## Meeting the challenges of the next generation of user interfaces



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#### **Overview**

#### Metview

a meteorological workstation

The next generation of user interfaces
 Challenges and solutions

Magics++

→a meteorological graphics plotting library



#### **Metview**



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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

📅 TrajPlot-1.0 - /home/graphics/cgi/metview

#### powerful meteorologically oriented language

File Edit Search Preferences Shell Macro Windows Help			
orial/macro_tut1/Solutions/TrajPlot-1.0 11736 bytes L: 165 C: 0			
for i = 1 to n_trajs do			
<pre>traj_name = list[i] traject = read(traj_name) cur_area = traj_limits(traject) if i = 1 ther[subtract](traine)</pre>			
area = cu observations read (string) else geopoints read (string) area[1] = list read (string)			
area[2] = netcdf read (string) area[3] = Reads a data file whose name is passed as the argument. area[4] = area[4] =			
<pre>end for #print( area ) The variable of type list is used to hold the contents of an ASCII file - the elements of this list variable are themselves</pre>			
<pre>s_lat = area[1] - excess = 0 if (s_lat &lt; -90) excess = -90 - s_lat s lat = -90 end if</pre>			
<pre>w_lon = area[2] - g_tolerance</pre>			
<pre>n lat = area[3] + g_tolerance + excess if (n_lat &gt; 90) then     excess = n_lat - 90     n lat = 90     s lat = s_lat - excess end if</pre>			
e_lon = area[4] + g_tolerance			
<pre>if g_date_line_crossed then     area = [ int(s_lat), 90, int(n_lat), 270 ] else</pre>			

- 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, ...

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2850		File Edit Search Preferences Shell Macro Windows Help
1221	?	rial/macro tut1/g advection allinone 5791 bytes L: C:
· · · · · · · · · · · · · · · · · · ·	$F+G F+X \times F f(F) f(F,G) f(F,X) f(X,F)$	Tial/macro_cacr/q_adveccron_arrinone 5/51 byces B. 0.
Class Operations	- Function	v = retrieve(
и Туре		date : -1.
, <sup>200</sup>	Parameter 1 GEOPOINTS, GRIB File	param : "v",
J Stream		level : 700,
u Expver	tc	area : area XX,
J*	I Parameter 2GEOPOINTS_GRIP File	grid (1:5,1:5)
Spherical Harmon		,
a Cibitype		
> l*	tan	# Compute the gradient of Q
Pressure Levels		q = gradientb(q)
Evelist	-	the second descent of the second state of the
I Param		# Extract the area we are calculating on
•  2		q = read ( area : area_xx, data : q)
Geopotential Gravity Wave D	1951	
Height Geopoter Height Of O De	ntia	
Heigth Of Snow	fall	# Compute the advection of 0
High Vegetation	h Ca	a = q[1]*u + q[2]*v
Humidity Tender Humidity Tender	ncy [sl]a	a = -a * (10 ^ 8) # units will be 10e-8 (kg/kg)/sec
Ice Age	Aprily Reset   1 Stay onen Close	
Date	Network a play open	
<u>م</u>	ξ.	
/ Templates / MARS Catalogue \		
Apply Reset u Stay open	Close	

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# **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



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## **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)





## **Metview - Current Developments**

- More automated installation
  - Jusing the 'configure' tool, learning from experience with Magics++

#### GRIB 2 support

replacement of GRIBEX with GRIB API library for decoding/encoding GRIB data





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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
- Juser 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**



## **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)



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#### what about web applications?

 Adobe AIR, Mozilla PRISM, Microsoft Silverlight take web applications to the desktop



## **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**

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• The next generation of user interfaces

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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?

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- The Magics++ interactive functionalities.
- Magics++ latest news.

- 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 :

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- → Researchers
- Forecasters
- → Web users

- 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.



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



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!

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#### **Magics++ as presented last workshop**





## Magics++ latest News - Version 2.3



#### **Programming interfaces**



#### Magics++ - Grib2

• Decoding of Grib data is done using *Grib API*.

• Use of *Grib API* keys to customise the automatic title



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Magics++ 2.3.0 - njord - cgs - Thu Oct 25 13:25:48 2007

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#### **Magics++ - Netcdf plotting**



Magics++ 2.3.0 - njord - cgs - Thu Oct 25 13:44:44 2007

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60°S

36 4242.8441

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### Magics++ - Odb Access

#### Using the in-house ODB server.



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#### **Magics++: Box plots and wind roses**

Wave Epsgram 60°N 20°W (EPS sea point) Extended Range Forecast based on EPS Distribution Thursday 25 October 2



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## Magics++ - Simple polyline shading





## Magics++ : KML output



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### **Magics++: SVG output**



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## 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

