

# ecCharts

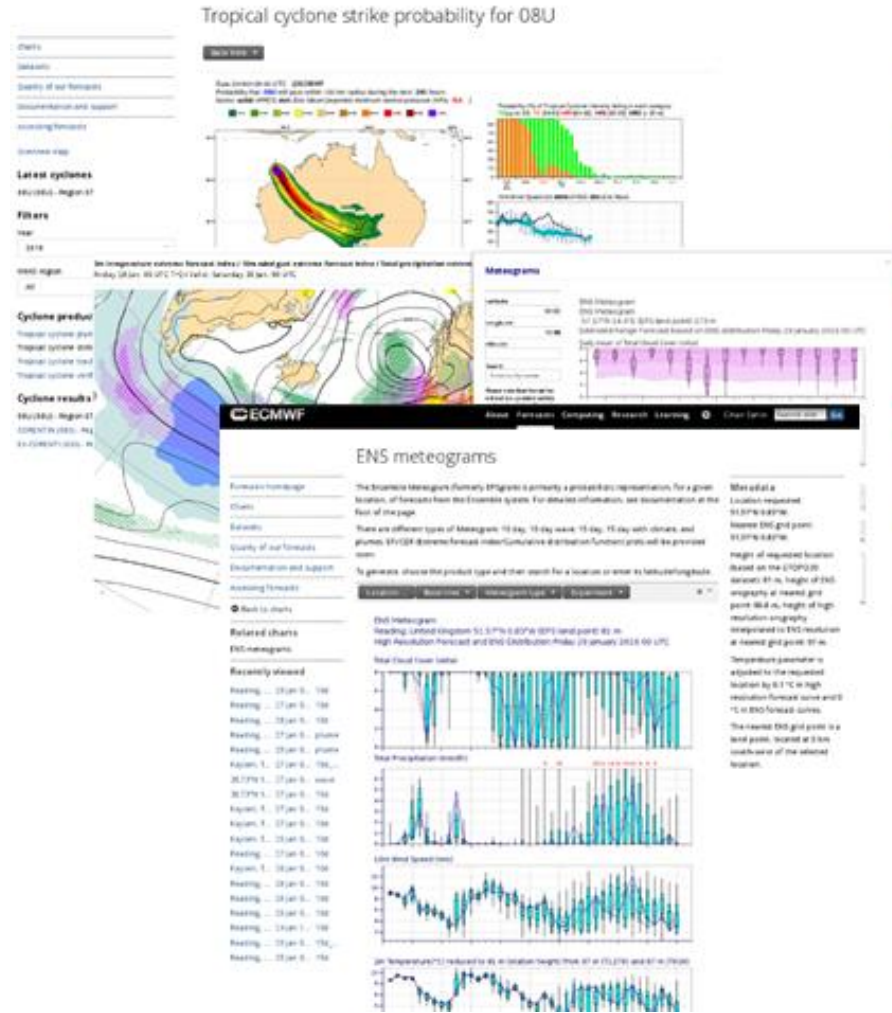
Introducing ECMWF's web charts applications

Cihan Sahin

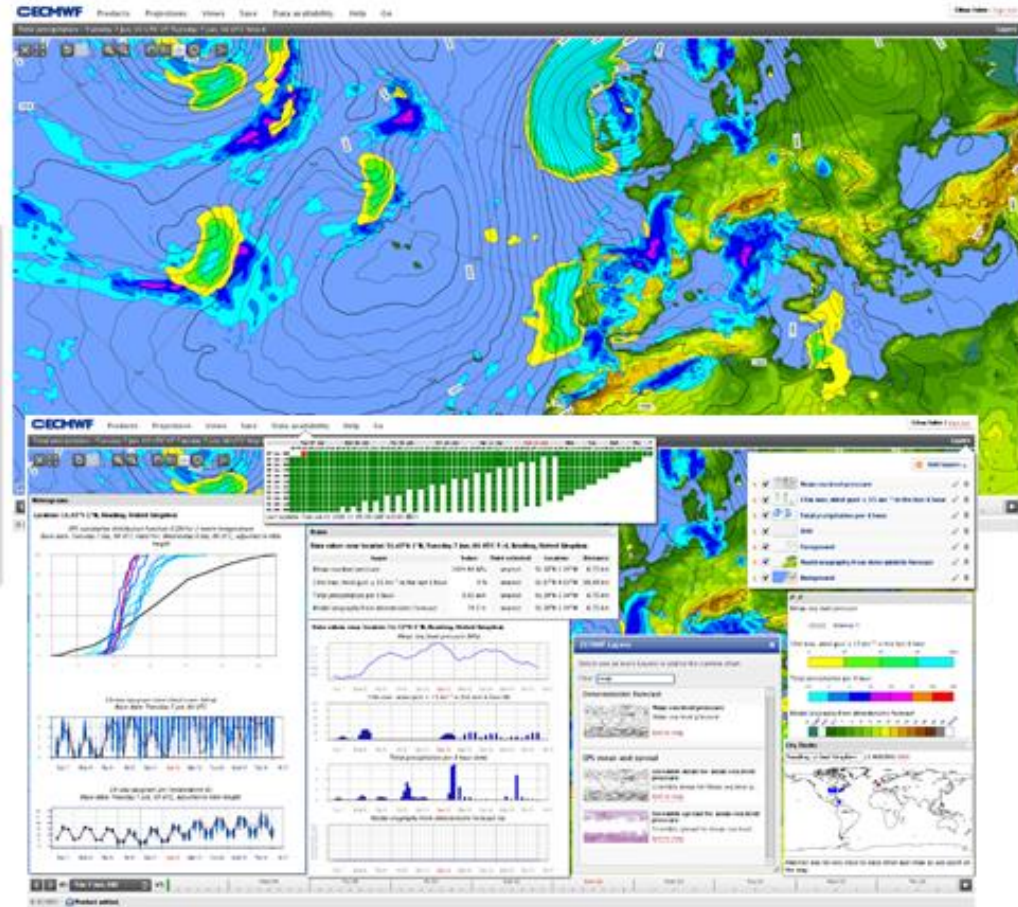
[Cihan.sahin@ecmwf.int](mailto:Cihan.sahin@ecmwf.int)

# ECMWF graphical products

Charts on www

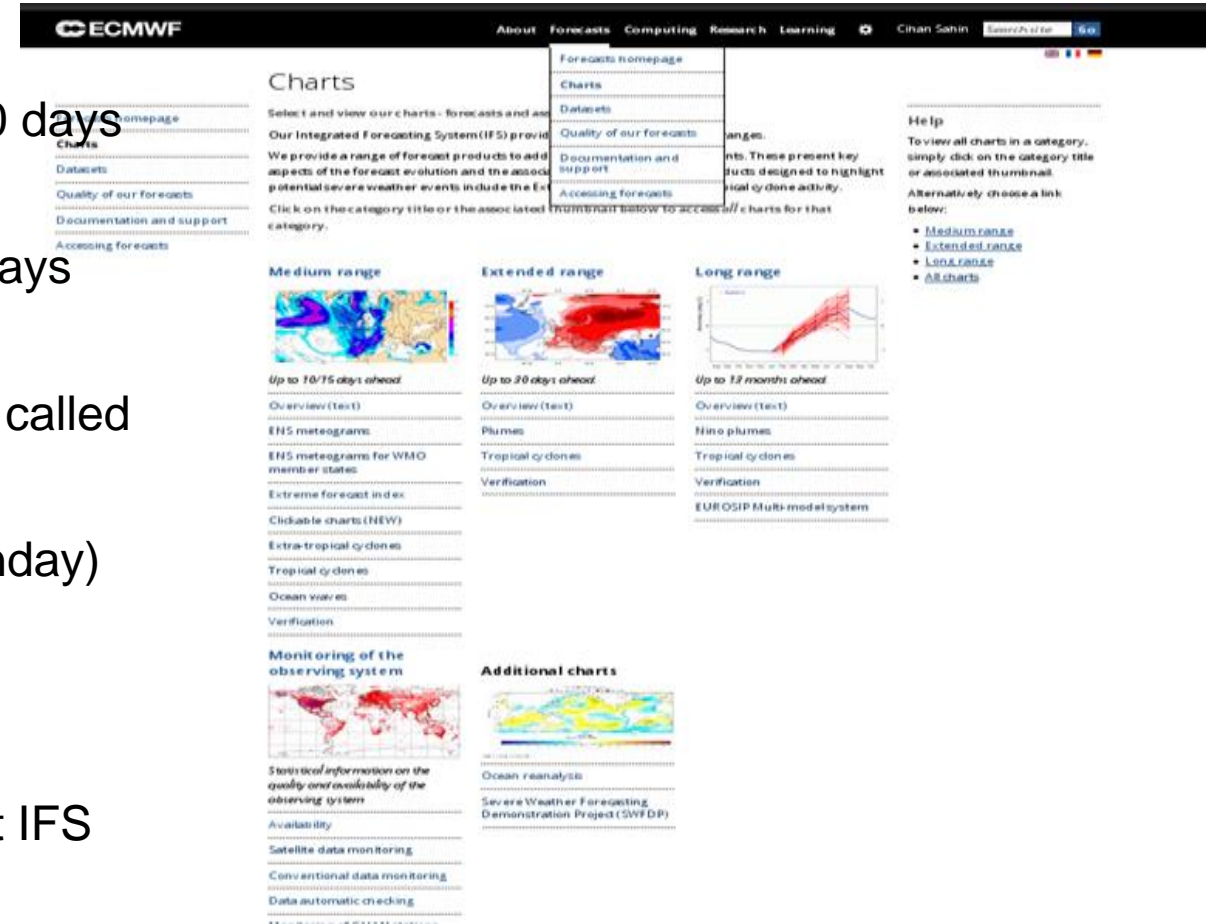


ecCharts



# WWW Charts

- High resolution (HRES) forecast charts (Updated at 06:55 and 18:55)
- Ensemble prediction system (ENS) charts up to 10 days (Updated at 7:40 and 19:40)
- Ensemble prediction system (ENS) charts 10-15 days (Updated at 8:00 and 20:00)
- Position generated time series from Ensemble, so called ENS meteograms.
- Monthly forecast charts (Every Thursday and Monday)
- Seasonal forecast charts (once a month)
- Observation monitoring charts (Daily, monthly ...)
- Research charts (Model climate based on different IFS cycles, Ocean reanalysis, special projects ...)

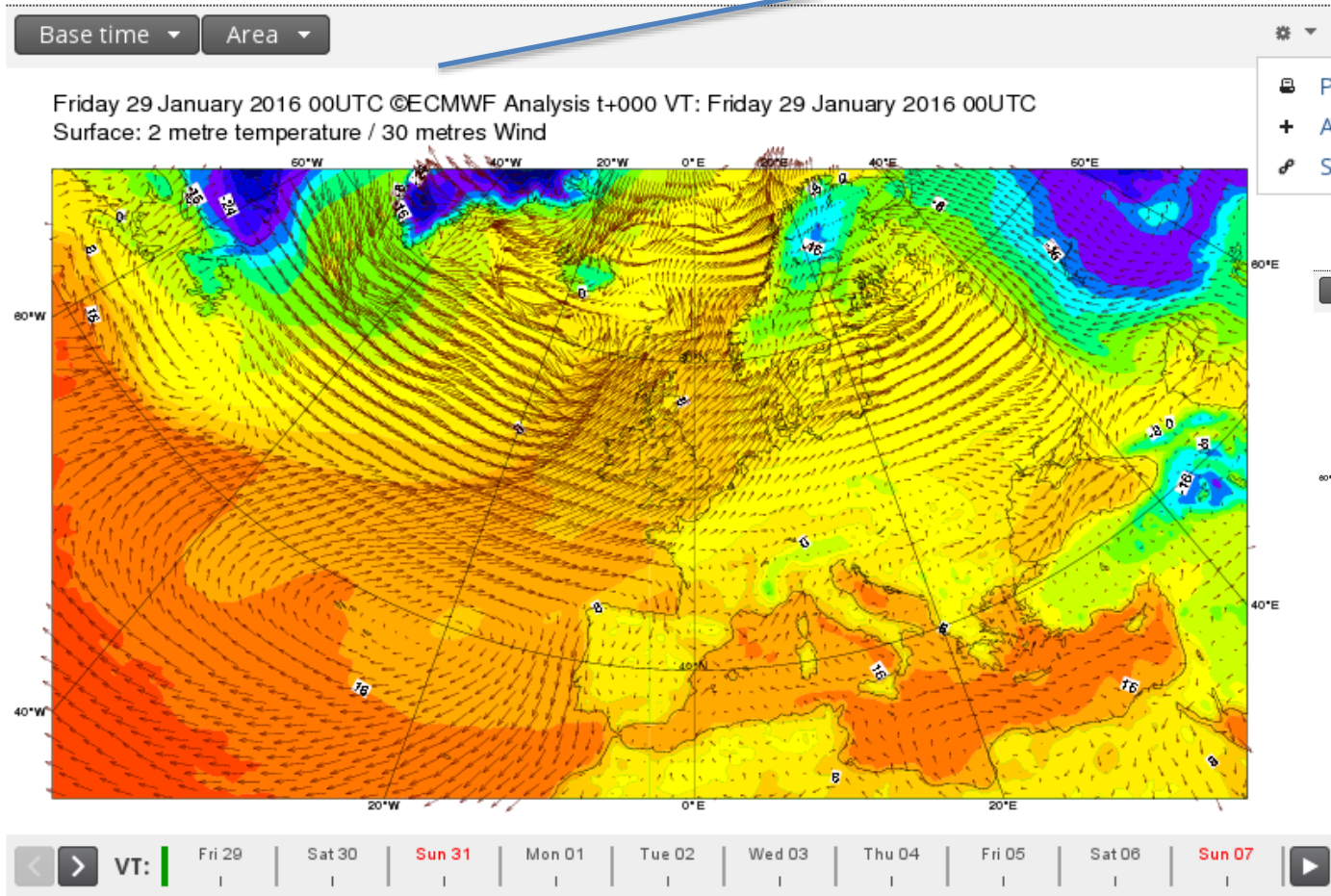




# Chart functionalities

2m temperature and 30m winds

Chart options



Add to dashboard

- Print
- + Add to dashboard
- Share

URL for batch access to this chart

Chart permanent link

The following URL can be used to download charts automatically

```
https://apps.ecmwf.int/plots/product-download/medium/w_t2m30mw/?time=2016012900,0,2016012900&area=Europe&token=c9affd84d43ff547cb6510c64ea2f42f&email=mot@ecmwf.int
```

Add '&format=pdf' to the end of URL if you wish to download PDF version.

Forecast steps / animation



# Clickable charts

- Many medium-range charts are clickable.

Charts

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Datasets

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Quality of our forecasts

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Documentation and support

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Accessing forecasts

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**Filters**

**Product type**

ENS (2)


Extreme forecast index (1)

HRES (1)


Medium range charts (Clickable)

4 matching items


No filters currently applied




Ensemble mean and spread for MSLP



MSLP and rain from high resolution



Multi-parameter EFI (24-h up to valid)



Total precipitation probability

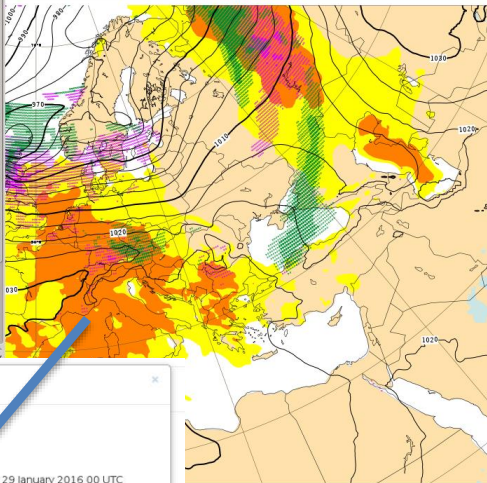
Base time: Monday 1 Feb

Area: Europe

- Europe
- Global
- Central Europe
- North West Europe
- North East Europe
- South West Europe
- South East Europe
- Northern Africa
- North Atlantic
- Arctic
- Antarctic
- North America
- Central America
- South America
- Eurasia
- Southern Asia
- Western Asia
- Eastern Asia
- South East Asia & Indonesia
- Middle East & India
- Southern Africa
- Australasia
- West Tropic

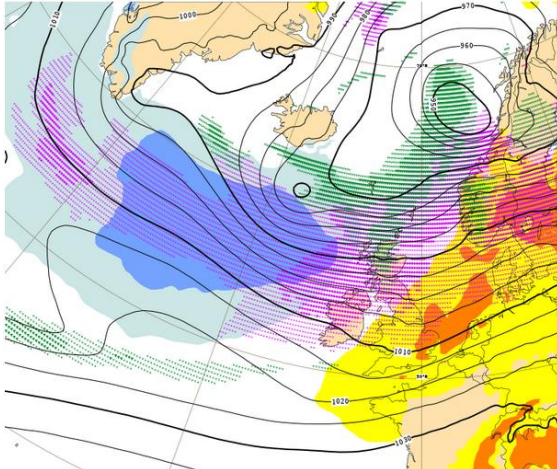
2m temperature extreme forecast index / 10m wind gust extreme forecast index / Total precipitation extreme forecast index / Ensemble mean for mean sea level pressure

Monday 1 Feb, 00 UTC



2m temperature extreme forecast index / 10m wind gust extreme forecast index / Total precipitation extreme forecast index

Friday 29 Jan, 00 UTC T+24 Valid: Saturday 30 Jan, 00 UTC



**Meteograms**

Latitude: 57.53

Longitude: 13.98

Altitude:

Search: Enter a city name

Please note that the location will not be updated unless an item is selected from the drop-down list, otherwise the text will be treated purely as a label.

OK

10-day meteogram

15-day meteogram

15-day with climate

Plume

10-day wave

EPI-CDF

**Download**

PDF

Show grid point info

**Recently viewed**

15-day clim(57.53/13.98)

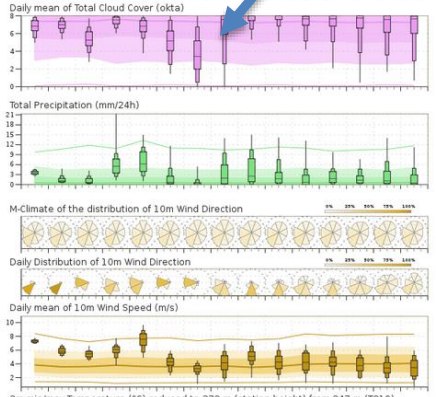
10-day(57.53/13.98)

ENS Meteogram

ENS Meteogram

57.57°N 14.4°E (EPS land point) 273 m

Extended Range Forecast based on ENS distribution on Friday 29 January 2016 00 UTC



# Chart dashboard

Organise multiple charts and meteograms in the same "page".

Access to chart dashboard

The screenshot shows the 'ENS meteograms' page. On the left, there is a sidebar with navigation links: 'Forecasts homepage', 'Charts', 'Databases', 'Quality of our forecasts', 'Documentation and support', 'Accessing forecasts', 'Back to charts', 'Related charts', 'ENS meteograms', and 'Recently viewed'. The main content area includes a title 'ENS meteograms', a brief description of the Ensemble Meteogram, and a 'Metadata' section with location details for Izmir, Turkey. Below this is a 'Total mean of Total Cloud Cover (okta)' chart and a 'Total Precipitation (mm/24h)' chart. A blue arrow points from the text 'Add chart to dashboard' to the 'Add to dashboard' button in the metadata section.

Add chart to dashboard

The screenshot shows the website header with navigation links: 'About', 'Forecasts', 'Computing', 'Research', 'Learning', 'Cihan Sahin', 'Search site', and 'Go'. A dropdown menu is open, showing 'Chart dashboard' and 'Log out' options. A blue arrow points from the 'Chart dashboard' option to the 'Add chart to dashboard' text in the previous block.

The screenshot shows the 'Chart dashboard' interface. At the top, there is a navigation bar with links: 'Extreme weather', 'Reading EPSGRAMS', 'Precipitation', 'Epsgrams', 'New epsgrams', 'Reading temperature and cloud', and an 'Add Tab' button. Below this, there are several chart widgets: 'Rainfall and MSLP' (a map of Western Turkey), 'Cloud cover' (a map of the region), 'New chart widget' (a time-series plot), 'ENS meteograms' (a detailed view of the ENS meteogram for Izmir, Turkey), 'All sky radiances from AMSR2 (Hovmoeller Latit...)', 'Weekly probability anomaly' (a map showing probability anomalies), and 'Probabilities, 2m temperature' (a map showing temperature probabilities). The 'ENS meteograms' widget is highlighted with a blue border.

<https://software.ecmwf.int/wiki/display/FCST/Chart+dashboard>



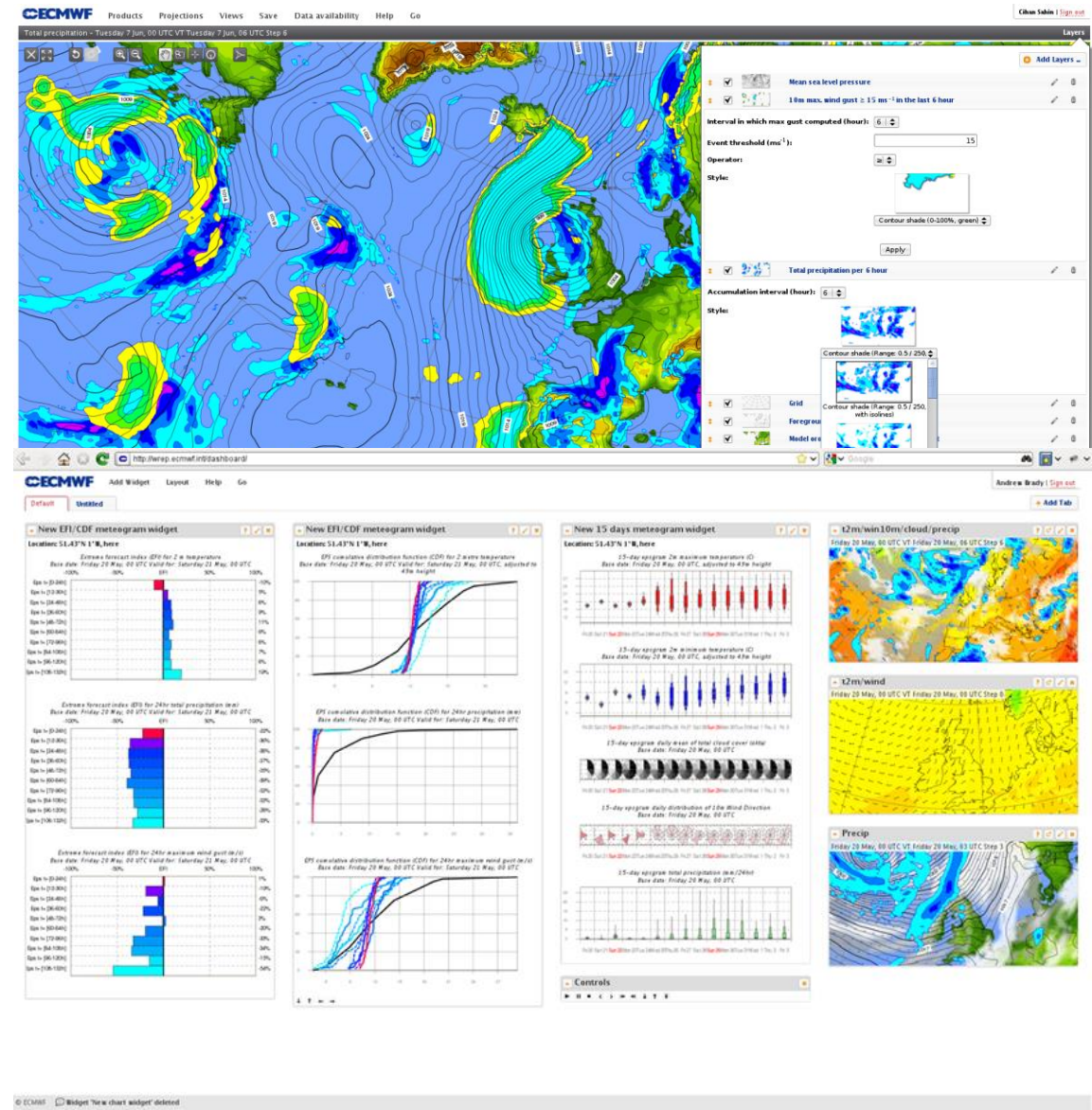
# ecCharts

Web based application to inspect and visualize ECMWF medium-range and extended-range data (NEW !)

- Web based immediate access to charts
- Native data resolution
- Interactive features (zoom, pan, click, extract data information, ...)
- User controlled visualization
- Customisable parameters
- Download charts (through WMS)

URL

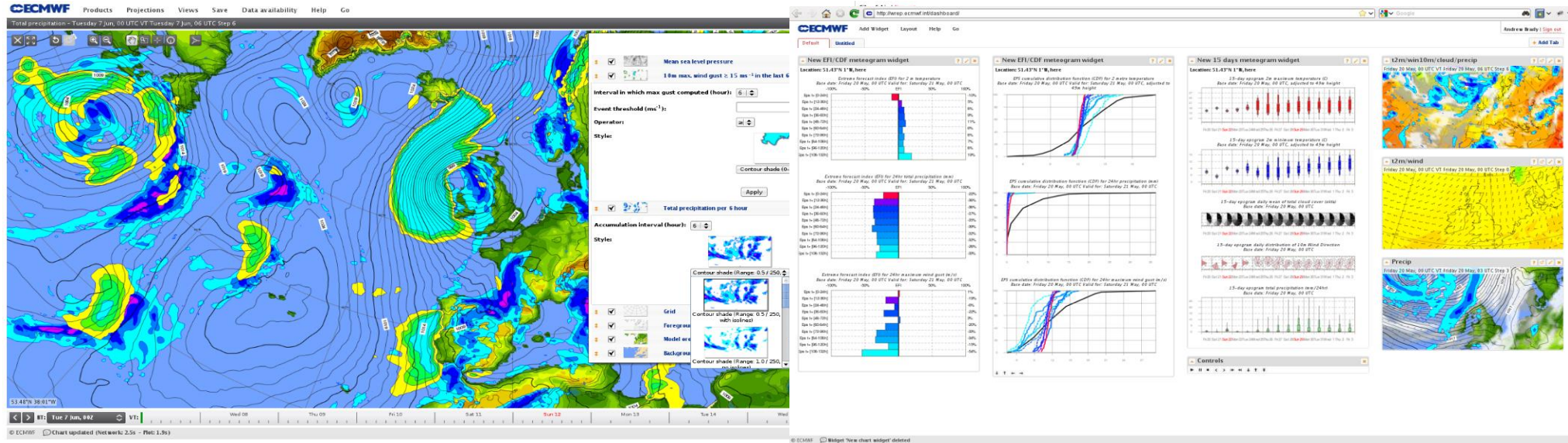
[eccharts.ecmwf.int/forecaster/](http://eccharts.ecmwf.int/forecaster/)



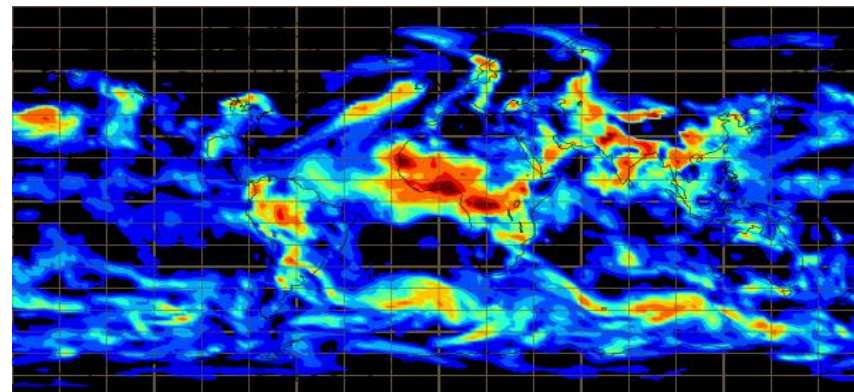


# ecCharts user interfaces

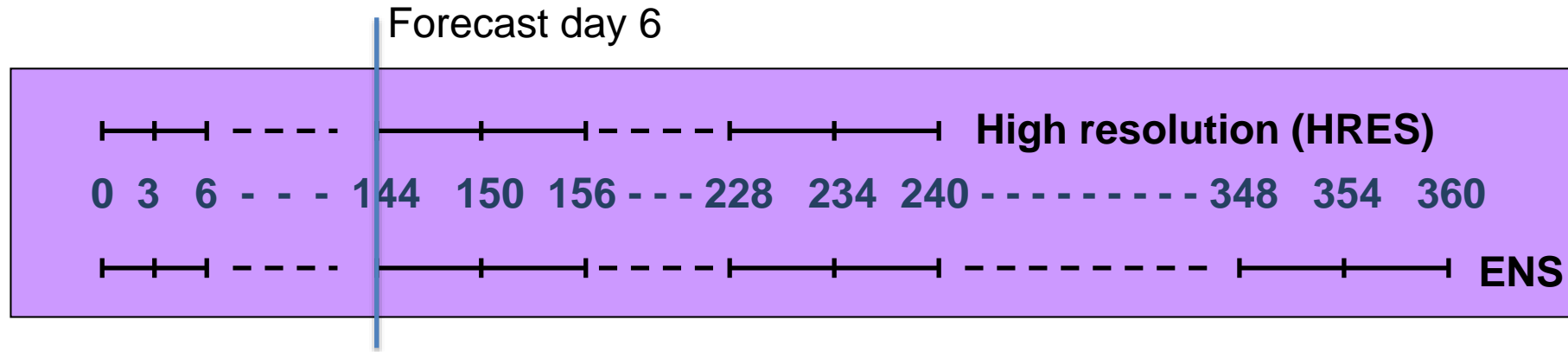
## Forecaster / Dashboard / WMS



[https://apps.ecmwf.int/wms/?token=public&request=GetMap&layers=composition\\_aod550,grid,foreground&width=600&bbox=-180,-90,180,90](https://apps.ecmwf.int/wms/?token=public&request=GetMap&layers=composition_aod550,grid,foreground&width=600&bbox=-180,-90,180,90)



# Data in ecCharts



- High resolution and Ensemble model output (atmospheric & wave parameters)
- Point extracted data (for a given latitude/longitude)
  - Time series from all available parameters
  - ENS meteograms for a selected parameter set
- Ensemble derived data
  - Probabilities, Percentiles, EFI/SOTs, Model-climate, Ensemble mean and spread ...

NEW !

Extended range data available : updated twice a week (Monday/Thursday at 22:00 UTC)





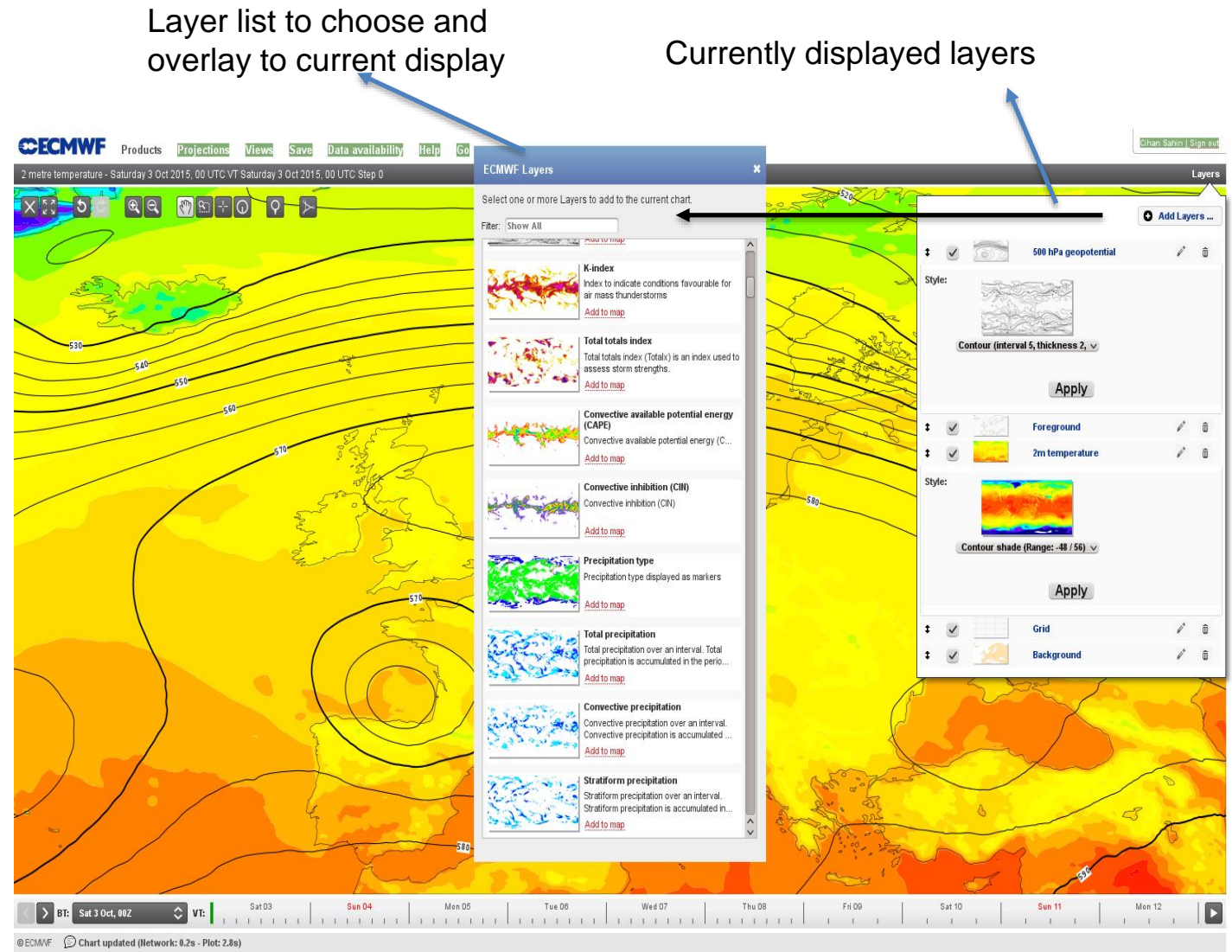
# Basic ecCharts concepts

- Basic components to build a plot : Style, Layer, Projection
- What you have on your screen is combination of those components and is called a Product

The screenshot shows the ECMWF Forecaster web interface in Mozilla Firefox. The main plot displays a 2-metre temperature map for Saturday 3 Oct 2012, with a color scale from blue (cooler) to red (warmer). Overlaid on the map are 500 hPa geopotential contours. A 'Projections' menu is open, showing options like 'North atlantic', 'Europe (cylindrical)', 'Around brazil', 'Global', 'South hemisphere', and 'North hemisphere'. A 'Layers' panel on the right shows the active layers: '500 hPa geopotential' (selected), 'Foreground', '2m temperature', 'Grid', and 'Background'. The '500 hPa geopotential' layer is configured with a 'Contour (interval 5, thickness 2)' style. The '2m temperature' layer is configured with a 'Contour shade (Range: -48 / 56)' style. Annotations with blue arrows point to these elements: 'Projection' points to the projection menu, 'Product (Combination of several layers)' points to the main map area, 'A layer (500 hPa Z)' points to the '500 hPa geopotential' layer in the Layers panel, and 'Style selected for this layer' points to the contour style for the 500 hPa geopotential layer.

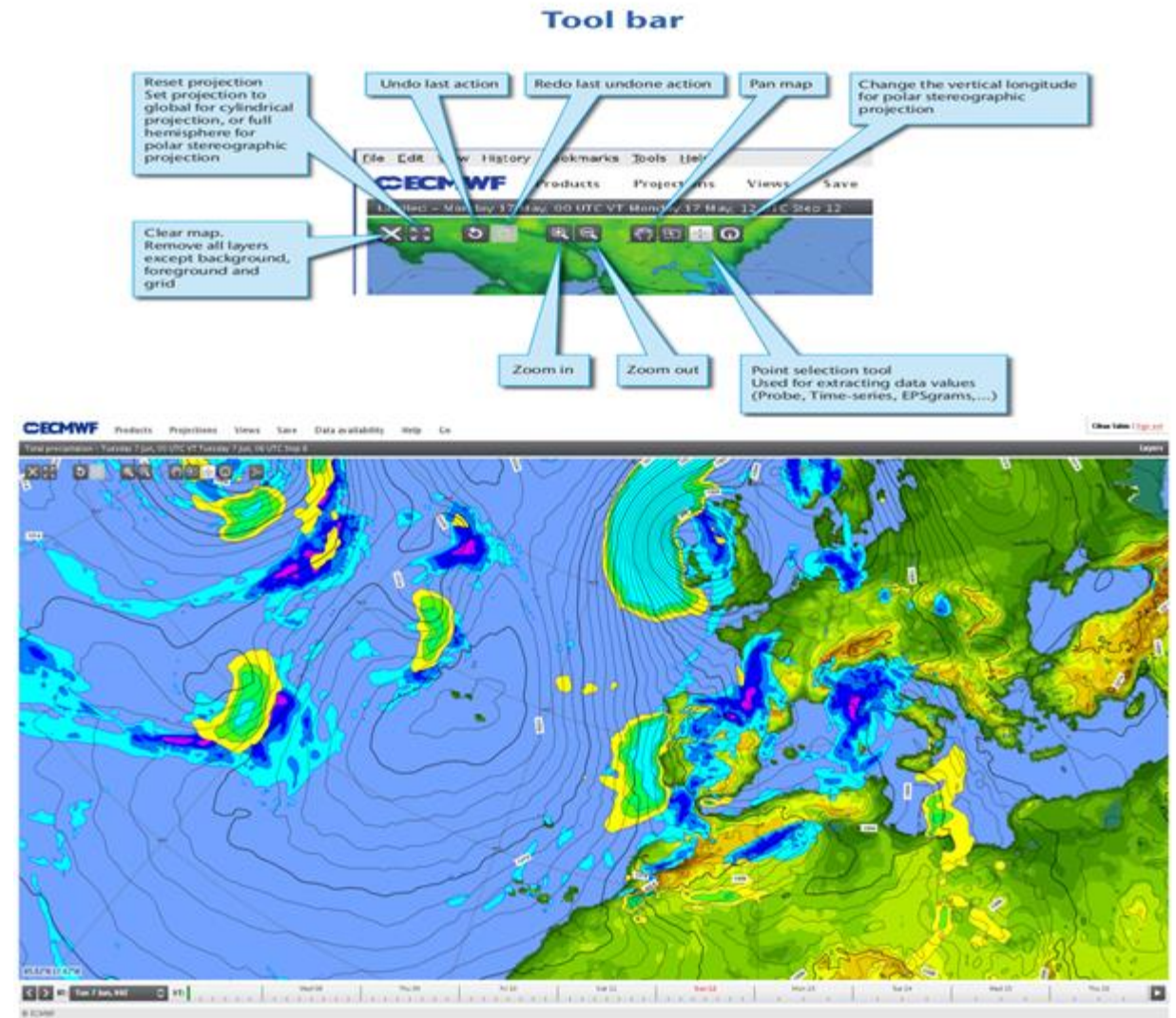
# More on layers and products

- Layers are basic visual elements (meteorological parameters, result of complex computations, coastlines ...)
- Overlay-able
- Customisable (ie. Accumulation period for total precipitation, Event threshold and event operator for probability layers, Interval in which maximum wind gust computed ...)
- Can be re-ordered
- Final display is “Product”. Can be saved for re-use.
- A small set of pre-defined Products are available. But idea is that user creates products as they wish.



# User interfaces – Forecaster tool

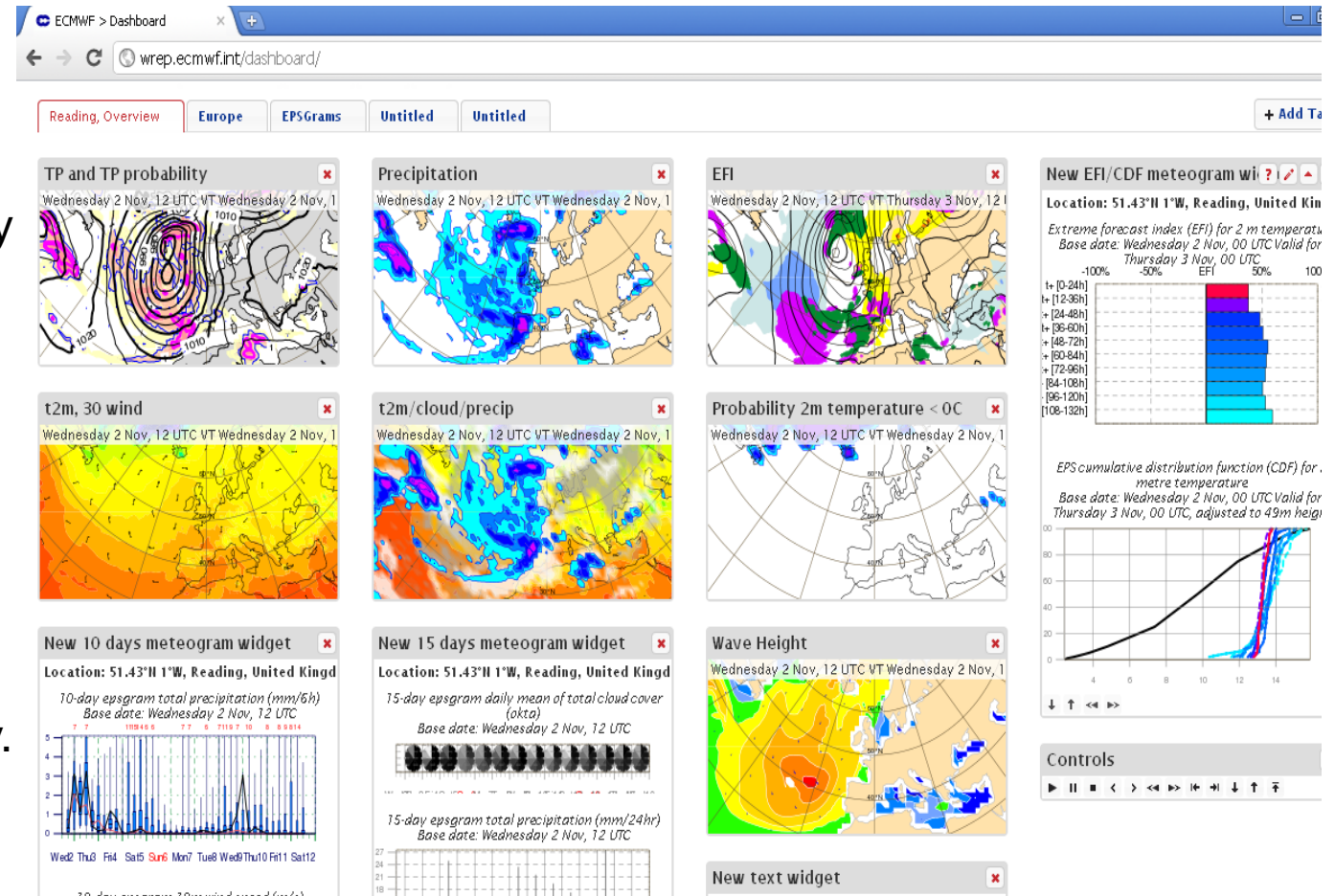
- Interactive (zoom, pan ...)
- Plot area maximised (See weather room ...)
- Work and create a product and save as your own.
- Data fields are global.
- Charts are clickable to extract information
- Overlay any combination of parameters (currently around 230) from HRES and ENS.
- Design and save as your “own” product to re-use.
- Control projection and time (animations ...)





# User interfaces - Dashboard

- Organise multiple charts and meteograms in the same “page”. Basic elements are called widgets.
  - A chart widget is used to display a product either from ECMWF pre-defined set or your saved products.
  - ENS meteograms widgets (10 days, 15 days, EFI/CDF)
  - Control widget to apply collective actions for the charts on the same page ie. All charts in a tab animate simultaneously.
- User can create many tabs each containing many widgets.



## More on Ensemble data

ecCharts provides an easy way to access and visualise ECMWF Ensemble data

Ensemble data = 50 perturbed forecasts (lower resolution) + Control forecast (No perturbation)

What is the probability of precipitation > 5 mm/ 6 hr ?  
How about over 24 hr ?

Show ENS temperatures for 90 th percentile ?

How about ENS distribution for a given point ?

What is the probability of precipitation > 5 mm/ 6 hr AND wind speed > 10 m/s ?  
How about over 24 hr ?

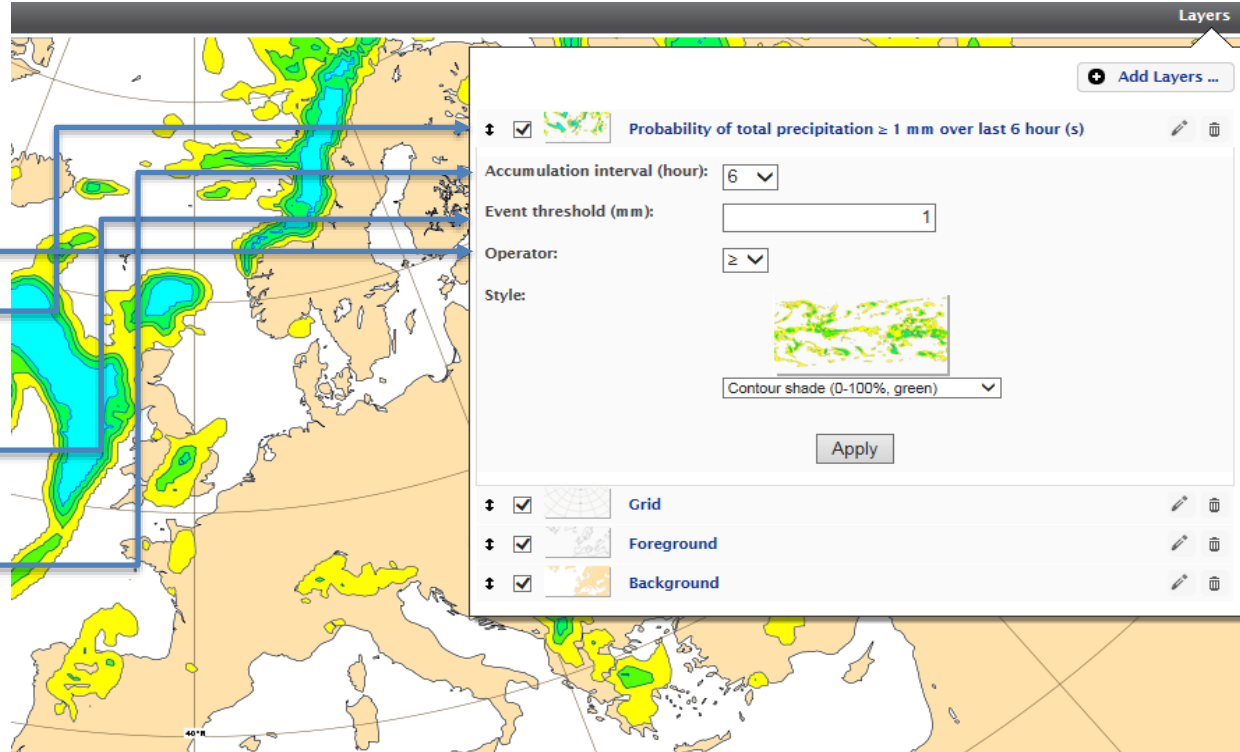
Customising charts is the key functionality to explore Ensemble data in detail.

- Charts need to be generated dynamically from raw data.

# ENS Probabilities

- To convey forecast uncertainty information by the probability of the occurrence of an event.

What is the probability of precipitation > 5 mm/ 6 hr ?  
How about over 24 hr ?

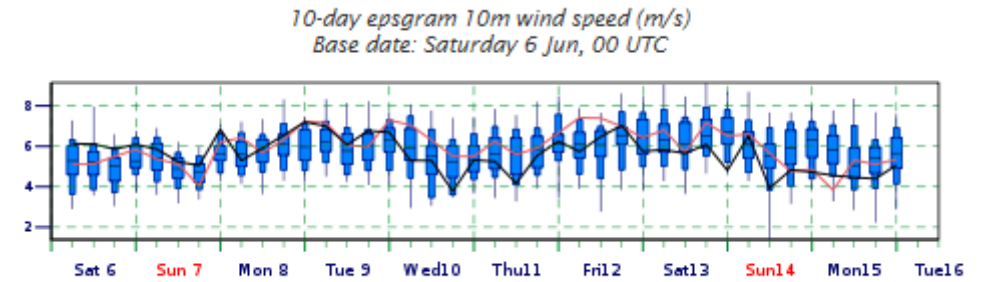
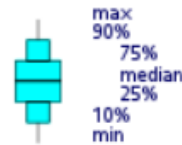


- Similar customisation applies for percentiles and probability of combined events.

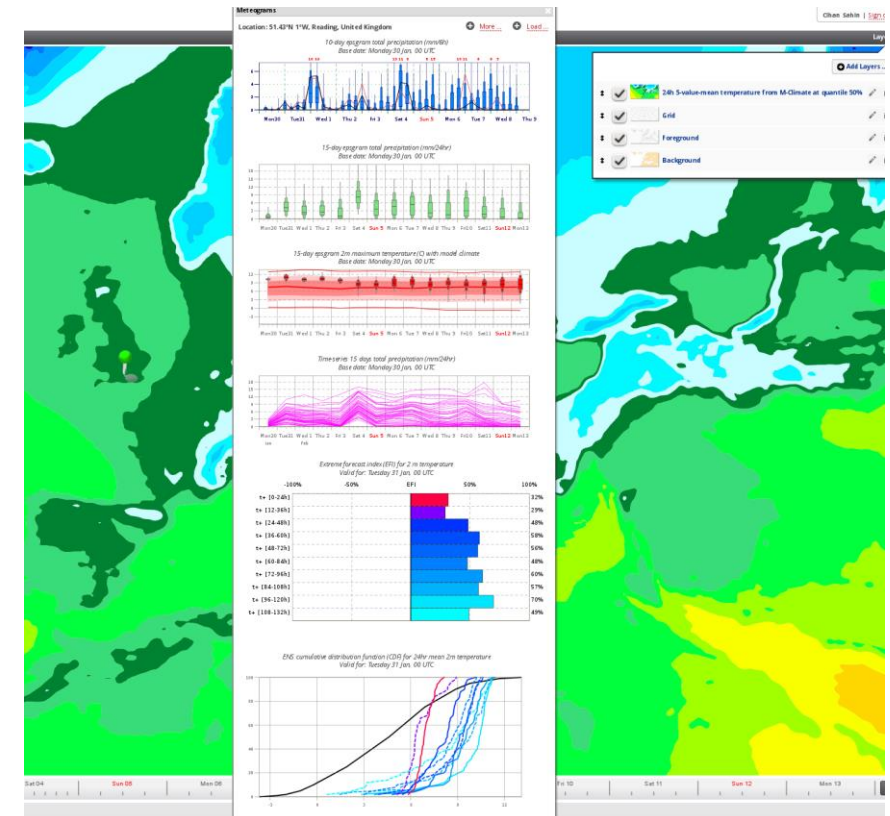


# Meteograms

- Position based forecast plots displaying pre-defined ENS percentiles.
- Distributions are displayed using a box and whisker plot.
- Types of meteograms;
  - 10-day meteograms
  - 10-day meteograms for wave parameters
  - 15-day meteograms
  - 15-day meteograms with model climate
  - Plumes
  - ENS members (individual lines)
  - EFI and CDF diagrams
  - Extended range meteograms (Anomalies)
- All charts are clickable to show selected meteograms for a chosen location.

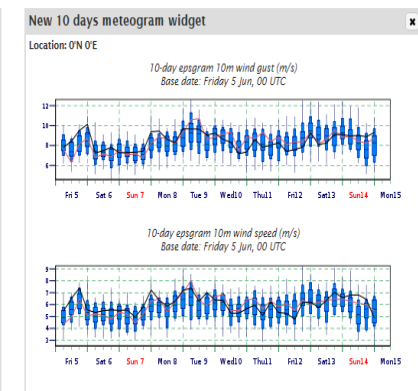
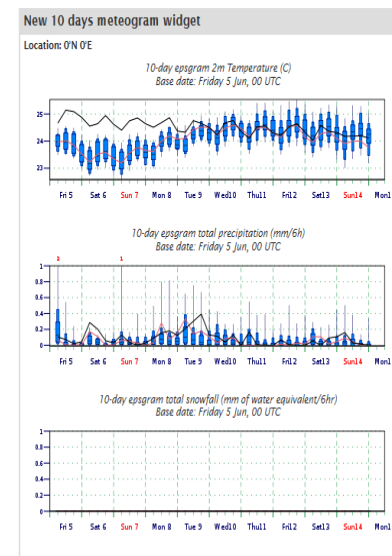
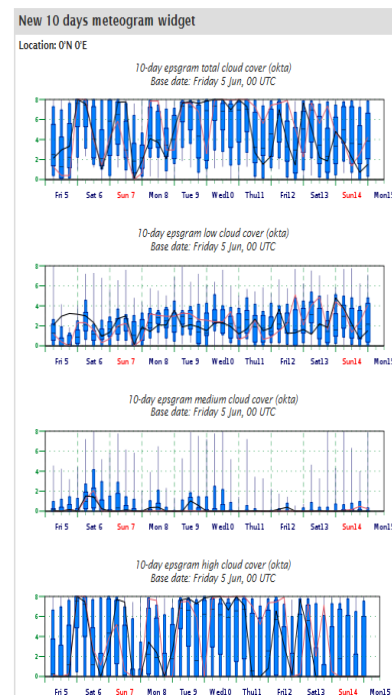
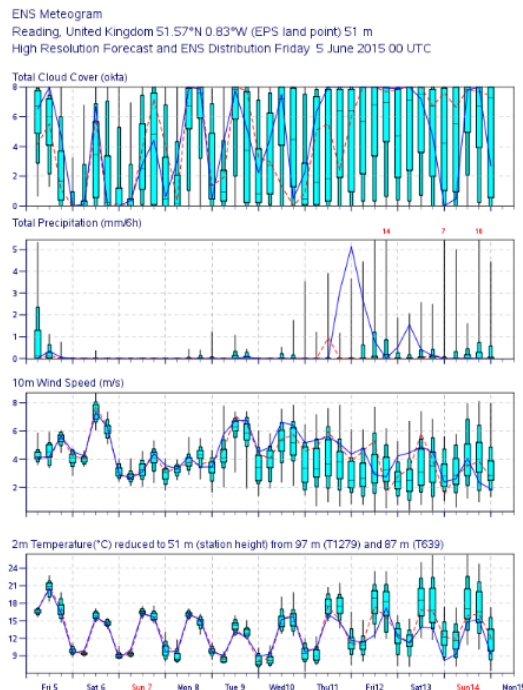


ENS Control(31 km) High Resolution (16 km)



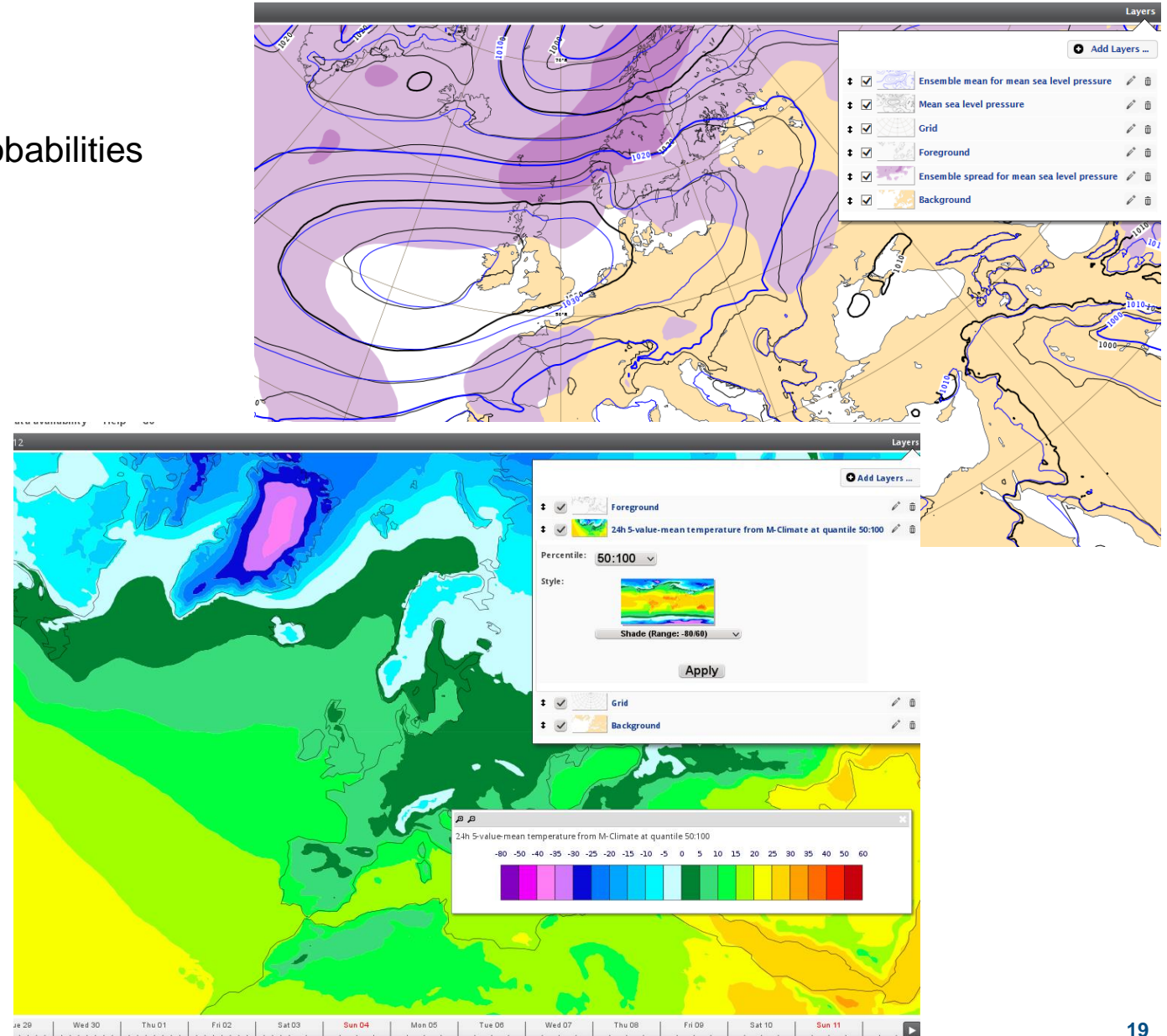
# Meteograms – more parameters in ecCharts

- Classical meteograms (as in www and clickable charts) have a limited number of parameters (4 for 10-day meteogram)
- ecCharts displays meteogram parameters individually. That allows users to customize and present Meteograms as they wish to.
- (2t, total precipitation, wind gust, low/medium/high/ total cloud cover, snowfall, wind speed, mean wave period/direction, wave direction, significant wave height, Most probable precipitation type (NEW) )



# Other ensemble data

- Derived products
  - ENS combined and weighted probabilities
  - ENS mean and spread
  - EFIs
  - SOTs
  - Cyclone strike probabilities
  - Cyclone tracks
  - Model-climate
  - Spaghetti plots
  - Post processed products
    - Precipitation type
    - Point rainfall ...



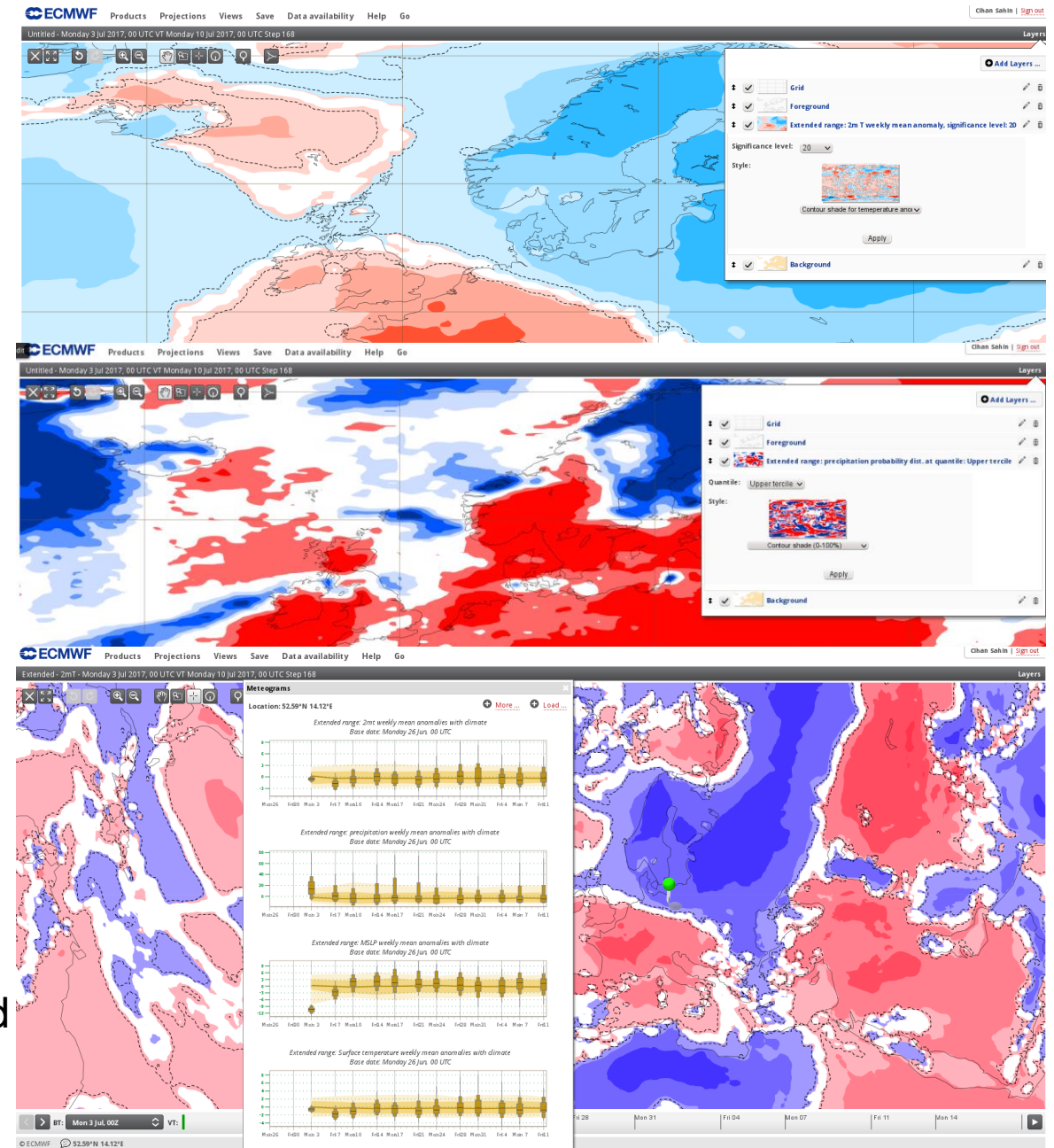


# June 2017 update

- Dedicated to Extended-range forecast parameters (Up to 6 weeks)
  - Weekly mean anomalies (2mT, surface temperature, precipitation and MSLP) with controllable significance levels.
  - Probability distributions for weekly mean anomalies (Same parameters)
  - Extended range meteograms: Weekly mean anomalies with climate distribution (Same parameters)
  - Updated twice a week: Monday/Thursday 22:00 UTC
- ENS
  - SST and sea ice cover from Control forecast
  - Speed improvements for Spaghetti plots

Full list available

<https://software.ecmwf.int/wiki/display/ECCHARTS/Updates>





# November 2017 update

- More Extended-range forecast parameters (Up to 6 weeks)

- More weekly mean anomalies (Wind at various levels, 500 hPa, sunshine duration)
- Weekly mean anomaly probabilities
- Updated twice a week: Monday/Thursday 22:00 UTC

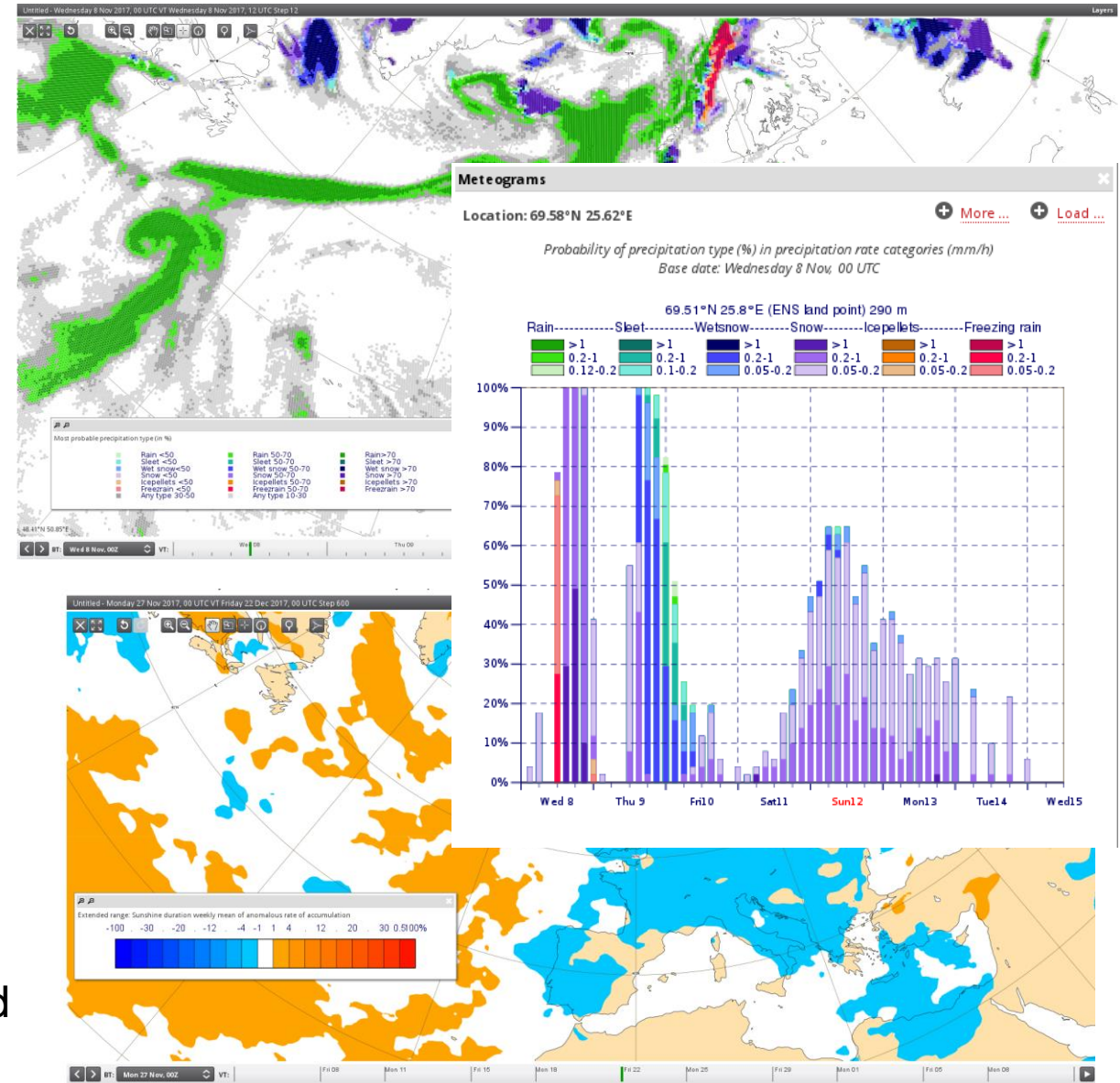
- ENS

- Most probable precipitation type
- Freezing rain probability
- Extra SOTs (CAPE, CAPES, MAXSWH)

- Meteograms

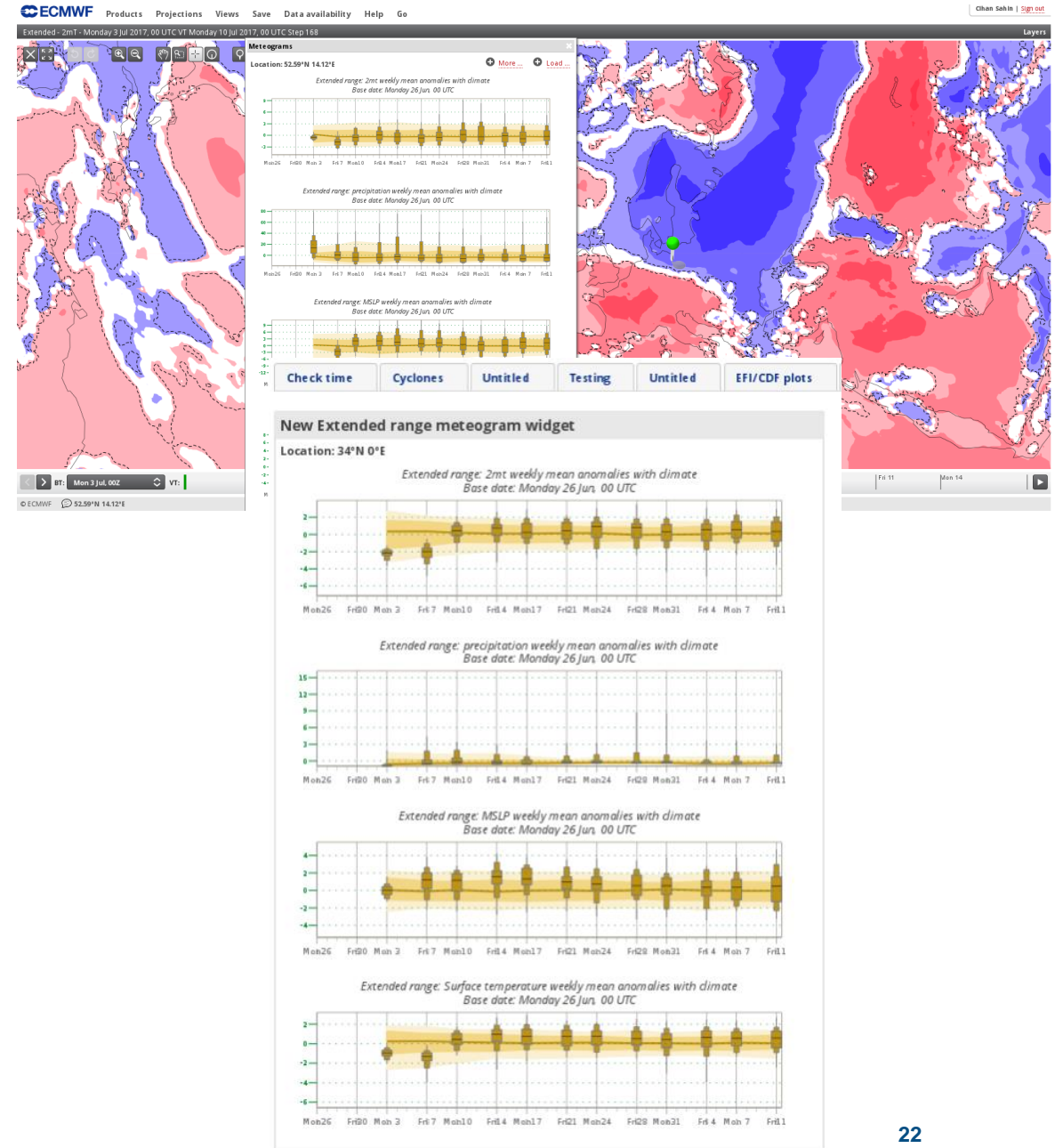
- Probability of precipitation type (%) in precipitation rate categories

<https://software.ecmwf.int/wiki/display/ECCHARTS/Updates>



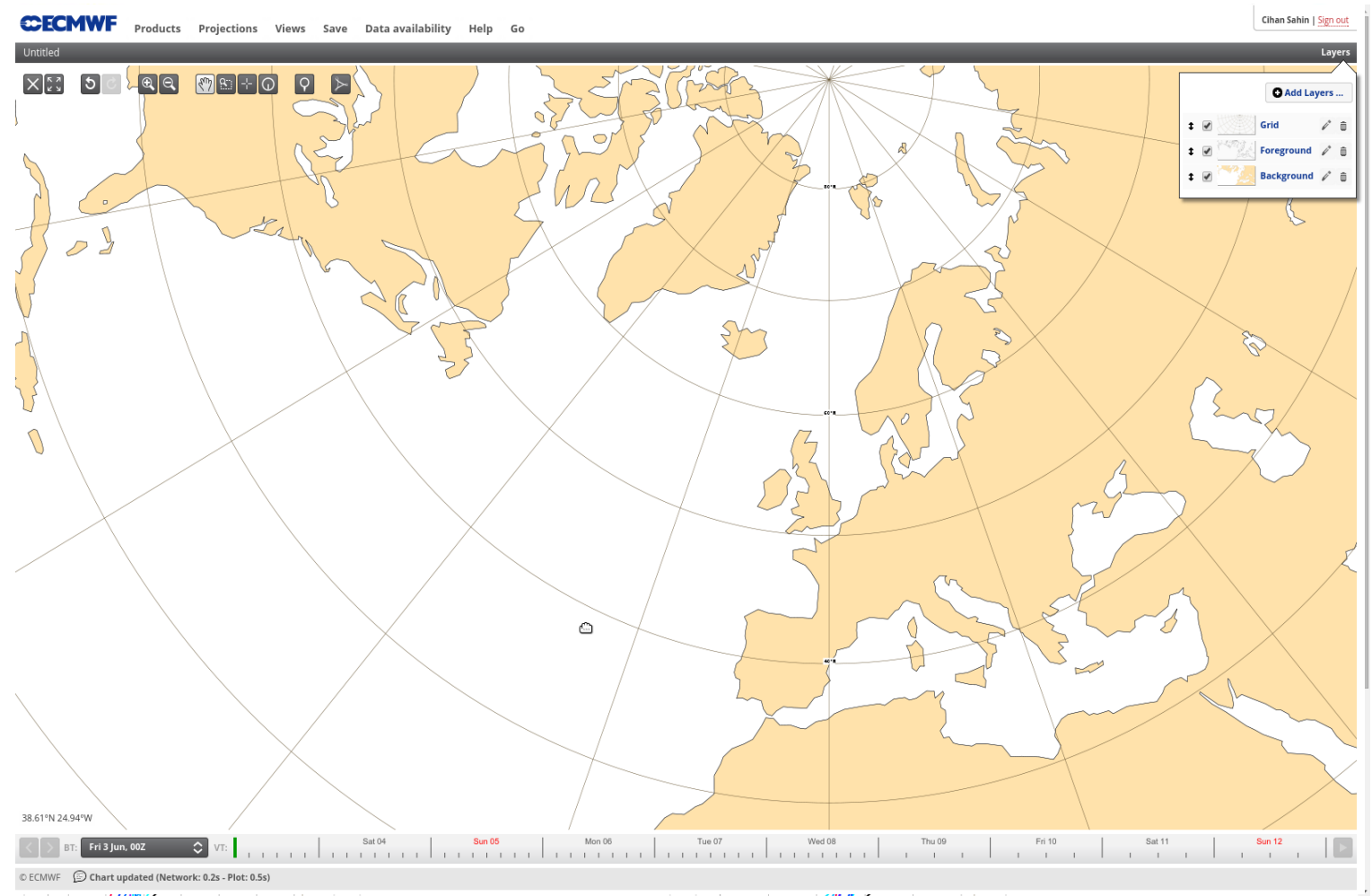
# Extended range meteograms

- Weekly mean anomalies from real-time forecast (box plot) with Climate distribution (background shading)
- Forecast: Percentiles of weekly mean anomalies of 51 ENS members
- Climate: 20-year re-forecast (20 \* 11 members = 220 samples) of weekly mean anomalies (Colour shading for percentiles)
- Parameters: 2m T, surface temperature, precipitation, mean sea level pressure
- Box plot is positioned on valid-time (Actually valid for a past week)



# Use case: Make your own products

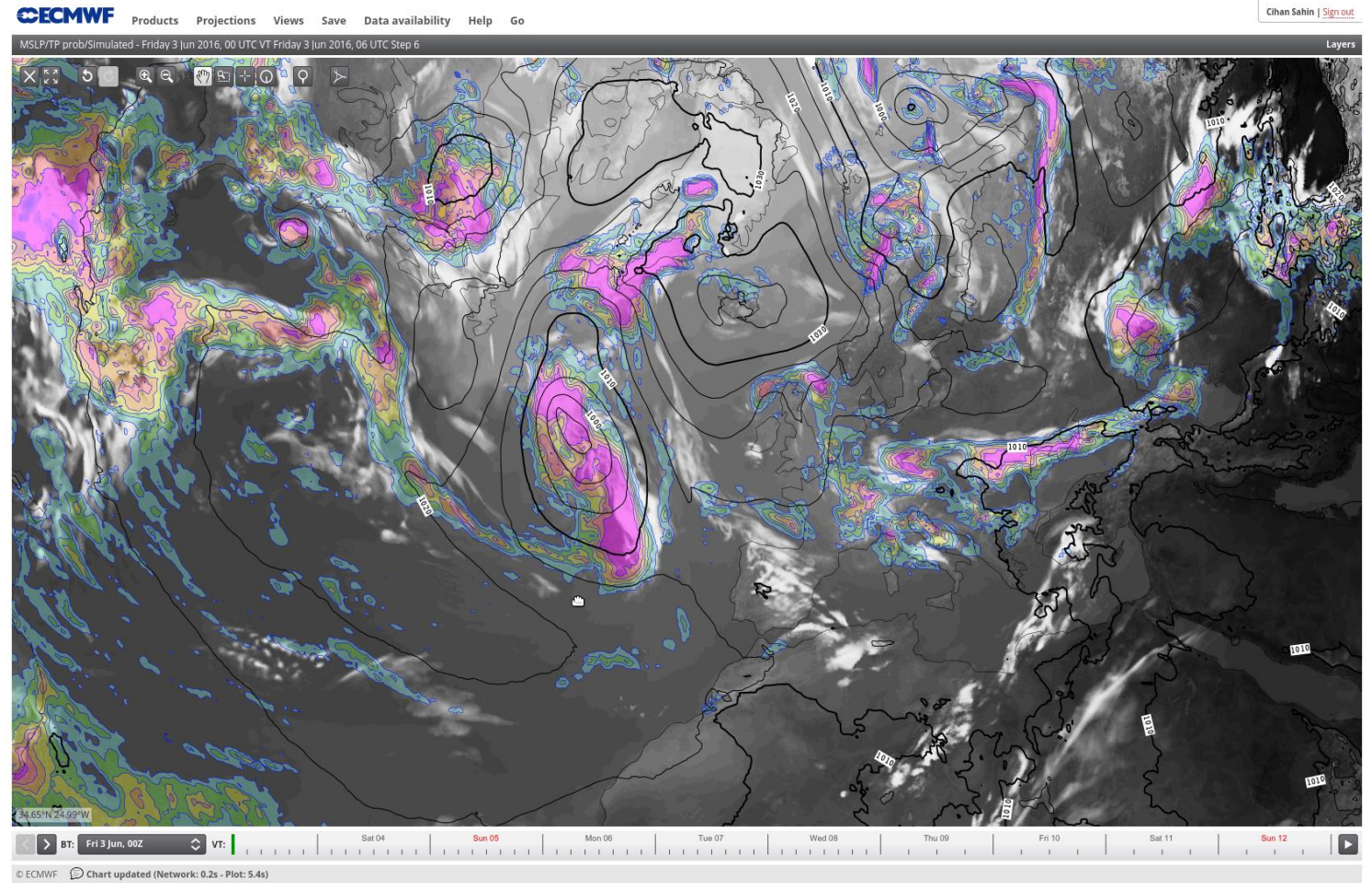
- Design your product
- Save as your own product
- Display in your Dashboard





# Use case: Explore data

- Display your product
- Probe data values
- Generate time series
- Display meteograms



## Update procedure

- Product updates are done twice a year June and November.
- Requests are collected via meetings, requests coming to ECMWF documentation pages, e-mails, Training courses ...
- ecCharts will contain only parameters that are in [The Catalogue of ECMWF Real-Time Products](#)
- Full information available in ecCharts documentation pages.

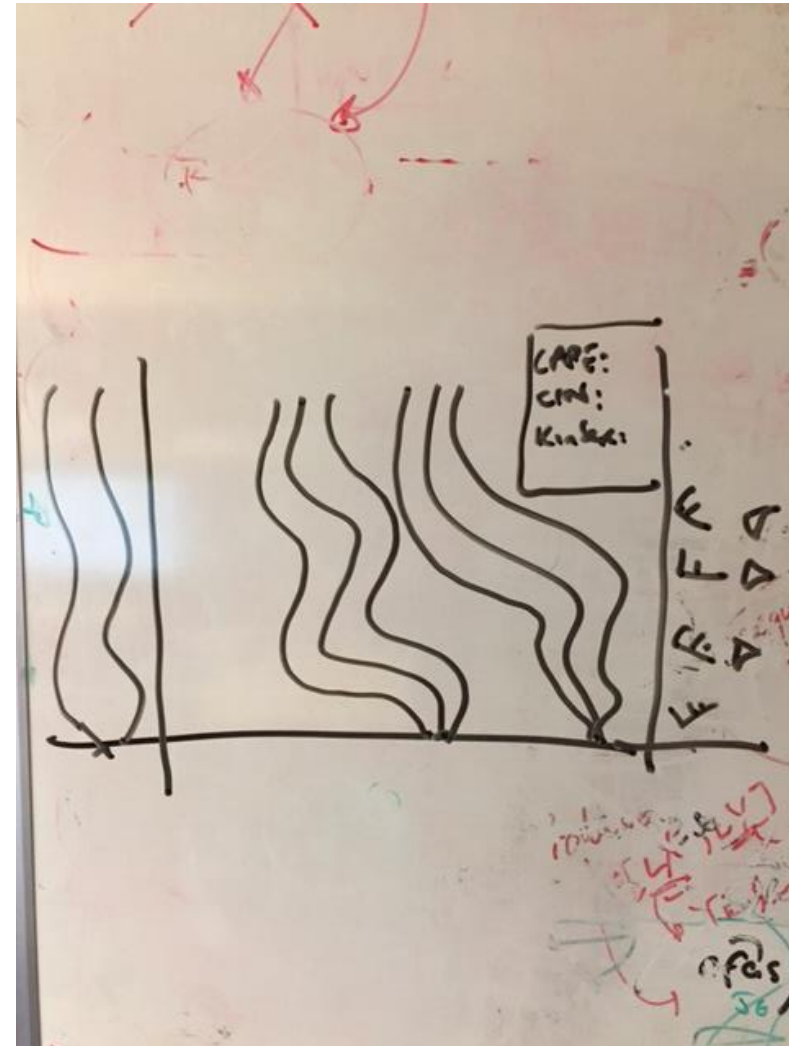
You can follow the updates here;

<https://software.ecmwf.int/wiki/display/ECCHARTS/Updates>

Please contact us if you wish to see additional parameters in ecCharts.

## Next update

- Vertical profiles in progress ...
  - ENS percentiles and HRES similar to Meteograms but a plot per step.
  - Temperature (T, Tdew-point, Tdepression)
  - Wind speed, wind direction
  - Indices (Cape, Cape shear, Totalx, kx,cin ...)
  - Any feedback welcome
- Point rainfall
  - Probabilities
  - Percentiles(Fatima will demo ...)



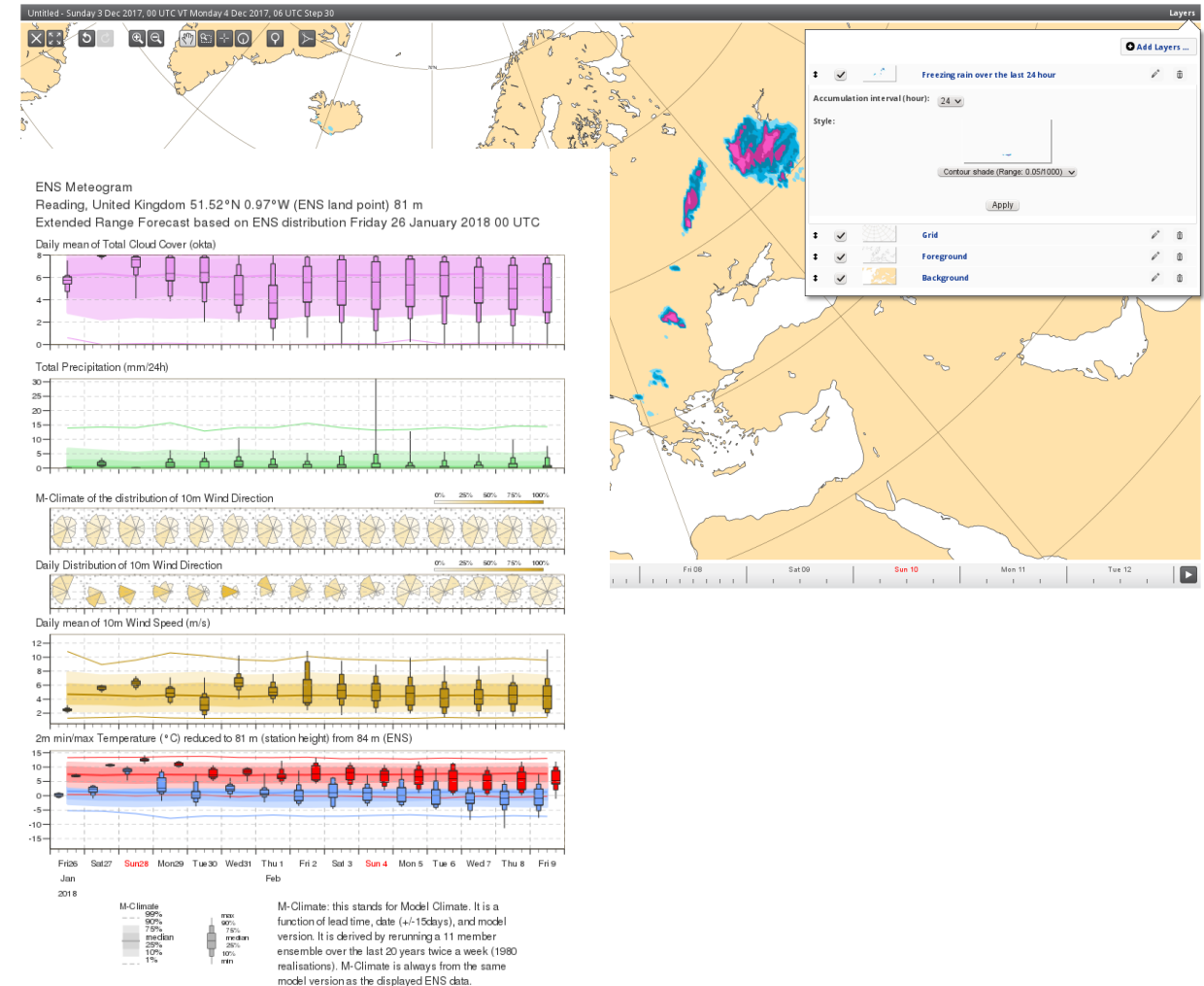


# To sum up ... ecCharts provides a complementary service

- Tries to help with non-trivial issues
  - Highly available service
  - Native resolution, global fields
  - Immediate availability
  - Utilizing Ensemble data
  - User oriented, large set of products
  - Complied with standards (OGC, WMS ...)

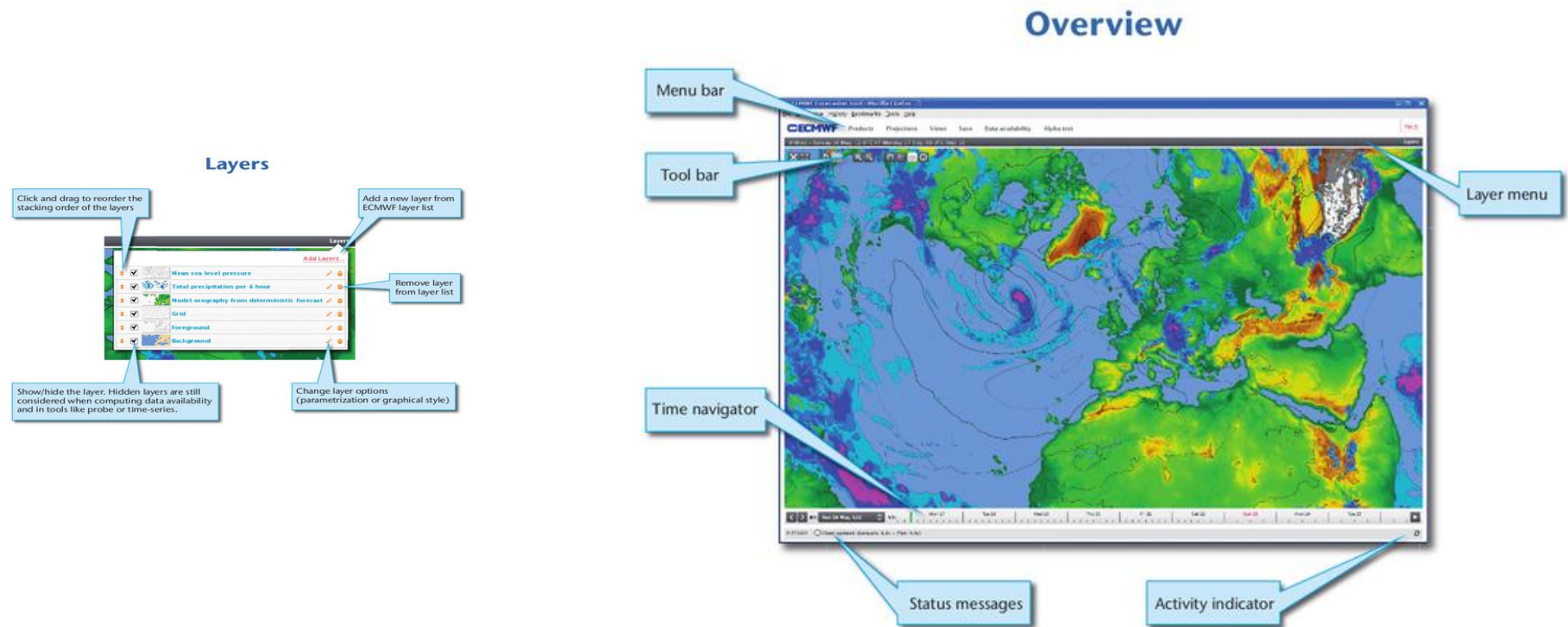
Cost ?

- Speed may be an issue



# Practicals

## Please follow hands-on practicals



Do not forget! There is a demo of precipitation type probability and point-rainfall layers after this.