
- ✓Automatically convert icons to equivalent macro code
- ✓Macro editor – built-in or selected by user
- ✓NEdit: enhanced Macro editor

Metview - Data Processing

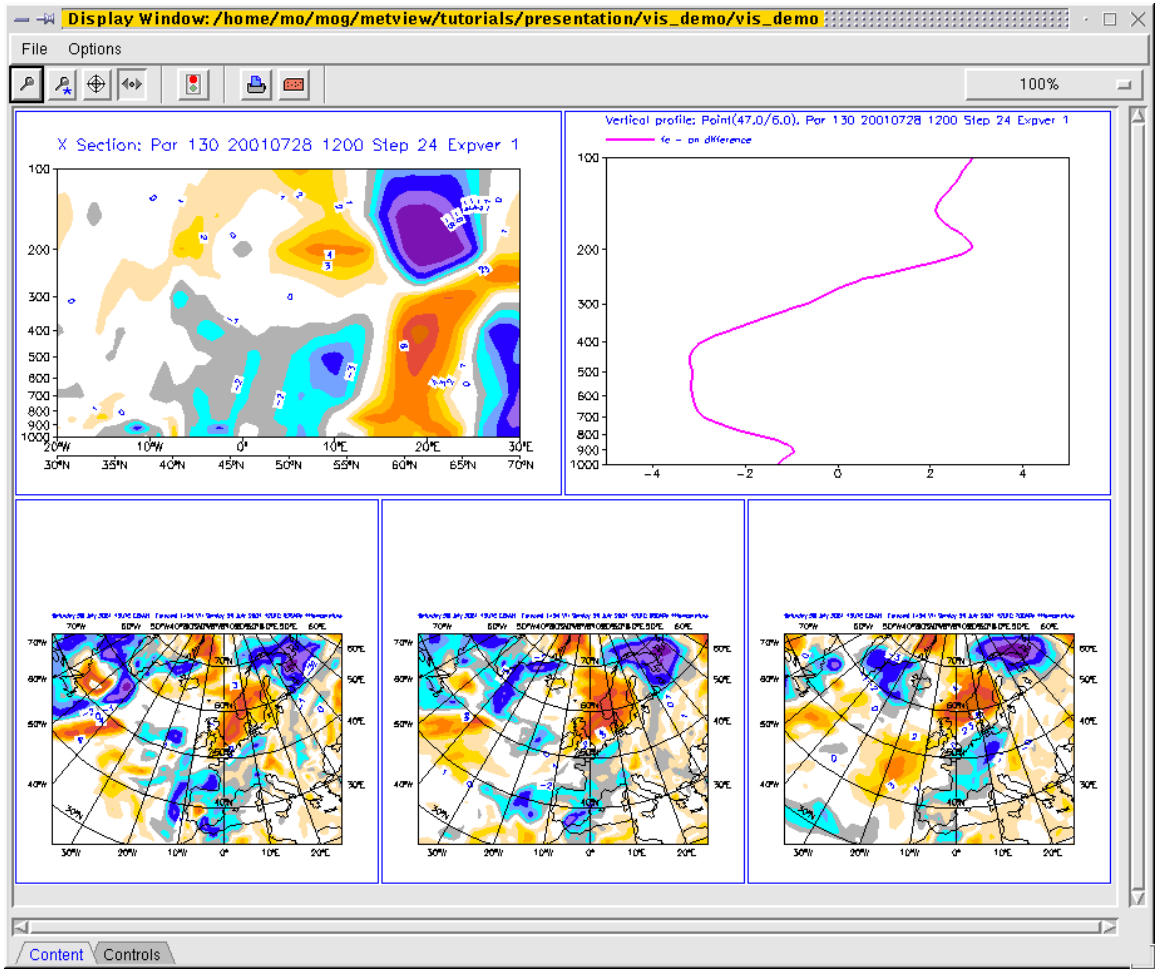
- Meteorological Data Access and Processing Package
- GRIB, BUFR, MARS, ODB, geopoints, …





Metview - Plotting

- Meteorological Desktop Plotting Package
- Uses MAGICS 6 as its plotting engine
- Will soon use Magics++



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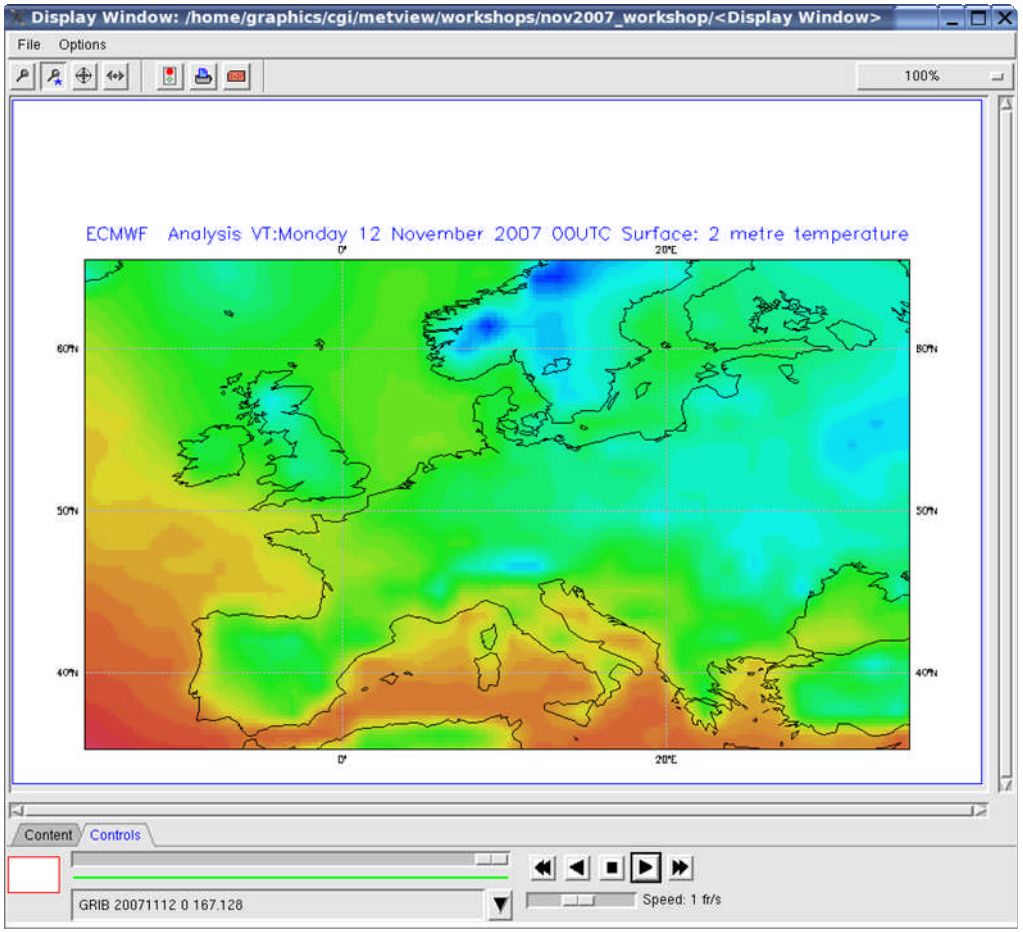
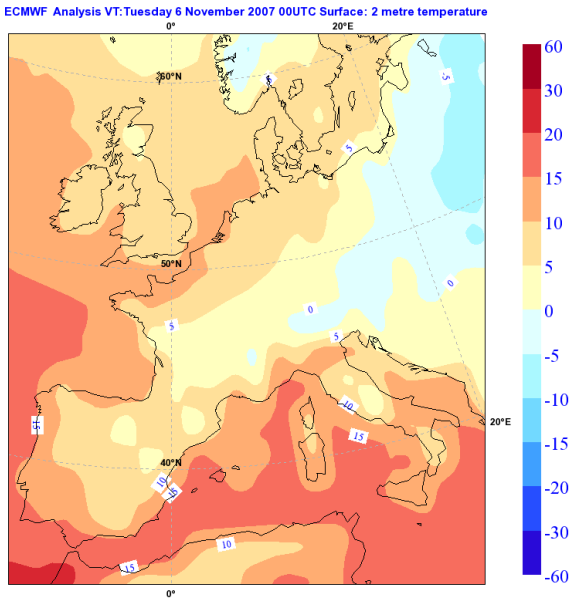
Metview – Display Window

- Interactive display window
- Zoom, scroll through fields, animate, print, generate macros
- Some interactive editing possible



Metview - New Features



- New Percentile application
- New Macro language capabilities
  - ➔in-memory creation and manipulation of geopoints
    - bypasses need for temporary geopoints file
  - ➔stopwatch() macro functions for performance tuning
- Lots more new functions and improvements
- Quick Installation Guide

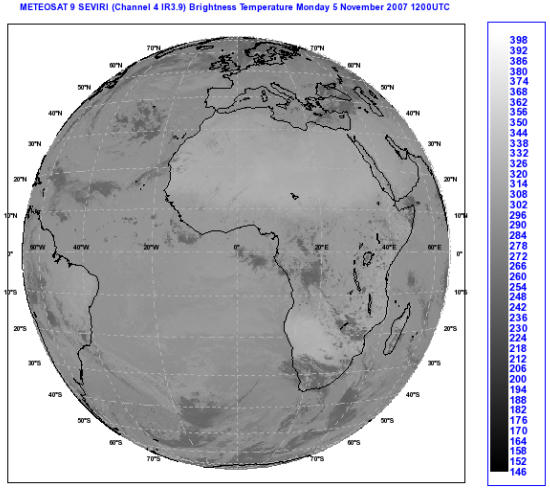
Metview - Availability

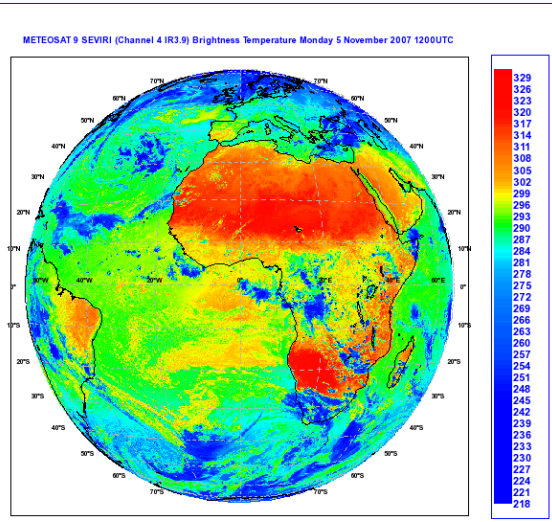
- Available as source code for build/install on own system
- Export version 3.10 available soon from Software Services: http://www.ecmwf.int/products/data/software/
- Installed in more than 50 organisations around the world
- 📖 Annual training course at ECMWF (Feb / March)

```
% cd metview
% ./mvbuild
```

Metview - Current Developments

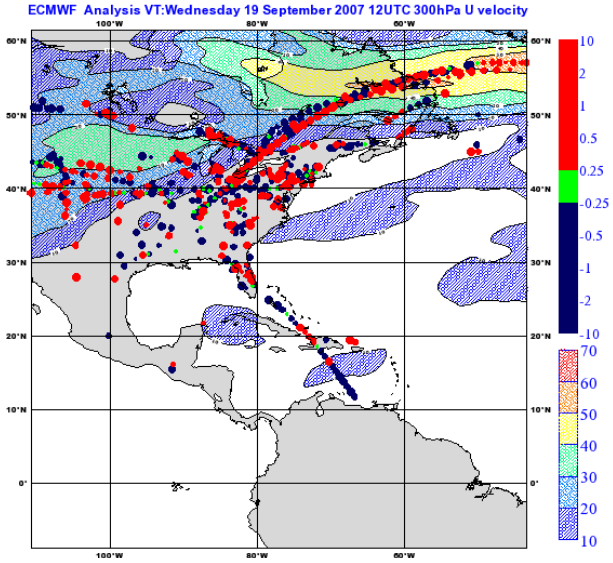
- More automated installation
  - ➔using the ‘configure’ tool, learning from experience with Magics++
- GRIB 2 support
  - ➔replacement of GRIBEX with GRIB API library for decoding/encoding GRIB data
- Macro Library / Examples





Metview - Current Developments

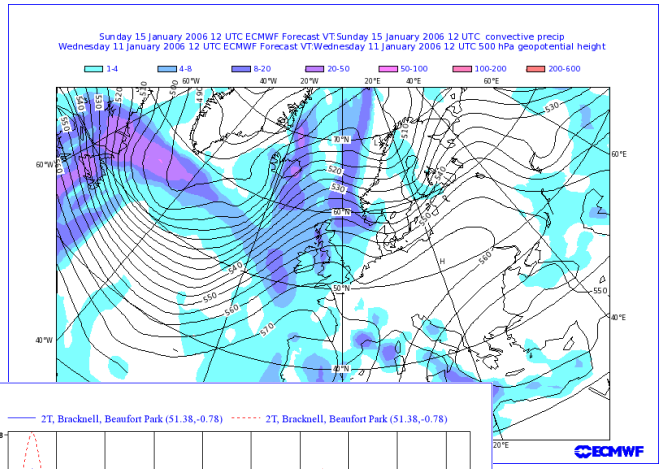
Use Magics++ in the new plotting module

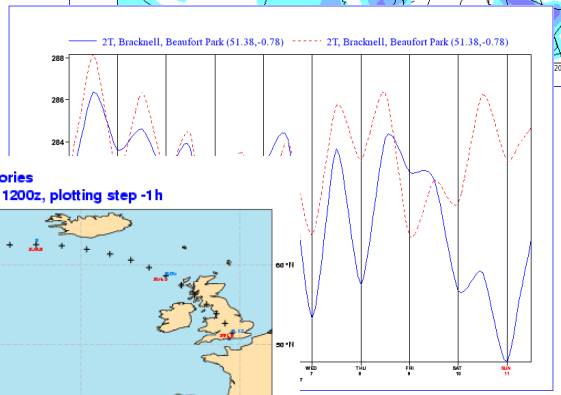


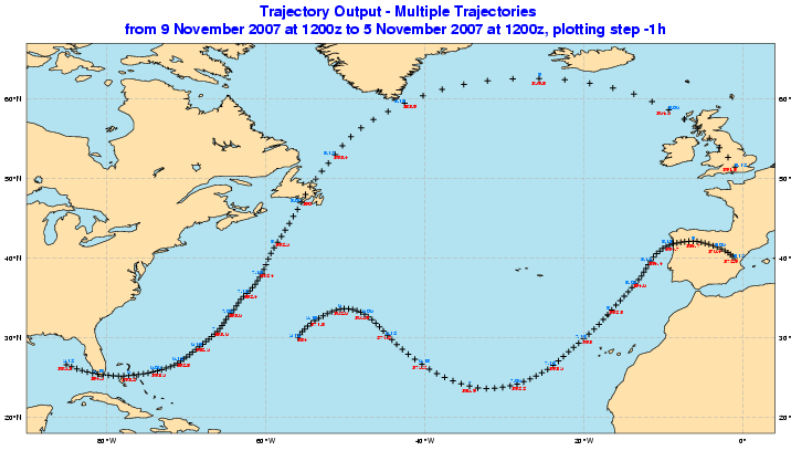
- convert Metview icon definitions to Magics++ objects
- plot using the new Magics++ OpenGL driver
- user can select and modify some elements of the plot; modifications are sent back to Magics++
- experimental – need to create a new Display Window to take full advantage of new features

Metview - Future Focus

- **Full integration with Magics++**
  - ➔ **new Display Window module**
  - ➔ **all the advantages of Magics++**
  - ➔ **64-bit Metview possible**

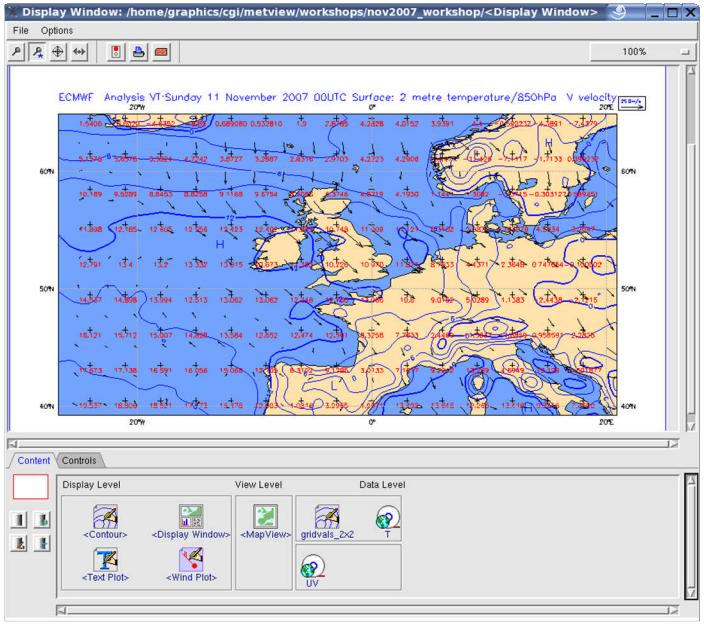






Metview - Future Focus

- New user interface?
  - ➔time to replace Motif?
    - e.g. GTK, Qt
  - ➔developments in Magics++ are putting more interactivity into outputs themselves (SVG, PNG + JavaScript)
  - ➔what about web applications?
    - Adobe AIR, Mozilla PRISM, Microsoft Silverlight take web applications to the desktop



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Metview - Future Focus

- A web interface for Metview?
  - → Run on a local web server
  - → Calculations performed using local resources
    - still important in meteorology
    - but remote calculations also possible
  - → User interface
    - JavaScript, widgets libraries
      - e.g. jQuery, YUI
  - ? Debugging tools
  - ? Maintainability

Overview

- Metview
  - → a meteorological workstation
- The next generation of user interfaces
  - → challenges and solutions
- Magics++
  - → a meteorological graphics plotting library

Interactive Magics++

The new design of Magics++ will allow it to be used in the new generation of meteorological workstations:

Desktop or Web-oriented!

- **What is the role Magics++ as a graphical package in a meteorological application?**
- **The Magics++ interactive functionalities.**
- **Magics++ latest news.**

Interactive Magics++

- Magics++ is meteorologically oriented, but it is not a standalone application…
- Magics++ is the visualisation component of a more complex framework.
- Magics++ offers a set of interactive functions: The client application will be designed on top of it to offer a powerful tool tailored to the need of its users :
  - → Researchers
  - → Forecasters
  - → Web users

Interactive Magics++

- Designed in parallel in 2 interactive environments
  - ➔An OpenGL driver for the desktop applications
    - Motif Widget
  - ➔A JavaScript module for web applications
    - JavaScript-on-demand
    - jQuery
- Offers a toolkit which can be used consistently in both environments.
- Tested in the new Metview Visualisation module and in the service-on-demand web project.

Interactive Magics++

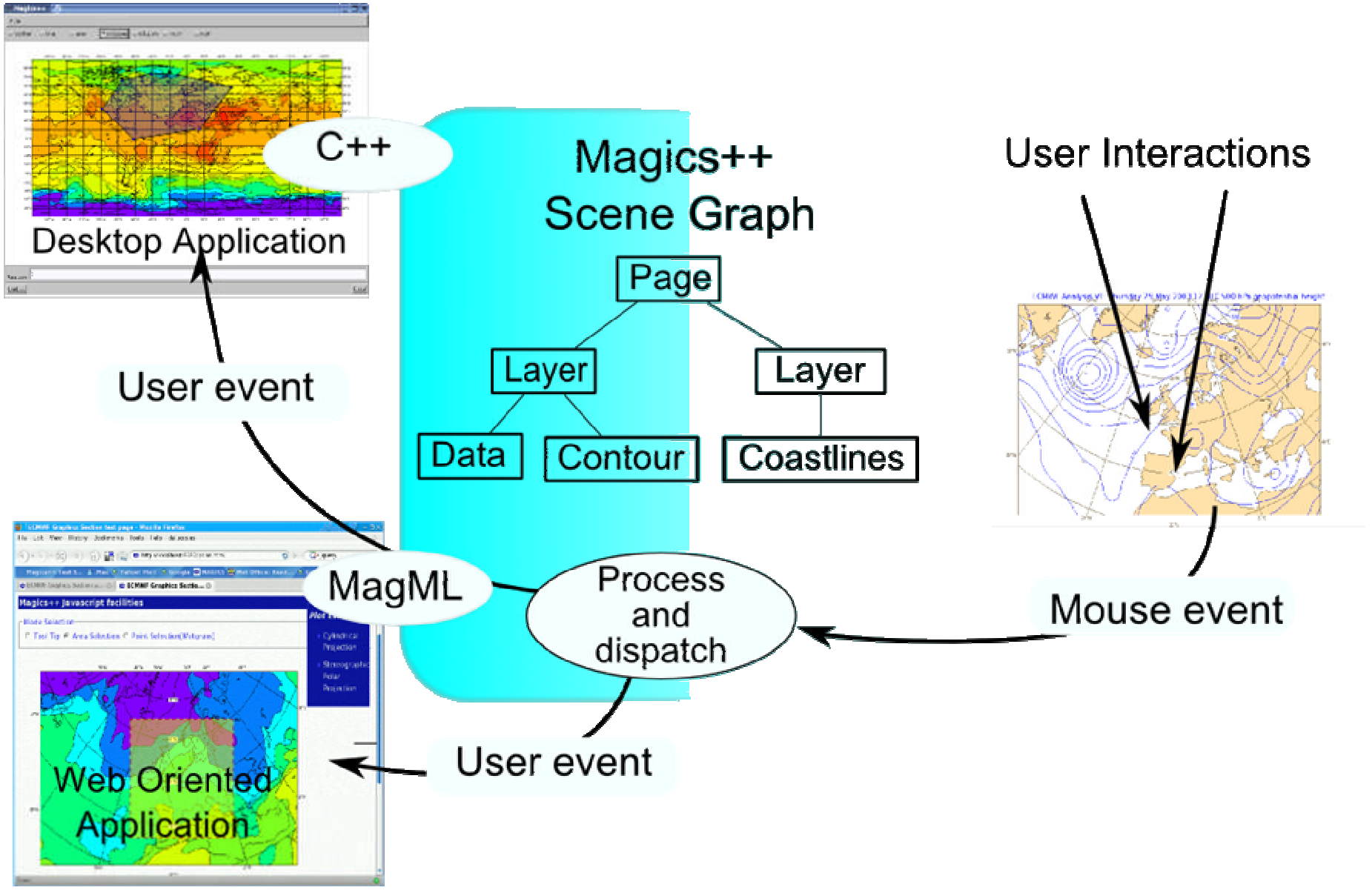
- Navigation of the maps
  - → Implementation of a tooltip facility
- Selection Modes
  - → Area
  - → Line
  - → Polyline
- Layers
  - → Defined by the client application
  - → Visible or not

Interactive Magics++

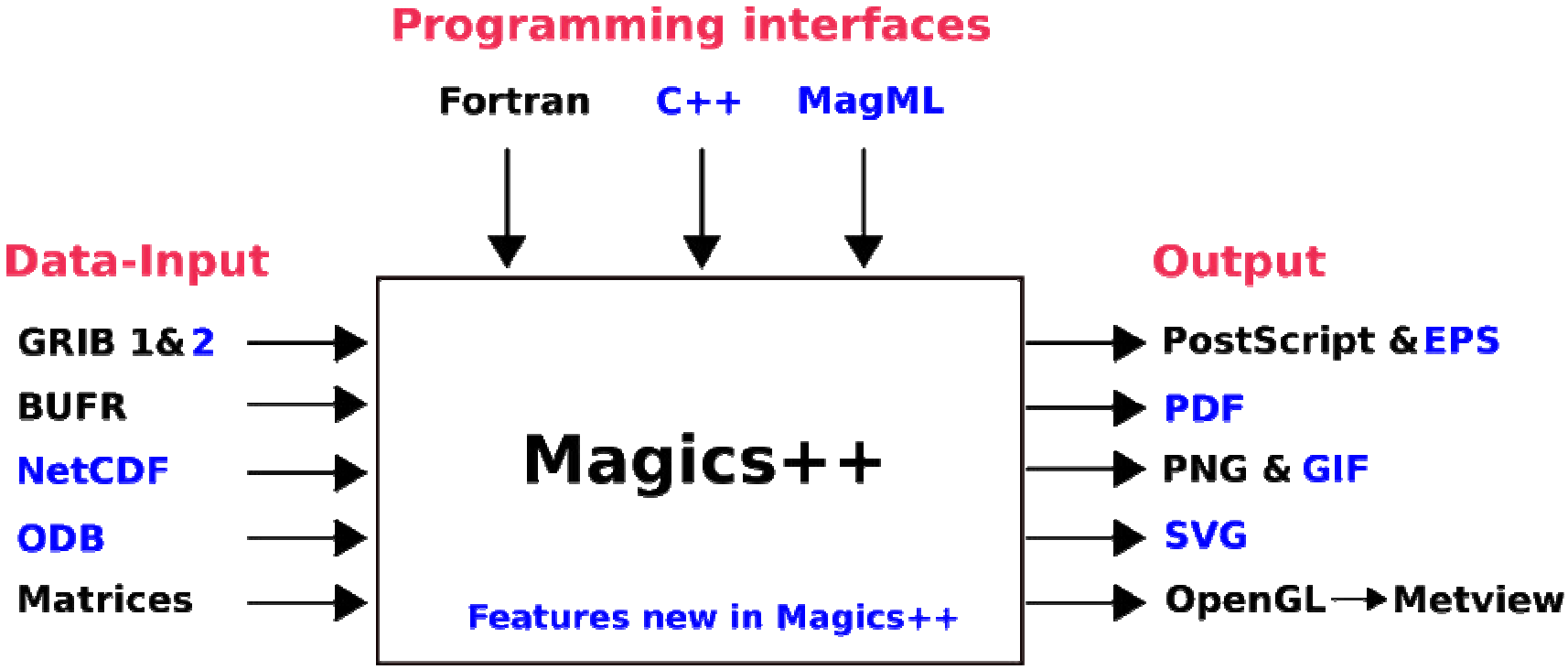
- **Change of layout or graphical properties**
  - **➔Resizable plots.**
  - **➔Resizable texts.**
  - **➔Positioning of the legend or text box.**
  - **➔Change of graphical properties** (ex: lines attributes)

Can these changes be saved?

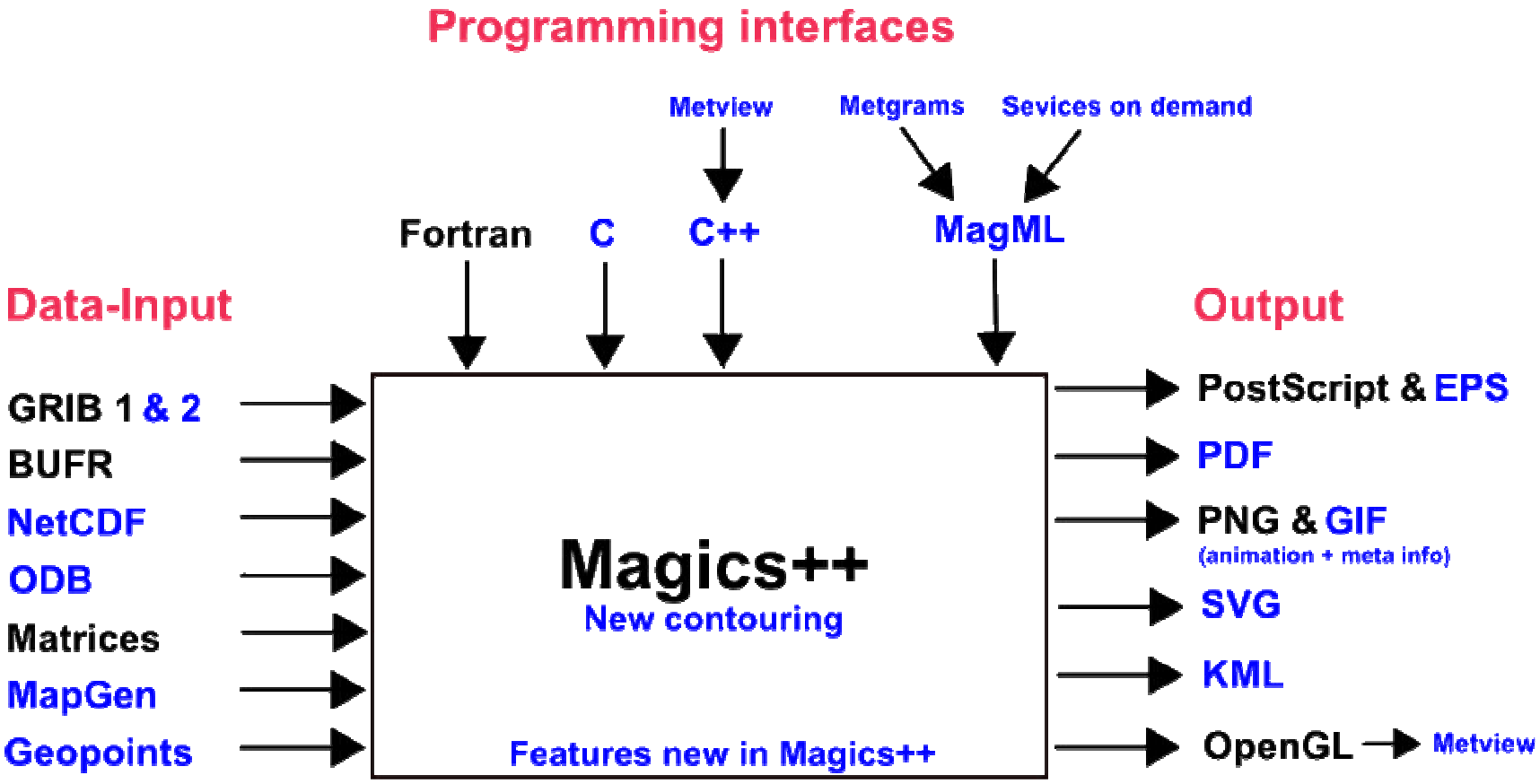
if yes, the Magics graphical tree can be saved at any time and the application informed of the changes!


C++
Desktop Application
Magics++
Scene Graph
Page
Layer
Layer
Data
Contour
Coastlines
User Interactions
User event
MagML
Process
and
dispatch
Mouse event
User event
Web Oriented
Application

Magics++ as presented last workshop

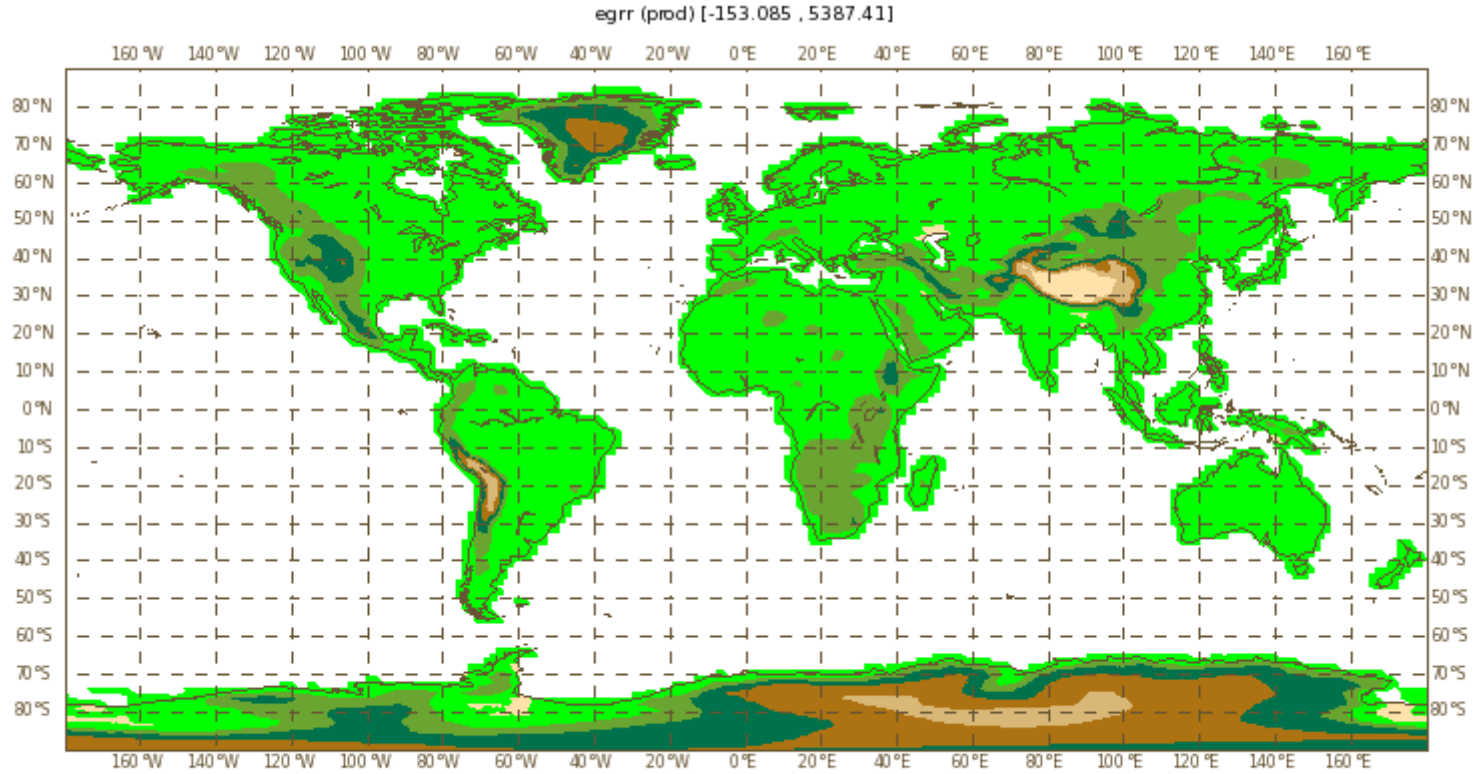


Magics++ latest News – Version 2.3

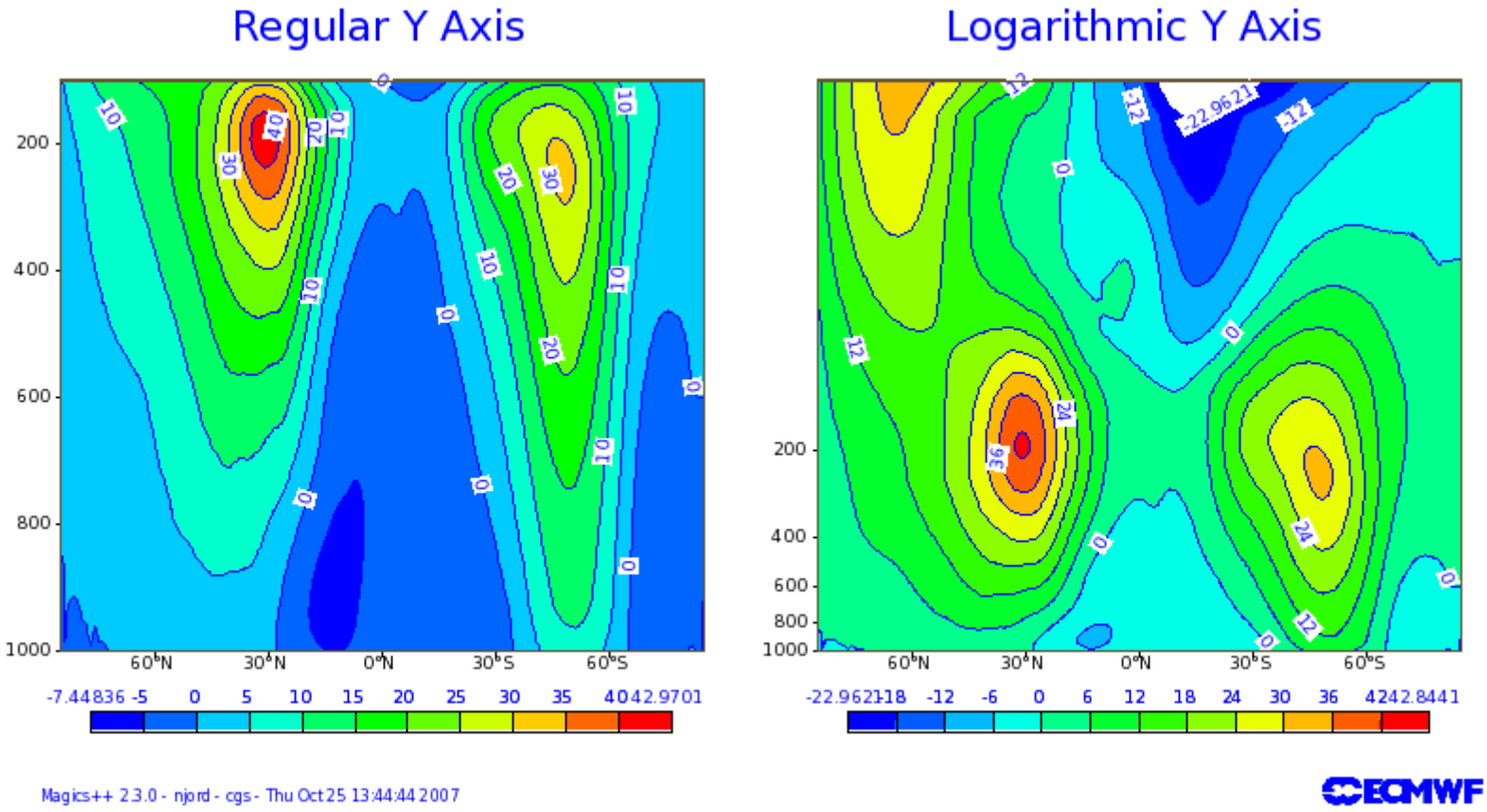


Magics++ - Grib2

- Decoding of Grib data is done using *Grib API*.
- Use of *Grib API* keys to customise the automatic title



Magics++ - Netcdf plotting



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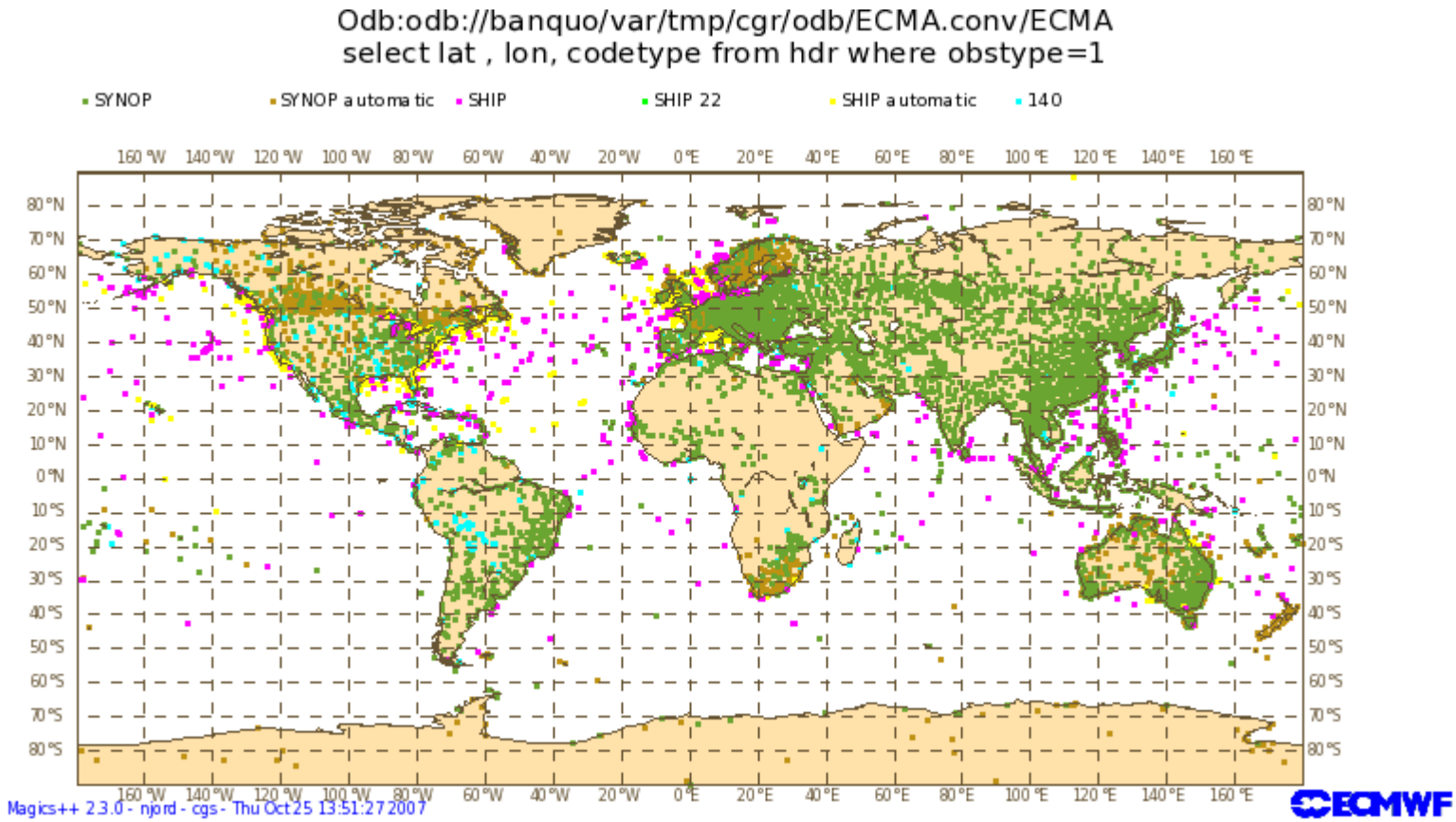
Magics++ - Odb Access

Using the in-house ODB server.



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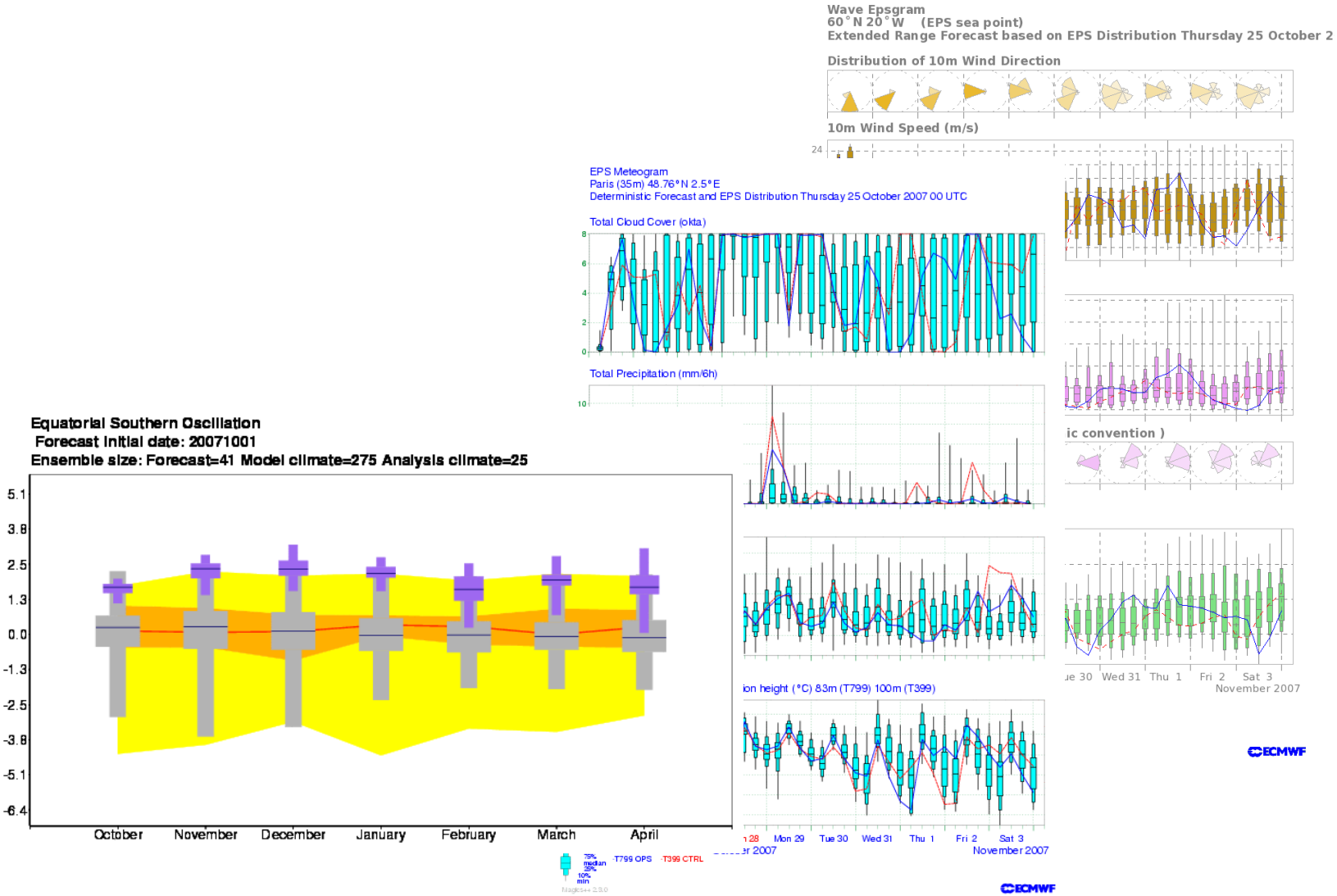
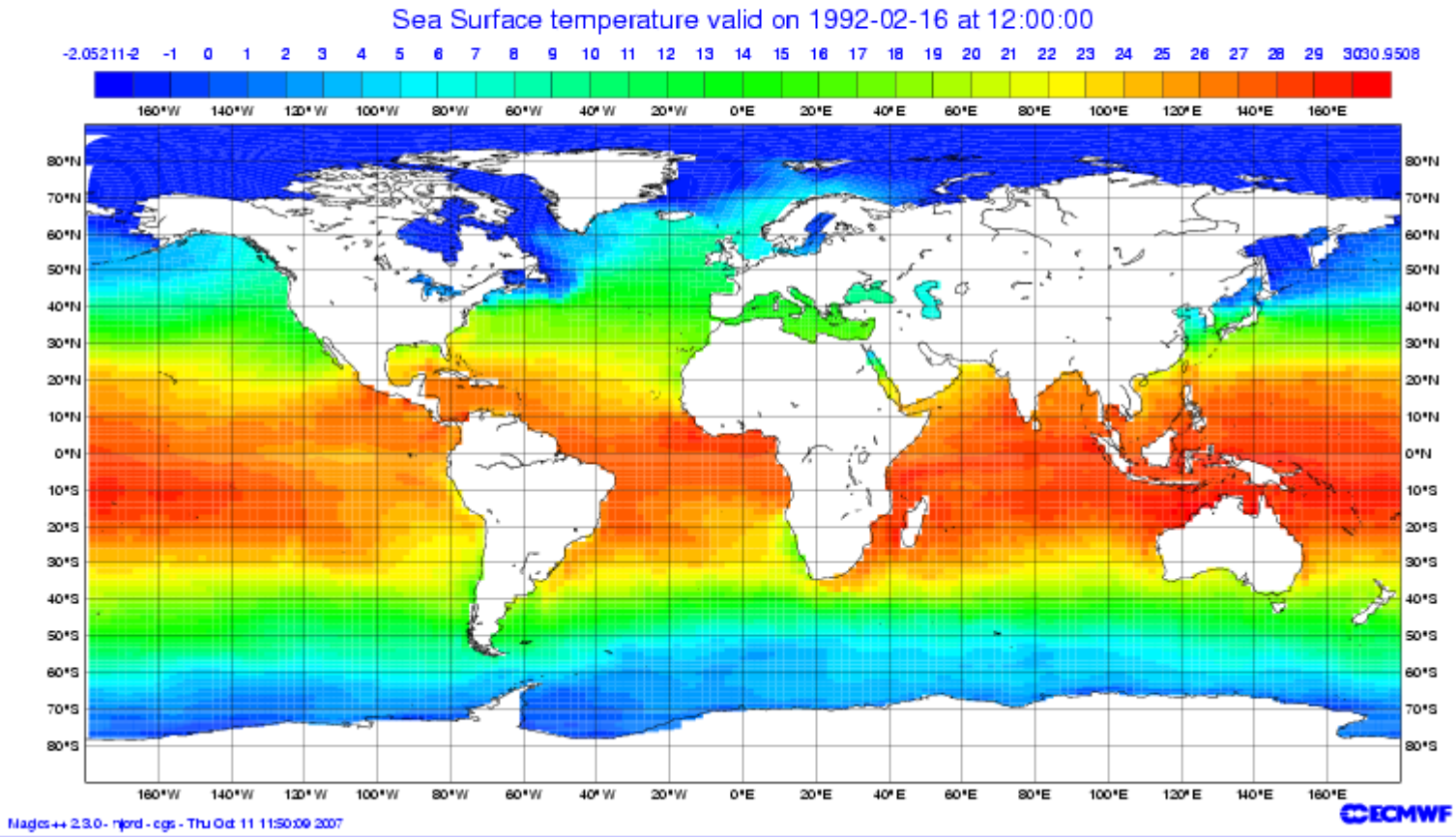
Magics++: Box plots and wind roses



Magics++ - Simple polyline shading



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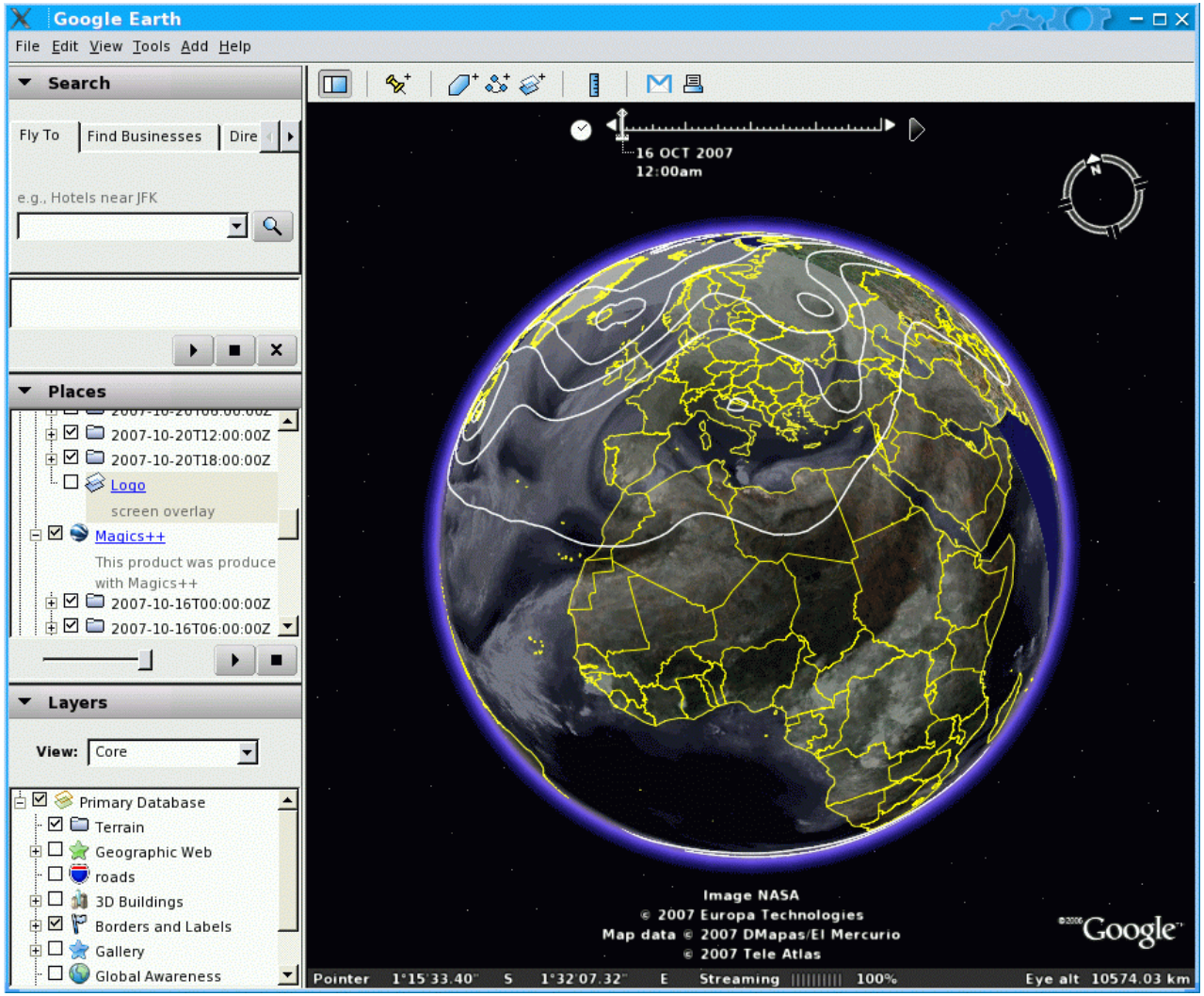
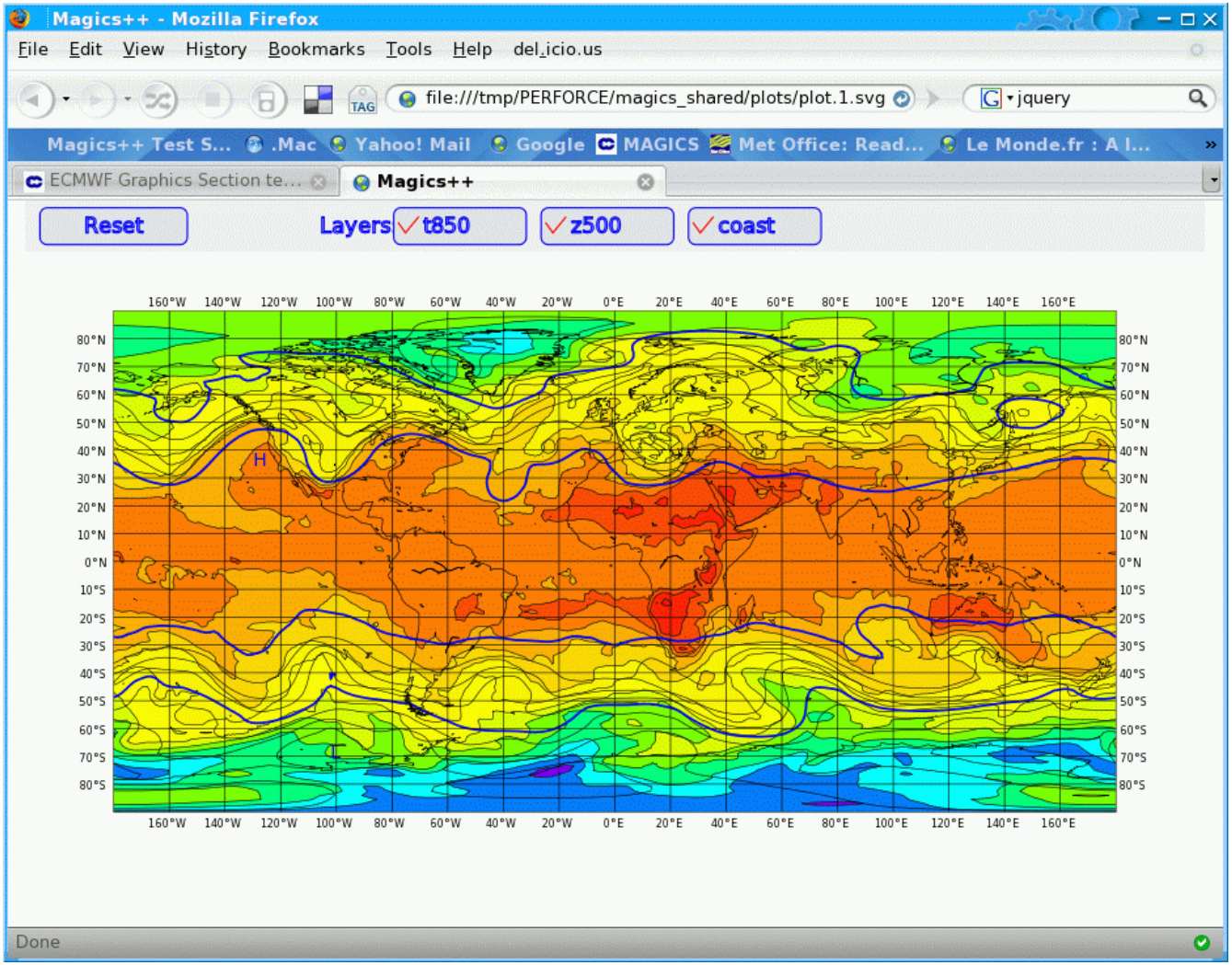
Magics++ : KML output



Magics++ : SVG output



Magics++ - MagML 3.0

- XML based format to describe Magics++ plots.
- A MagML template is interpreted to produce an output.
- Description close to Metview's icon convention.
- Interpreter can be easily called in user code
- Can be integrated into more complex XML request descriptions

➔Ideal as backend for web interfaces with static layout and visual properties but changing data

MagML – code example

```
<magics version='3.0'>
 <drivers>
   <ps name='${name=myname}'/>
 </drivers>
 <definition>
   <contour id='tempe' .../>
 </definition>
 <page>
    <nopageid/>
    <map >
       <cylindrical upper_right_longitude='60' upper_right_latitude='60'
              lower_left_longitude='-20' lower_left_latitude='20'/>
       <plot>
          <grib input_file_name ='${grib=t850.grb}' />
          <contour use_id='tempe'/>
       </plot>
       <coastlines/>
     </map>
  </page>
</magics>
```

To interpret this template :

magmlx template.magml –grib=today_t850.grib –name=today

General benefits of Magics++

- Fortran interface was cleaned-up and made more consistent (driver calls, default values)
- Support user's interactions
- Magics++ produces better publication-quality plots by supporting PNG, EPS and by optimising PostScript output
- Supports 64 bit memory addressing
- The *Apache license* makes Magics++ available freely for everyone

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, 5:30pm**
  - ➔ **Meeting room 1 near the atrium in the new building**