

201902 - Heatwave - north-western Europe

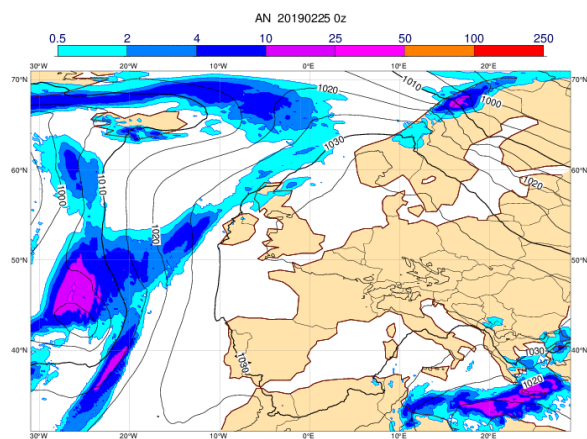
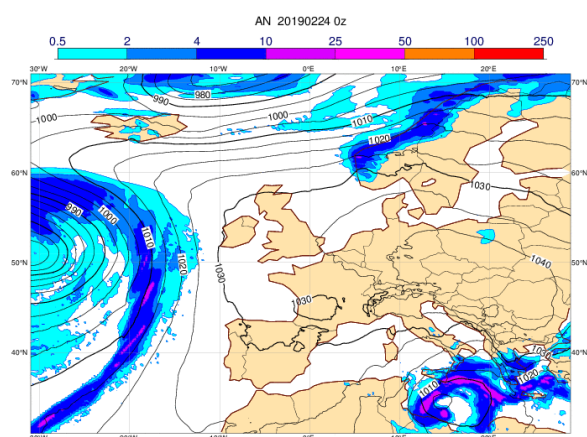
Status: Finalised Material from: Linus, David L., Jonny, Polly

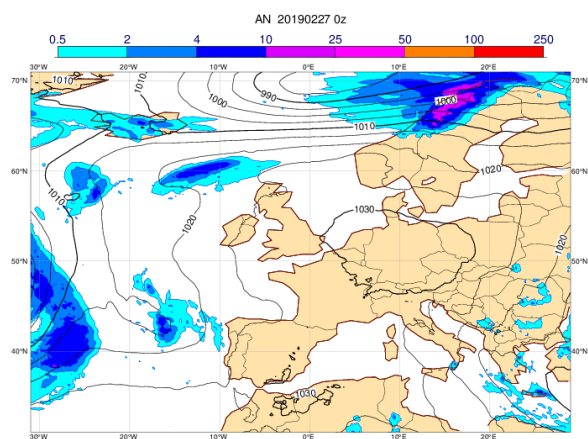
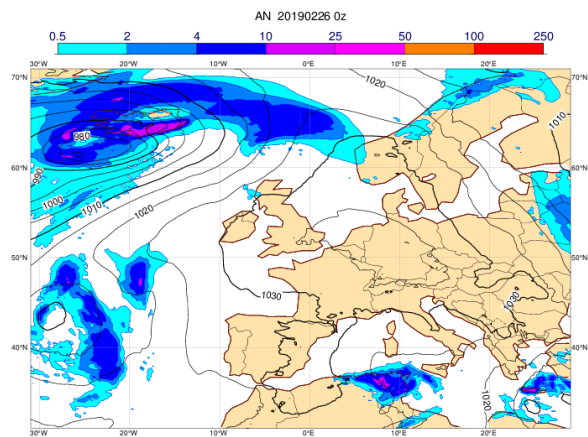
1. Impact

In the end of February north-western Europe experienced extreme daily maximum temperatures, and for the first time the temperature reached 20 degrees during a winter month in UK. Also in Sweden the February record was broken and possibly other countries as well. The hot period over UK lasted from 23 to 27 February. It is worth noting that the nights were cold with freezing temperatures in Reading.

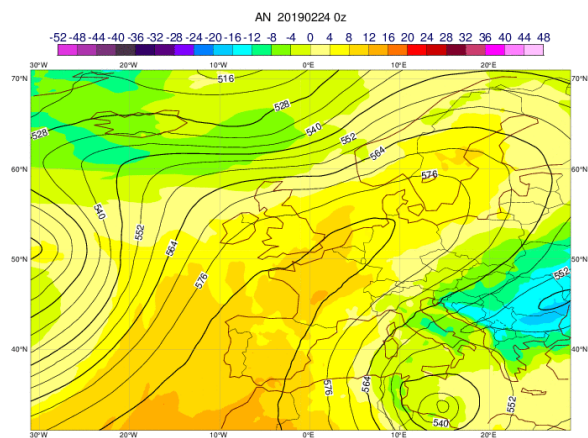
2. Description of the event

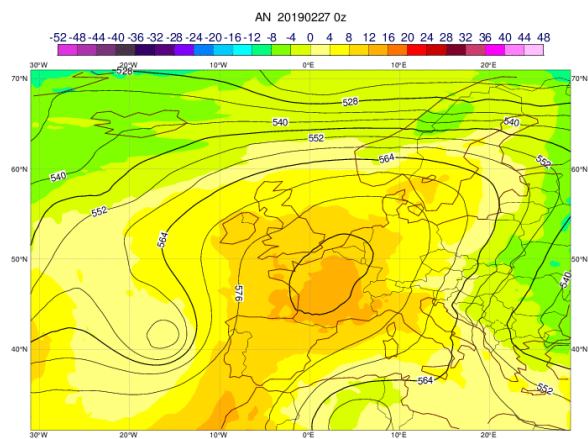
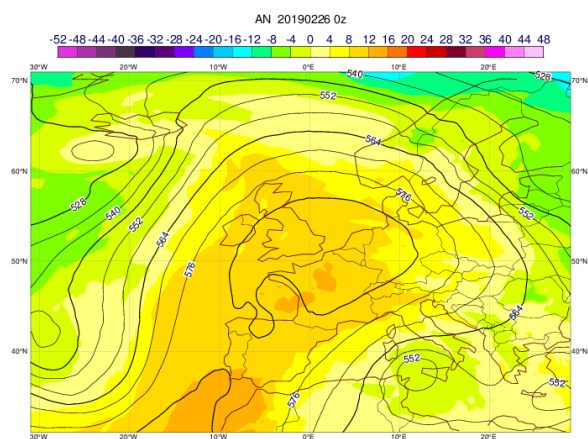
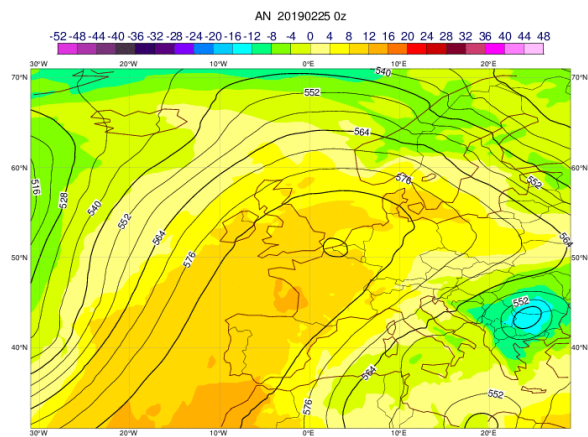
The plots below show MSLP and 6-hourly precipitation from 24 to 27 February (all 00UTC).



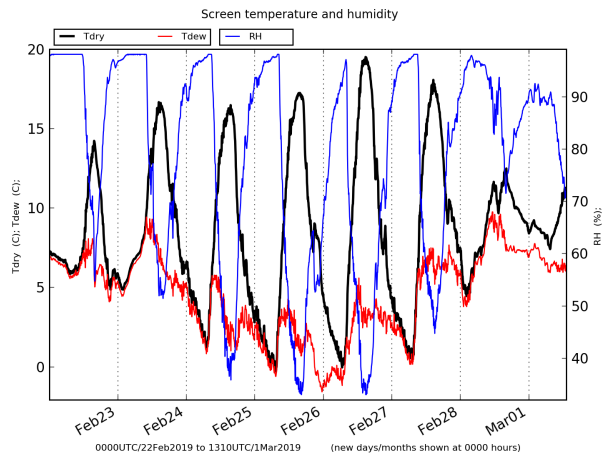


The plots below show z500 and t850 from 24 to 27 February (all 00UTC).





The plot below shows the time-series of 2-metre temperature from Reading University.

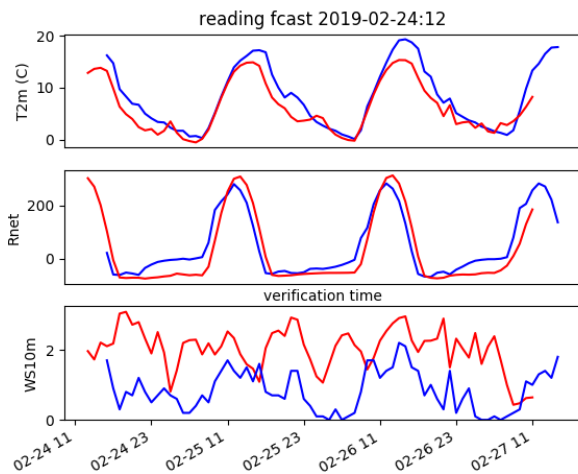


3. Predictability

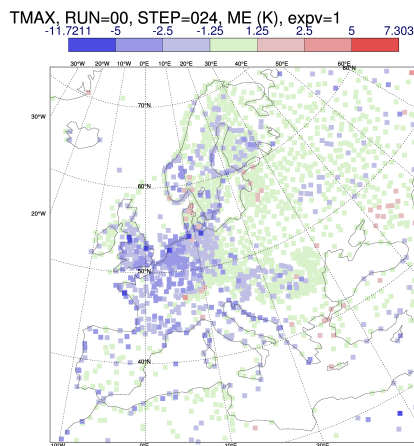
3.1 Data assimilation

3.2 HRES

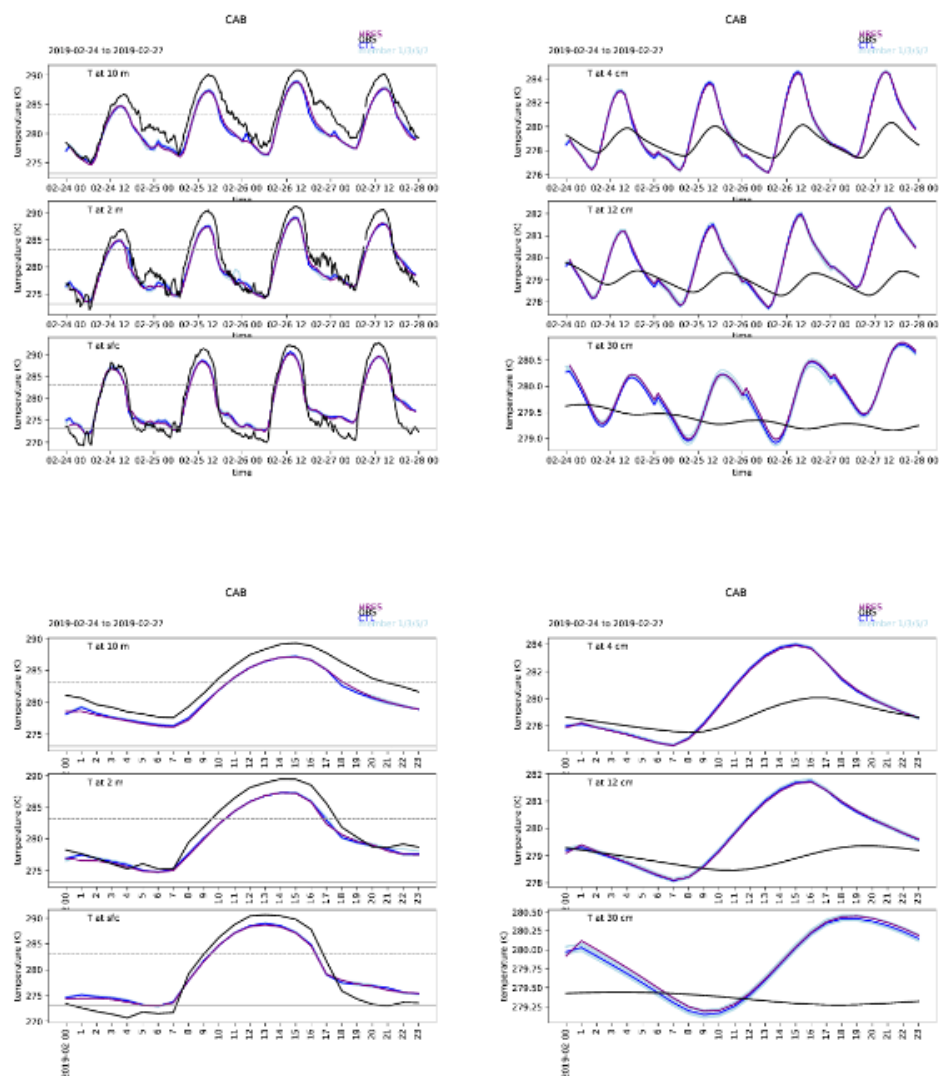
The plot below shows evaluation of 2-metre temperature, net radiation and 10-metre wind speed for forecasts (red) and observations (blue) for Reading University. The forecast clearly underestimated the daily maximum temperature and overestimated the wind speed.

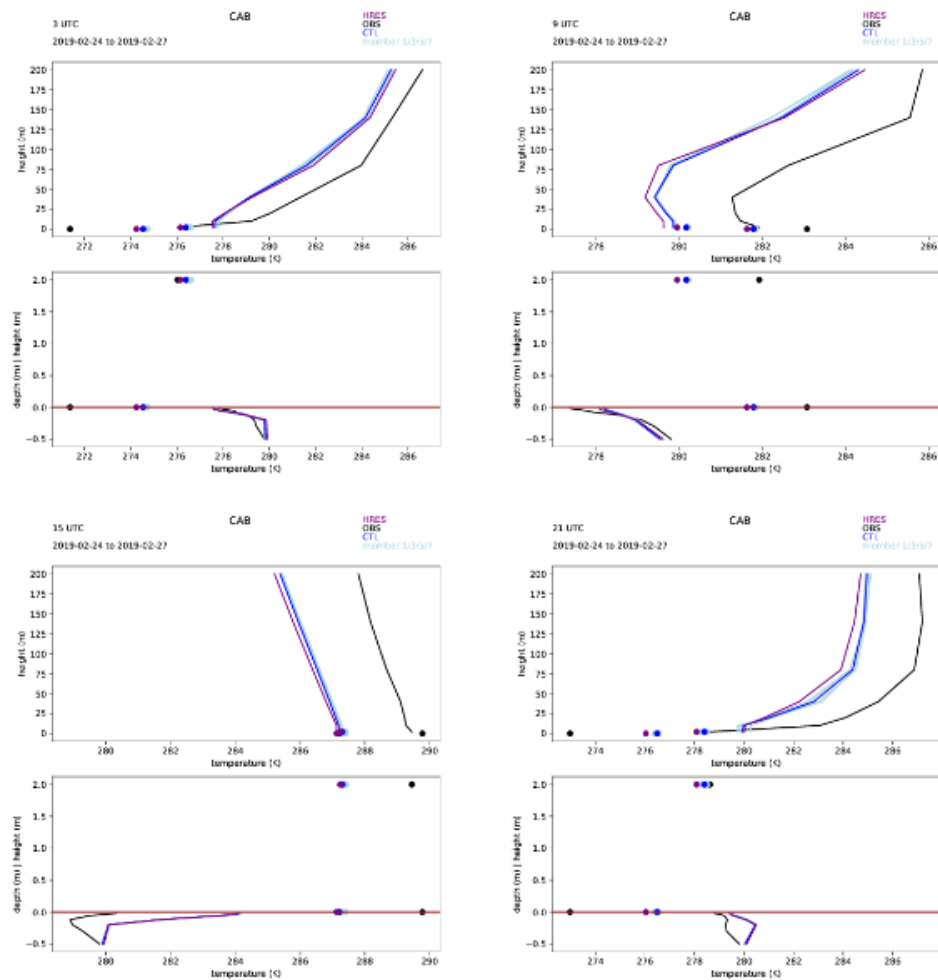


The plot below show mean error of daily maximum temperature for 24-27 February, in short-range HRES forecasts. The verification shows clearly the underestimation of the daily maximum temperature in north-western Europe.



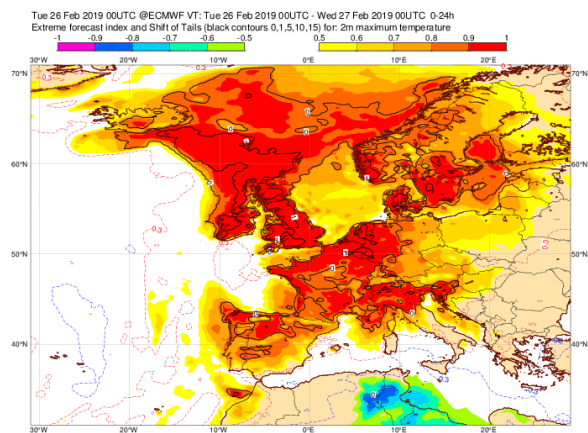
The plots below show verification of short-range forecasts for Cabauw (the Netherlands) on 24-27 February. The first plots below show time-series of air (left) and soil temperature (right) at different levels. The second row shows composites of diurnal cycle over the 4 days for air (left) and soil temperature (right) at different levels and the third row composites of vertical profiles at 03z, 09z, 15z and 21z. The atmospheric near-surface temperature was underestimated in the forecasts during the afternoons and somewhat high night-time. For the soil temperature we find the opposite pattern with too warm soil day-time and too cold night-time. One can also note that the forecasts were too cold at 200 metres level all times of the day.



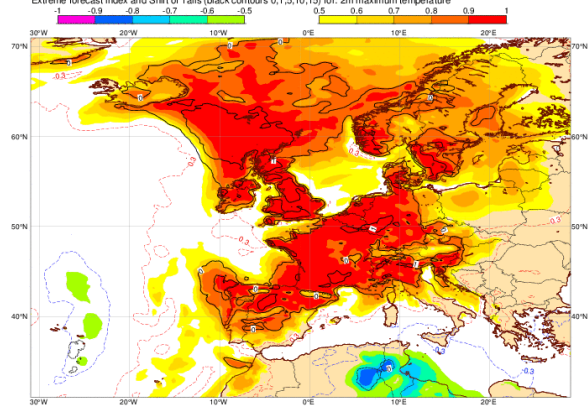


3.3 ENS

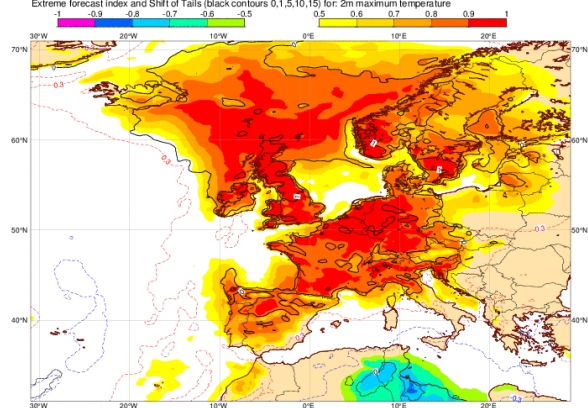
The plots below show EFI and SOT for the maximum temperature on 26 February from different initial times.



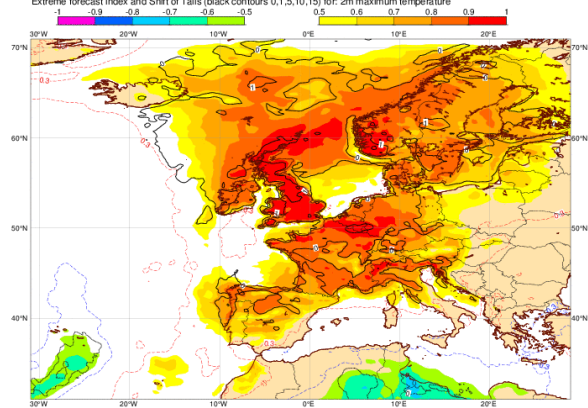
Mon 26 Feb 2019 00UTC @ECMWF VT: Tue 26 Feb 2019 00UTC - Wed 27 Feb 2019 00UTC 24-48h
Extreme forecast index and Shift of Tails (black contours 0,1,5,10,15) for: 2m maximum temperature

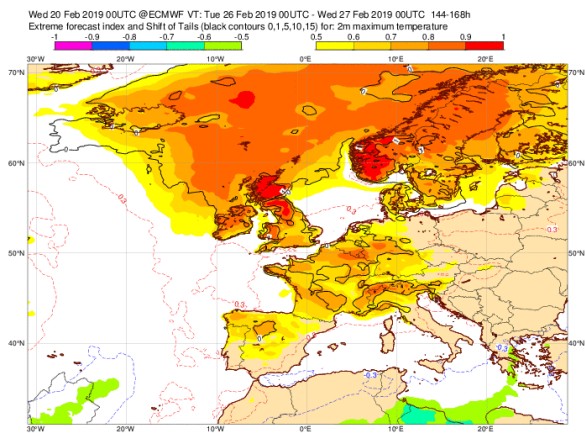
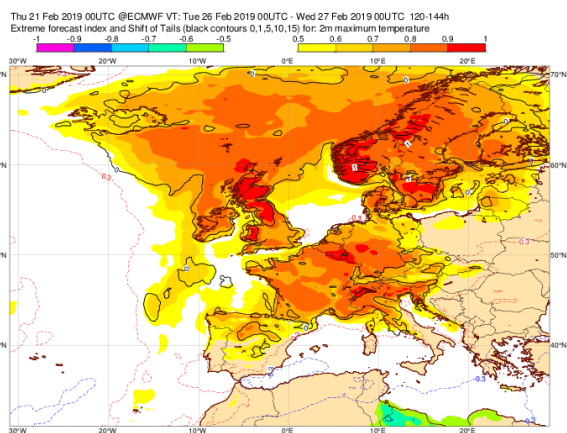
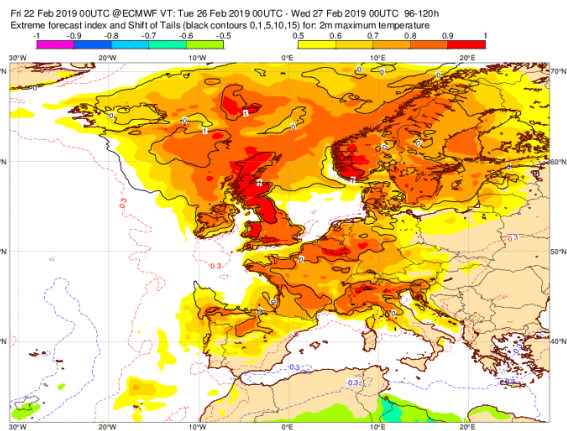


Sun 24 Feb 2019 00UTC @ECMWF VT: Tue 26 Feb 2019 00UTC - Wed 27 Feb 2019 00UTC 48-72h
Extreme forecast index and Shift of Tails (black contours 0,1,5,10,15) for: 2m maximum temperature

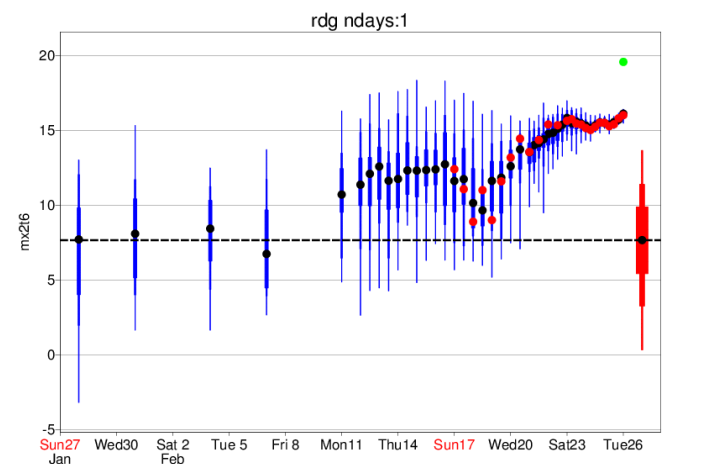
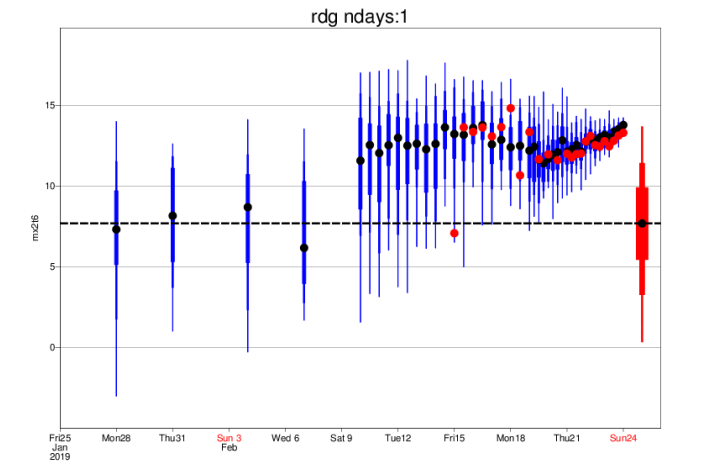


Sat 23 Feb 2019 00UTC @ECMWF VT: Tue 26 Feb 2019 00UTC - Wed 27 Feb 2019 00UTC 72-96h
Extreme forecast index and Shift of Tails (black contours 0,1,5,10,15) for: 2m maximum temperature

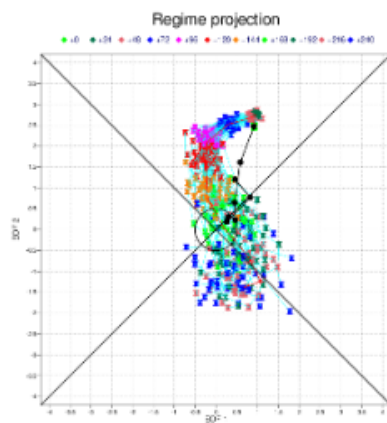
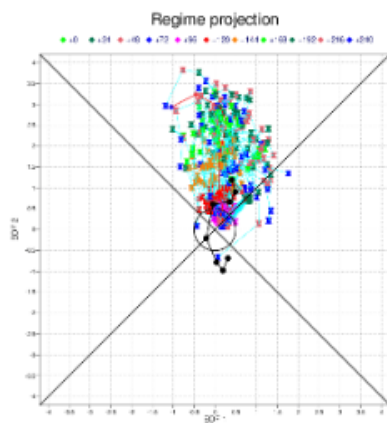




The plot below shows the evolution of forecast for 24-hour maximum temperature valid 24 (left) and 26 (right) February for Reading. The plot includes ensemble (blue box-and-whisker), HRES (red dot) and model climate (red box-and-whisker). The temperature on the 26 February reached 19.6 degrees (green dot). For both dates the warm signal was picked up at least 15 days before the event. Note that for 26 February the forecasts from 18-19 February were colder than before and after. The observed maximum temperature on 26 (and also on 24) was significantly higher than in the forecasts.

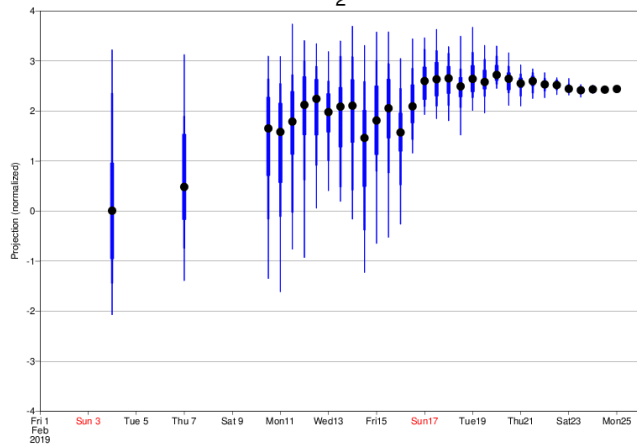


The plots below two regime forecasts from 15 February and 22 February. During the warm period a very strong ridge appeared over north-western Europe giving a strong projection on EOF2 (Blocking).



The plot below shows the evolution of ensemble forecasts for predicting the projection on the blocking pattern valid 25 February 00UTC. The likelihood of a strong ridge appeared at least 15 days before.

2



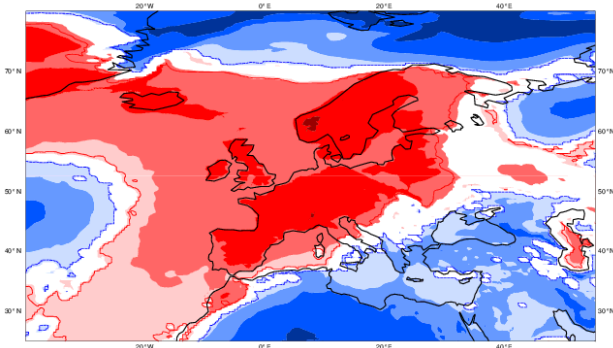
3.4 Monthly forecasts

The plots below show weekly anomalies of 2-metre temperature for 25 February - 3 March. The warm signal was picked up already in the forecast from 11 February.

ECMWF EPS-Monthly Forecasting System
2-meter Temperature anomaly
Forecast start reference is 25-02-2019
ensemble size = 51 , climate size = 660

Day 1-7
25-02-2019/TO/03-03-2019
Shaded areas significant at 10% level
Contours at 1% level

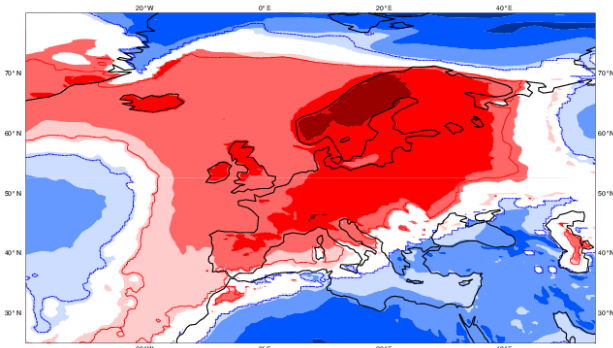
Legend for temperature anomalies (in degrees Celsius):
 <-10deg, -10..-6, -6..-3, -3..-1, -1..0, 0..1, 1..3, 3..6, 6..10, >10deg



ECMWF EPS-Monthly Forecasting System
2-meter Temperature anomaly
Forecast start reference is 21-02-2019
ensemble size = 51 , climate size = 660

Day 5-11
25-02-2019/TO/03-03-2019
Shaded areas significant at 10% level
Contours at 1% level

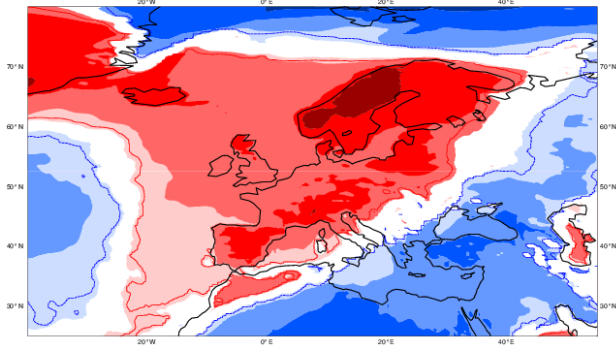
Legend for temperature anomalies (in degrees Celsius):
 <-10deg, -10..-6, -6..-3, -3..-1, -1..0, 0..1, 1..3, 3..6, 6..10, >10deg



ECMWF EPS-Monthly Forecasting System
2-meter Temperature anomaly
Forecast start reference is 18-02-2019
ensemble size = 51 , climate size = 660

Day 8-14
25-02-2019/TO/03-03-2019
Shaded areas significant at 10% level
Contours at 1% level

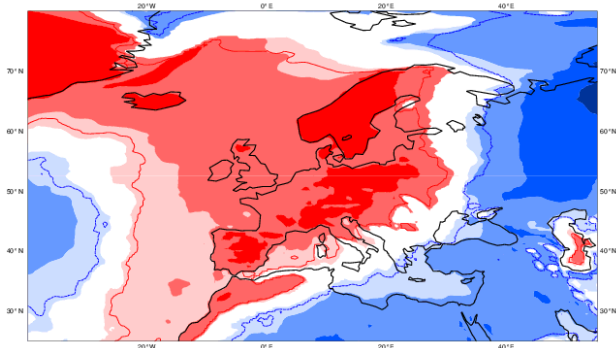
<-10deg -10..-6 -6..-3 -3..-1 -1..0 0..1 1..3 3..6 6..10 >10deg



ECMWF EPS-Monthly Forecasting System
2-meter Temperature anomaly
Forecast start reference is 14-02-2019
ensemble size = 51 , climate size = 660

Day 12-18
25-02-2019/TO/03-03-2019
Shaded areas significant at 10% level
Contours at 1% level

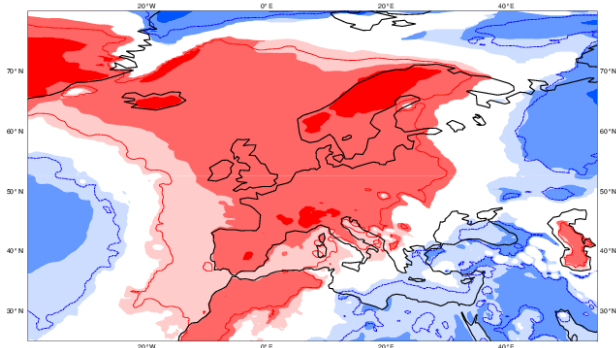
<-10deg -10..-6 -6..-3 -3..-1 -1..0 0..1 1..3 3..6 6..10 >10deg

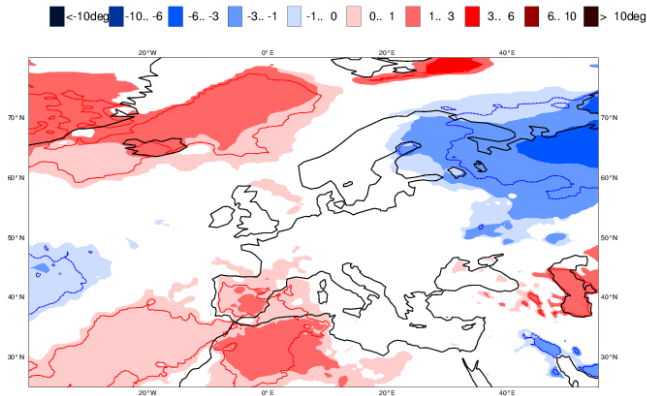


ECMWF EPS-Monthly Forecasting System
2-meter Temperature anomaly
Forecast start reference is 11-02-2019
ensemble size = 51 , climate size = 660

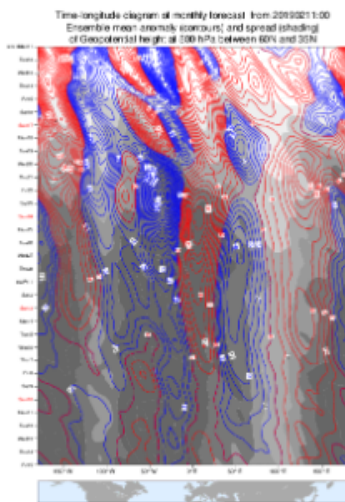
Day 15-21
25-02-2019/TO/03-03-2019
Shaded areas significant at 10% level
Contours at 1% level

<-10deg -10..-6 -6..-3 -3..-1 -1..0 0..1 1..3 3..6 6..10 >10deg





The plot below shows the Howmuller diagram of 500hPa geopotential height anomalies in ensemble mean from 11 February.



3.5 Comparison with other centres

4. Experience from general performance/other cases

5. Good and bad aspects of the forecasts for the event

- Good signal 15 days before the event
- Underestimation in daily maximum temperatures

6. Additional material