

ECMWF Meteorological Forecast

Medium Range predictions of extreme events

Paul Smith

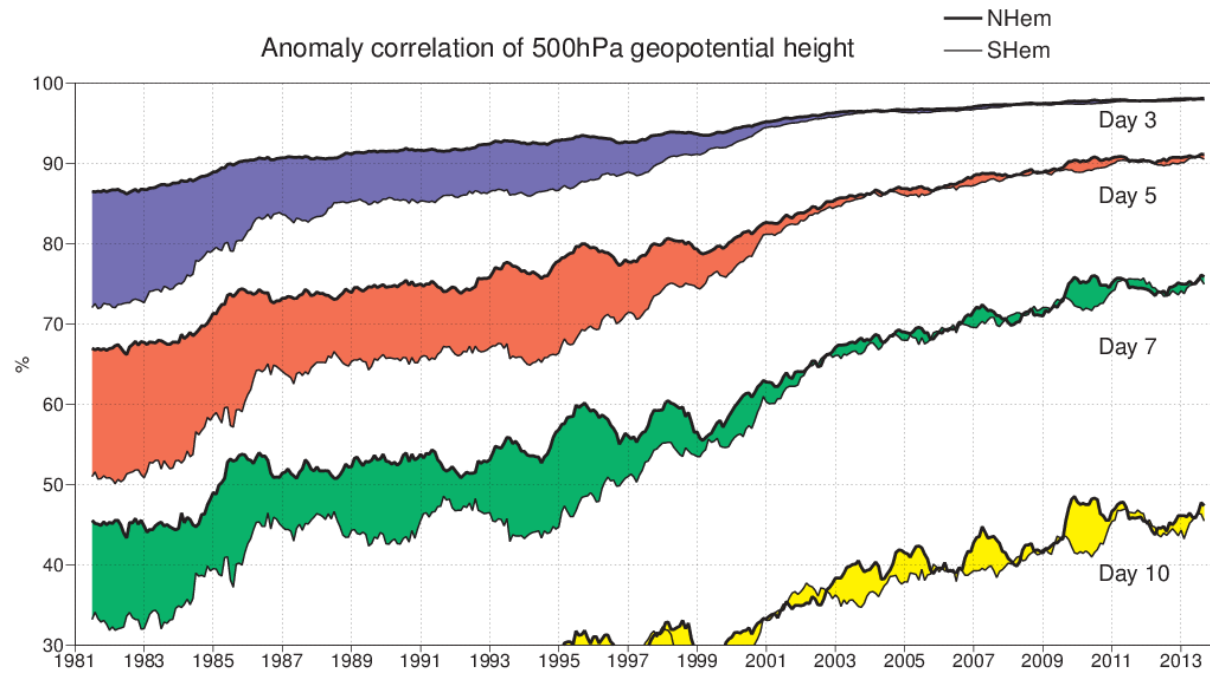
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ECMWF operational forecasting system

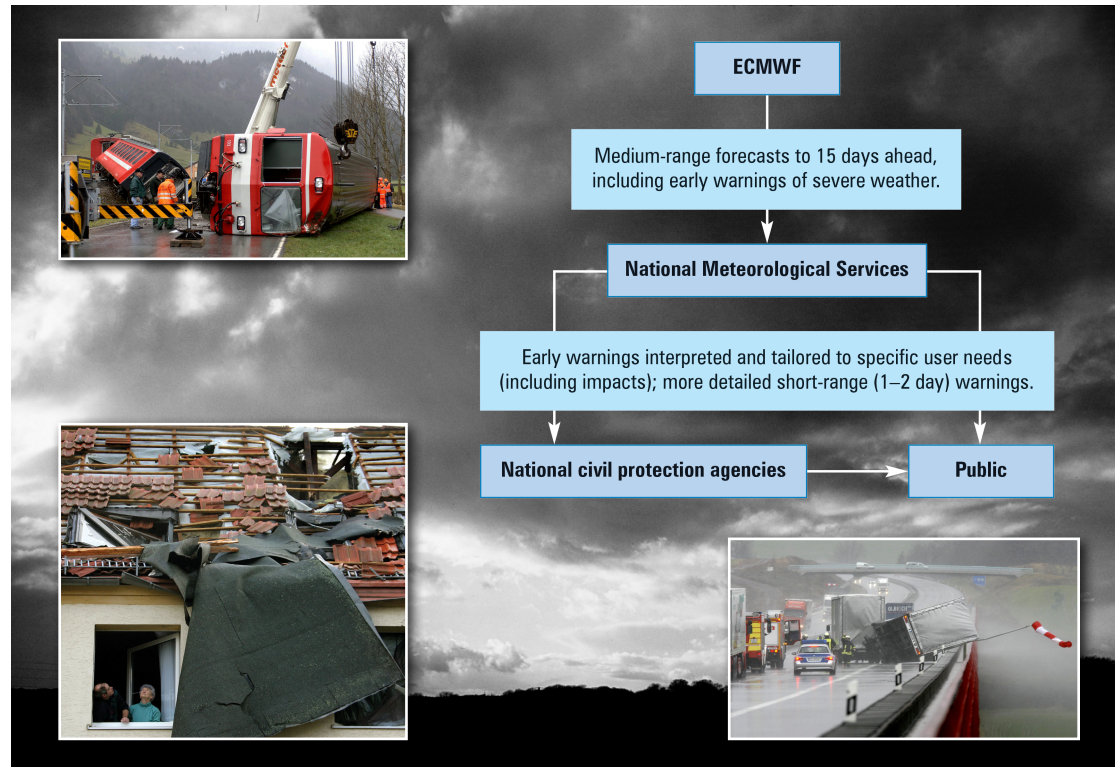
- High resolution deterministic forecast (HRES):
 - twice a day ~9 km, 137-level, to 10 days ahead
- Ensemble forecast (ENS):
 - twice a day, ~18 km 91-level, to 15 days ahead
 - 50 perturbed members (account for initial and model uncertainties)
 - Monday/Thursday 00 UTC extended to 46 days ahead (~36km)
- Ocean waves: twice a day
 - Global: 10 days ahead at 14 km (fully coupled)
 - Global: 10 days ahead at 11 km
 - Ensemble: 15 days ahead at 28 km (then 55km for 46 days)
- Seasonal forecast: once a month
 - 51 members, 80 km 91 levels, to 7 months ahead

Increasingly skillful forecasts

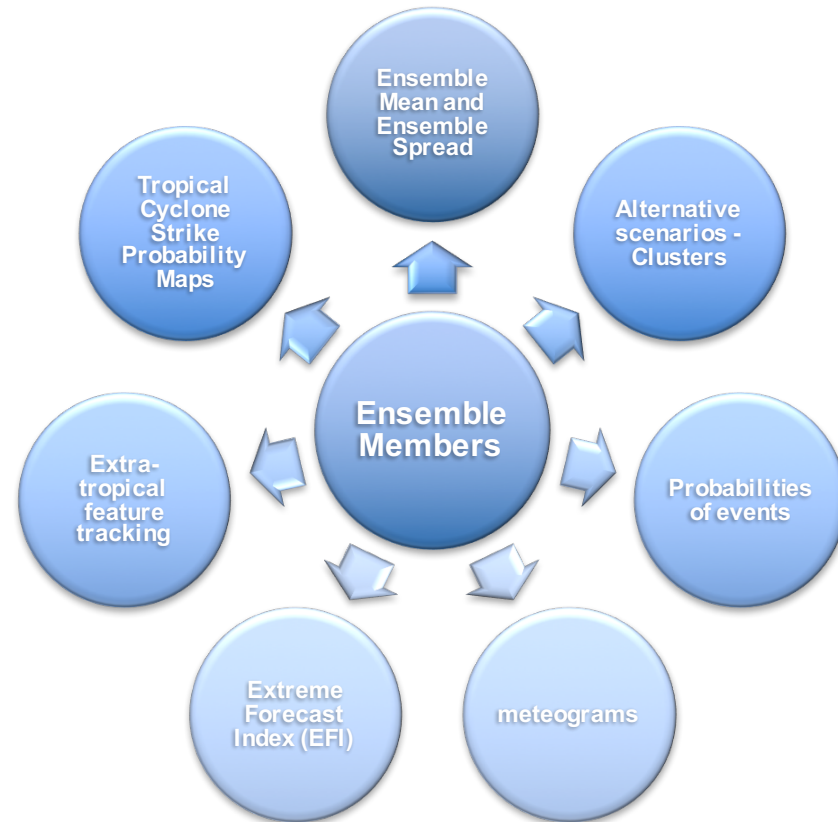


Forecast Products

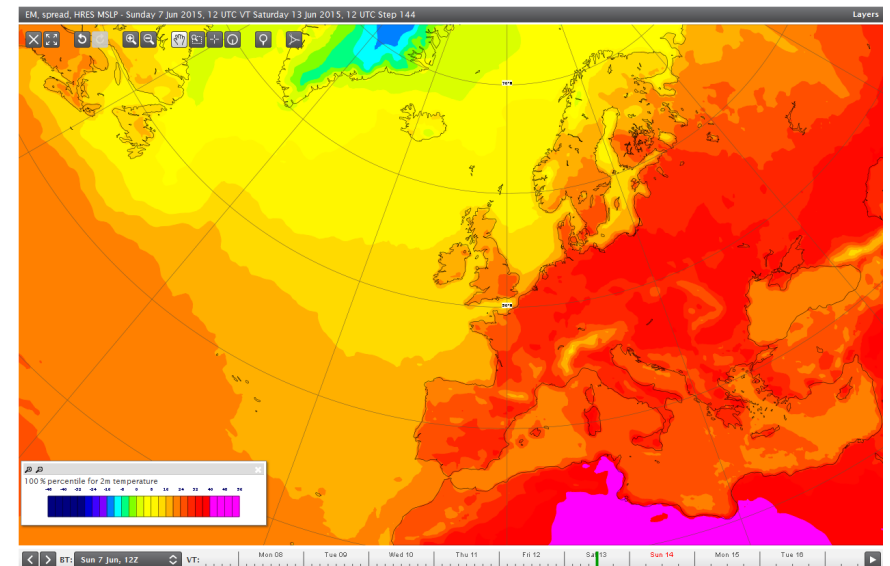
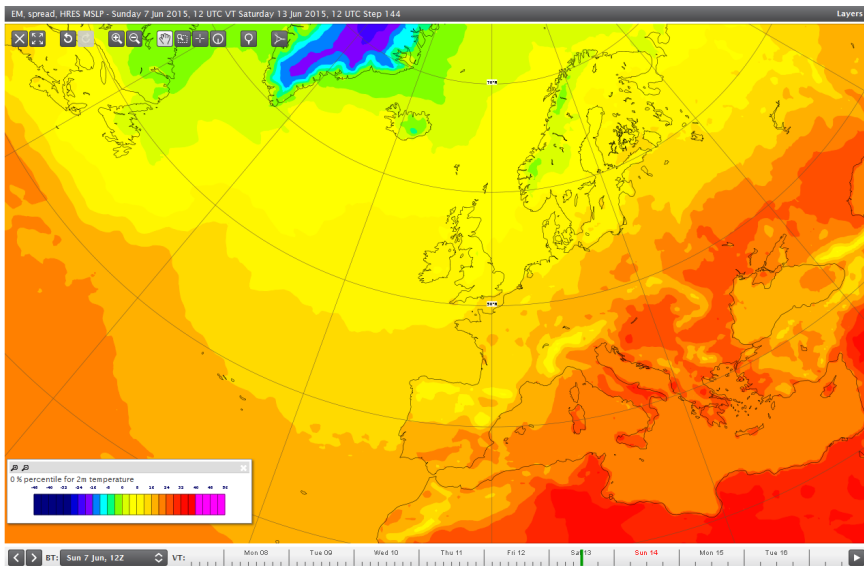
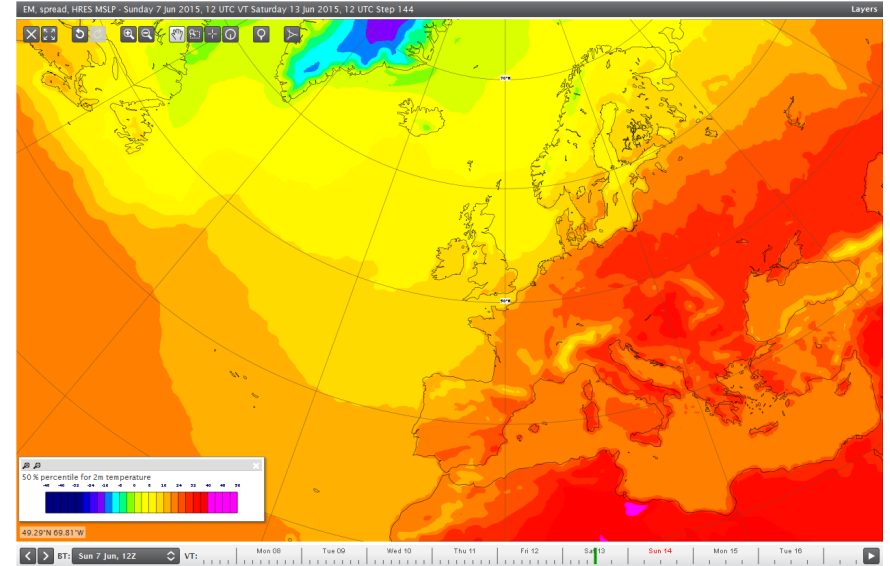
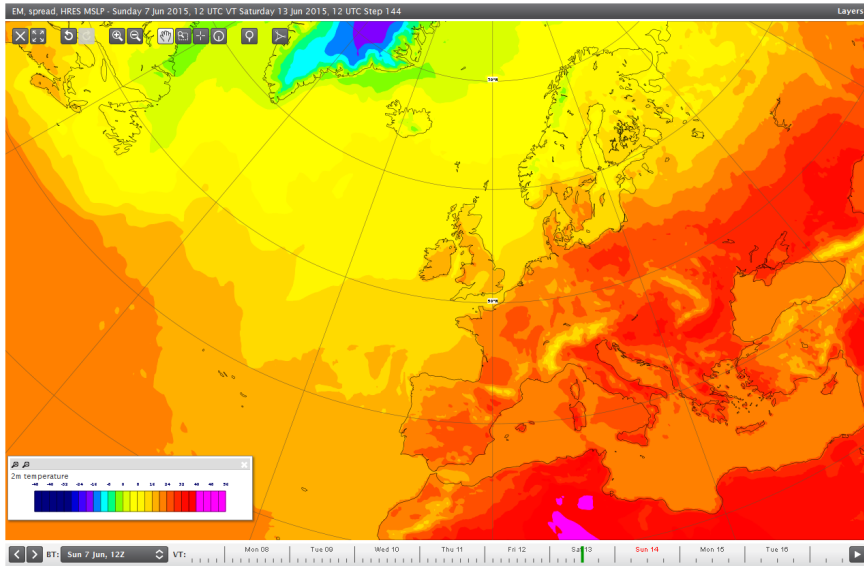
- To assist forecasters
- Summarise information in HRES and ENS
- Represent uncertainty
- Broad-scale evolution out to 15 days, month, season
- Highlight potential for severe weather few days ahead
- Allow you to generate tailored products for specific applications



Ensemble products



Quantiles as maps (ecCharts)



ATHER FORECASTS

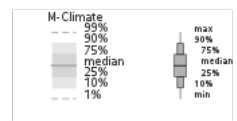
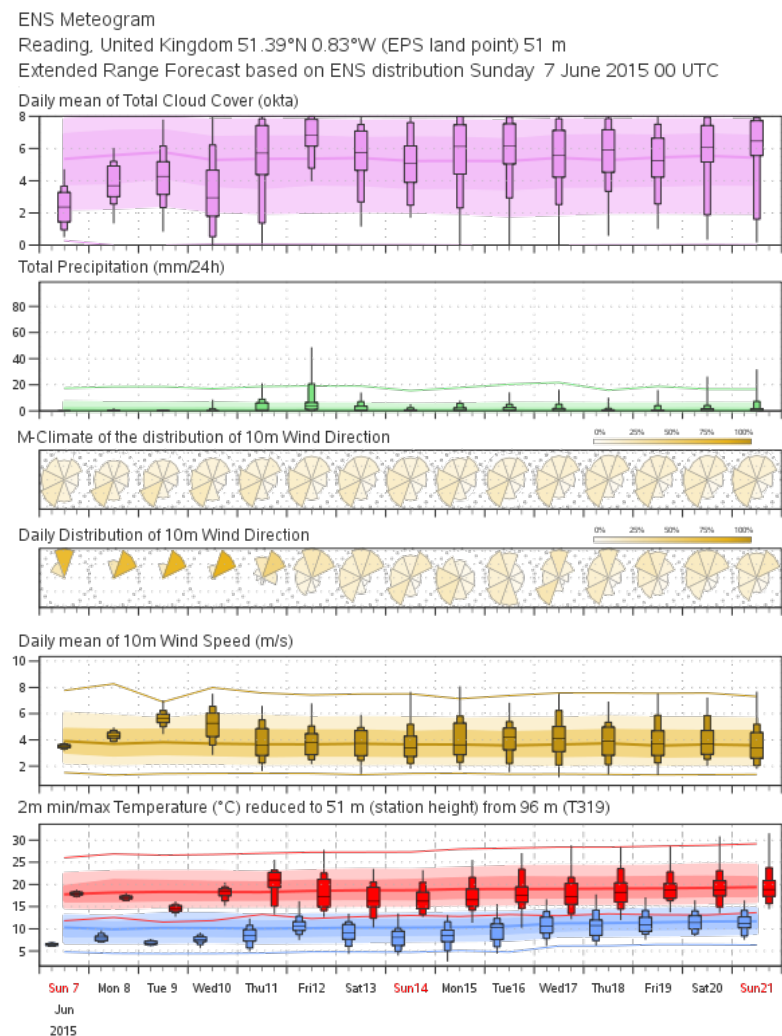
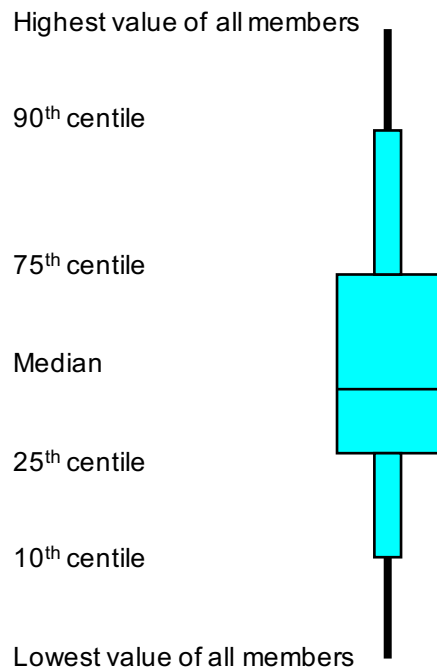
Point forecasts: timeseries (meteogram)

15-day meteogram

Summary of ENS members

Complement to the 10-day meteogram

Fields for days 1-10 interpolated to day 10-15 grid



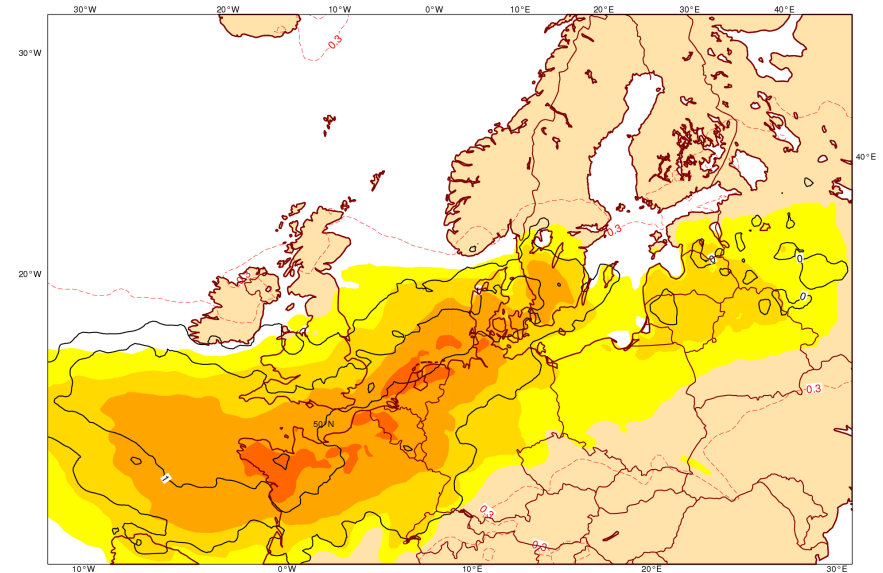
M-Climate: this stands for Model Climate. It is a function of lead time, date (+/-15days), and model version. It is derived by rerunning a 11 member ensemble over the last 20 years twice a week (1980 realisations). M-Climate is always from the same model version as the displayed ENS data.

Extreme forecast index (EFI)

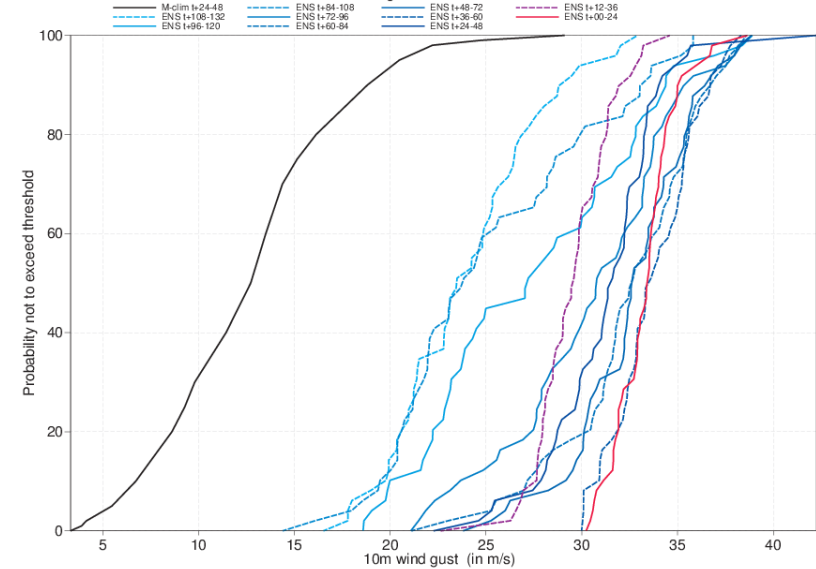
Measures the distance between the ENS cumulative distribution and the model climate distribution

Ranges from -1 (all members break climate minimum records) to $+1$ (all beyond model climate records)

Indicates places where the ENS distribution is towards the extreme of the climate distribution

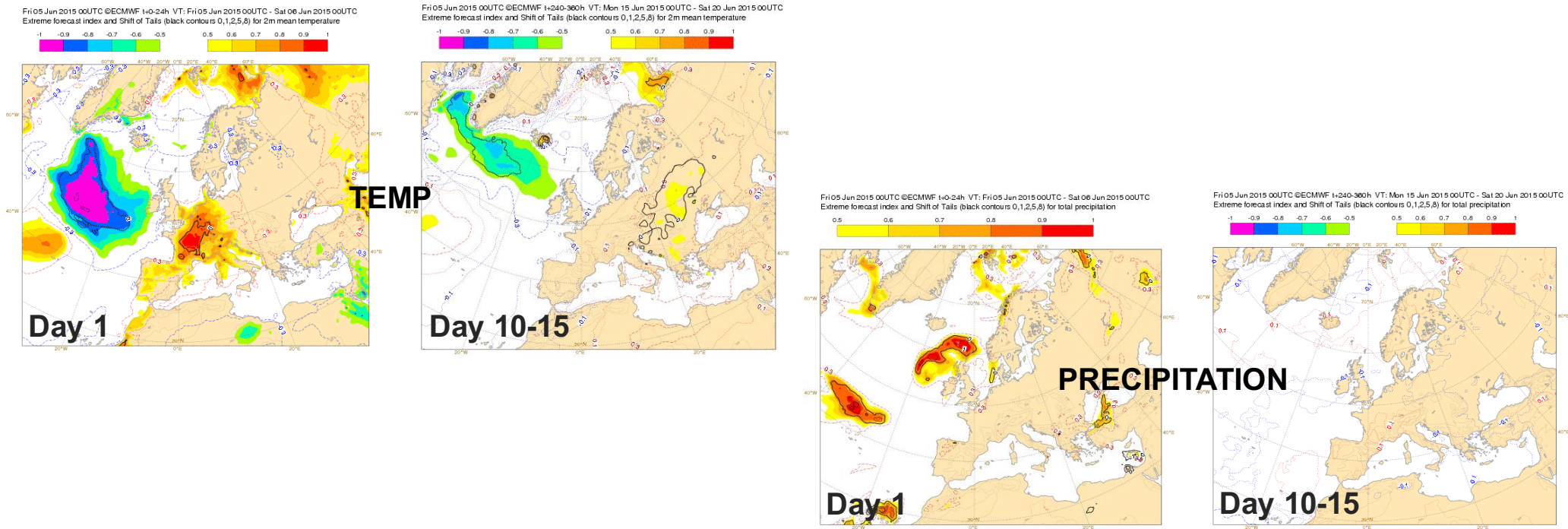


Cumulative Distribution Functions for 10m wind gust at 52.41°/4.89° VT: 28/10/2013 00UTC - 29/10/2013 00UTC



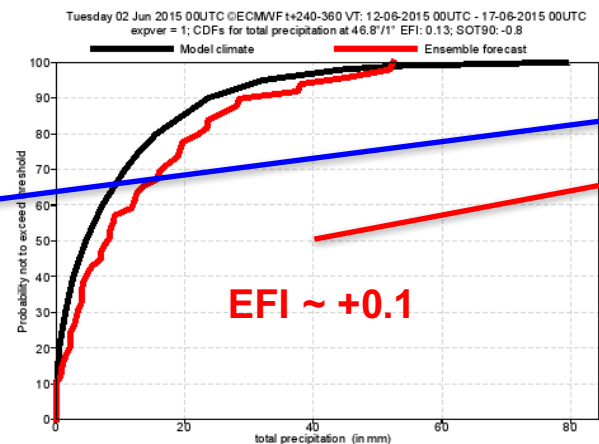
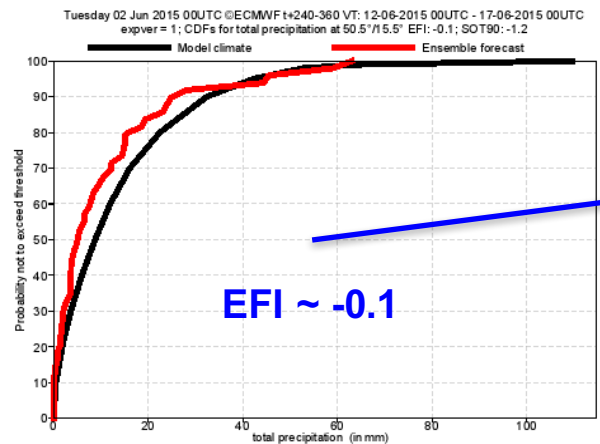
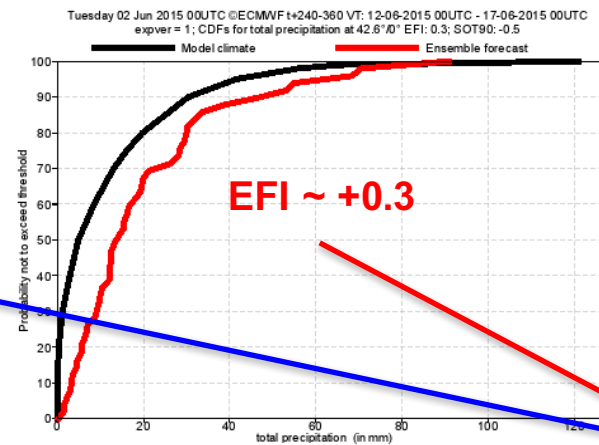
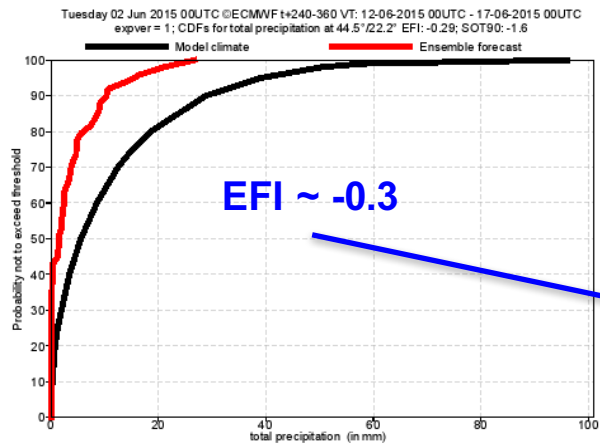
New Longer Range products for the EFI

- Because ensemble spreads increases with lead time, getting strong signals of extreme weather beyond day 10 is difficult and rare (example plots are shown below)
- Therefore EFI maps for Day 10-15 often look empty, especially for precipitation.
- Need to consider lower EFI values - we plot also contours for EFI values of +0.1 and -0.1

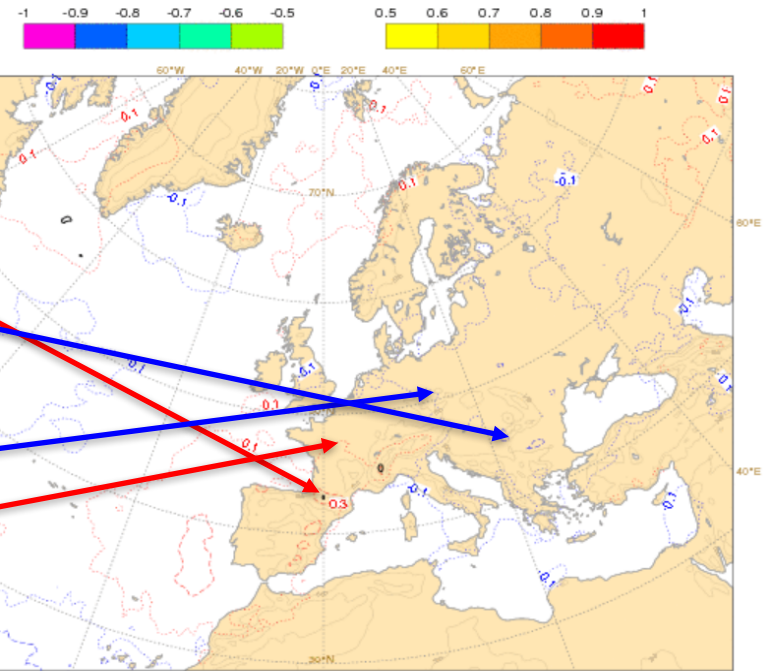


So how might small magnitude EFI values be interpreted?

Example cdf profiles for day 10-15 precipitation



Tue 02 Jun 2015 00UTC @ECMWF t+240-360h VT: Fri 12 Jun 2015 00UTC - Wed 17 Jun 2015 00UTC
Extreme forecast index and Shift of Tails (black contours 0,1,2,5,8) for total precipitation



The difference between forecast and M-Climate is statistically significant in all 4 examples

Various EFI values for extreme weather

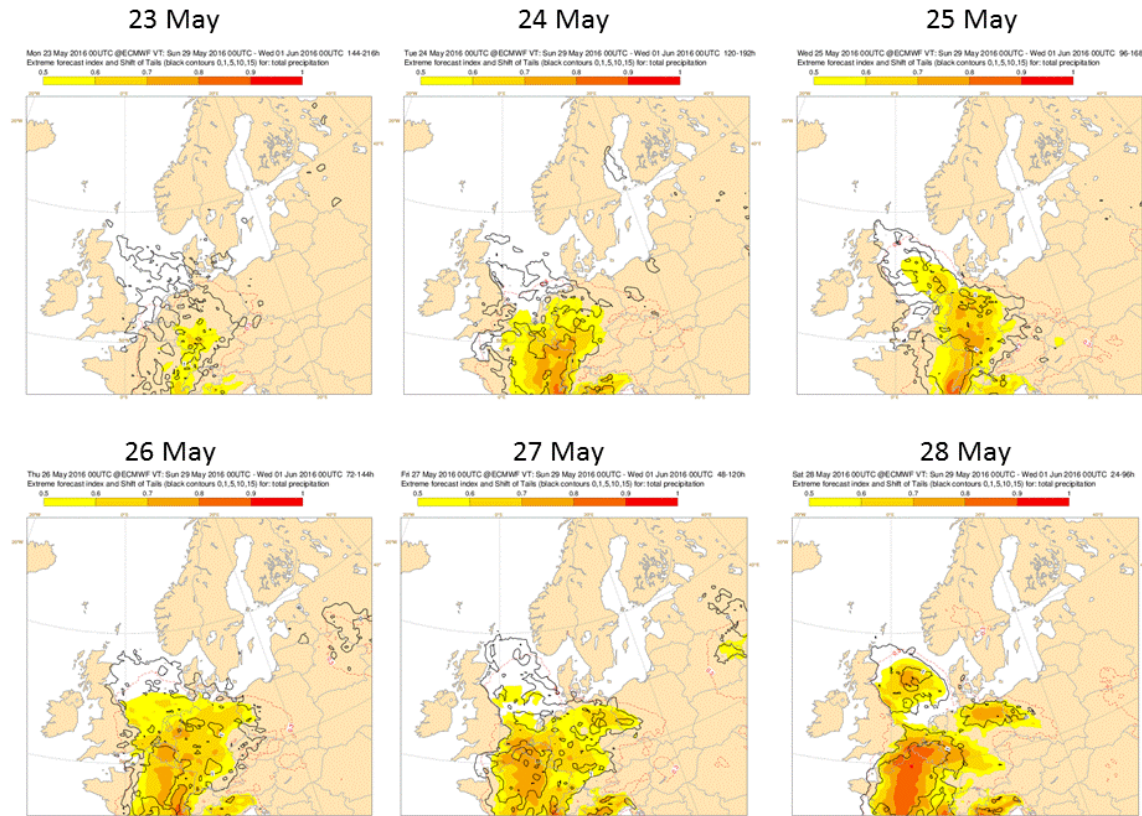
- 10 metre wind gust
- 10 metre wind speed
- 2 metre temperature
- Convective available potential energy
- Convective available potential energy shear
- Minimum temperature at 2 metres
- Maximum temperature at 2 metres
- Snowfall index (SFI) – accumulation
- Total precipitation index (TPI) – accumulation

Other variables we don't do EFI e.g.

- Precipitation type (including freezing rain)
- Visibility

Paris Flooding

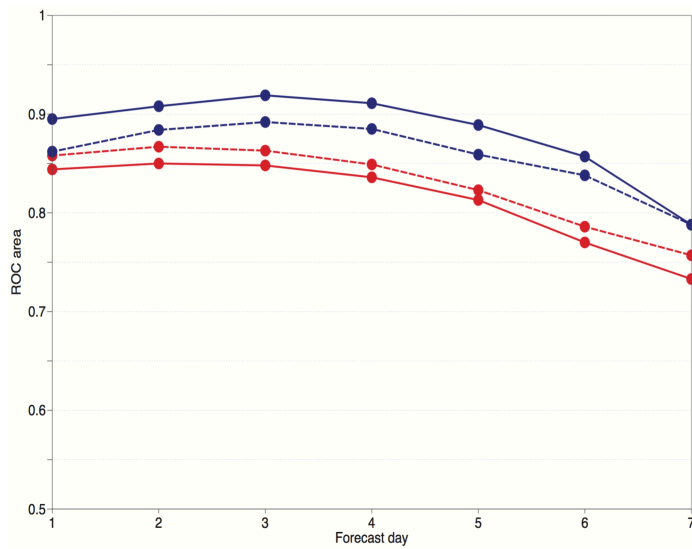
EFI and SOT for precipitation 29-31 May



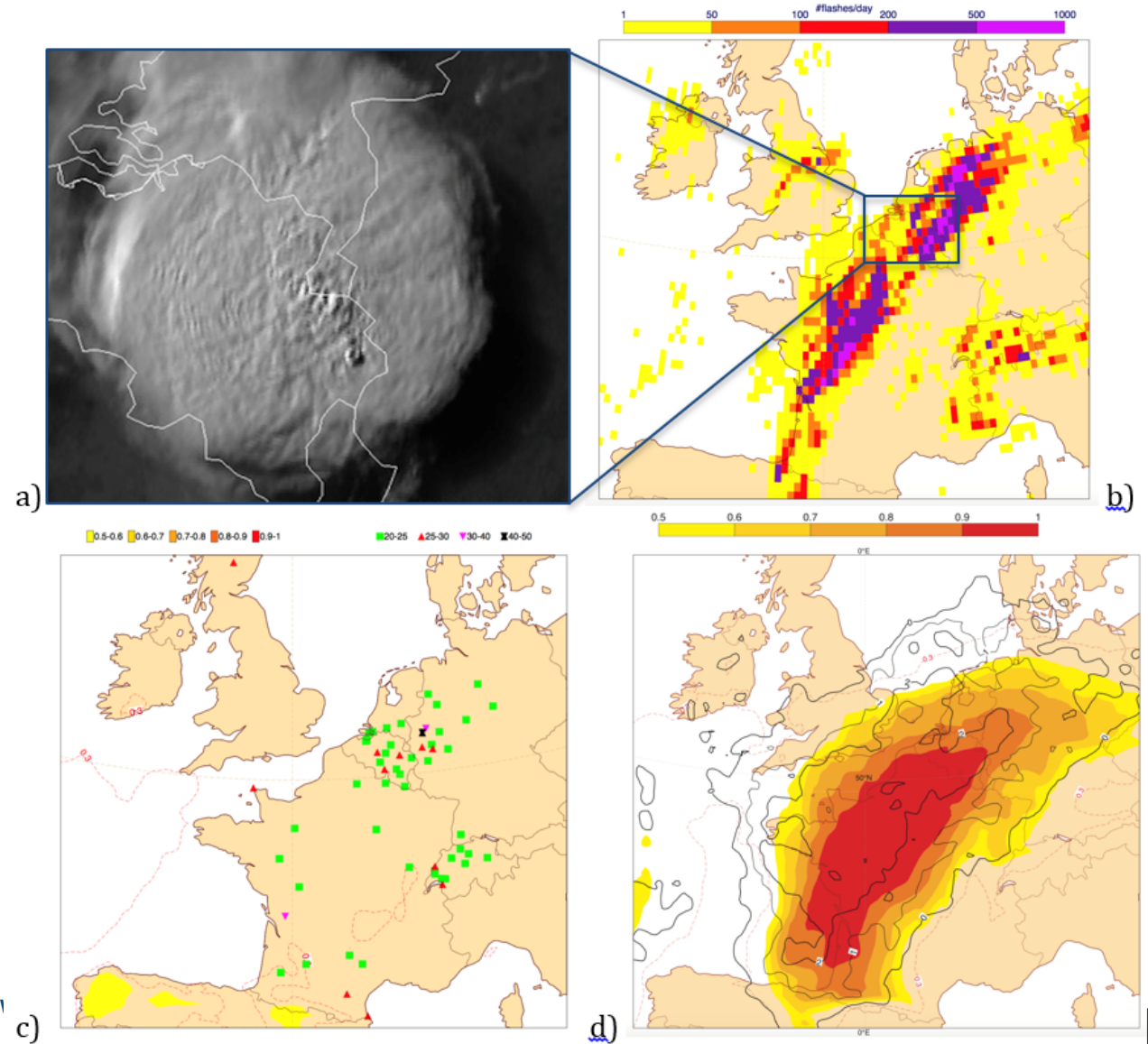
EFI for severe convection

Based on CAPE and shear

More details in Newsletter

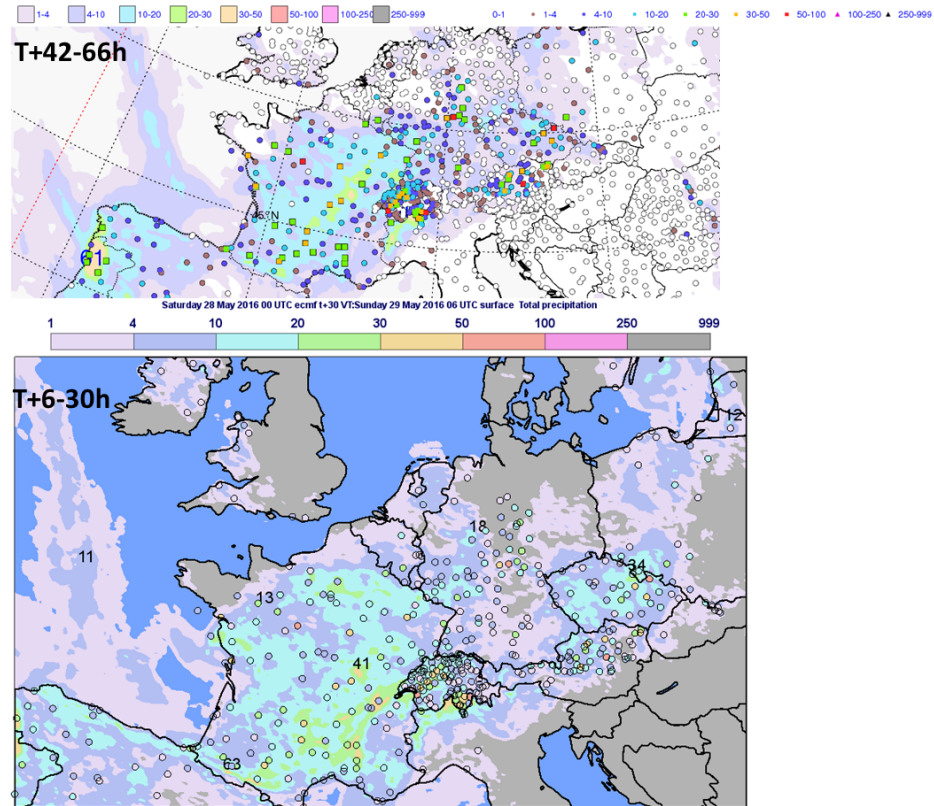


From Ivan Tsonevsky

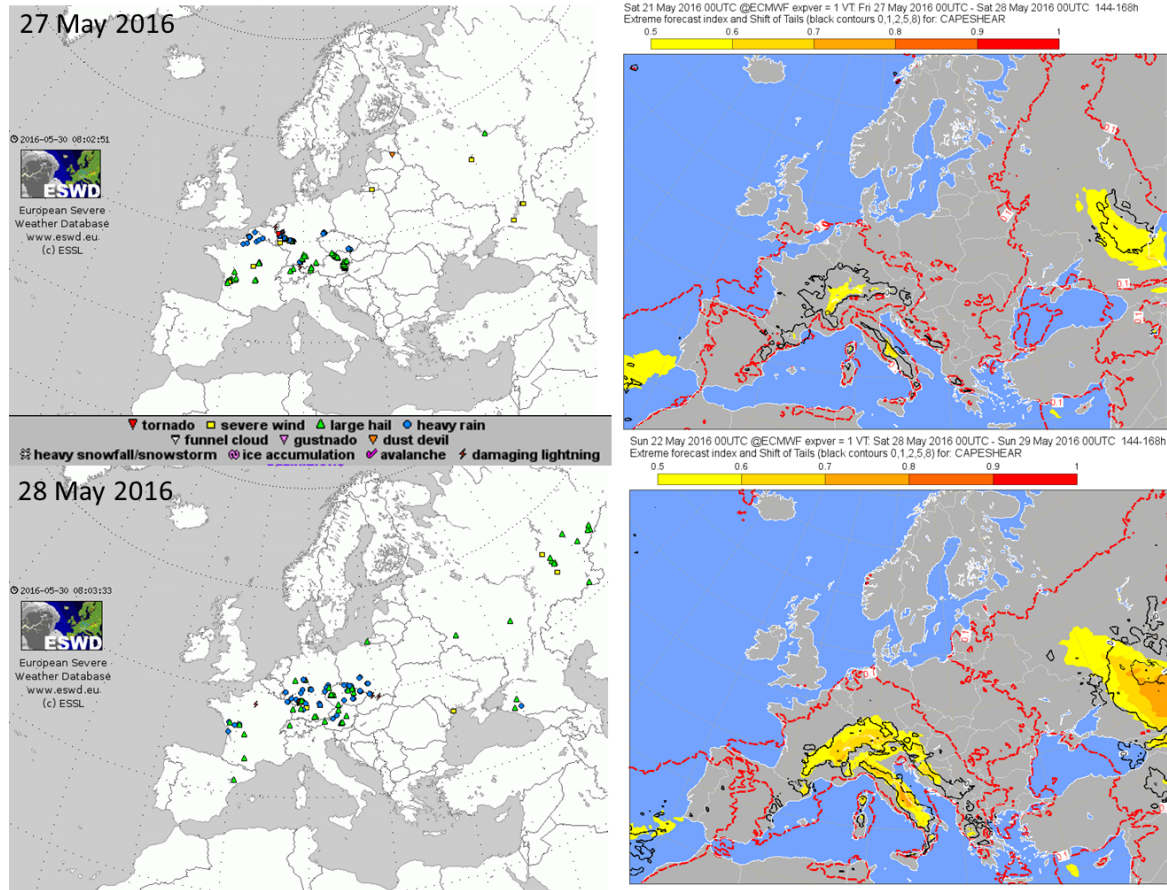


Convective Events over Europe

Total precipitation over 24 hours circles: observations
 FC:2016-05-26 12:00:00 RANGE: 42 - 66 VT: 2016-05-28 06:00:00 to 2016-05-29 06:00:00
 N=2308 BIAS= -2.9mm STDEV= 6.8mm MAE= 2.9mm
 errors for [north=75.00, west=-12.50, south=95.00, east=42.50]



Convective events of Europe



Summary

- Given a flavour of what ECMWF can offer
- Other products in development (see poster)
- Look forward to seeing what might of use for the case studies