

Magics++ – meteorological graphics library generating weather maps and graphs for the web

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The mission of the ECMWF Graphics Section is to develop and support graphical software to help researchers in the manipulation and visualisation of meteorological data.

Magics++, freely available under the Apache license, is part of this work. It enables the plotting of meteorological fields and observational data on geographical maps or Cartesian graphs, and generates these plots for a large selection of output formats.

Magics++ is now used as the graphical kernel of Metview 4 and the new ECMWF-Web project. The ECMWF-Web project will provide the forecasters of the ECMWF Member States with a tool to display products, interact with them (eg panning, zooming) and additionally distribute these same products via WMS.

Magics++ enters its consolidation phase...

- **Magics++, successor of Magics, is a graphics library specialized in meteorological plots.**
- **Magics++2.8 is now ready for download at :**
<http://www.ecmwf.int/products/data/software/magics++.html>
- **It is free under the Apache license.**
- **Magics++ is a meteorologically- oriented library, but it is not a standalone application...**

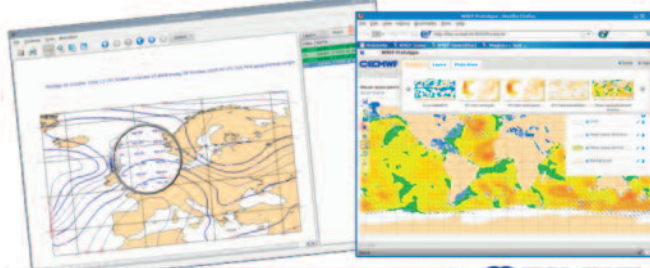
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2



**Its modern object-oriented design allows it to be used in the new generation of meteorological workstations:
Desktop or Web-oriented!**

- **...Magics++ is the visualisation component of a more complex framework.**
 - Desktop applications, Web application, WMS ...

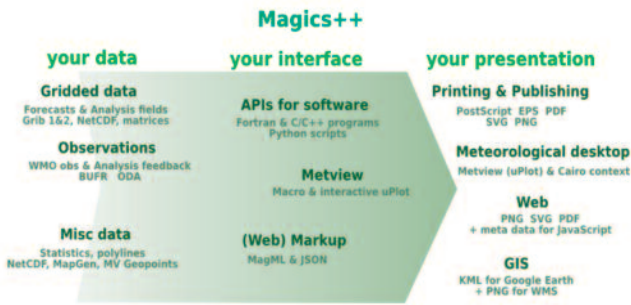


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3



Magics++ is a library !



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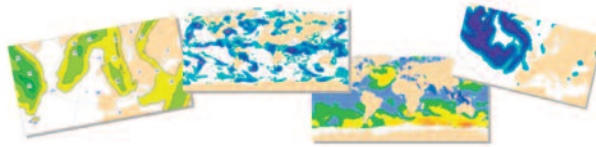
4



Magics++ is meteorologically oriented...

➤ Magics++ is a modern meteorologically-oriented software...

- It is able to visualise most of the meteorological data coded in GRIB1/GRIB2 and BUFR formats.
- Its support for netCDF opens it up to the scientific community.
- Work is being done to build a library of typical visualisations for specific meteorological parameters.



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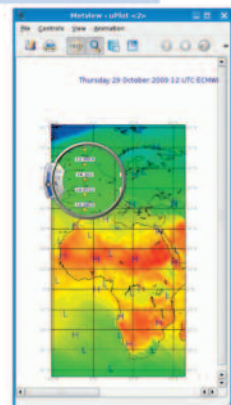
5



Magics++ and high resolution data...

➤ Magics++ offers solutions :

- Choosing an tailored visual definition
- Tuning the resolution of the input data
- Tuning the resolution of our contouring algorithm (Akima – INPE/CPTEC)
- It also provides facilities to examine data in depth.

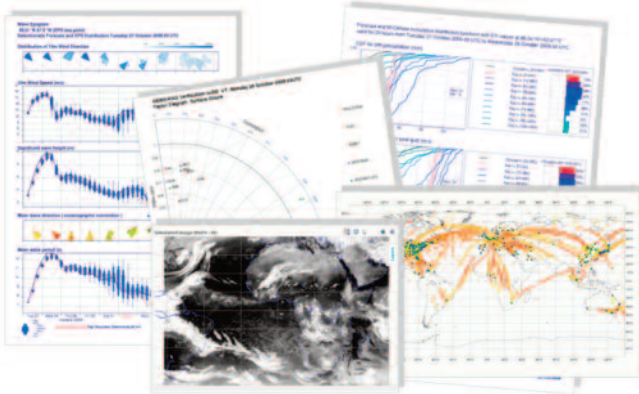


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6



Magics++ is ready to plug in new types of visualisation...



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7



Magics++ produces high quality outputs

- Magics++ produces better publication-quality plots by supporting PNG, EPS and by optimising PostScript output
- Magics++ uses Cairo to generate PNG and PDF
- Magics++ has an enhanced OpenGL driver to fulfil the requirements of Metview 4.
- We wrote our own SVG driver to have full control over the output.
- We are creating our own meta internal format for speeding the web production.

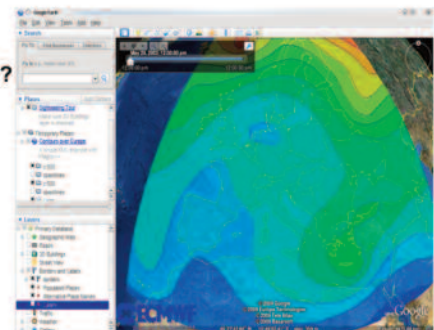
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8



KML : A very different driver!

- KML and projection?
- Concept of time
- Concept of height
- Concept of layers
- Generates OGC compliant KML 2.2



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9



Magics++ is WEB-aware !

- As a modern software, it knows about the web requirements ...



- Easily embedded in a Web "Plot on demand" application.
- Generates metadata for title and legend.
- Generates simple javascript to enable the navigation of the maps (click-zoom-pan)

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10



Magics++: our programming experience...

- **Autotools (configure) based installation enables easier spread of Magics++**
 - Users are more confident to update
 - Debian and Fedora community have or plan to package Magics++
- **C++ proved again to be a good choice**
 - Already used in Metview for 15 years
 - Fast, clear structured object-oriented code
 - Only issue: compiler support
- **Cairo**
 - A modern vector graphics library
- **Backwards compatibility**
 - Important in an operational environment, but...
 - Can limit new developments, and slow the developments down.

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11



Magics++ in the Web era

Re-engineering the Web system with a view to providing a resilient service with interactive features such as zooming and on-demand production of customised plots for Members States...

- **Users expectations of web services are increasing**
 - Large catalogue of products
 - High availability
 - More interactivity: zooming, panning, customisation of visualisation or computation
 - Clickable maps

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12



How can Magics++ help?

Products - Precipitation - WREP

Layers

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Program

Current grid point: 44.837°N 48.127°E
 Total Precipitation: 3.0 mm
 Mean Sea Level Pressure: 1024.8 Pa

Observation grid point: 44.837°N 48.127°E
 Difference: Forecast and SRS Observation: 20091030 0000 UTC

Total Cloud Cover (ctot):

Total Precipitation (mm(24h))

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Easy description of layers using MagML/JSON both Metview-like

Generation of Javascript to navigate the Maps.

```

Metview Icon Style (
  contour_level_selection_type: "interval",
  contour_interval: 4,
  contour_shade_colour_method: "list",
  contour_shade: "on",
  contour_shade_method: "area_fill",
  contour_shade_colour_list: ["blue","green","red"]
)

JSON/ MagML (
  "contour_level_selection_type": "interval",
  "contour_interval": 4,
  "contour_shade_colour_method": "list",
  "contour_shade": "on",
  "contour_shade_method": "area_fill",
  "contour_shade_colour_list": ["blue","green","red"]
)
    
```

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Magics++ serving maps for a WMS...

- Styling
 - Fits well for with our Visual Definition concept
- Tiling
 - Can trigger border effects!
- Projection
 - Should be compliant.
- GetLegendGraphics



