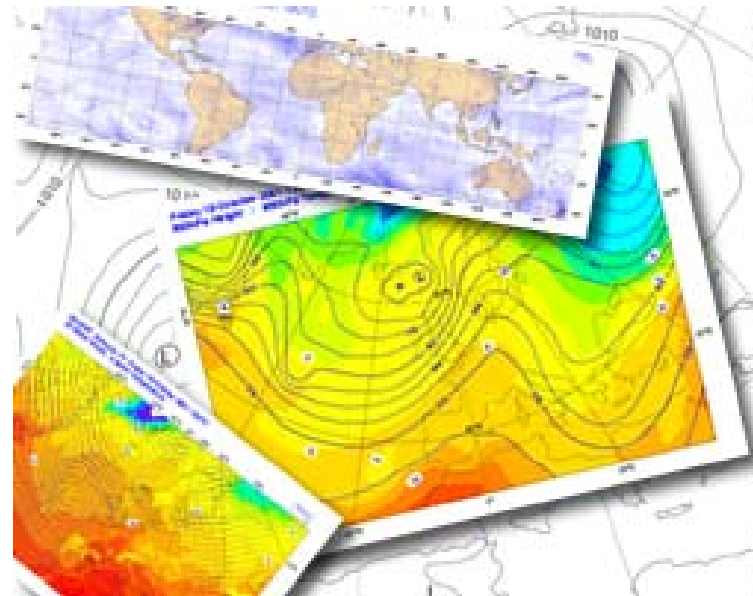




# O INPE e o ECMWF



**Fernando li**

*DPI-INPE*

*Visualization Section-ECMWF*

# Outline



- **ECMWF**
- **Co-operation INPE-ECMWF**
- **Visualization section**
- **Main software developments**

# What is ECMWF?



- **European Centre for Medium Range Weather Forecasts**
- **We provide operational medium- and extended-range forecasts and a state-of-the-art super-computing facility for scientific research.**
- **Supported by 34 States**
- **220 Employees**
- **Founded 36 years ago**
- ***Headquarters* at Reading, ~60km W London**





# Supporting States and Co-operation

**Belgium**  
**Denmark**  
**Germany**  
**Spain**  
**France**  
**Greece**

**Ireland**  
**Italy**  
**Luxembourg**  
**The Netherlands**  
**Norway**  
**Austria**

**Portugal**  
**Switzerland**  
**Finland**  
**Sweden**  
**Turkey**  
**United Kingdom**

## **Co-operation agreements or working arrangements with:**

**Czech Republic**  
**Croatia**  
**Estonia**  
**Hungary**  
**Iceland**  
**Latvia**  
**Lithuania**

**Montenegro**  
**Morocco**  
**Romania**  
**Serbia**  
**Slovakia**  
**Slovenia**

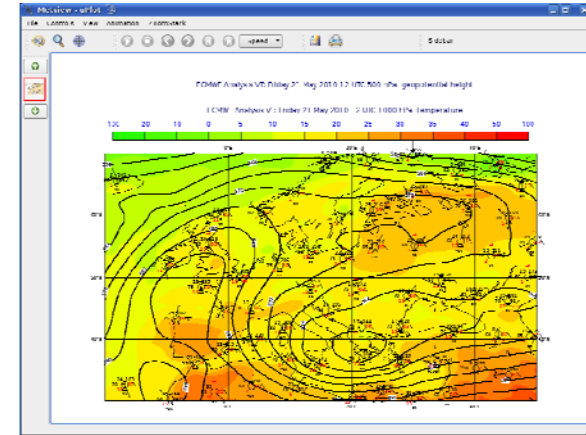
**ACMAD**  
**ESA**  
**EUMETSAT**  
**WMO**  
**JRC**  
**CTBTO**  
**CLRTAP**

# ECMWF – what we provide (1)



## ● Forecast data dissemination

- RMDCN
- GRIB (fields) & BUFR (weather parameters)



## ● Data archive - MARS

- world's largest archive of numerical weather prediction data
- ~15PB
- large-scale Data Handling System (DHS)
- IBM's HPSS



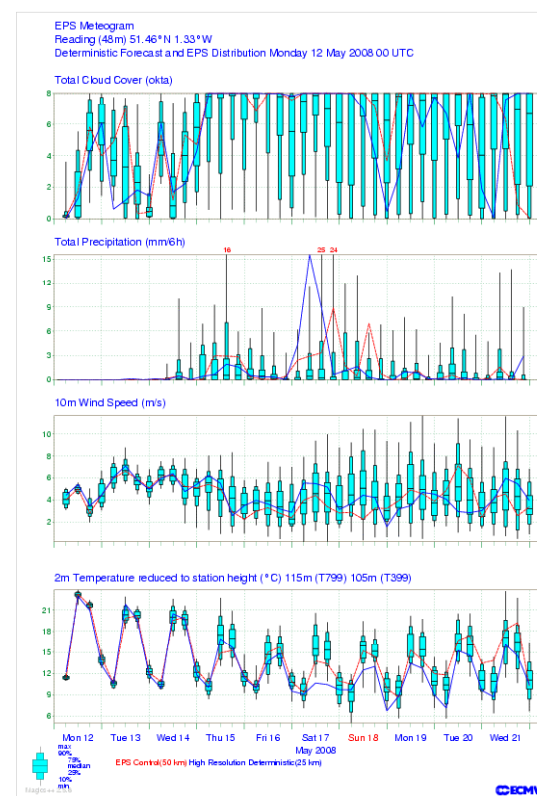
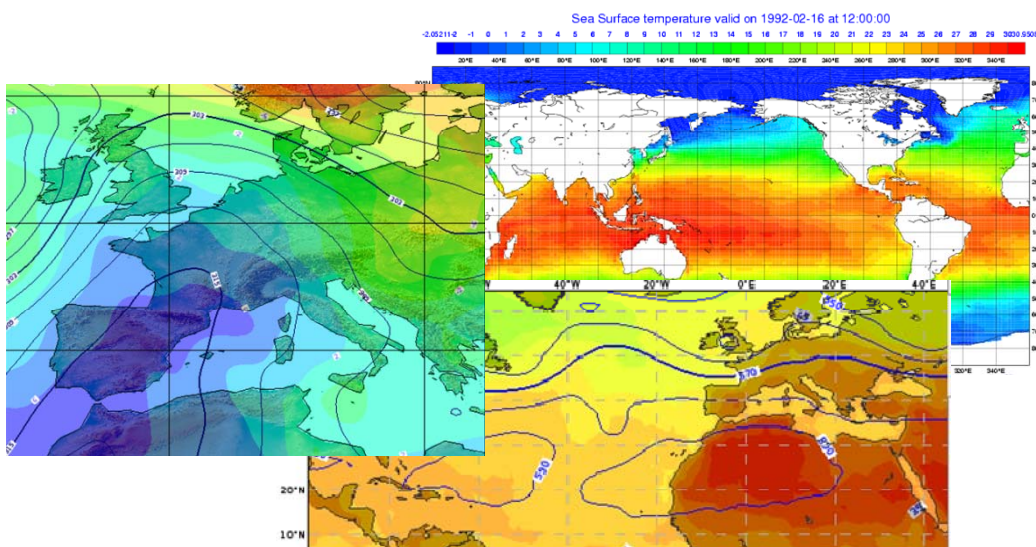




# ECMWF – what we provide (3)

- **Meteorological software packages**

- **Libraries: Grib\_API, Magics, Emoslib**
- **Applications: Metview, MARS, SMS**



# ECMWF – operational forecast system



- **High resolution deterministic forecast:** twice per day  
16 km 91-level, to 10 days ahead
- **Ensemble forecast (EPS):** twice daily  
51 members, 30/60 km 62-level, to 15 days ahead
- **Ocean waves:** twice daily
  - Global: 10 days ahead at 28 km
  - European Waters: 5 days ahead at 10 km
  - Ensemble: 15 days ahead at 55 km
- **Monthly forecast:** once a week  
51-members, 30/60 km 62 levels
- **Seasonal forecast:** once a month  
41-members, 125 km 62 levels, to 7 months ahead
- **Each day we deliver 13 millions products (fields) to Member and Co-operating States and customers**

# Co-operation INPE-ECMWF



- **Started 23 years ago**
- **Main Contract + Additional Terms**
- **Metview Additional Term**
  - software development
  - strong relationship: INPE/DPI-ECMWF/MetVis
- **History DPI and MetVis**



## DPI and MetVis (1)

- **1984: DPI, the beginning**
  - I-100
  - “Meteorologia-Engenharia-Beta”
  - “Auditorio”
- **1986: DPI SITIM -> SGI**

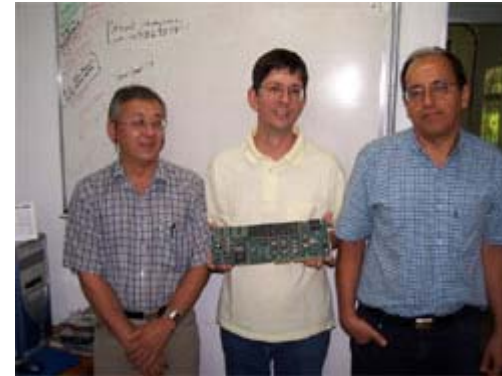




## DPI and MetVis (2)

- **1988: co-operation INPE-ECMWF**

- ECMWF Micro-Magics
- based on UVI (Unidade Visualizadora de Imagens)
- GKS, dpi.font



- **1989/1990: DPI Spring**

- SUN workstations: Huguinho, Zezinho e Luizinho (Sputnik, Soyuz, Meteosat)

# DPI and MetVis (3)



- **1991: ECMWF Metview 1**

- “Spring” prototype
- SGI workstation
- GKS, dpi.font



- **1997: DPI SPRING Windows**





## DPI and MetVis (3)

- **1998: ECMWF Metview 2**

- new visualization module (OpenGL)
- move from GKS to PostScript/OpenGL



- **2000: ECMWF Metview 3**

- new user interface, Vis5D





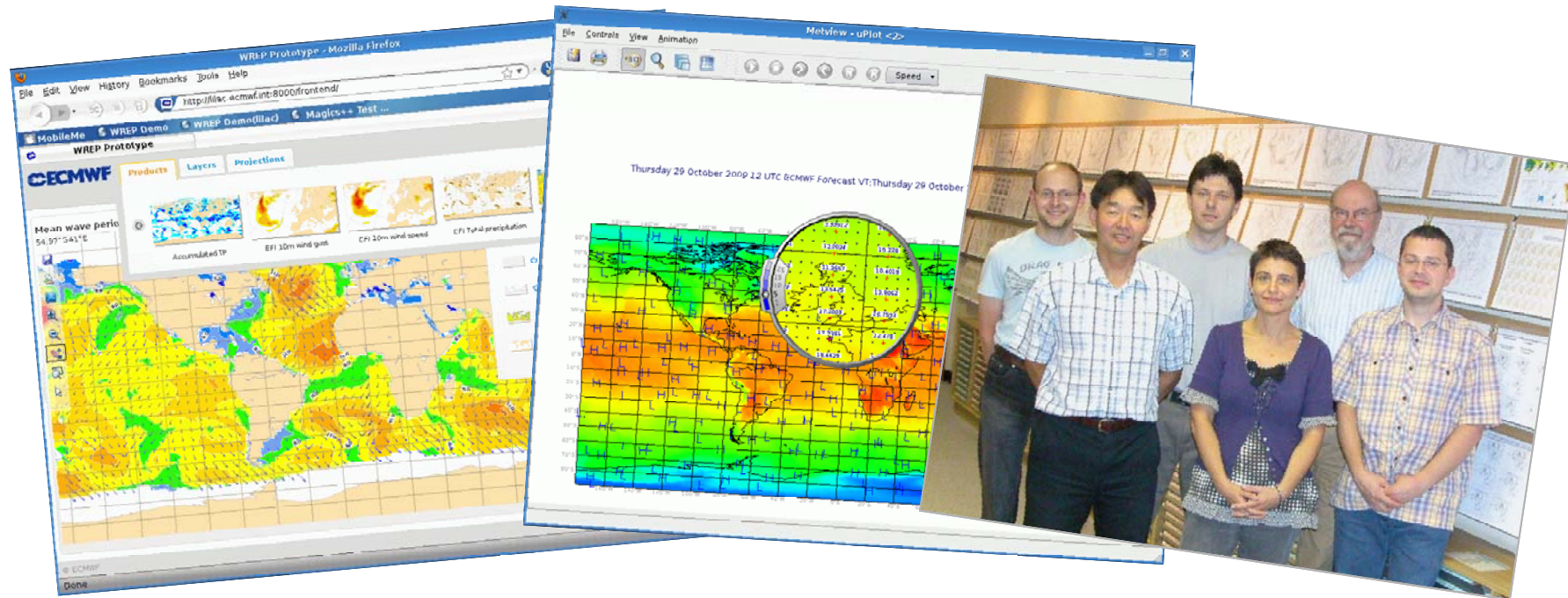
## DPI and MetVis (3)

- **2000: DPI Terralib**
- **2003: ECMWF Metview 3/4**
  - Akima, Terralib
  - 10 years anniversary



- **2011: DPI Terralib 5, ECMWF Metview 4**
  - under development

# The Visualization Section



**Stephan Siemen, Sylvie Lamy-Thépaut, Fernando li,  
Sándor Kertész , Iain Russell, Vesa Karhila**

*The Visualization Section*

*ECMWF*



## Magics

- **Plotting library for meteorological data**
- **Used as Metview's plotting engine and for generating web products**
- **Open Source**

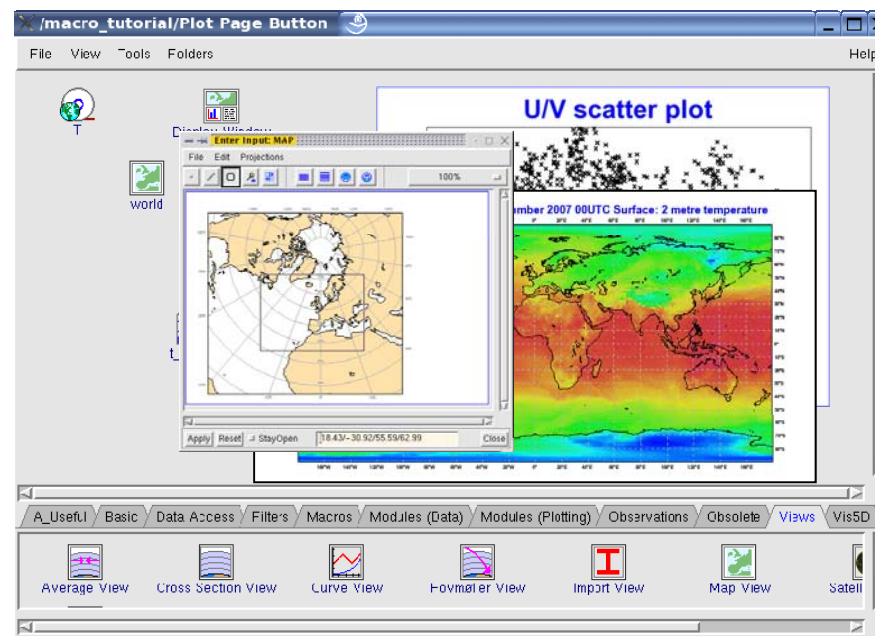
## Metview

- **Working environment for Operational and Research Meteorologists**

- Interactive & batch

- **Co-operative project:**

- *ECMWF*
- *INPE/CPTEC*
- *Météo France*





# Metview main features

- **Strength: its flexible SOA like architecture allows to easily overlay various types from various data sources**
- **Interacts with other established meteorologically oriented software and GIS systems**
- **Icon-based interface + Drag&Drop support**
- **Offers extensive batch facilities**

## Metview Macro

- **Working environment:**
  - C++, Qt, Perforce,
  - Magics, TotalView

```
# 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
```



# Metview concepts – icon dropping

The image illustrates the 'icon dropping' workflow in the Metview software. It shows two windows: a workspace window and a plot window.

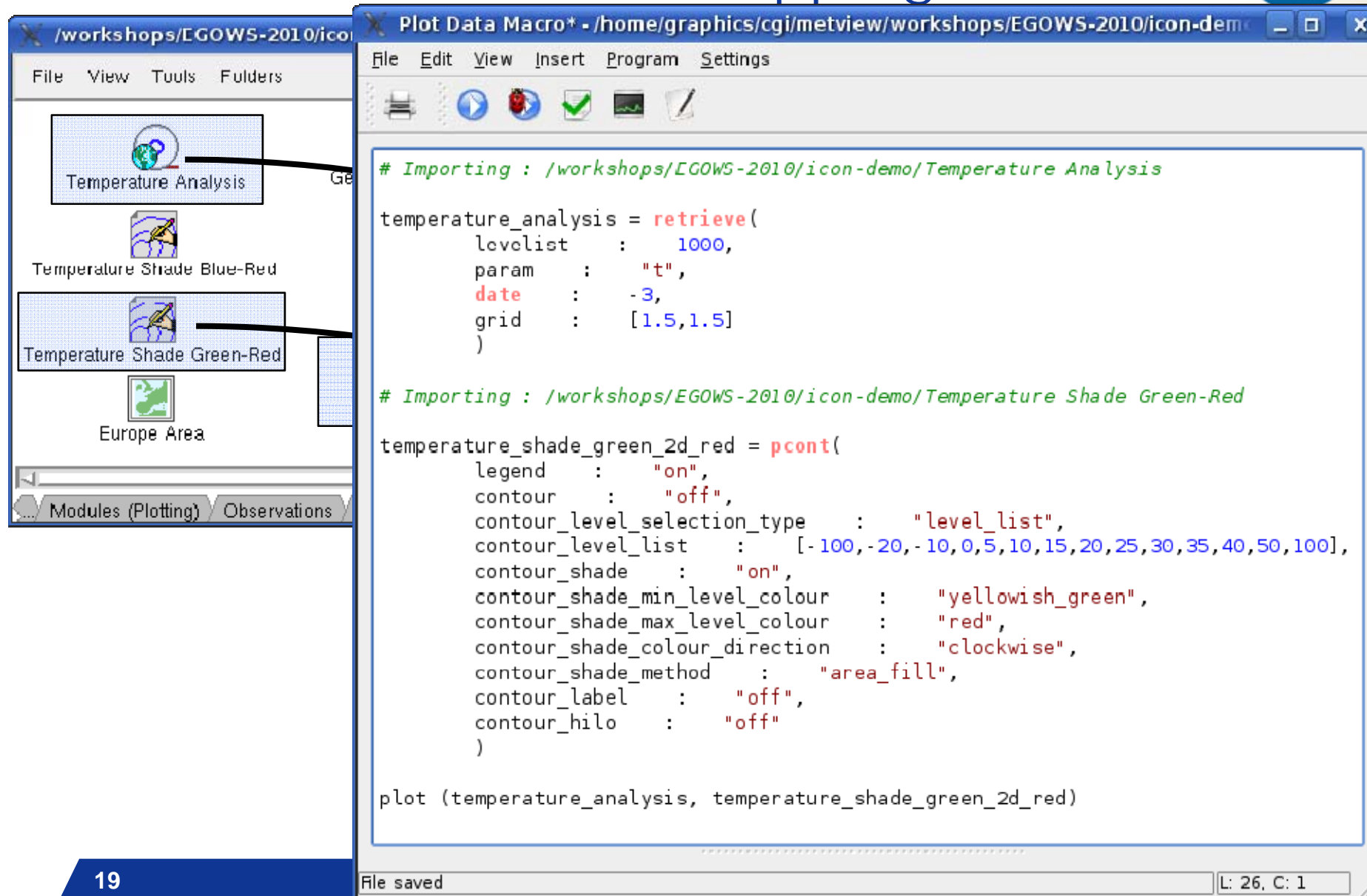
**Workspace Window (/workshops/EGOWS-2010/icon-demo):**

- Contains a menu bar (File, View, Tools, Folders, Help).
- Has a grid of icons: Temperature Analysis, Observations, Land Obs Filter, Observation Thin, Europe Area, and ECMWF WREP Clouds.
- A context menu is open over the 'Temperature Analysis' icon, listing actions: execute, visualise, examine, save, analyse, edit, duplicate, delete, insert, and output.
- Arrows indicate the process of dragging icons from the workspace to the plot window.

**Plot Window (Metview - plot):**

- Contains a menu bar (File, Controls, Animation, ZoomStack).
- Has a 'Speed' control and a 'Sidebar'.
- The plot area displays a global map titled 'ECMWF Analysis VT: Friday 21 May 2010 12 UTC 1000 hPa temperature'.
- The map shows temperature contours and wind vectors over a grid from 160°W to 160°E and 80°S to 80°N.

# Macro Editor – icon dropping



The image shows a software interface for editing macros. On the left is a palette with icons for different data analysis and plotting modules. On the right is a code editor window titled "Plot Data Macro+ - /home/graphics/cgi/metview/workshops/EGOWS-2010/icon-demo". The code editor contains the following macro script:

```
File Edit View Insert Program Settings

# Importing : /workshops/EGOWS-2010/icon-demo/Temperature Analysis

temperature_analysis = retrieve(
  levelist : 1000,
  param   : "t",
  date    : -3,
  grid    : [1.5,1.5]
)

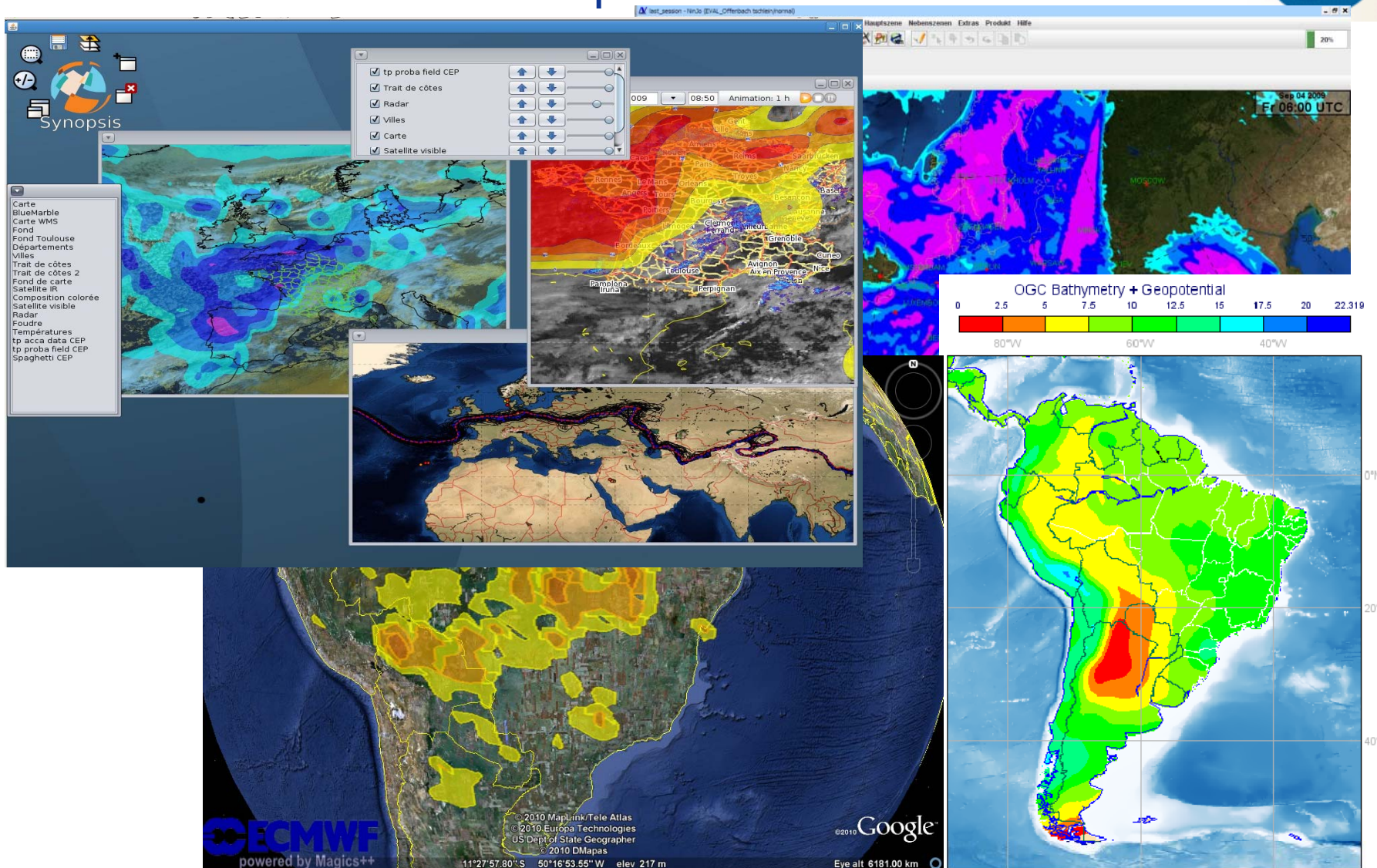
# Importing : /workshops/EGOWS-2010/icon-demo/Temperature Shade Green-Red

temperature_shade_green_2d_red = pcont(
  legend      : "on",
  contour     : "off",
  contour_level_selection_type : "level_list",
  contour_level_list : [-100,-20,-10,0,5,10,15,20,25,30,35,40,50,100],
  contour_shade : "on",
  contour_shade_min_level_colour : "yellowish_green",
  contour_shade_max_level_colour : "red",
  contour_shade_colour_direction : "clockwise",
  contour_shade_method : "area_fill",
  contour_label : "off",
  contour_hilo : "off"
)

plot (temperature_analysis, temperature_shade_green_2d_red)
```

File saved L: 26, C: 1

# OGC WMS - examples



# ECMWF's WMS in INPE Terraview



The image displays two software windows. The left window is titled "OGC Web Map Service (WMS)" and shows the configuration for an "ECMWF WMS Server". It includes a "Layers" list with the following items:

- 200 hPa wind
- 200 hPa wind speed
- 2m temperature
- 2m temperature extreme forecast index
- 2m temperature probability
- 300 hPa geopotential
- 300 hPa relative vorticity
- 300 hPa wind

The "Layer Information" section shows the following details:

- Title: 2m temperature
- Query: Is Queryable
- Fixed Width: 0.00
- Fixed Height: 0.00
- CRS: EPSG:4326

The "Layers Settings" section shows "Choose Image Format" set to "image/png" and "Choose Feature Information Format" set to "text/plain". A "Layer Preview" window shows a color-coded temperature map. The right window is "TerraView 3.5.0 - [Tela de Visualização]". It shows a map of South America with a vector field overlay representing wind. The "Bancos de Dados" (Data Sources) list includes "wms.mdb". The "Vistas/Temas" (Views/Themes) list includes "hinn", "10m wind", and "Biomass do Brasil". A scale bar at the bottom right indicates 0, 10, 20, and 30 degrees in decimal degrees.