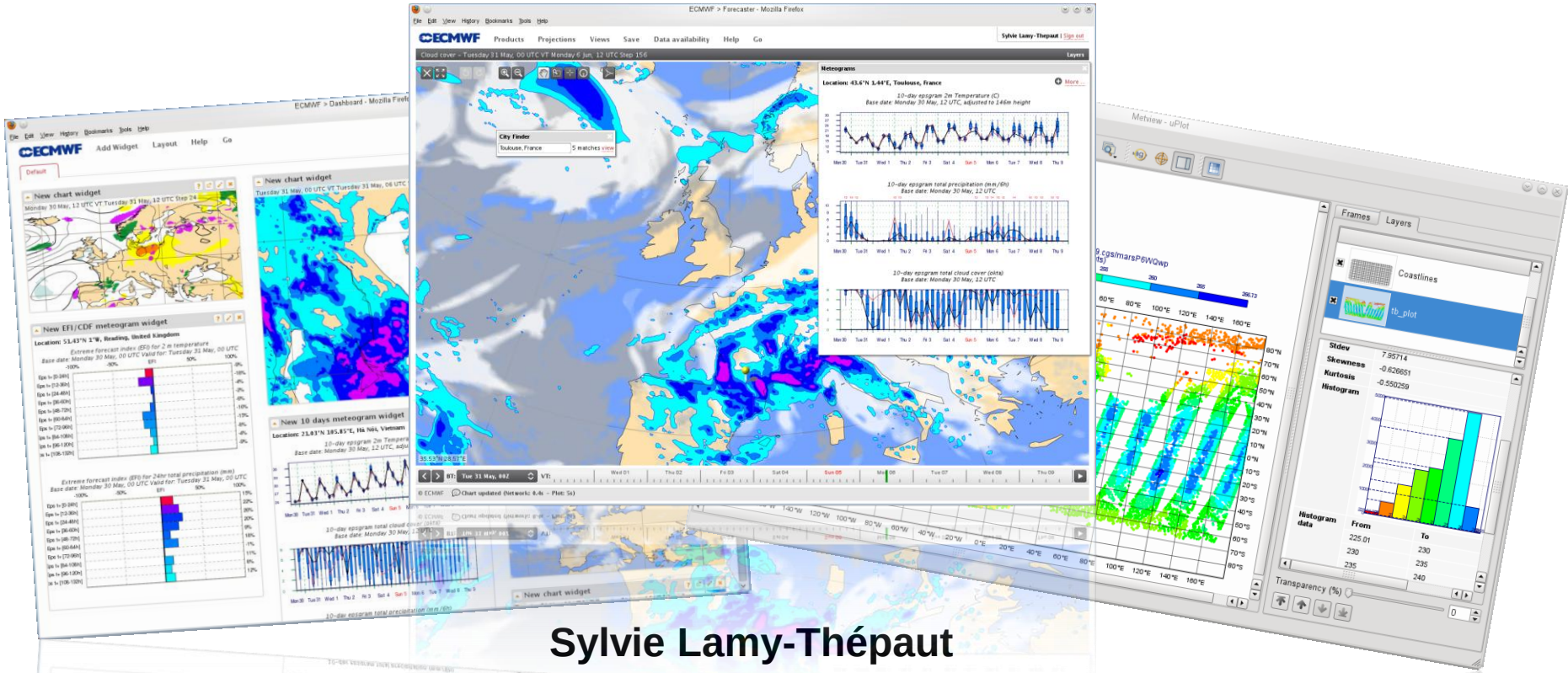
ecCharts and Metview 4

2 new visualisation systems at ECMWF



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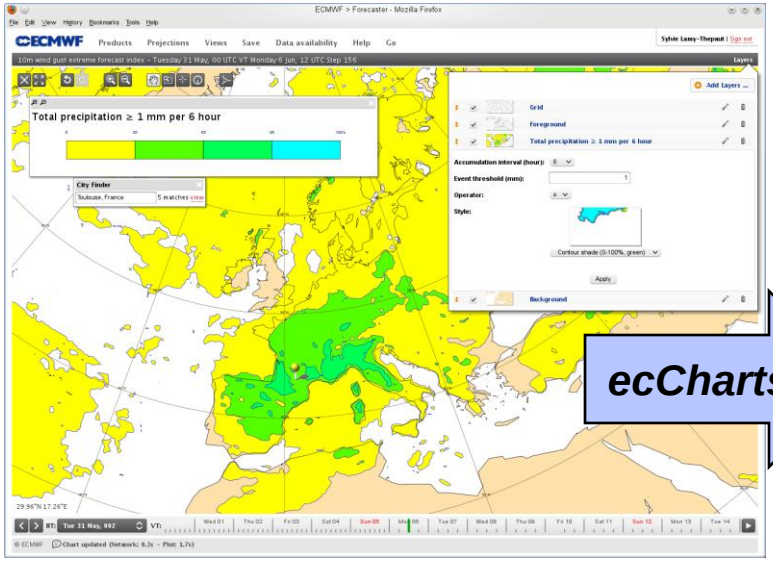
ecCharts and Metview 4

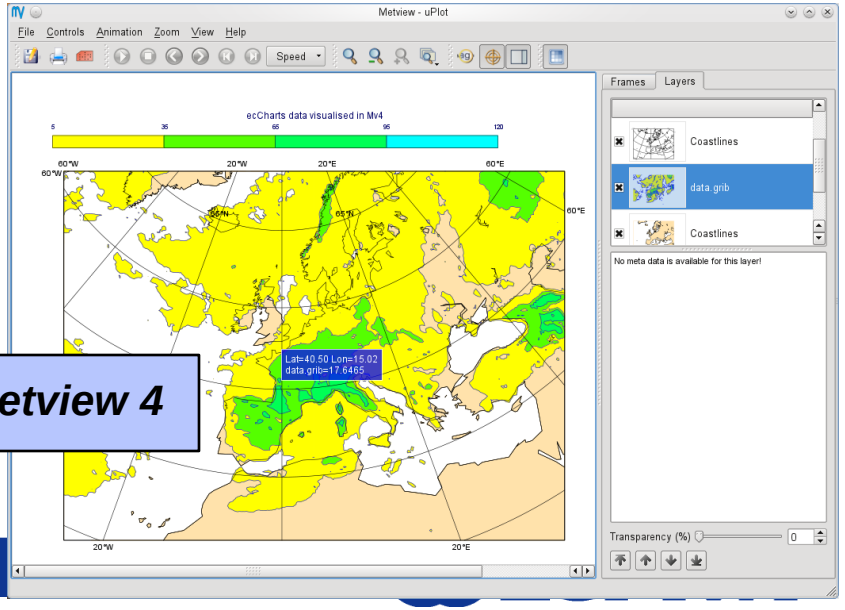


ecCharts

- **Web application**
  - Response Time, Monitoring
- **Dedicated to forecasters**
  - Simplicity of the User Interface, High availability
- **WMS server**

- **Desktop application**
  - Qt toolkit
- **Dedicated to researchers**
  - Macro language, examiner tools
- **WMS client**

Metview 4



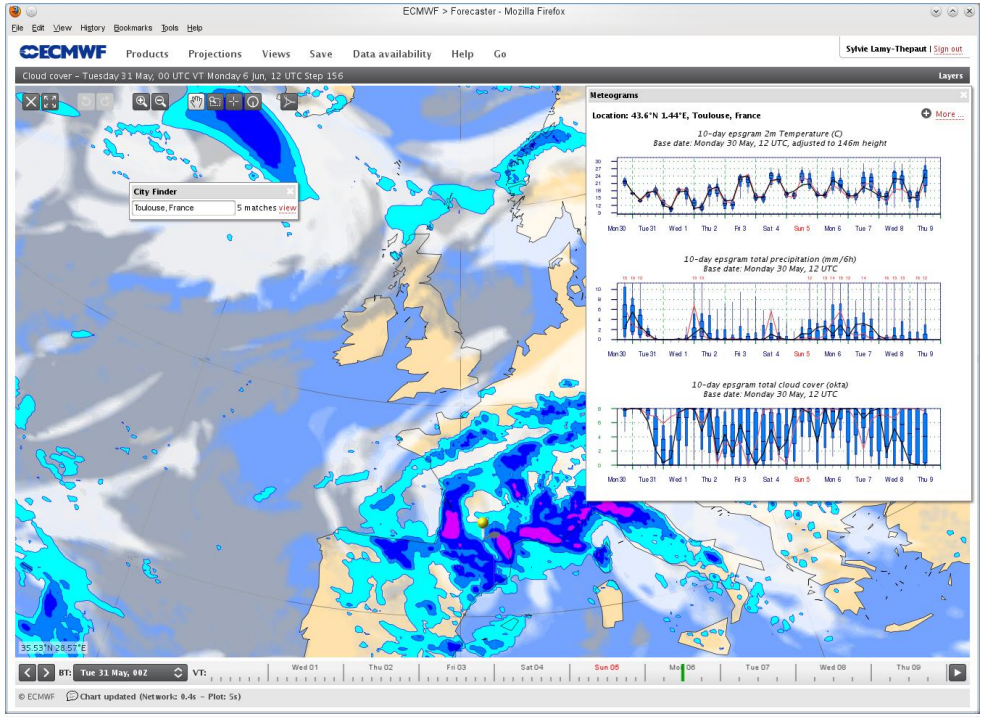
ecCharts and Metview 4 : What do they share?

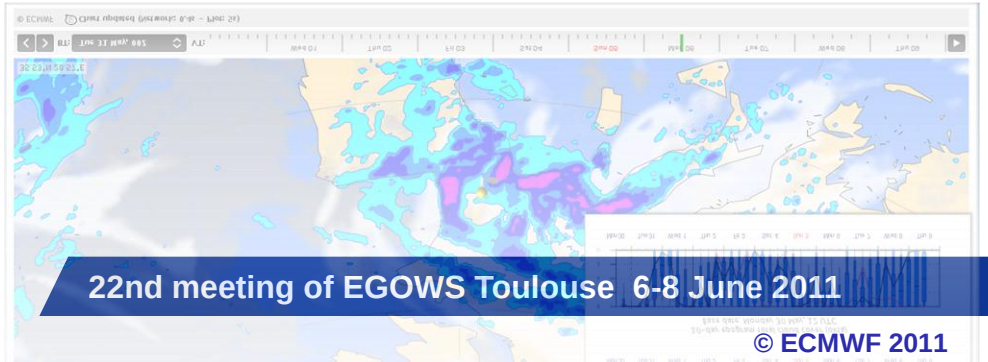
- Metview 4 and ecCharts are both services oriented.
  - Data access, compute service and visualisation
- They use the same graphical kernel : Magics++
  - The plots have the same look and feel
  - They share the concepts of visual definitions or styles
- They both implement a powerful cache system.
  - A complex visualisation is always the result of some basic data access/computation/visualisation. Every stage is cached.
  - Metview 4 uses his own one
  - ecCharts uses Memcached

ecCharts and Metview 4 : What is different?

- **The End-User**
  - A forecaster for ecCharts
  - A Researcher for Metview 4
- **The Dataset**
  - Metview 4 can potentially display any data in any style
  - ecCharts can only display ECMWF latest forecast in predefined styles
- **The technology**
  - Metview 4 uses a classic workstation environment
  - ecCharts is a Web Application
- **The level of operation**
  - ecCharts is highly available 24/7

ecCharts requirements:



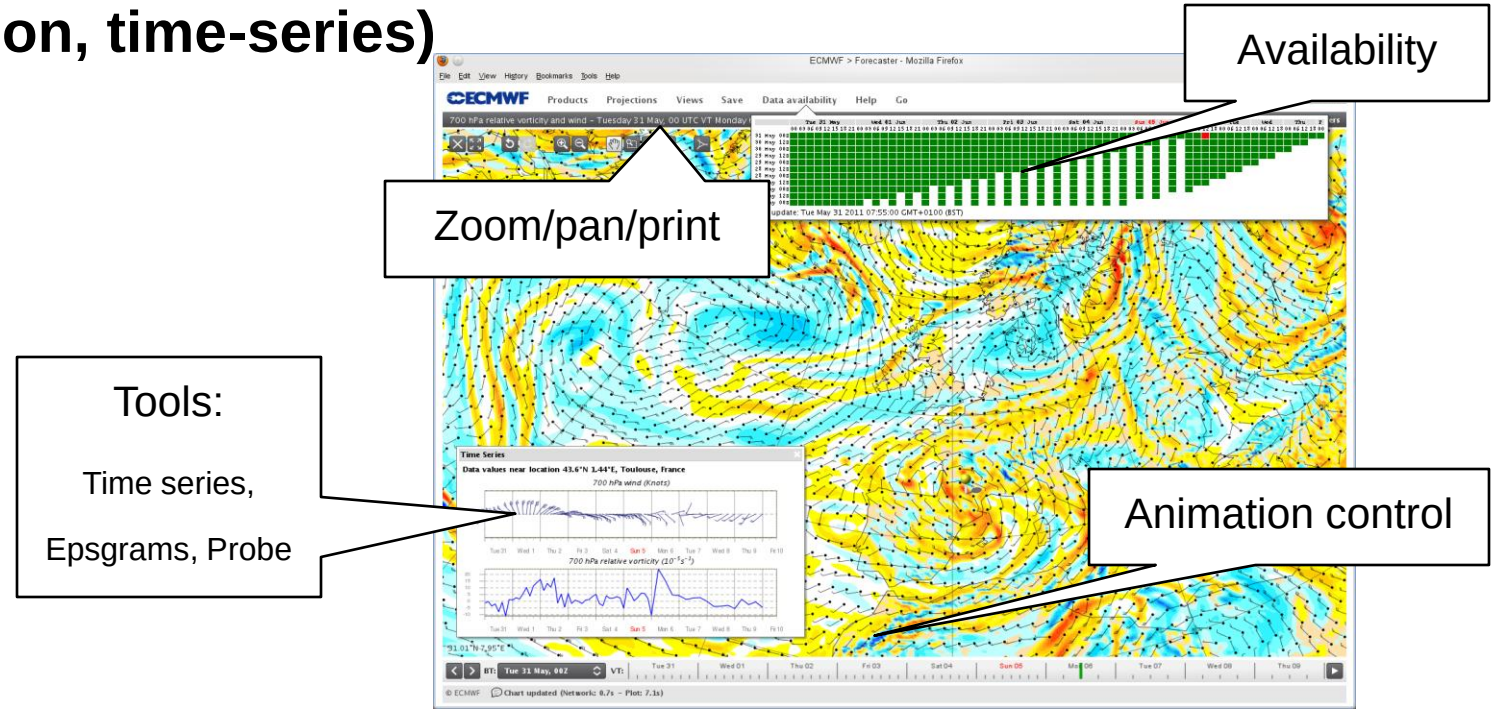


- Simple User Interface
- Few tools to examine the data
- Few options to customise user environment
- High availability
- Monitoring
- Response time

ecCharts - User Interface

The end-user of ecCharts is a forecaster

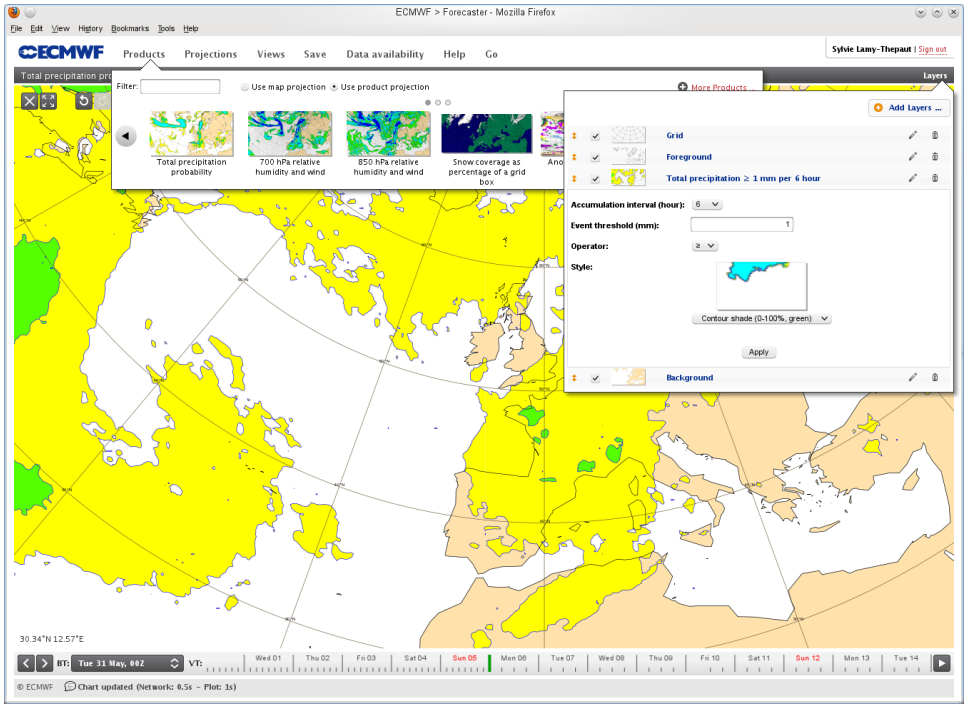
- **He needs a fast and easy to use user-interface to access ECMWF forecast.**
- **He needs few tools to navigate through the products (animation, time-series)**



ecCharts - User Interface

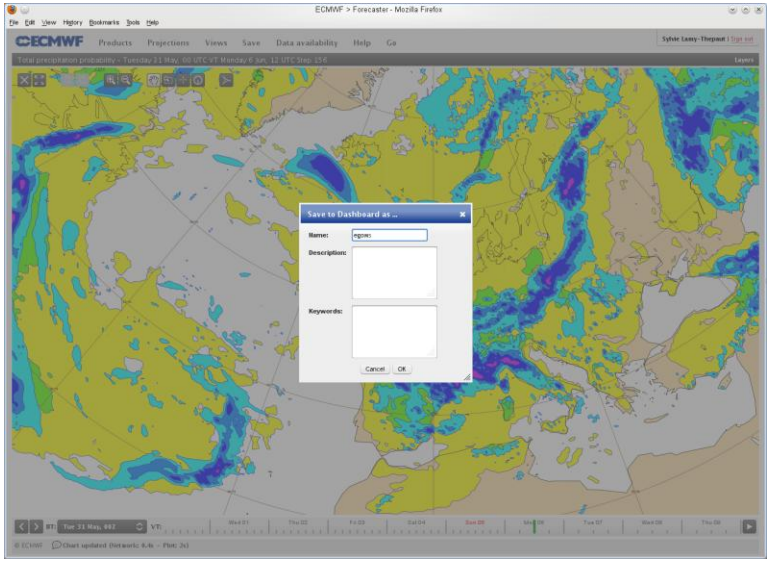
ecCharts offers a set of predefined products but also a way to create and save some tailored ones

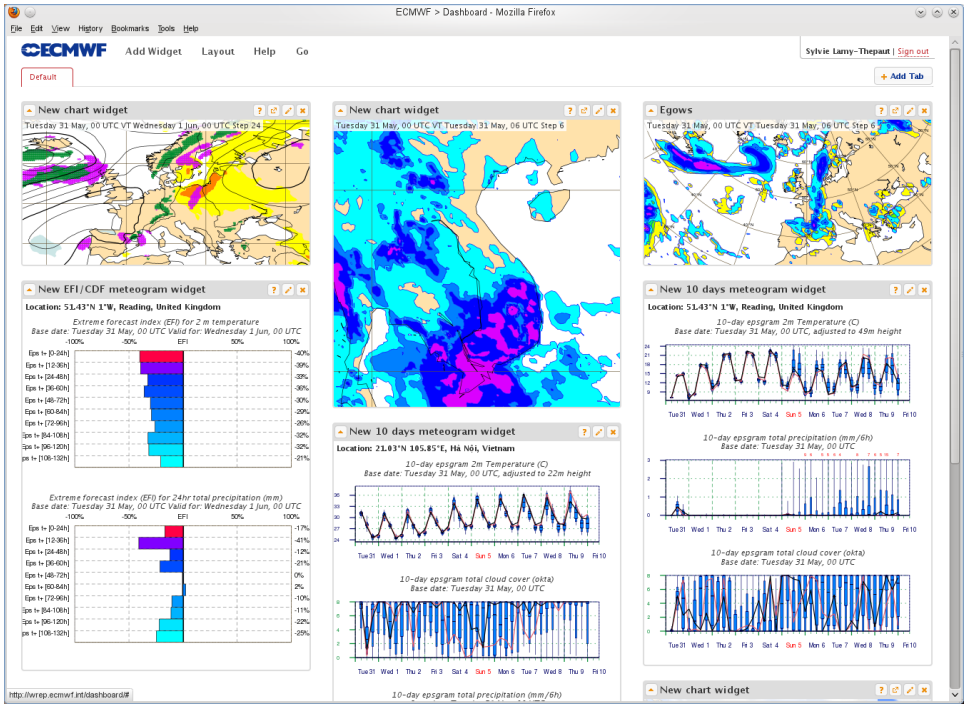
- A product is a set of layers.
- A layer is the visual representation of a meteorological parameter.
- A layer offers a set of styles.
- A layer can offer basic computation on the parameter.



ecCharts - User Interface

- A user can create and save his own product
- A user can export products to his dashboard.

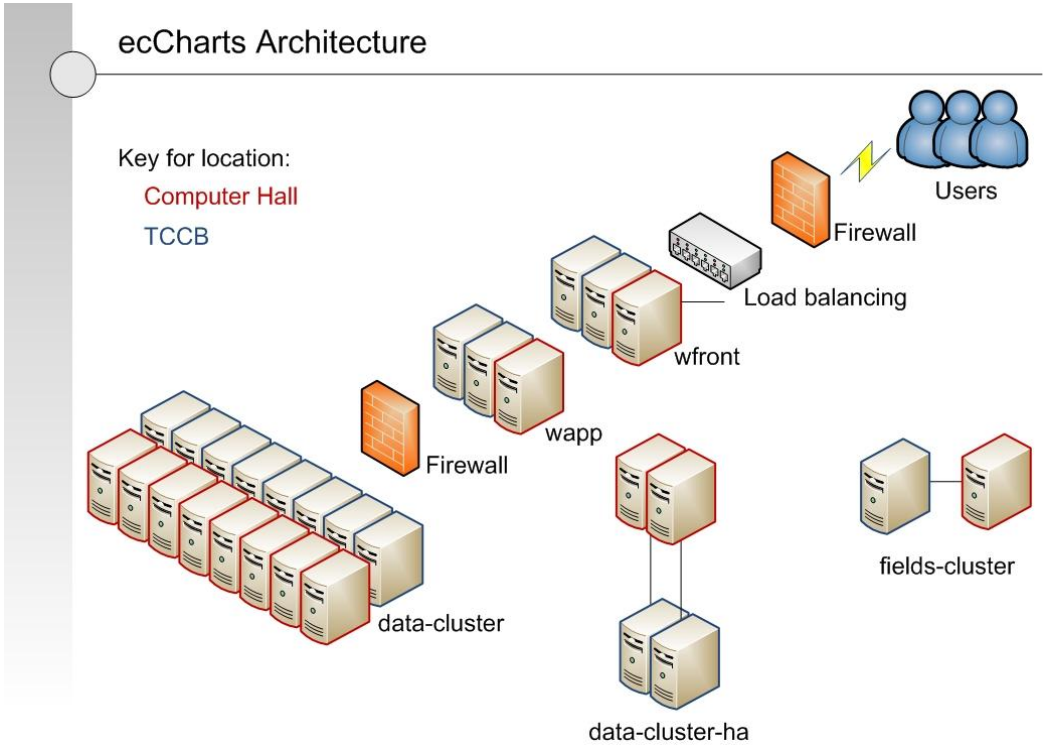




ecCharts - Architecture

ecCharts is highly available

- The products/layers/styles definitions are stored in a mongodb database
- Everything is replicated
- Systems are located in different parts of the building, attached to different network routers and different power sources



ecCharts - Monitoring

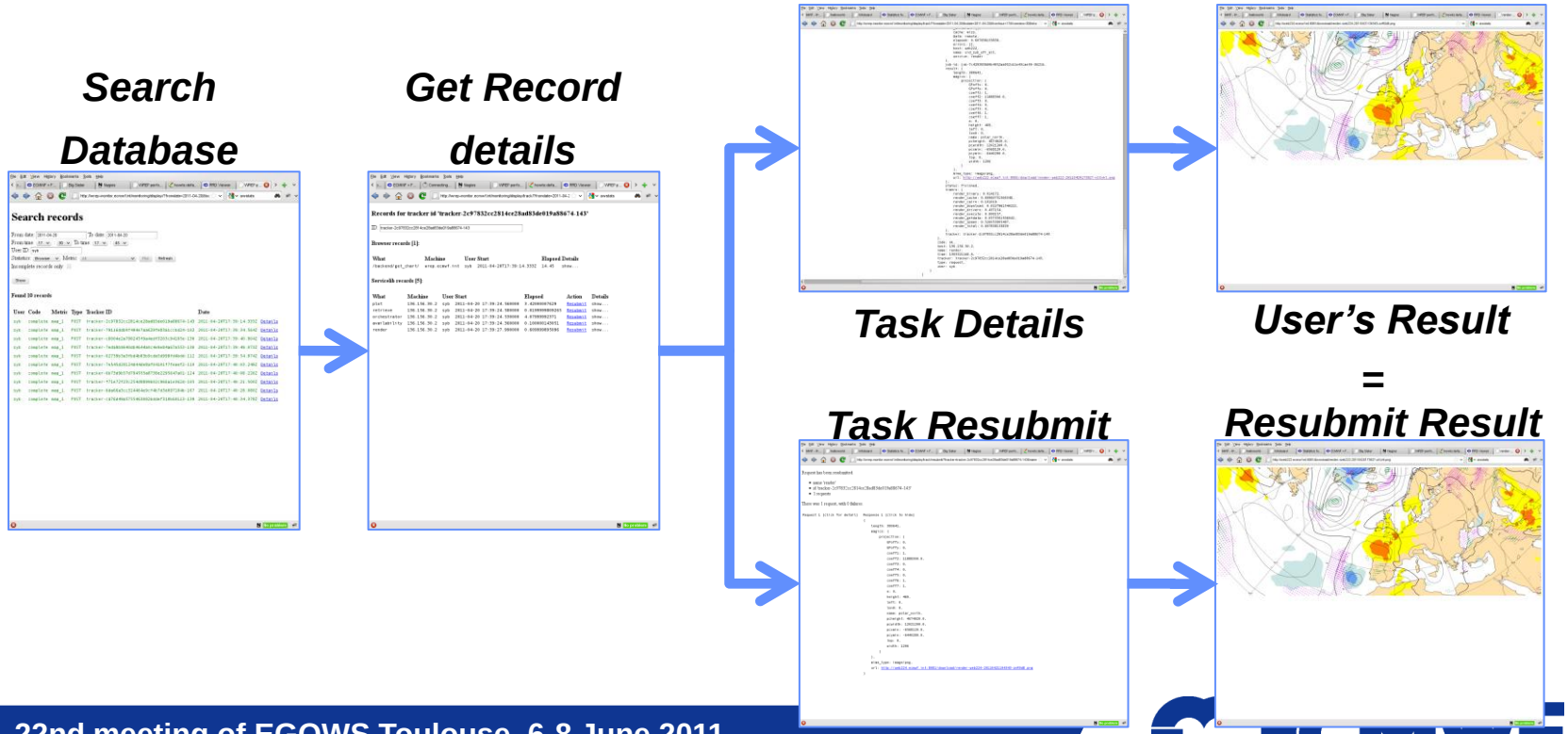
The End-User is behind a browser somewhere !

- **To understand what is going on, a powerful monitoring system had to be developed**
- **Log every ecCharts user request:**
  - **Record every request to our web service.**
  - **Record data collected within users' web browsers:**
    - **We can query the monitoring database for any request.**
    - **We can re-run requests to check the results.**
  - **Process request data into statistics in RRDs (Round Robin Databases).**
    - **Continuously in near real-time (10 minutes).**
    - **Web application to visualise the statistical data.**

ecCharts's Monitoring

We can get insight into end-user experience!

- **Web Interface to browse the database for requests**
  - Examine user's result
  - Resubmit



ecCharts's Monitoring

name	elapsed	plot	render	retrieve	compute
gusts_prob_data	9.54	0.71	0.49	4.96	6.58
2t_percentile	7.61	0.73	0.67	3.20	2.99
tp_percentile	7.47	0.59	0.41	1.59	5.51
wind_prob_data	6.04	0.69	0.68	3.18	1.47
tp_proba_interval	5.96	0.69	0.56	1.65	3.75
wind_percentile	5.84	0.93	0.50	1.06	3.35
700w	4.89	3.76	1.09	0.05	
500vorticity	4.30	3.04	1.21	0.05	
700vorticity	4.25	2.99	1.21	0.05	
300vorticity	3.92	2.71	1.15	0.06	
lcc	3.85	2.58	1.21	0.08	
snow_cover	3.62	1.03	0.37	0.17	4.23
700divergence	3.47	2.44	0.96	0.09	
hcc	3.25	2.36	0.87	0.05	
mcc	3.25	2.33	0.89	0.05	
2tprob	2.91	0.53	0.50	0.69	1.16
10m_fg_interval	2.83	1.27	0.59	0.18	0.75
rh925	2.64	1.85	0.73	0.05	
swh_percentile	2.63	0.51	0.54	0.41	1.13
mwp_percentile	2.60	0.47	0.47	0.39	1.17
wind_speed	2.39	1.78	0.54	0.07	
det_orography	2.30	0.91	0.47	0.18	0.77
850ws	2.25	1.64	0.53	0.07	
925ws	2.23	1.57	0.53	0.14	
swh_prob_data	2.19	0.40	0.56	0.48	0.66
700ws	2.13	1.43	0.62	0.07	
mwp_prob_data	2.09	0.46	0.47	0.39	0.71

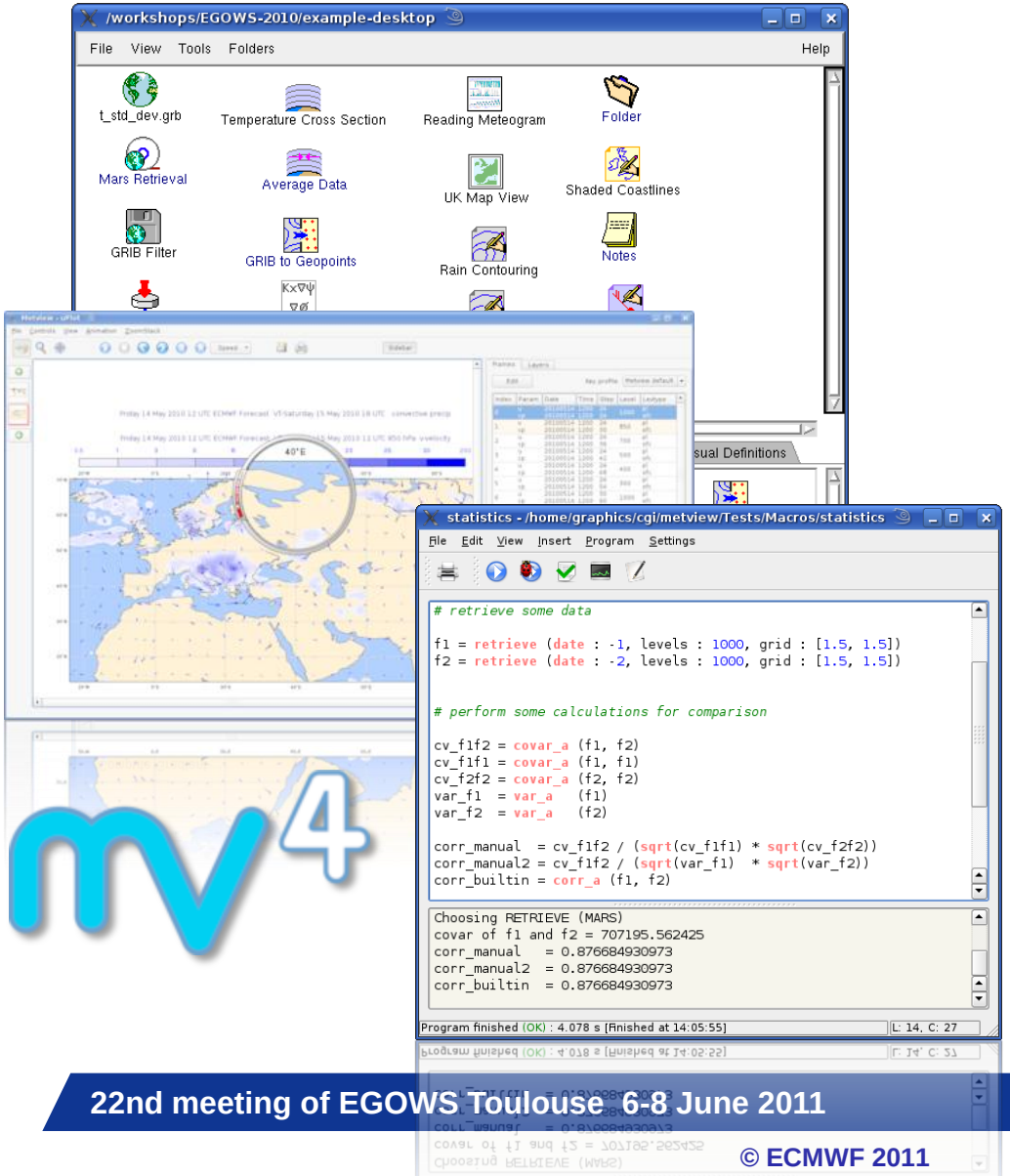
ecCharts - usability and response-time

- From http://www.useit.com/papers/responsetime.html, Miller 1968; Card et al. 1991:
  - 0.1 second is about the limit for having the user feel that the system is reacting instantaneously
  - 1 second is about the limit for the user's flow of thought to stay uninterrupted
  - 10 seconds is about the limit for keeping the user's attention focused on the dialogue
  - >10s and users will want to perform other tasks while waiting for the computer to finish
- ecCharts “get_chart” are nominally in the range 1s to 10s.
- ecCharts “animation” is nominally in the range 10s – 60s.

ecCharts - usability and response-time

- **Response time is a challenge!**
  - **ecCharts is using high resolution data**
  - **ecCharts is plotting tailored products that have to be produced from data on-demand**
  - **ecCharts data changes progressively with every forecast cycle**
  - **ecCharts caches every data retrieval, every calculation result, every plot and every image rendered**

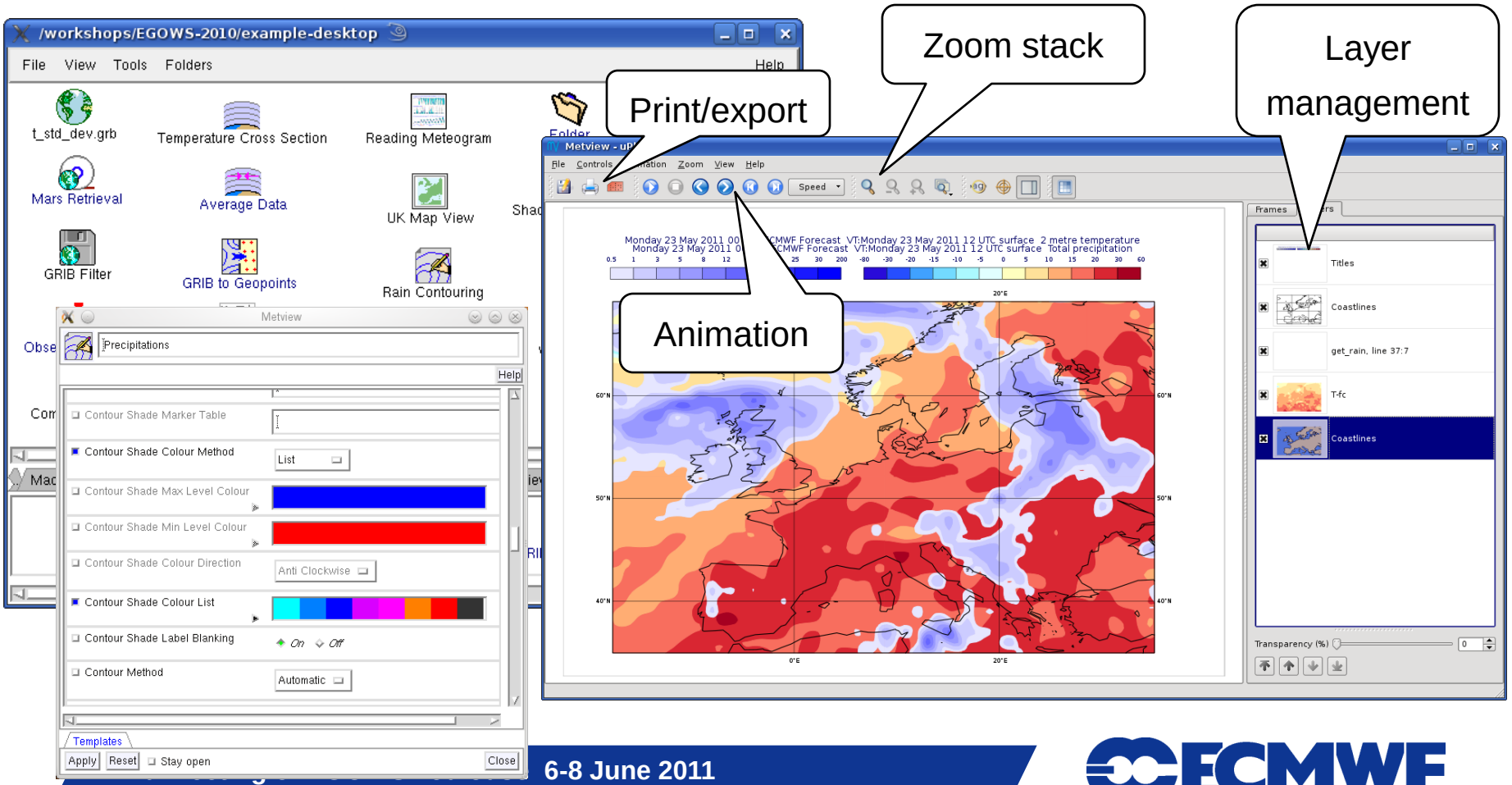
Metview 4 requirements



- Flexible visualisation
- Nice outputs for external publications
- Full control of the visualisation
- Powerful computation facilities
- Tools to examine the data contents
- Overlay data from different sources (external databases or local files)

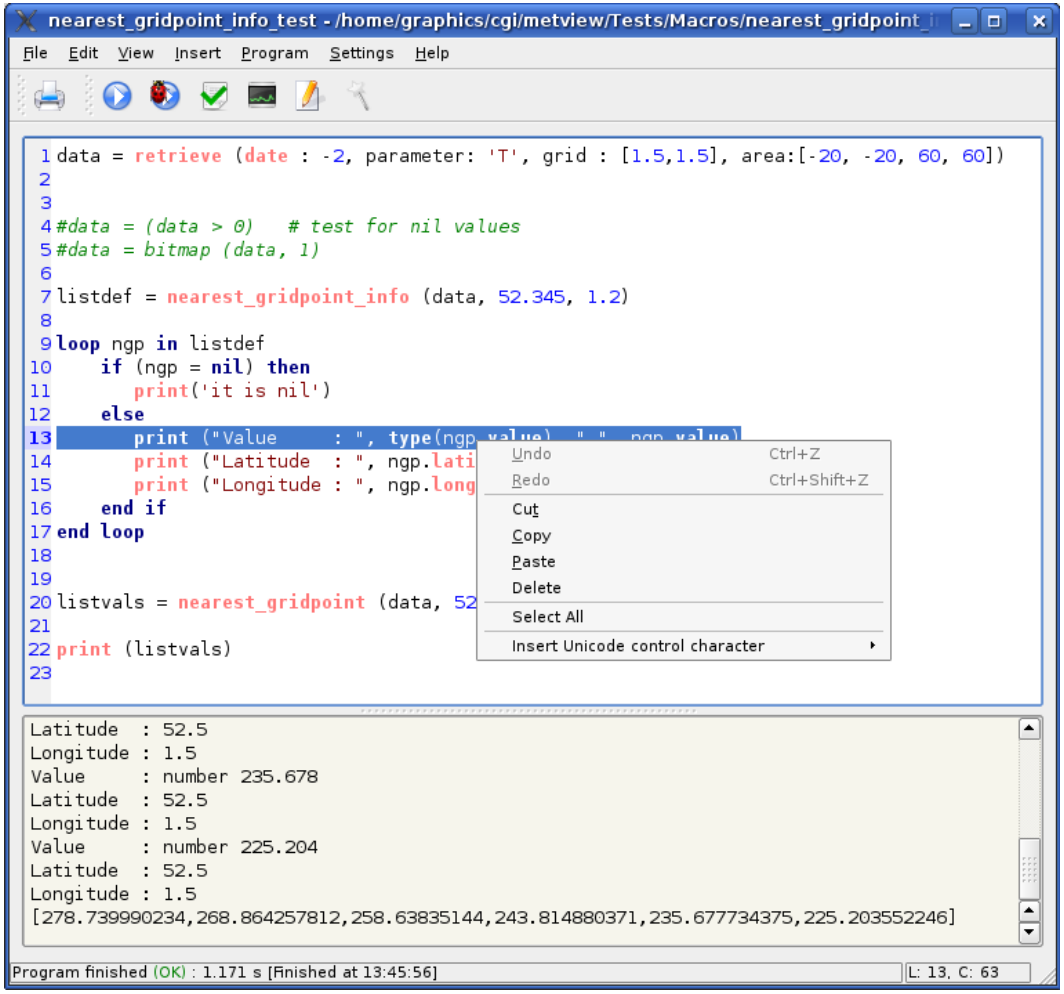
Metview 4 - User Interface

Full control of the visualisation



Metview 4 - Macro language

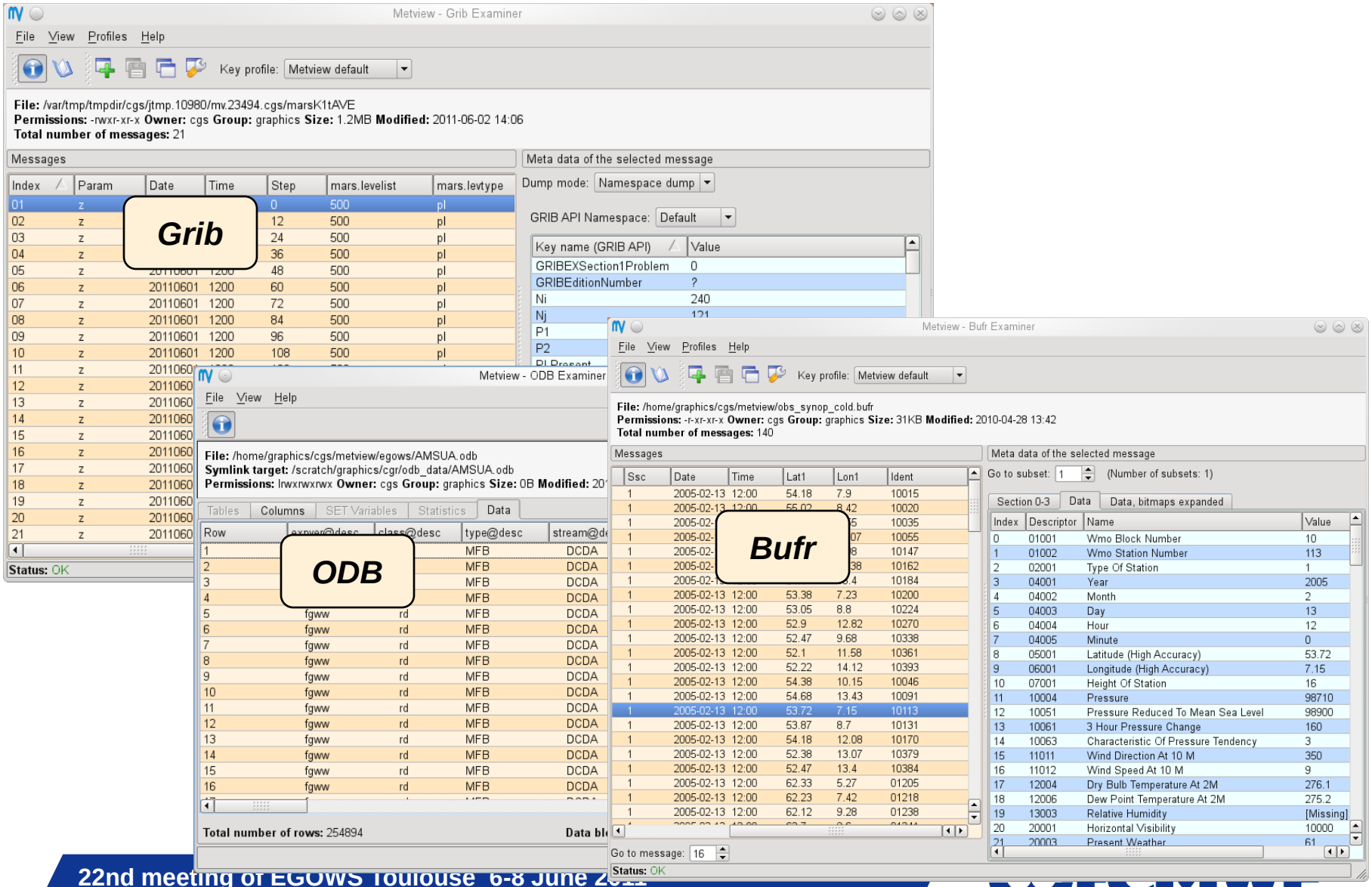
- Powerful high-level meteorologically oriented script language
- All Metview tasks can be written or saved as macro
- The Macro editor has been rewritten to ease the creation and debug of macros.



Metview 4 – Data Examiners

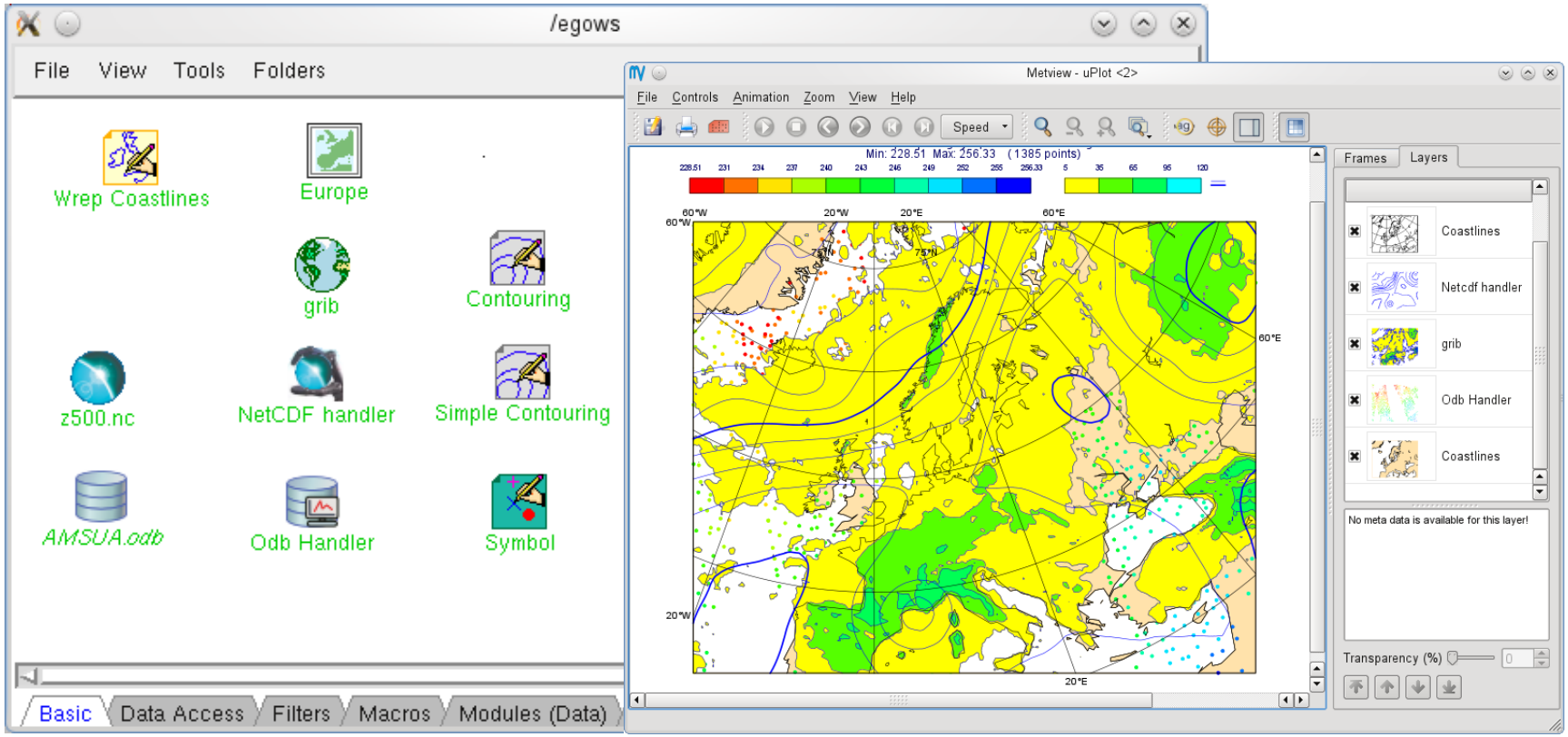
- Essential tools to inspect data, e.g. to check:
  - contents, structure
  - headers
  - errors or inconsistencies
- Also useful to compare files produced in different centres
- Various data types have a built-in examiner in Metview (e.g. GRIB, BUFR, ODB, NetCDF)

Metview 4 – Data Examiners



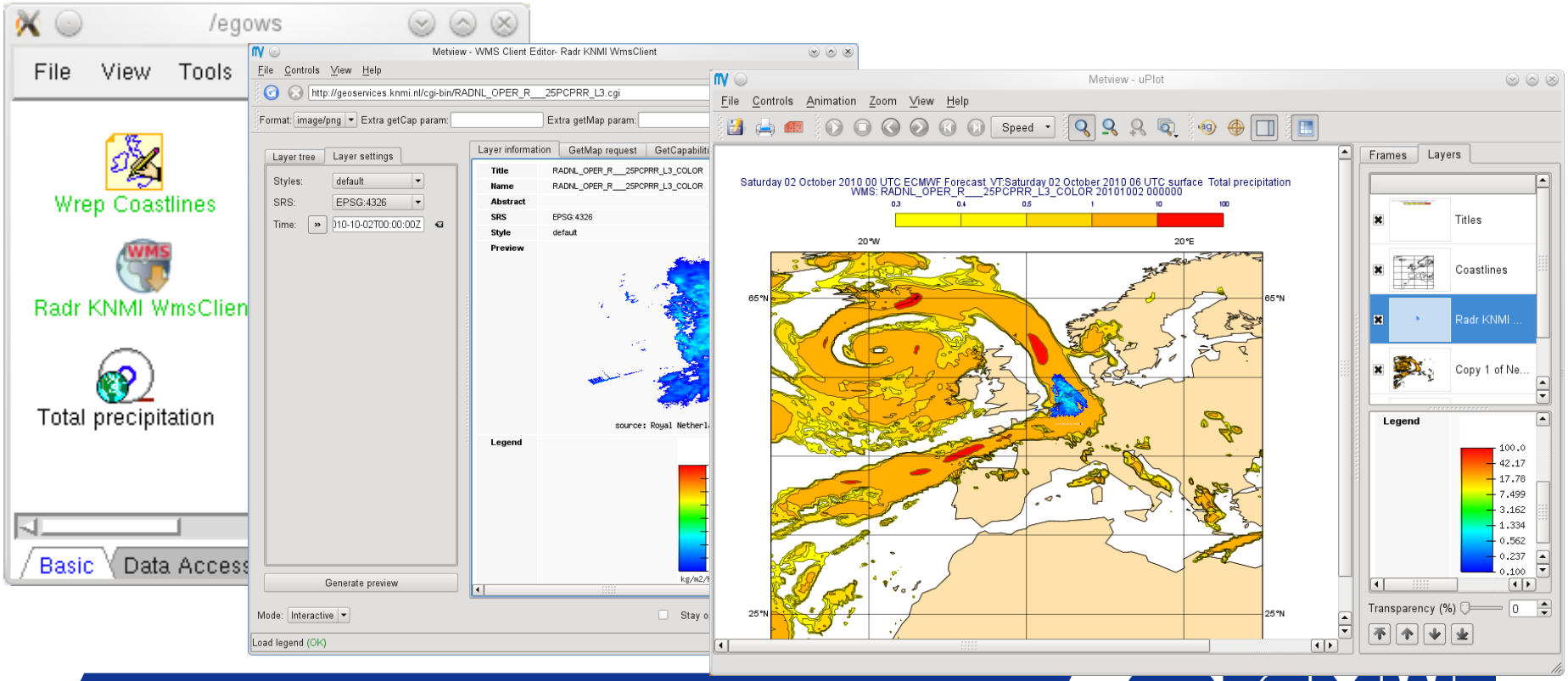
Metview 4 – WMS Client

Metview has always been able to overlay data coming from different sources

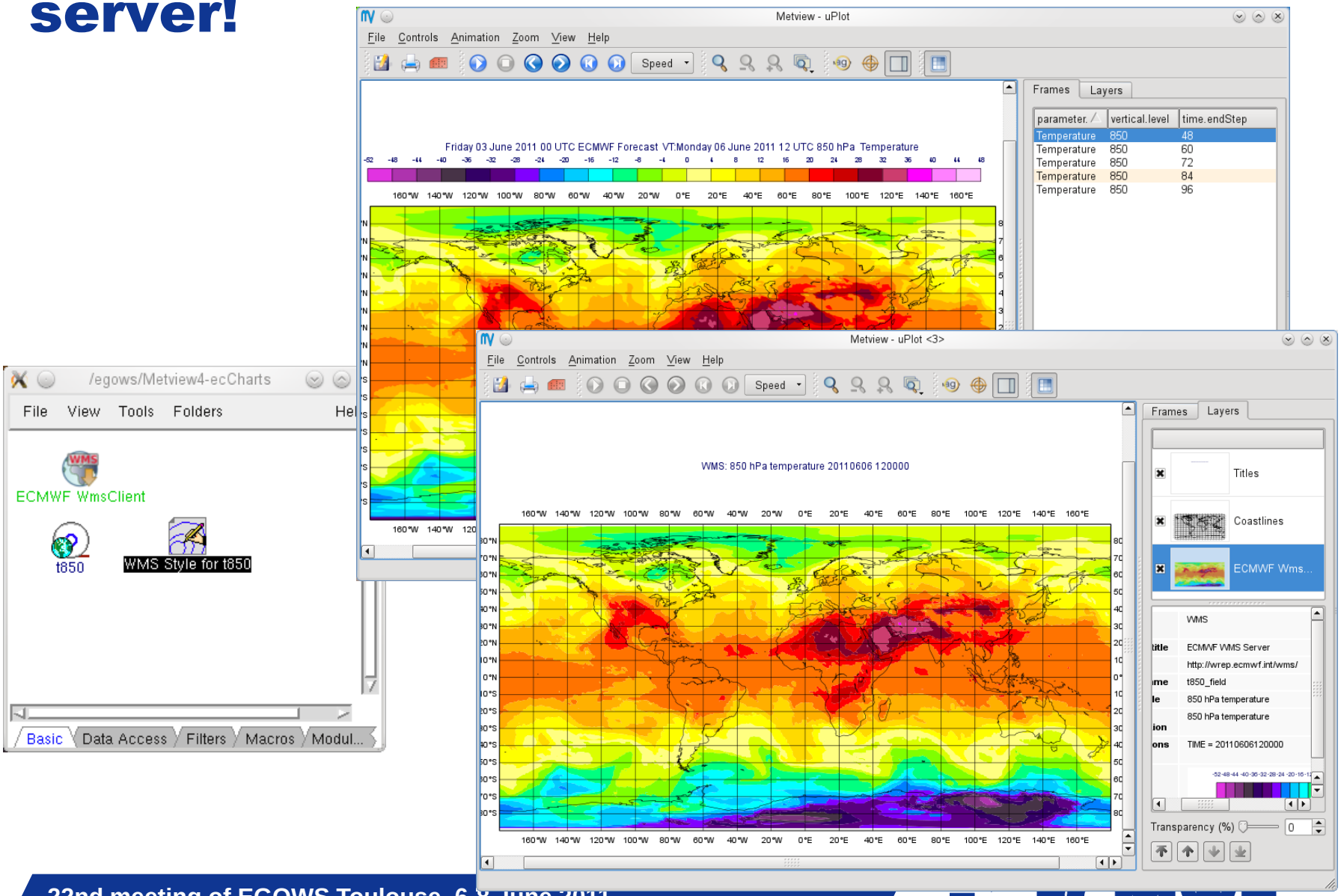


Metview 4 : WMS Client

- The getCapabilities function allows the creation of the icon editor.
- The getMap function allows the retrieval of the map for overlay in a Metview visualisation window.



Metview 4 WMS client of ecCharts WMS server!



Metview 4 - ecCharts : Chicken or egg?

- ecCharts developers need Metview to design new products and new visualisation styles
  - Export Icons to the ecCharts setup.
- Metview users want to access ECMWF forecasts with the same simplicity as ecCharts
  - Easier access to current forecast
  - Import Styles to Metview
  - More Interaction on visualisation in Metview such as paning
- But, They are definitely cooperative tools !

Metview 4 – ecCharts - Conclusion

- We are very happy with the developments
  - We took advantage of our new softwares GRIB API and Magics++
- We have very good user feedback
  - We have a lot of new exciting features to implement
- We have good foundation for the next years!
  - We have a good “Synergie” between all Magics based systems.