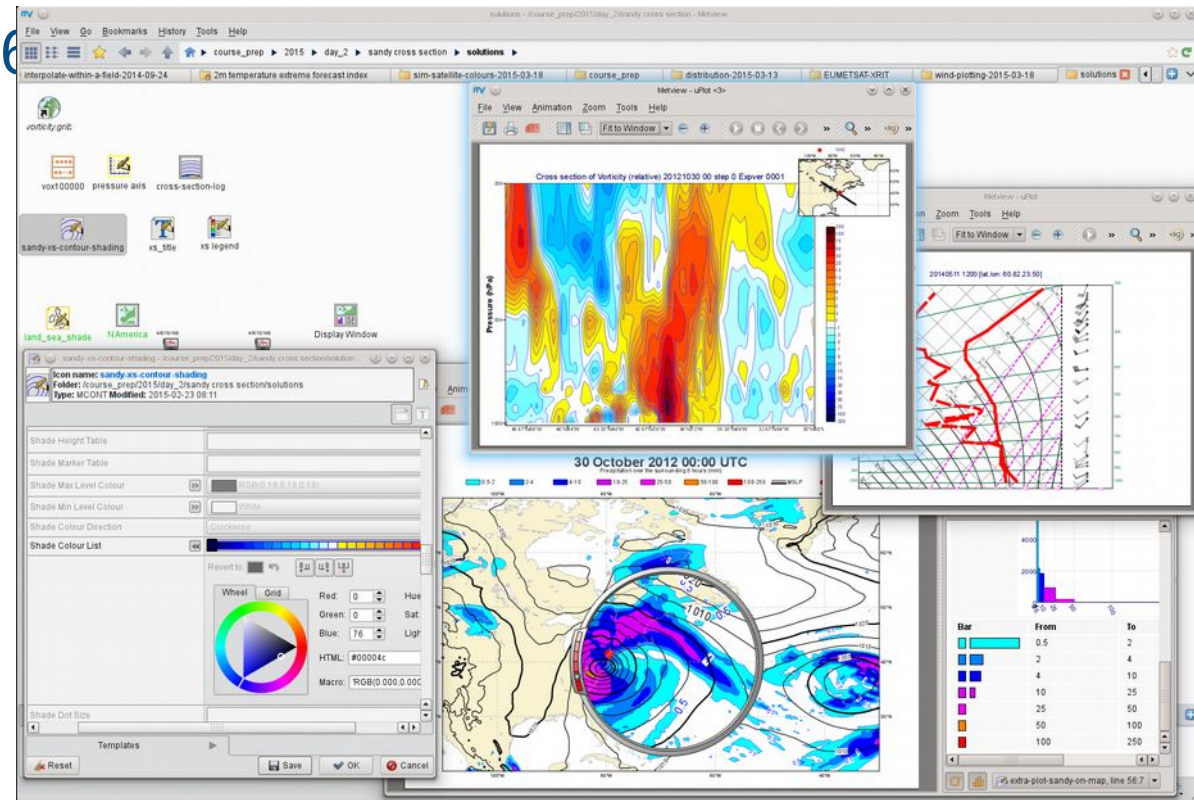


# Metview for retrieving, processing and visualising data

UERRA Showcase 2016

Iain Russell

Development Section, ECMWF





# What is Metview?

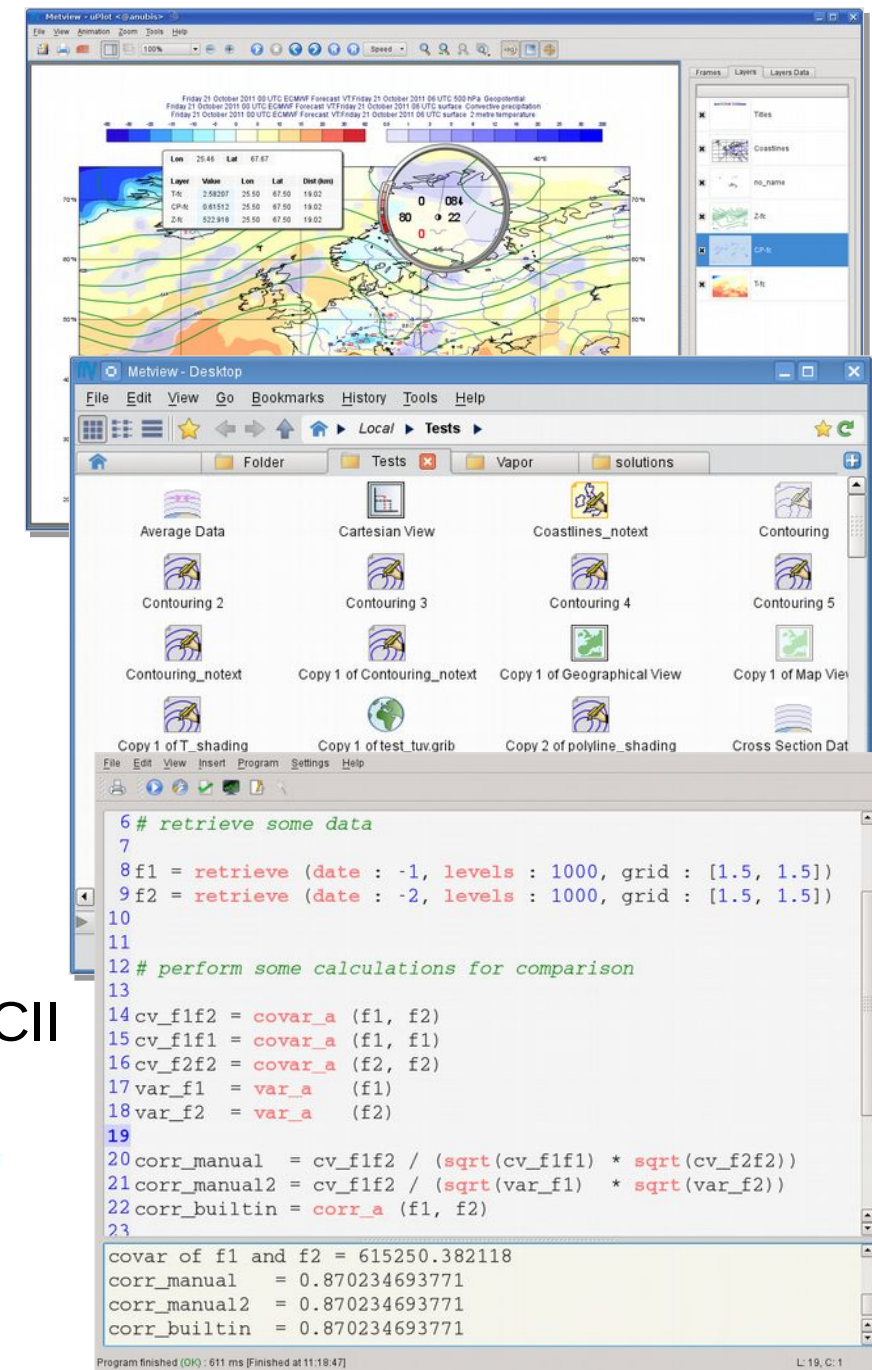
- Workstation software for researchers and operational analysts
  - Runs on UNIX, from laptops to supercomputers (now includes Mac OS X)
- Retrieve/manipulate/visualise/examine meteorological data
- Drag & drop user interface / powerful scripting language

Built on core ECMWF technologies:  
MARS, GRIB\_API, Magics, ODB, Emoslib  
(future: ecCodes, MIR)

- Handles GRIB, BUFR, NetCDF, ODB, Geopoints, CSV, ASCII
- Can access MARS, either locally or through the Web API
- Open Source under Apache Licence 2.0
- Metview is a co-operation project with INPE (Brazil)



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# Using Metview

- Icon-based user interface
  - interactive investigation of data
  - icons represent data, settings and processes
  - icons can be chained together – output from one is input to another
- Powerful Macro scripting language
  - more serious computations
  - batch or interactive usage

The screenshot displays the Metview software interface. The top window shows a file explorer with various icons representing data files (e.g., `fc_latest_oper.grib`, `fc_oper.grib`, `title_oper`, `wgust_shade`, `wgust_spread_shade`, `prob_shade`) and process icons (e.g., `fc_ens.grib`, `spag_ens.grib`, `ens_mean.mv`, `ens_spread.mv`, `ens_prob.mv`). A context menu is open over the `spag_ens.grib` icon, showing options like Visualise, Examine, Save result, Clear result, Duplicate, Copy, Cut, Rename, Move to wastebasket, Send, and Archive as ....

The bottom window shows a data table with columns: Index, Name, Date, Time, Step, Le, LevType. The table contains 25 rows of data. A 'Tree view' panel on the right shows a hierarchical structure of data sections.

The bottom-most window shows a macro editor with the following code:

```
181 v = retrieve(  
182     date      : -1,  
183     param     : "v",  
184     level     : 700,  
185     area      : area_xx,  
186     grid      : [1.5, 1.5]  
187 )  
188  
189 # Compute the gradient of Q  
190 q = gradientb(q)  
191  
192 # Extract the area we are calculating on  
193 q = read ( area : area_xx, data : q)  
194  
195 # Compute the advection of Q  
196 a = q[1]*u + q[2]*v  
197 a = -a * (10 ^ 8) # units will be 10e-8 (kg/kg)/sec  
198  
199 # Plot positive advection in blue, negative in red  
200 contour_common = (  
201     contour_level_selection_type : "interval",  
202     contour_interval             : 3,  
203     contour_label                 : "on",  
204     contour_label_height         : 0.25,  
205 )
```



# MARS and Metview

- Metview incorporates a MARS client module
  - Built from same source code
  - All processing options are available
  - Direct access to local MARS archive, or through the Web API for external access
- All MARS parameters can be accessed
- Metview caches retrieved data
- Metview can examine, visualise and process any data formats in MARS

The screenshot shows the Metview MARS client interface. At the top, a header bar displays the icon name 'ERA5-ens-z500', the folder path '/workshops/UERRA 2016', and the type 'RETRIEVE' with a modification timestamp of '2016-11-16 16:06'. Below this is a form with various parameters for data retrieval. The parameters are organized into a table-like structure with labels and input fields. Some fields have a blue circular icon with a white 'C' next to them, indicating they are checked or active. The parameters include Class (Esat), Type (FC), Stream (ENDA), Expver (12), Repres (Spherical Harmonics), Obsgroup (Sat), Reportype (OFF), Obstype (empty), Levtype (Pressure Levels), Levelist (500), Param (Z), Date (2016-02-16), Refdate (OFF), Hdate (empty), Fcmonth (OFF), Fcperiod (OFF), and Time (06:00:00). At the bottom of the form, there is a 'Templates' section with a right-pointing arrow. Below the templates section are four buttons: 'Reset', 'Save', 'OK', and 'Cancel'.

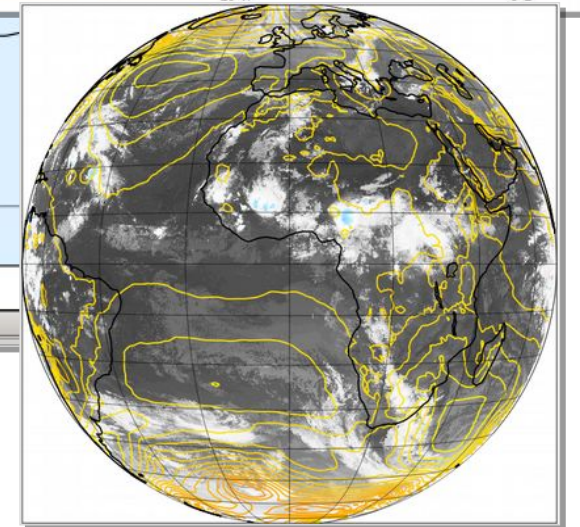
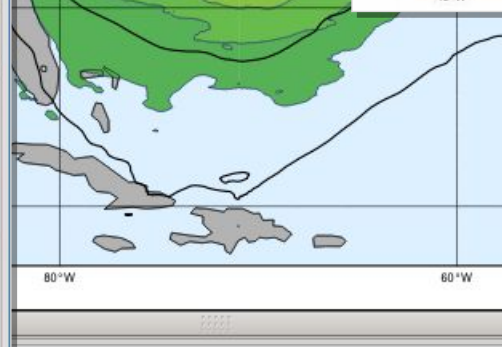
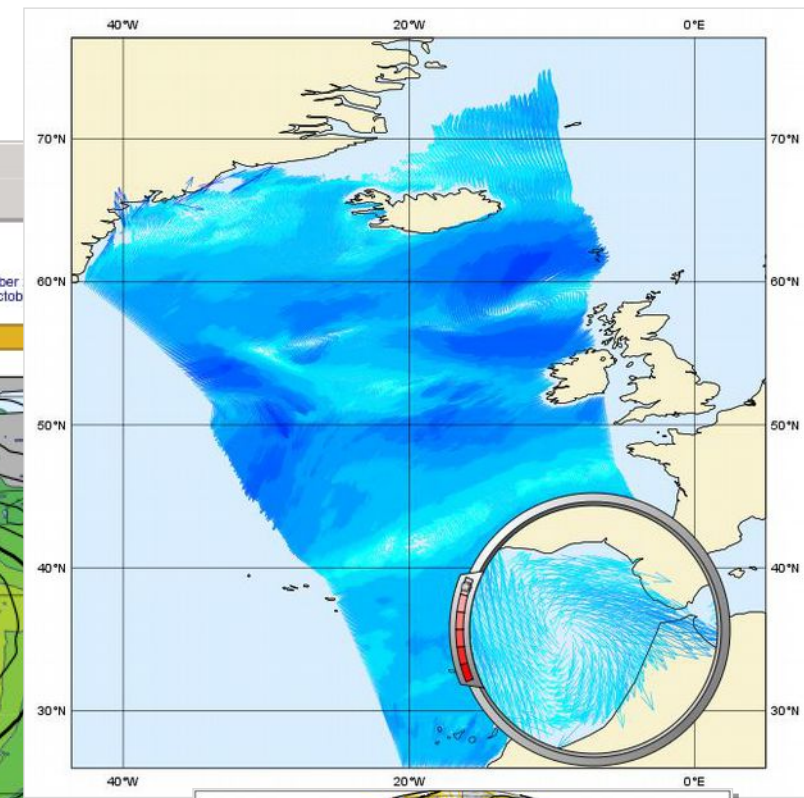
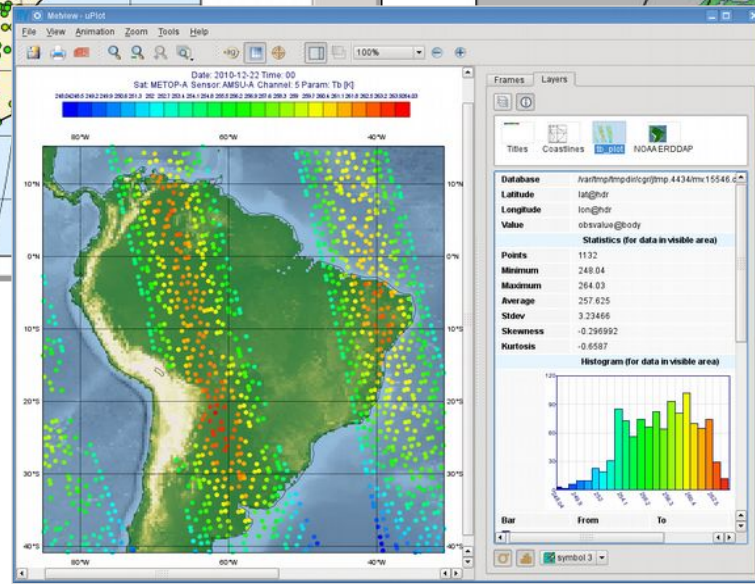
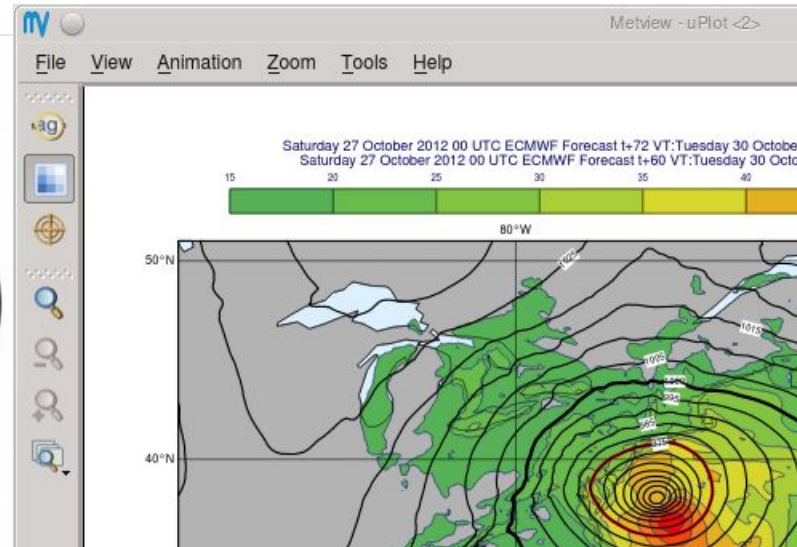
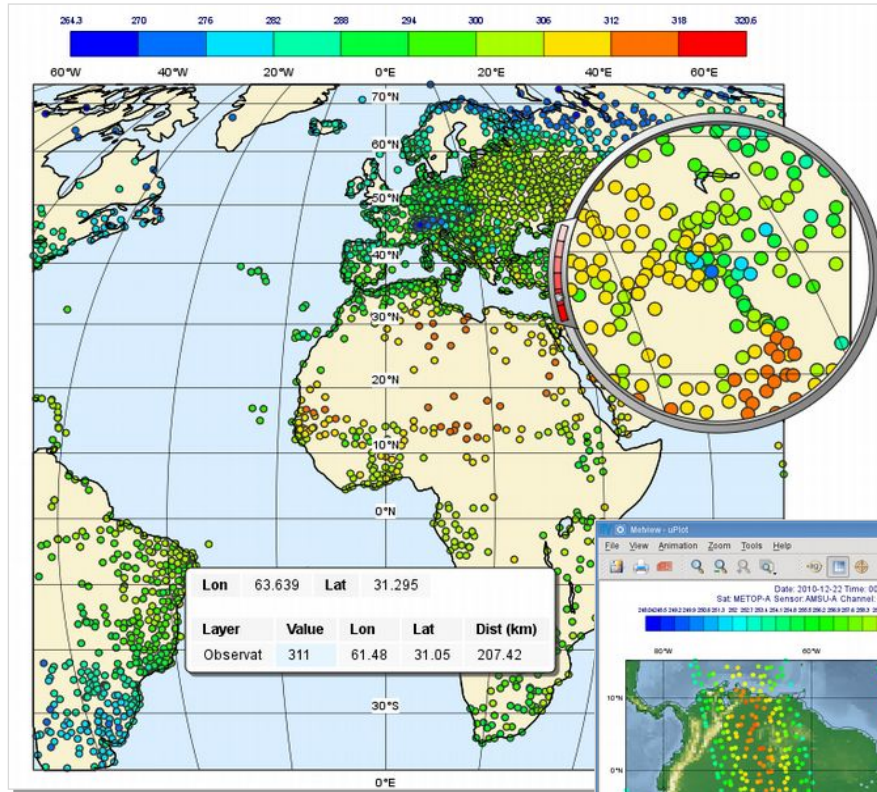
Parameter	Value
Class	Esat
Type	FC
Stream	ENDA
Expver	12
Repres	Spherical Harmonics
Obsgroup	Sat
Reportype	OFF
Obstype	
Levtype	Pressure Levels
Levelist	500
Param	Z
Date	2016-02-16
Refdate	OFF
Hdate	
Fcmonth	OFF
Fcperiod	OFF
Time	06:00:00

Templates

Reset Save OK Cancel

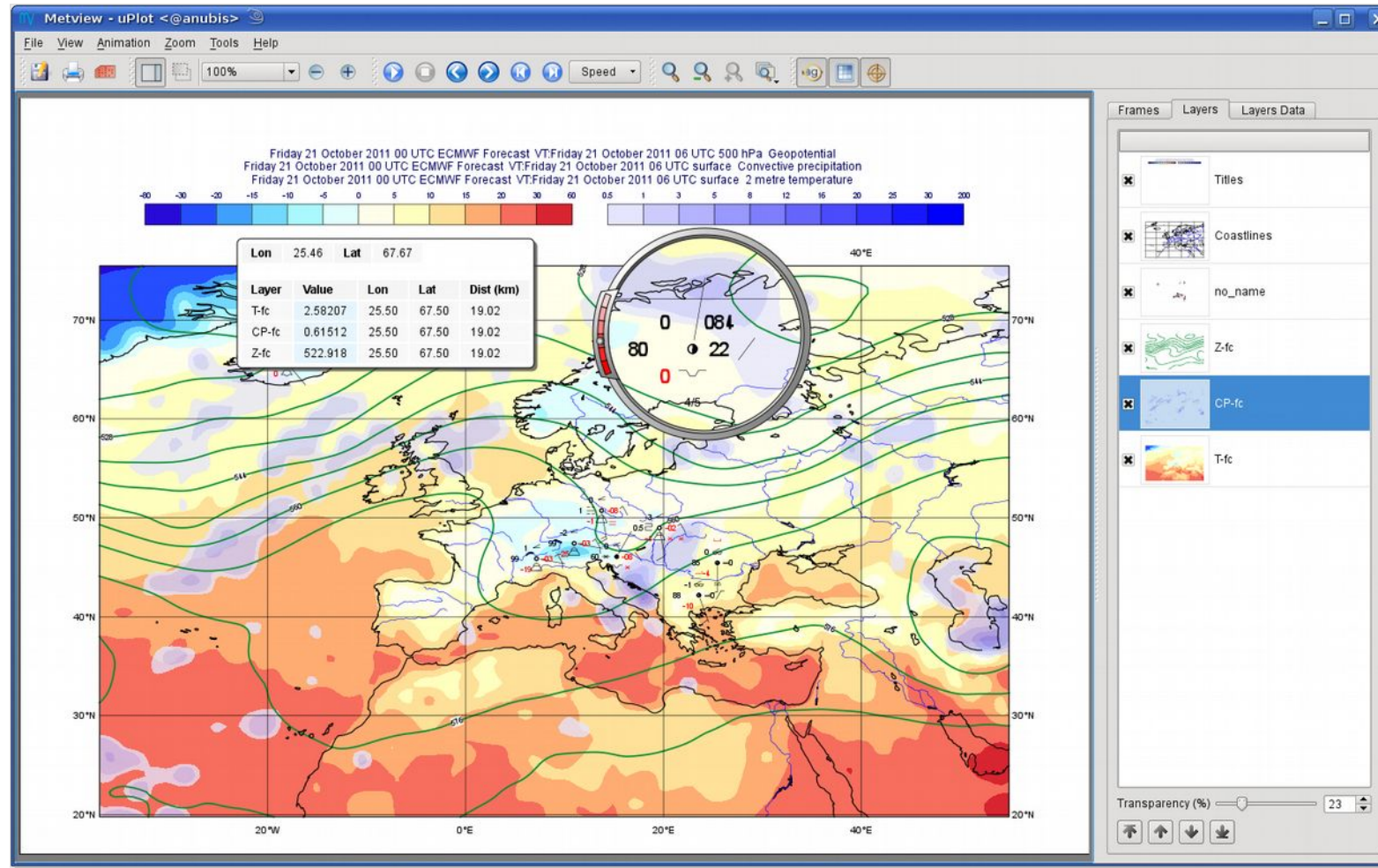


# Visualisation - Maps



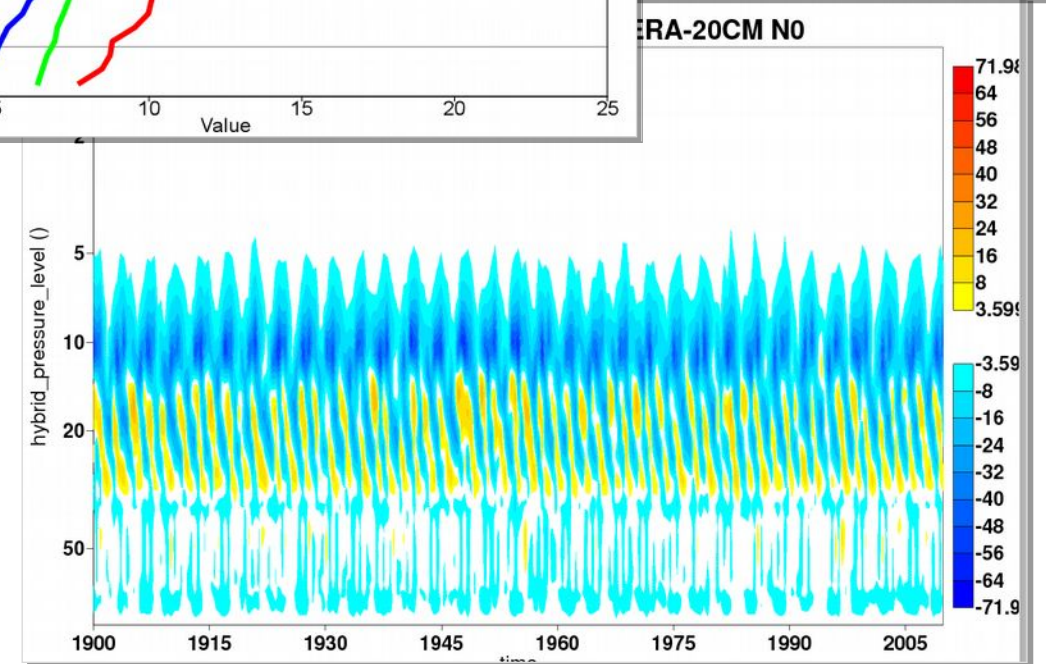
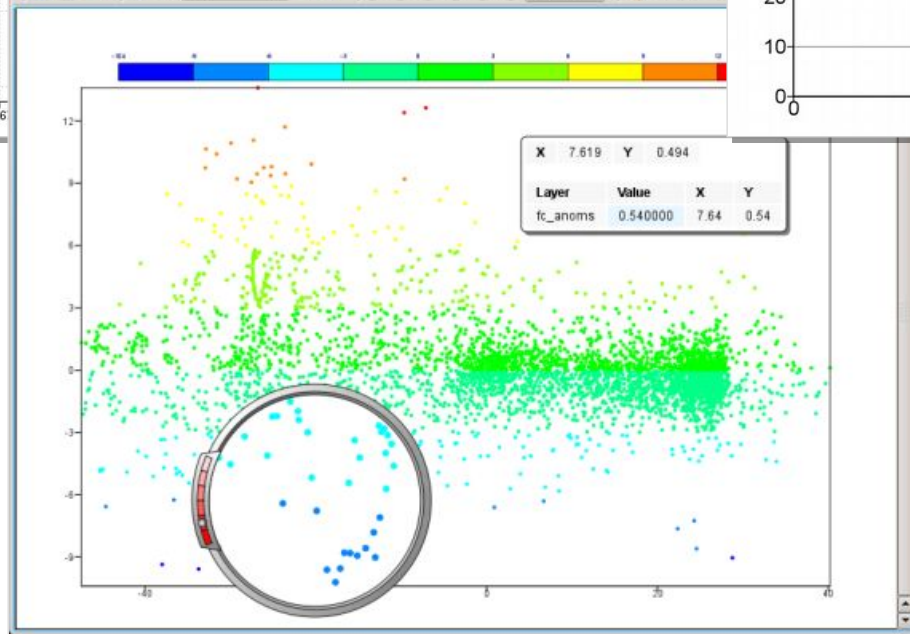
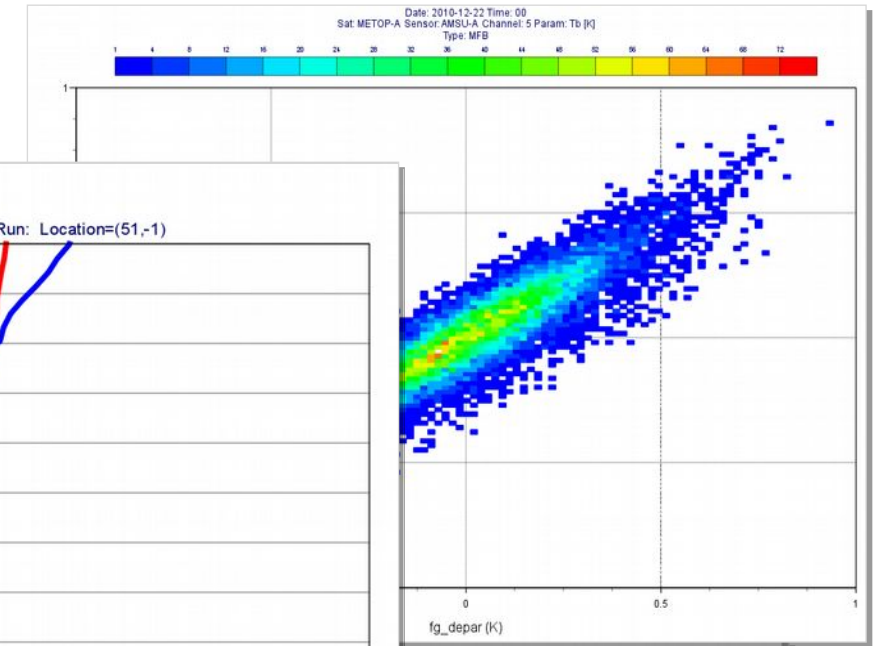
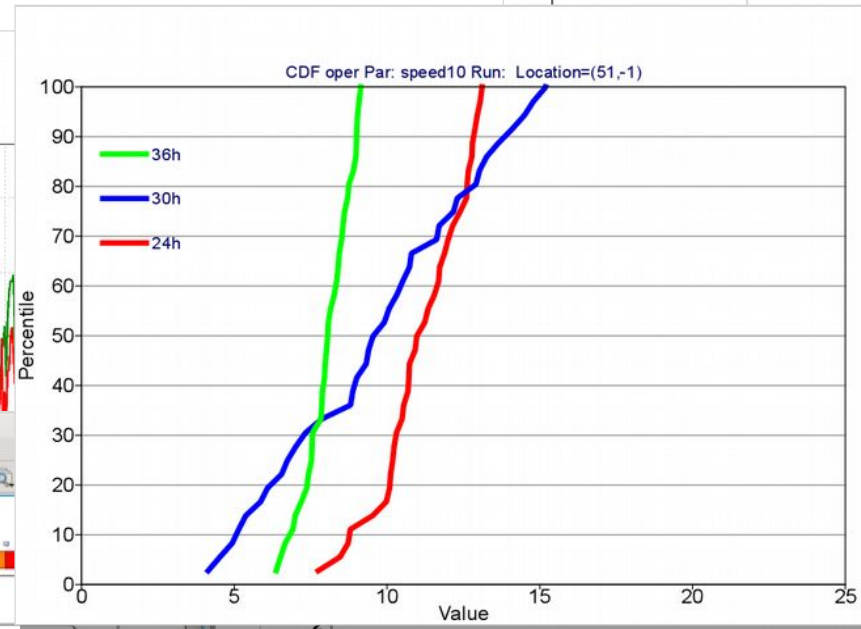
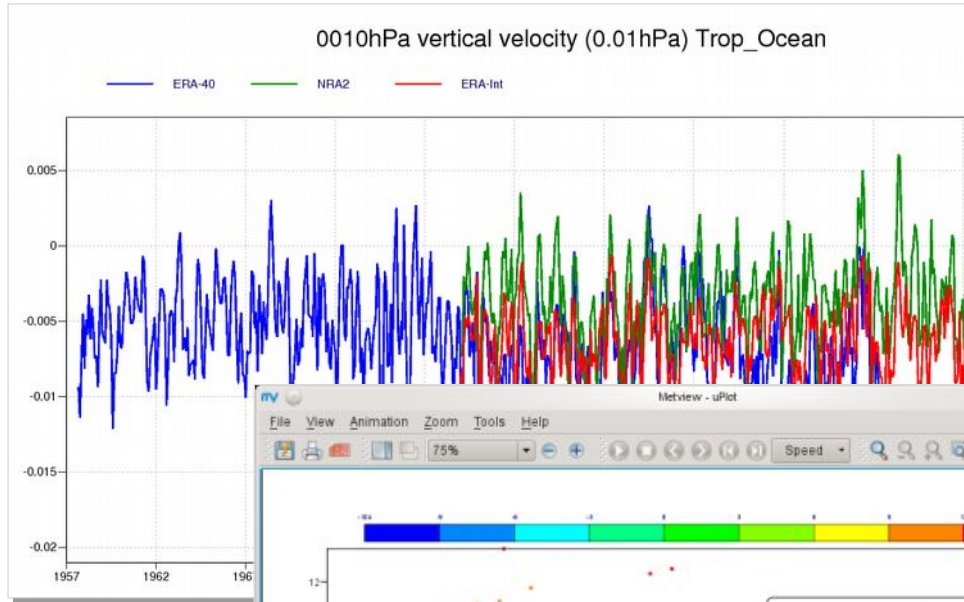


# Visualisation - Overlay



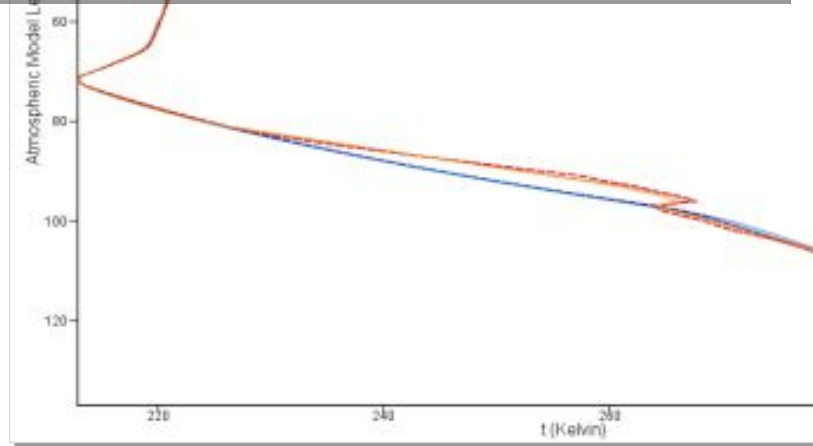
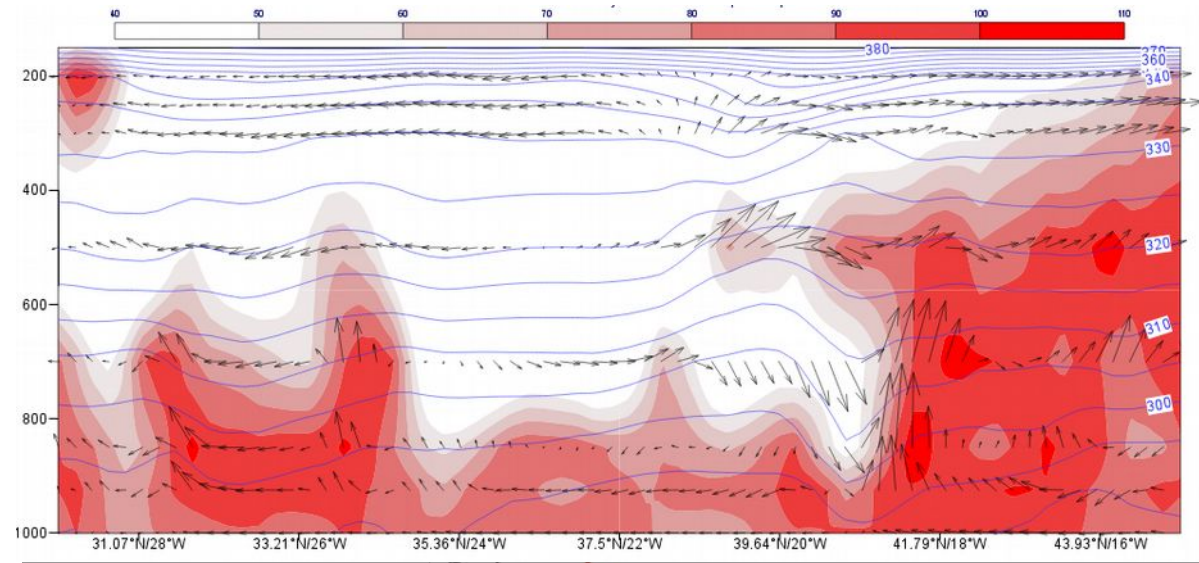


# Visualisation - Graphs





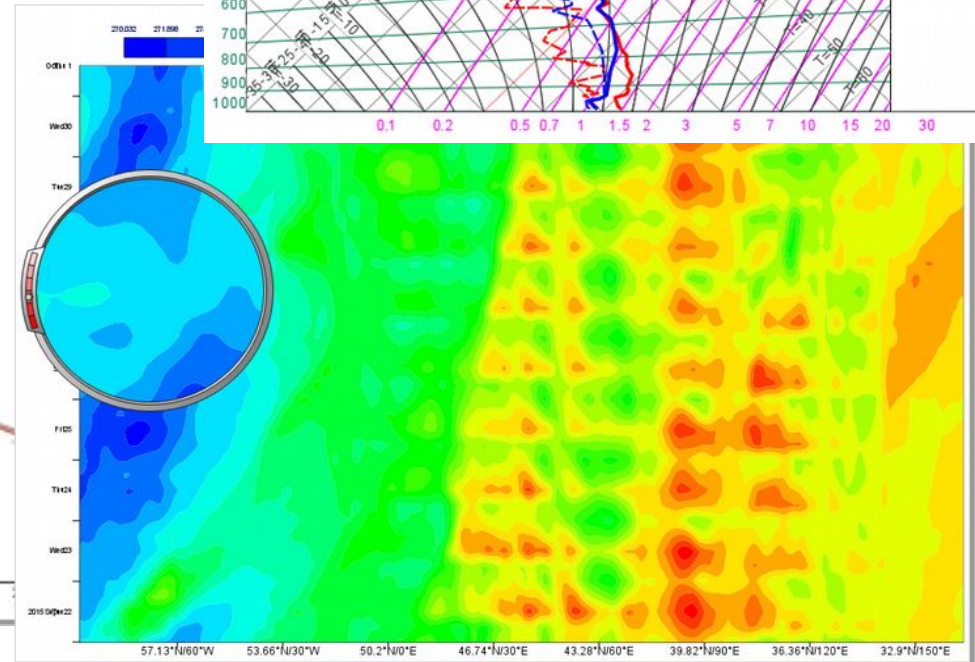
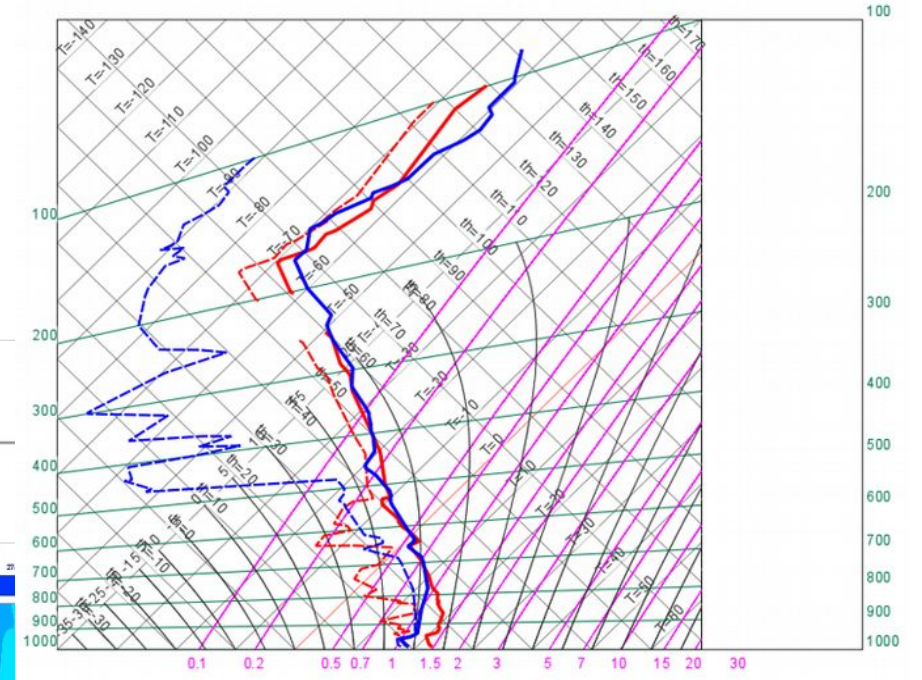
# Visualisation – Particular for Geo/Atmospheric Sciences



Obs: Little Rock (72340) 34.84N, 92.26W date: 20140427 12h and date: 20140427 18h

20140427 12h

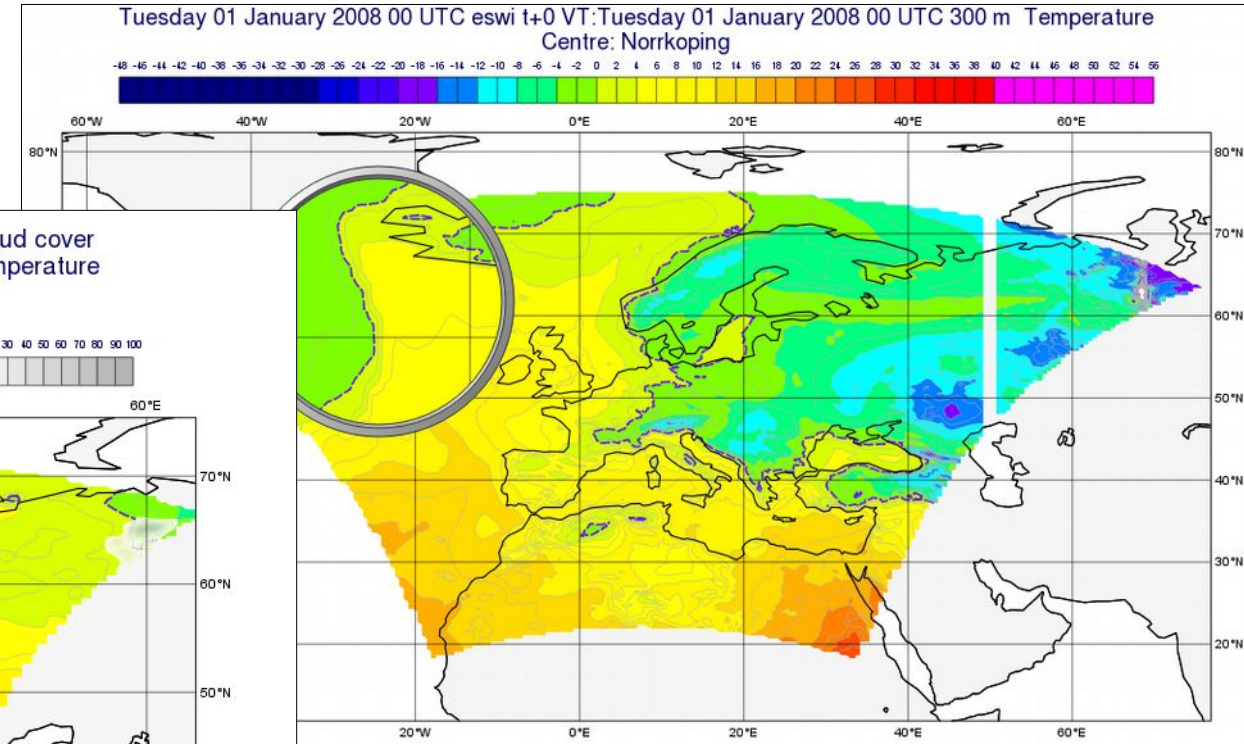
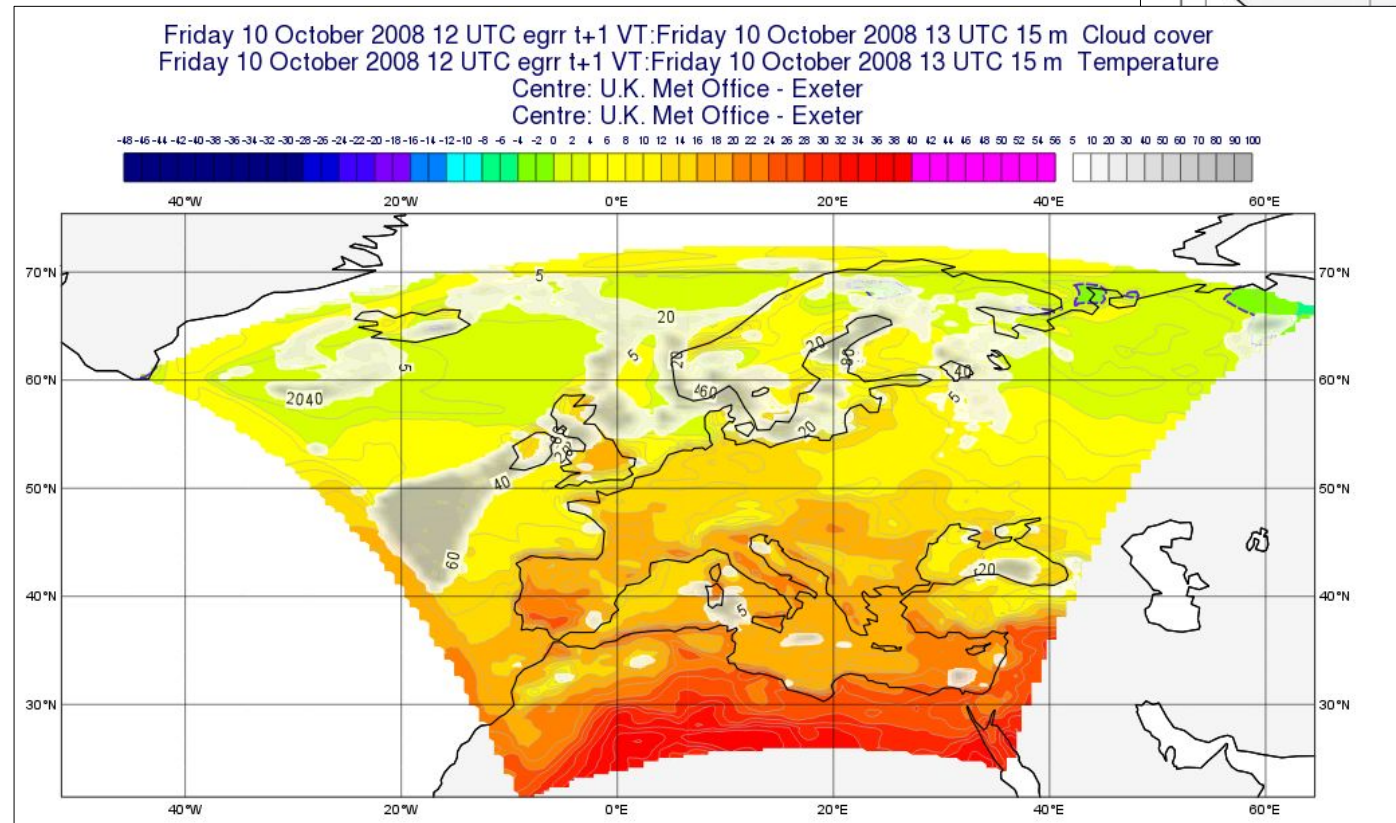
20140427 18h





# Metview and UERRA data

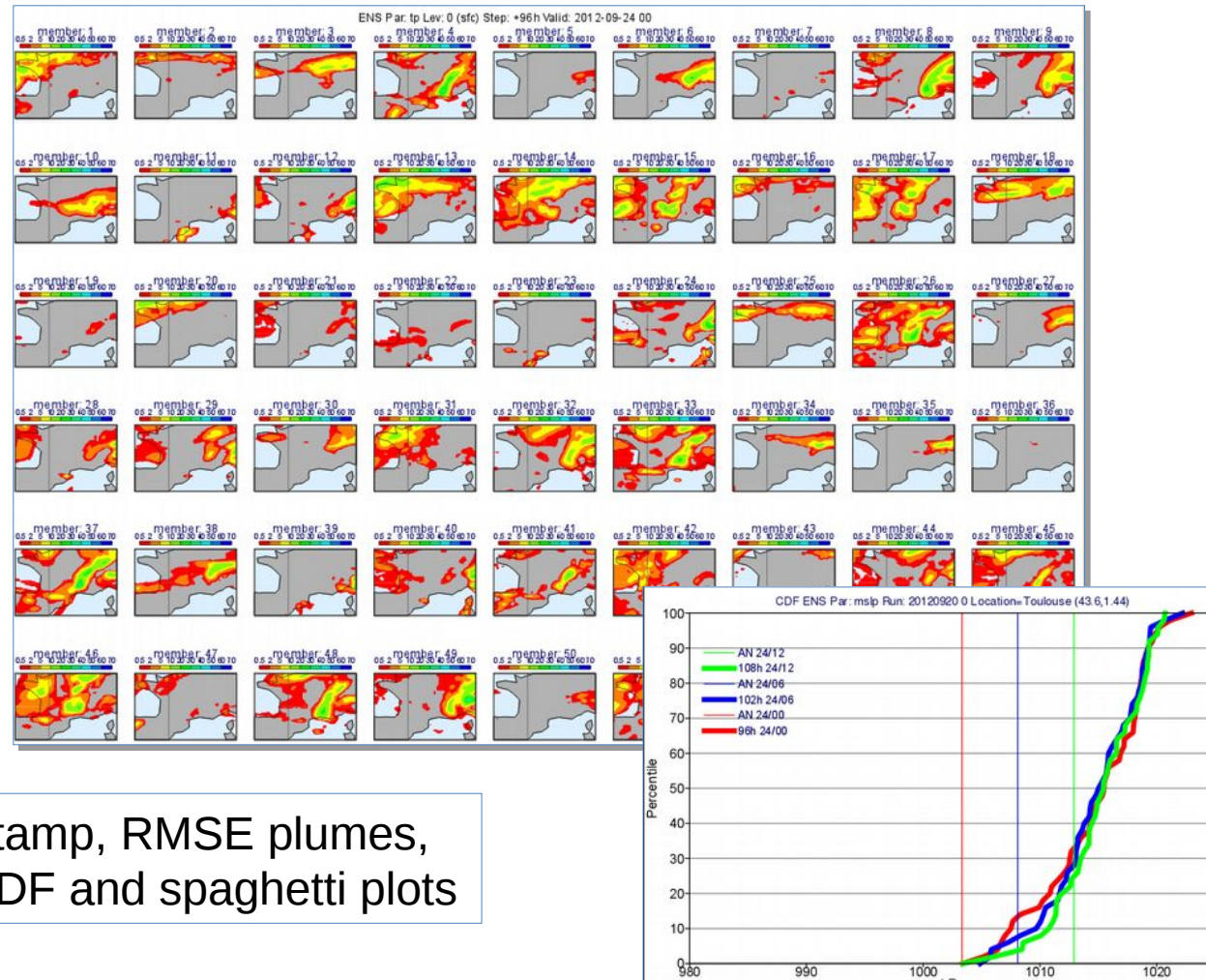
Not 100% tuned to Lambert projected GRIB data,  
but most functionality is there



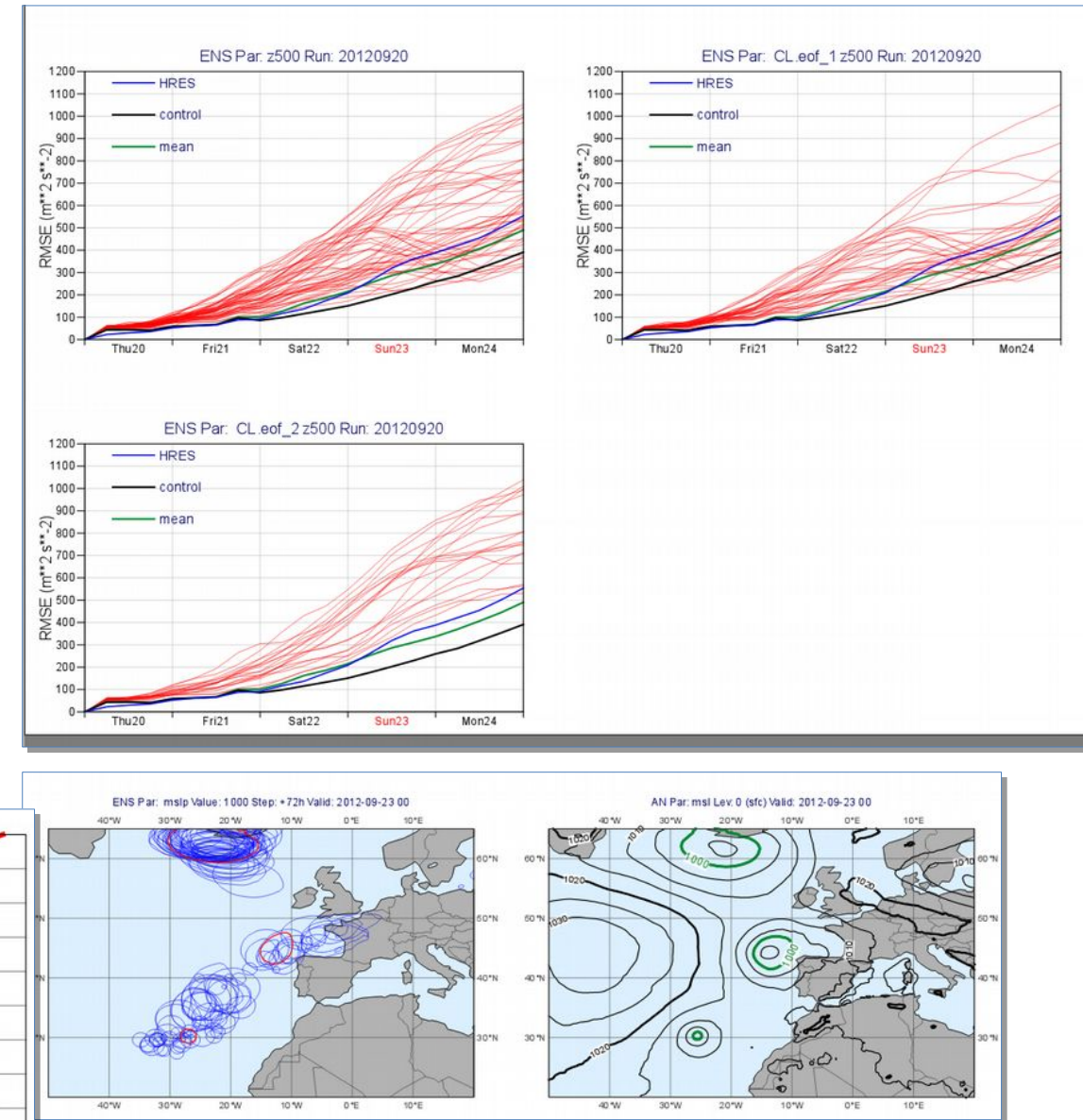


# Metview and ensemble data

- Many ways to process and visualise ENS data



Stamp, RMSE plumes,  
CDF and spaghetti plots



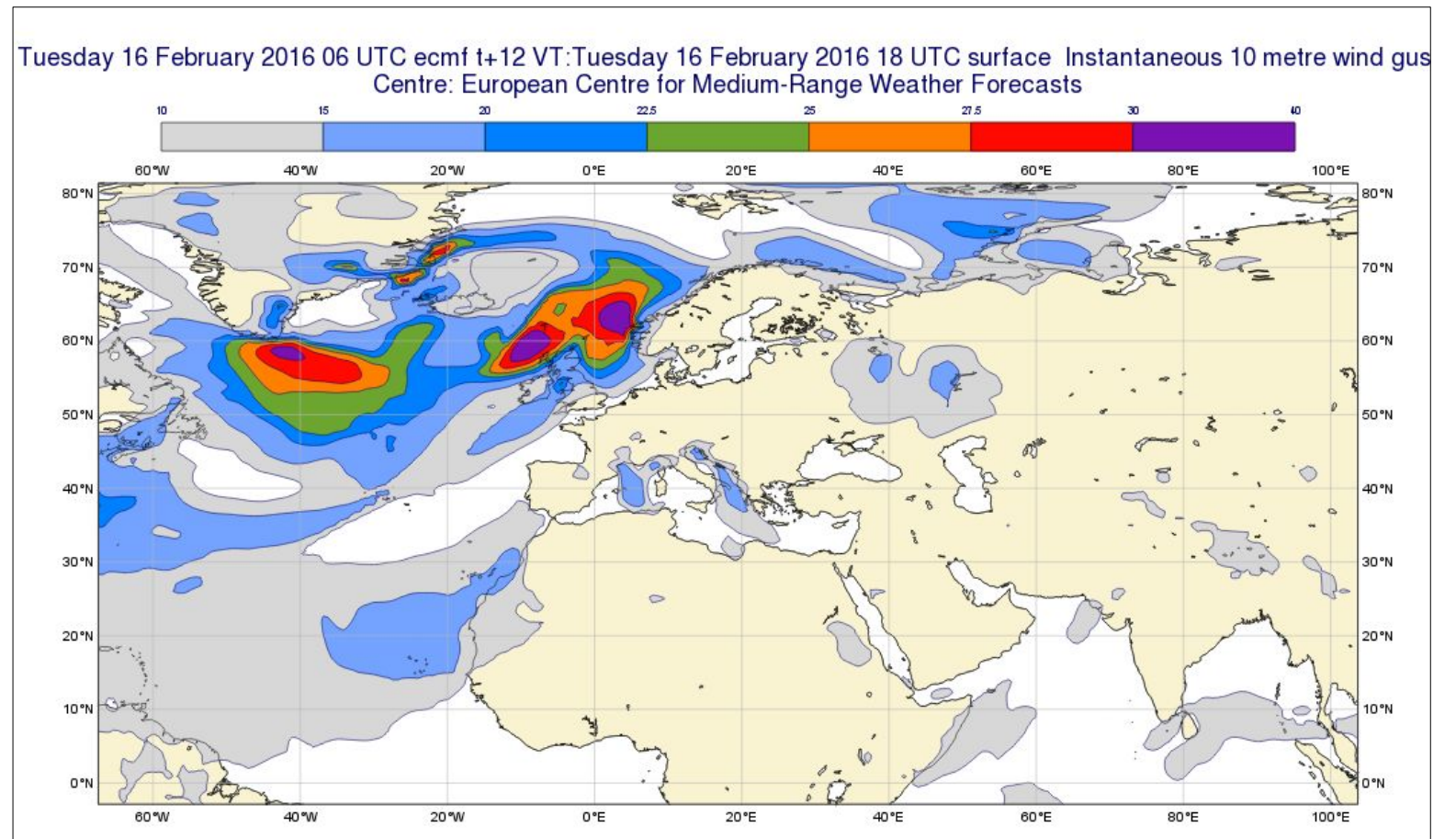


# Metview and ensemble data

- Ensemble mean:

```
data = retrieve (...)
```

```
ens_mean = mean(data)
```



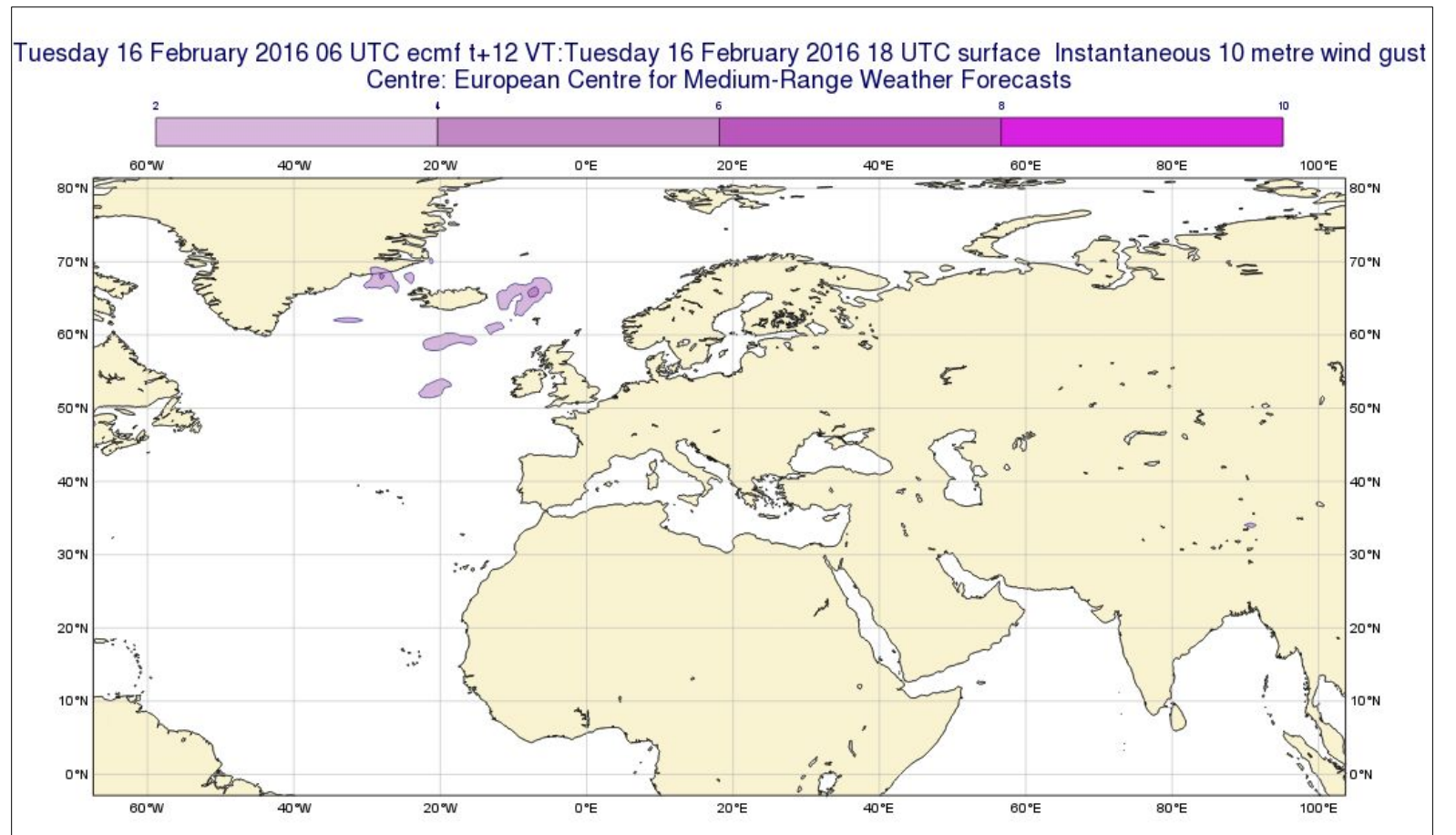


# Metview and ensemble data

- Ensemble spread:

```
data = retrieve (...)
```

```
ens_mean = stdev(data)
```



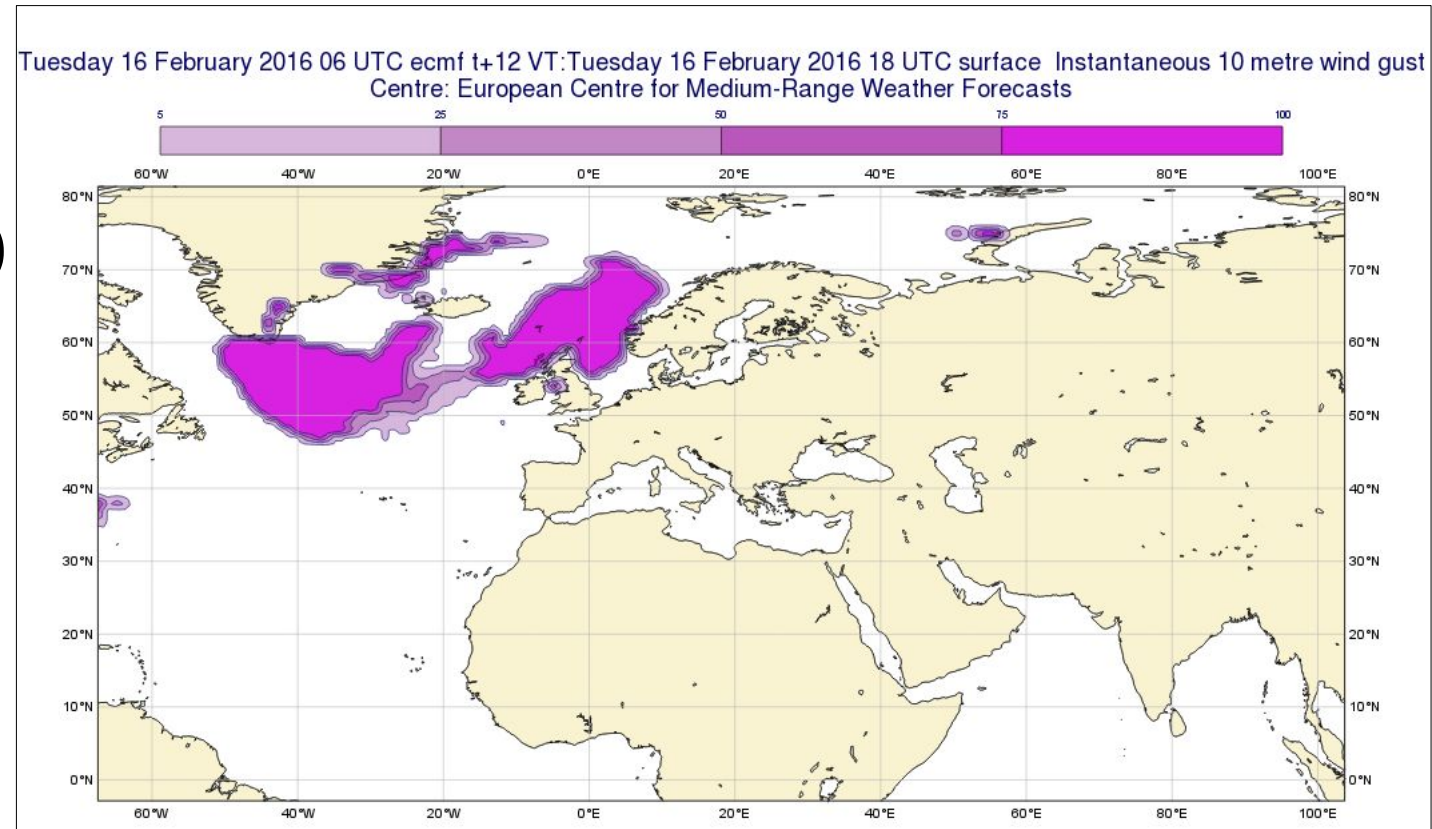


# Metview and ensemble data

- Ensemble probability:

```
data = retrieve (...)
```

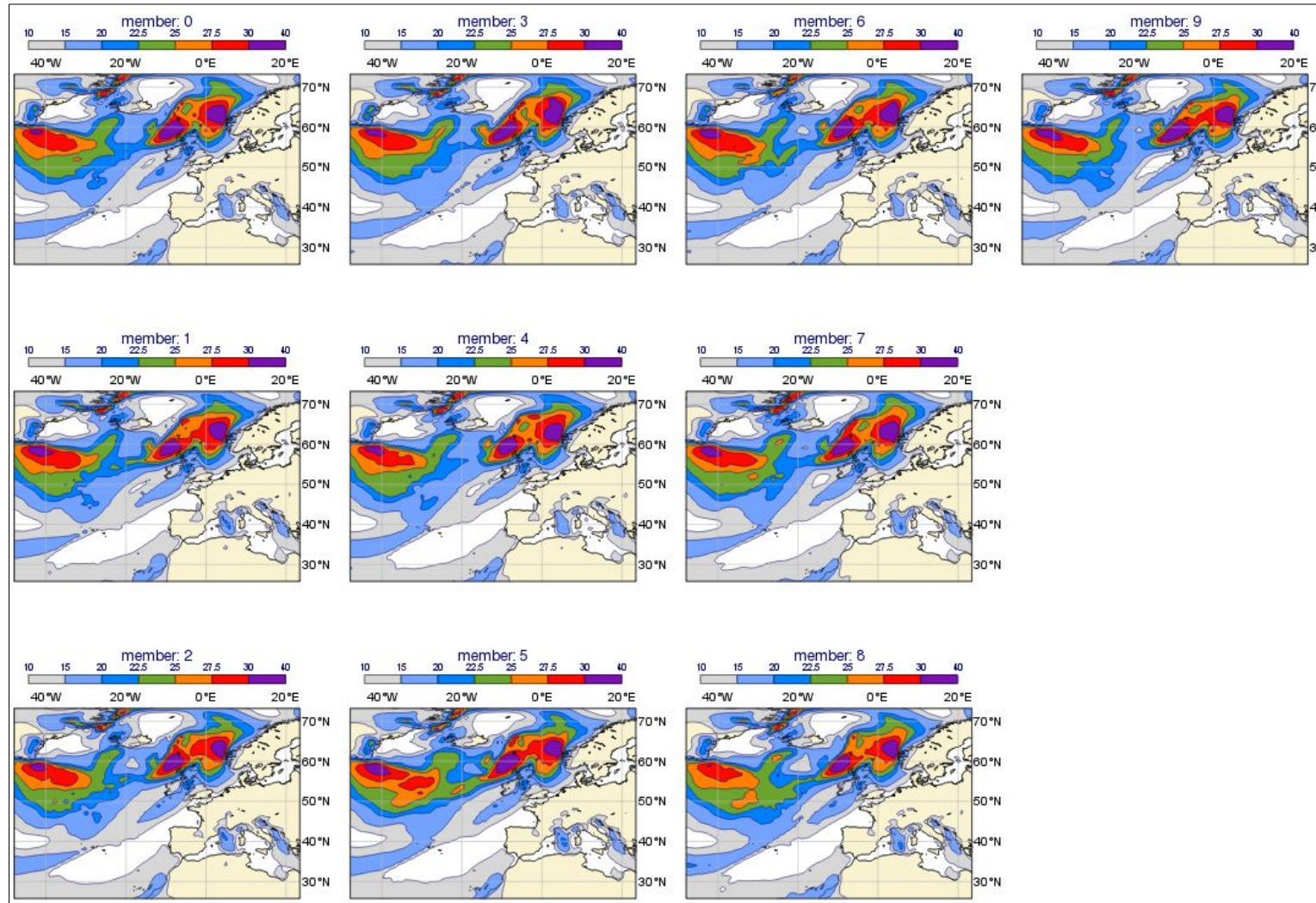
```
ens_mean = mean(data>22)*100)
```





# Metview and ensemble data

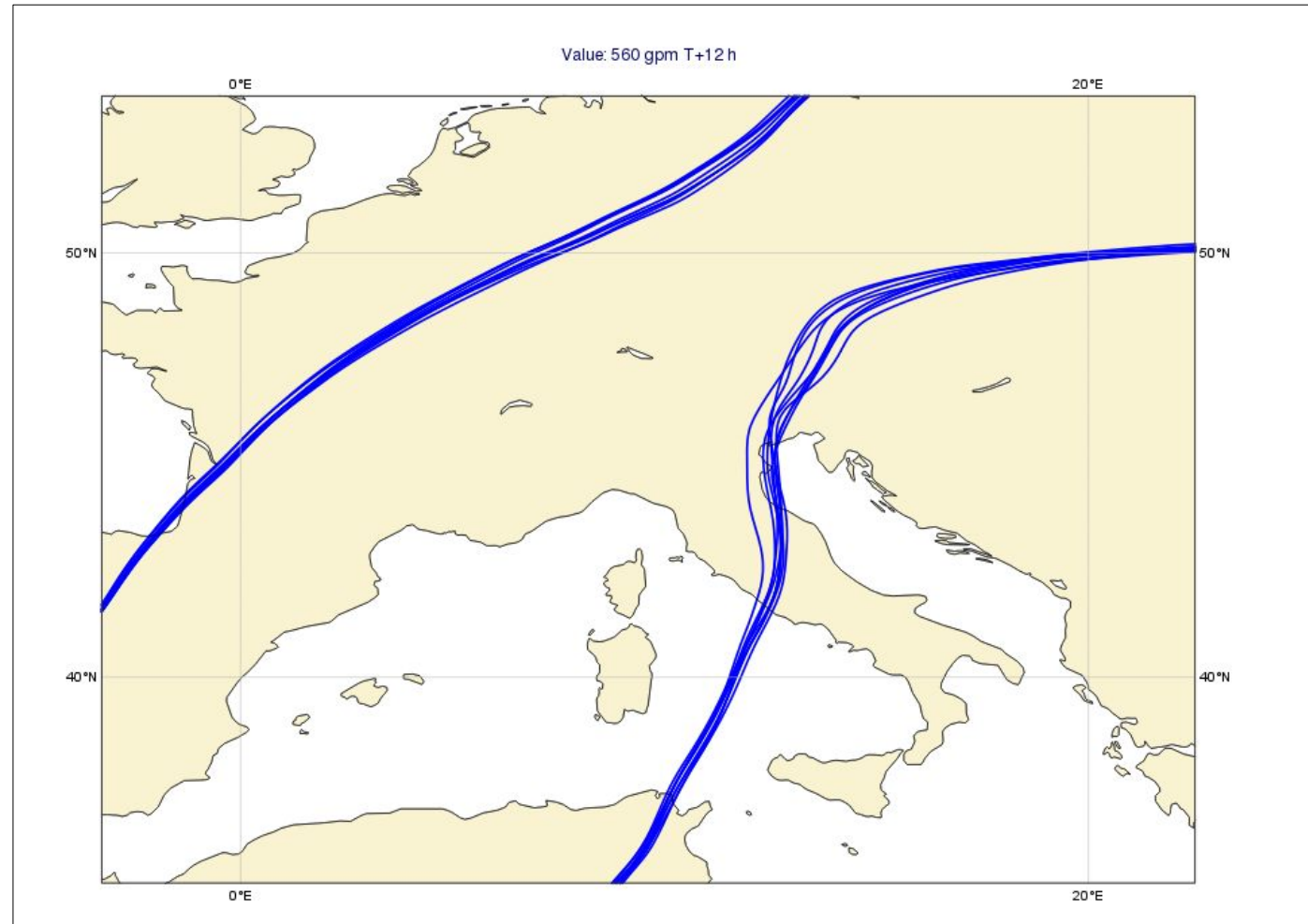
- Ensemble stamp plot:





# Metview and ensemble data

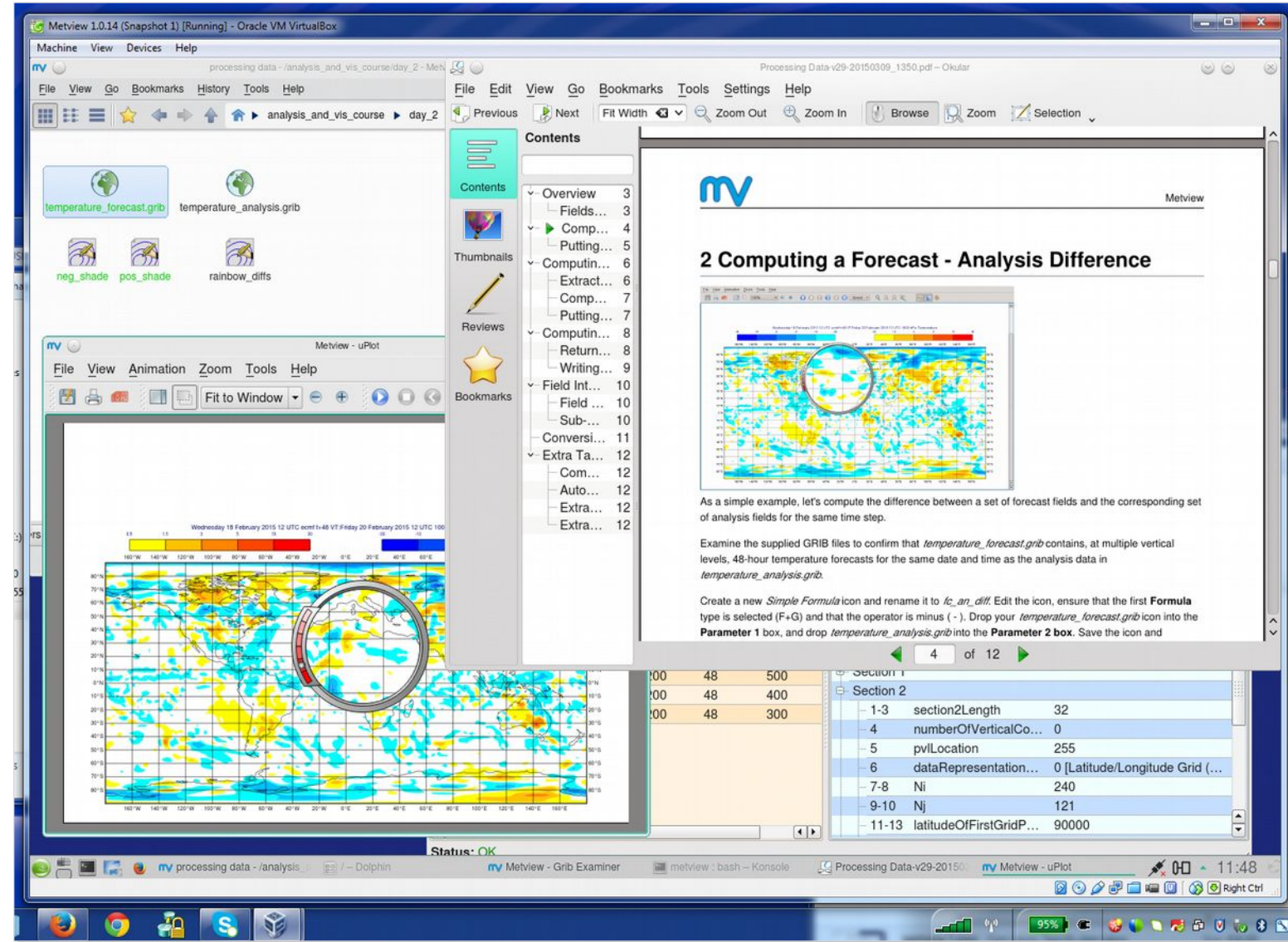
- Ensemble spaghetti plot:





# Metview Availability

- **The Metview Virtual Machine**
- Comes with Metview and other ECMWF software pre-installed
- Contains the latest Metview training course material
- Available on ecgate (just type 'metview')
- Alternatively:
  - Install from binaries
  - Build from source





## For more information...

- Email us:
  - [metview@ecmwf.int](mailto:metview@ecmwf.int)
- Visit our web pages:
  - <http://software.ecmwf.int/metview>
- Download (Metview source, binaries, virtual machine)
- Documentation and tutorials available
- Metview articles in ECMWF newsletters

Questions?

