

201802 - Cold - Europe

Status: Finalised Material from: Linus, Esti, Ivan, ..



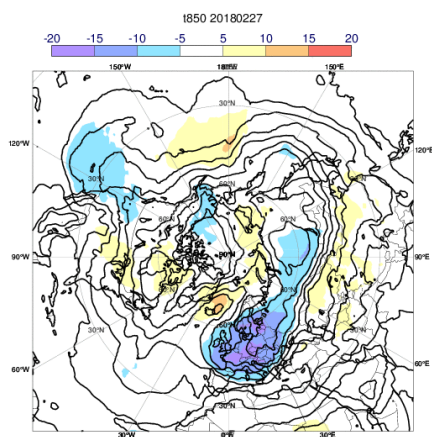
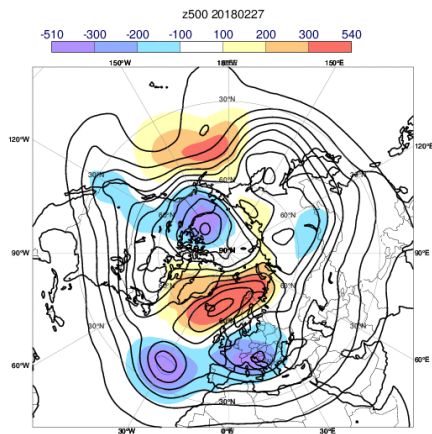
1. Impact

During the last week of February large parts of Europe were hit by a strong cold spell. The temperatures reached -40°C in Scandinavia and below -10°C in southern England, and Rome was hit by unusual snowfall. At the same time northern Greenland experienced extremely warm temperatures. The cold spell was due to a very strong negative NAO period that might be linked to a sudden stratospheric warming and/or MJO in phase 6/7.

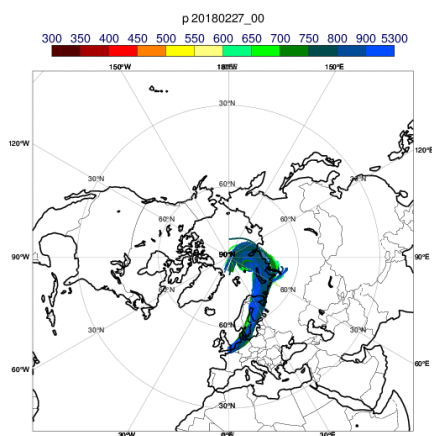
This investigation will focus on the prediction of the stratospheric warming (and MJO), the prediction of the cold temperatures in north-western Europe and the snowfall on the British Isles on 1-2 March (to be added).

2. Description of the event

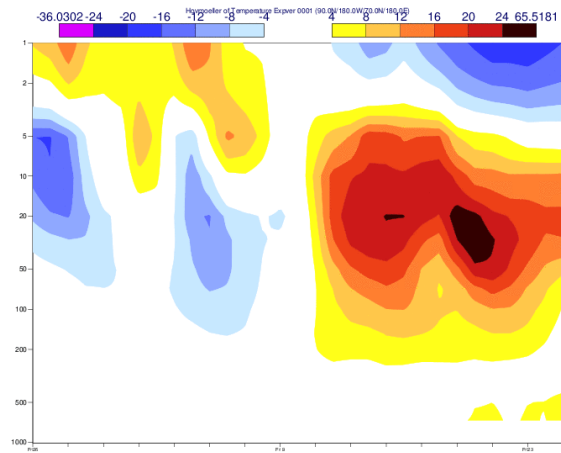
The plots below show the anomalies (shade) and full fields (contours) on 27 February for z500 and t850. One can note that eastern Greenland and central Italy had the same temperature at 850 hPa.



The plot below shows 6-day backward trajectories ending over south-eastern England on 27 February on 700-900 hPa levels. Most trajectories originated from central Arctic.

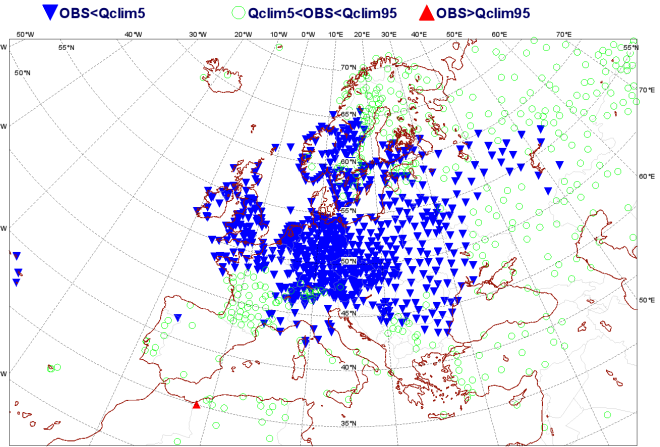
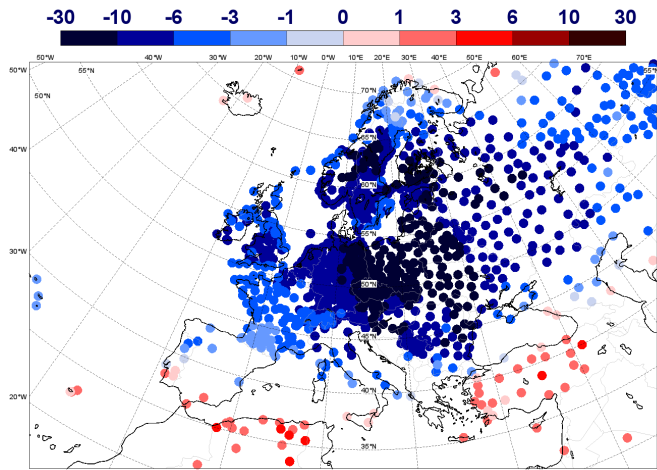


The plot below shows the time evolution of temperature anomalies over the Arctic (north of 70N). The onset of the stratospheric warming took place around 11 February.

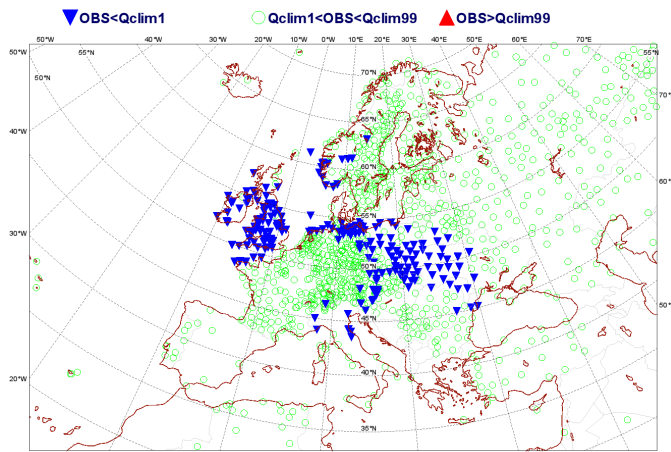


The plot below show the observed anomalies from 26 February to 4 March 2018 with respect to 15-year observed climatology (left), OBS < Q5 (blue) and OBS > Q95 (red) (middle) and OBS < Q1 (blue) and OBS > Q99 (red) (right).

Observed anomalies for 2-metre mean temperature valid for 26 Feb 2018 - 04 Mar 2018 Observed extremes for 2-metre mean temperature valid for 26 Feb 2018 - 04 Mar 2018



Observed extremes for 2-metre mean temperature valid for 26 Feb 2018 - 04 Mar 2018



3. Predictability

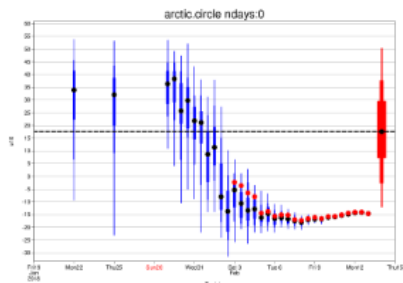
3.1 Data assimilation

3.2 HRES

3.3 ENS

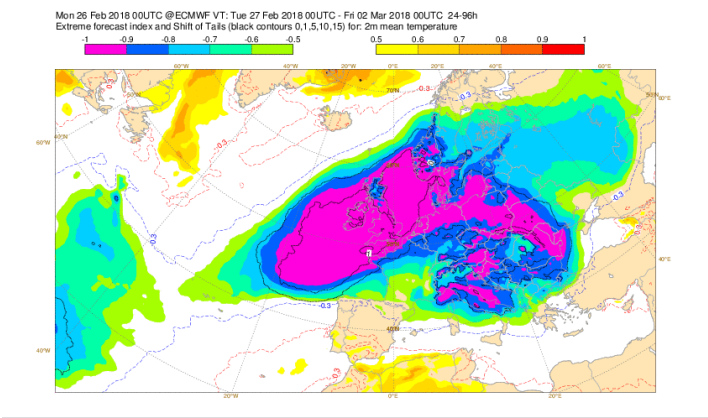
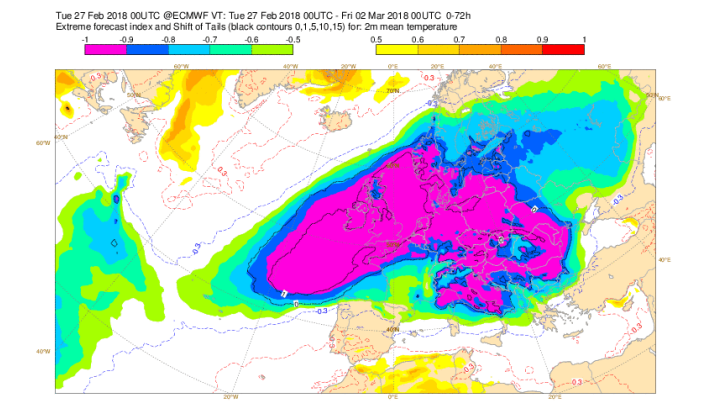
Stratospheric warming

The plot below shows the evolution of forecasts valid 13 February for zonal wind on 10 hPa averaged between 55N-65N. Negative winds imply warm Arctic. Ensemble forecasts are in blue box-and-whisker, HRES in red dot and model climatology red box-and-whisker. The forecast captured the extreme easterly anomaly from 2 February and onwards.

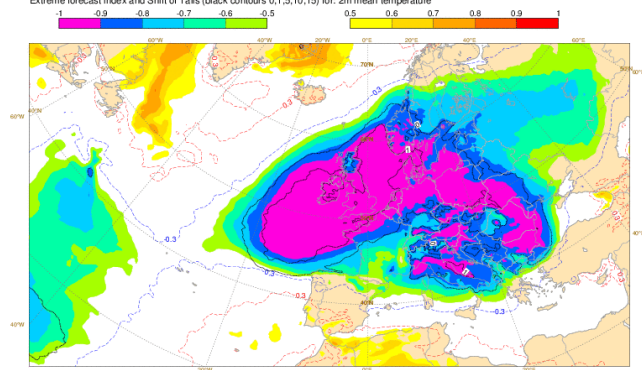


Cold temperatures over western Europe

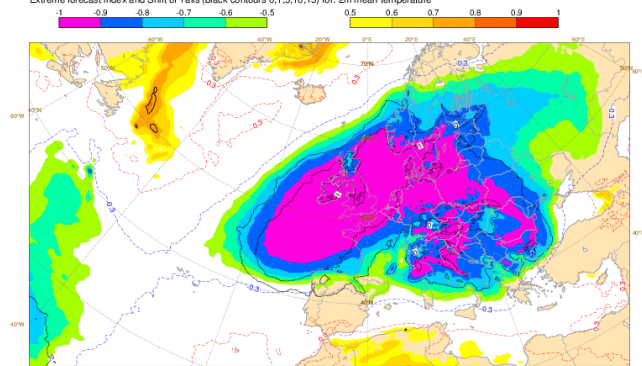
The plots below show the EFI and SOT for 2-metre temperature on 27-29 February (3-days average).



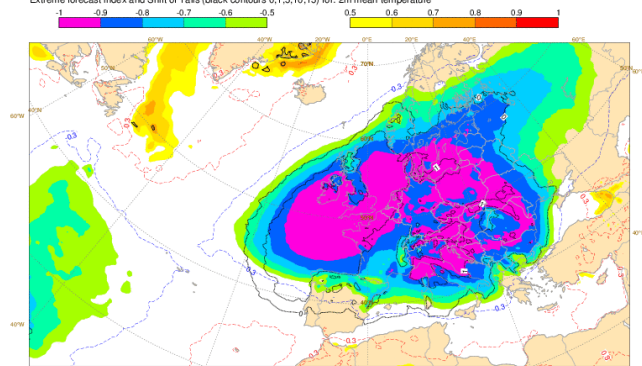
Sun 25 Feb 2018 00UTC @ECMWF VT: Tue 27 Feb 2018 00UTC - Fri 02 Mar 2018 00UTC 48-120h
Extreme forecast index and Shift of Tails (black contours 0.1,5,10,15) for: 2m mean temperature



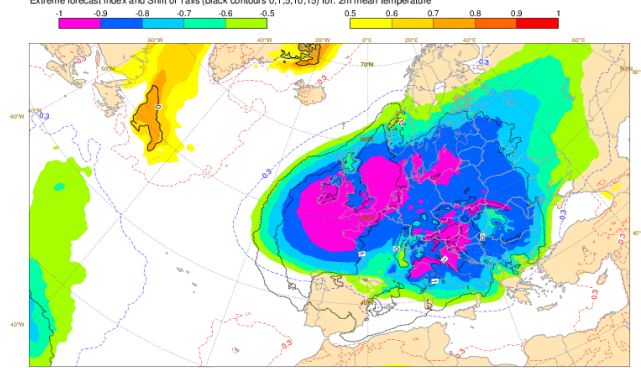
Sat 24 Feb 2018 00UTC @ECMWF VT: Tue 27 Feb 2018 00UTC - Fri 02 Mar 2018 00UTC 72-144h
Extreme forecast index and Shift of Tails (black contours 0.1,5,10,15) for: 2m mean temperature



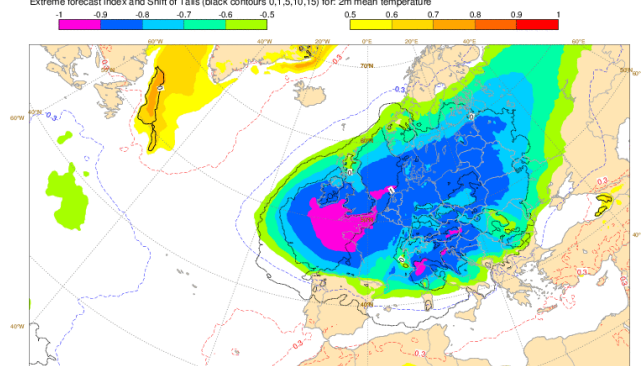
Fri 23 Feb 2018 00UTC @ECMWF VT: Tue 27 Feb 2018 00UTC - Fri 02 Mar 2018 00UTC 96-168h
Extreme forecast index and Shift of Tails (black contours 0.1,5,10,15) for: 2m mean temperature



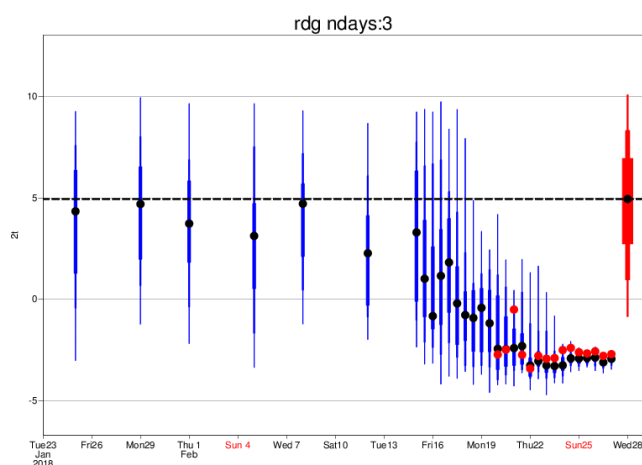
Thu 22 Feb 2018 00UTC @ECMWF VT: Tue 27 Feb 2018 00UTC - Fri 02 Mar 2018 00UTC 120-192h
Extreme forecast index and Shift of Tails (black contours 0.1,5,10,15) for: 2m mean temperature



Wed 21 Feb 2018 00UTC @ECMWF VT: Tue 27 Feb 2018 00UTC - Fri 02 Mar 2018 00UTC 144-216h
Extreme forecast index and Shift of Tails (black contours 0.1,5,10,15) for: 2m mean temperature

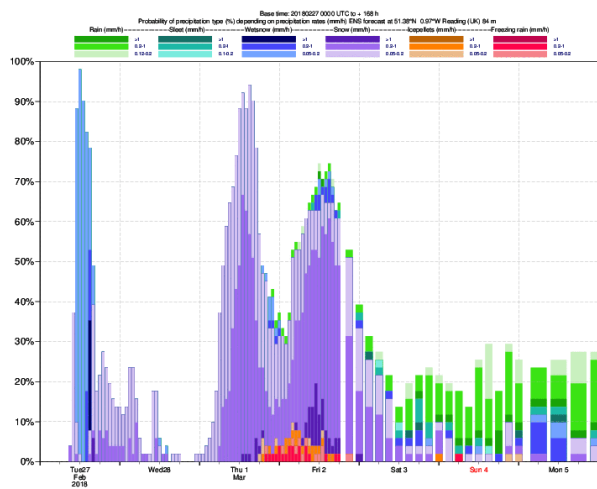
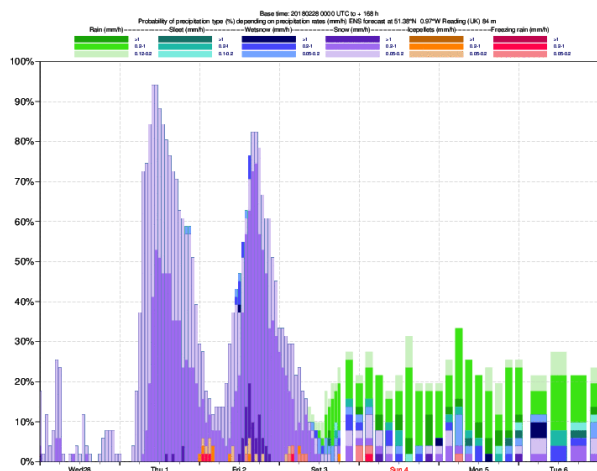
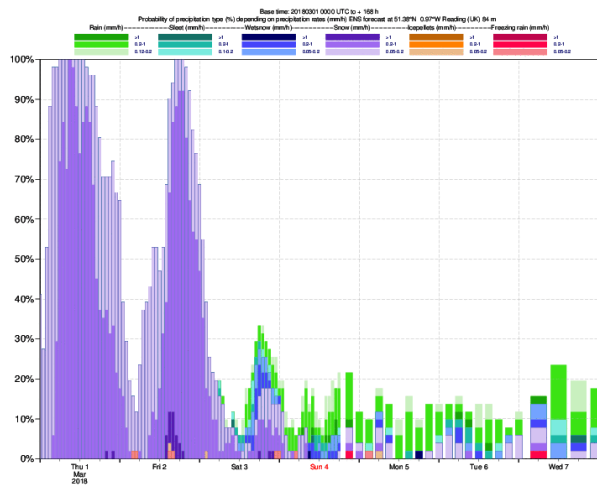


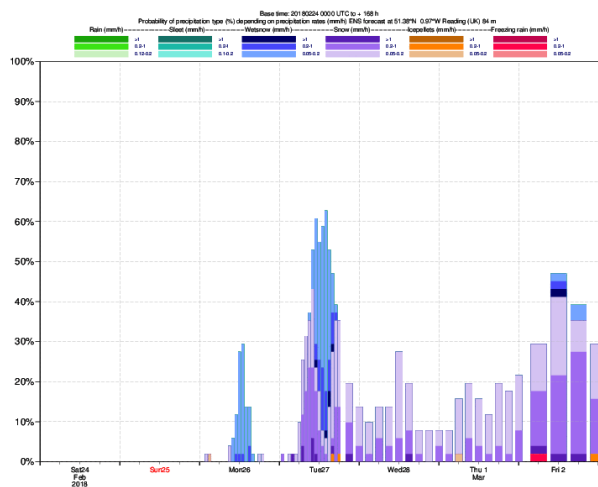
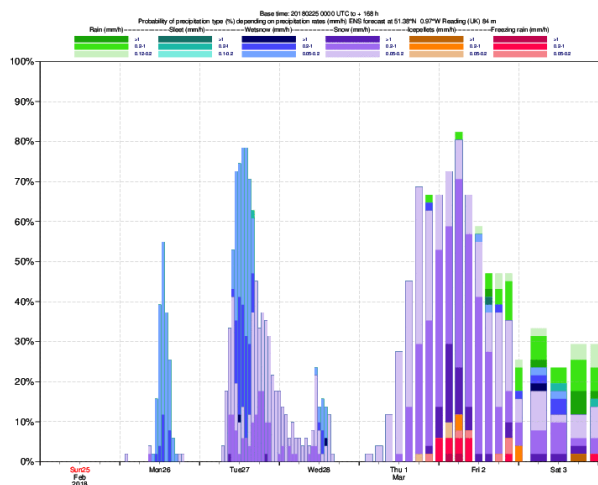
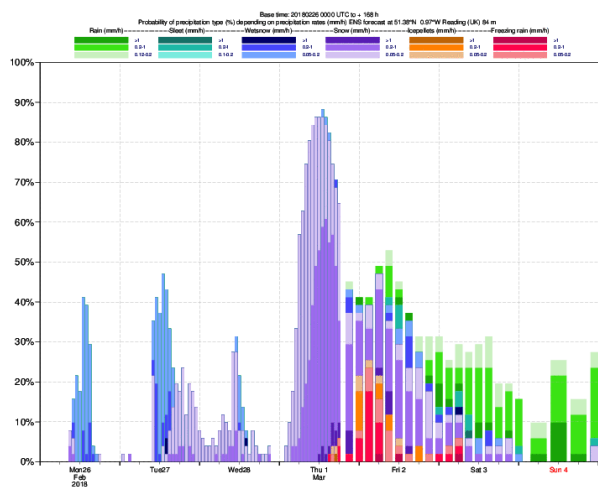
The plot below shows the evolution of forecasts valid 27-29 February for 2-metre temperature in Reading. Ensemble forecasts are in blue box-and-whisker, HRES in red dot and model climatology red box-and-whisker. The cold anomaly was in some of the early (monthly forecasts, see below) and consistently captured since around 16 February.

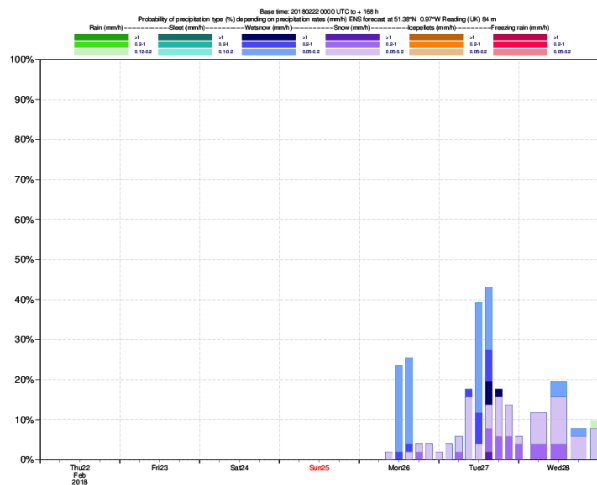
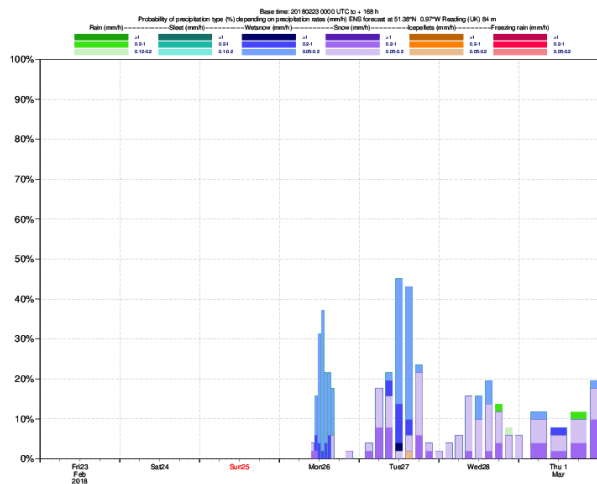


Snowfall in Reading on 1-2 March

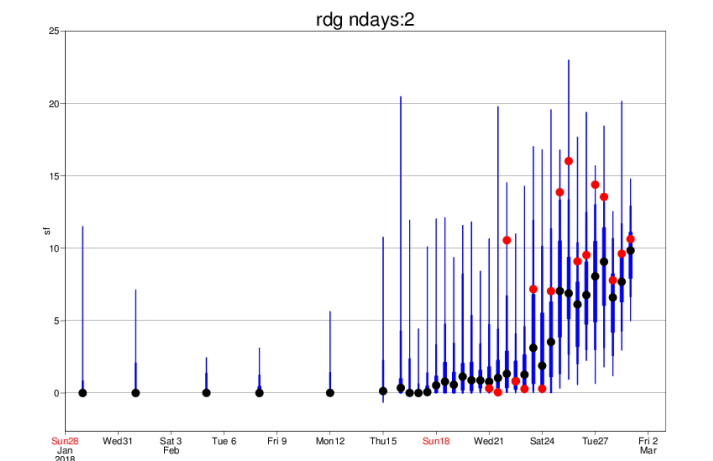
The plots below show the forecast for precipitation type in Reading, starting from the latest forecast before the event (1 March 00UTC) and ending with the forecast from 22 February 00UTC.







The plot below shows the forecast evolution for 2-day snowfall in Reading on 1-2 March. From 25 February the ensemble median was fairly consistent about the snowfall.

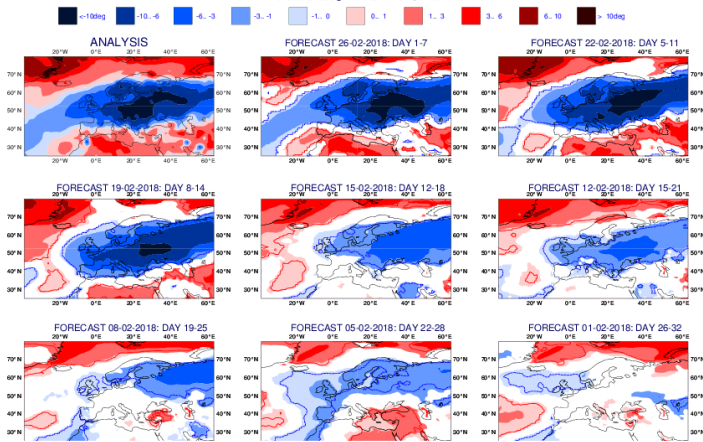


3.4 Monthly forecasts

The plots below show weekly anomalies of 2-metre temperature for 26 February to 4 March.

Analysis and ECMWF ENS Forecasting System

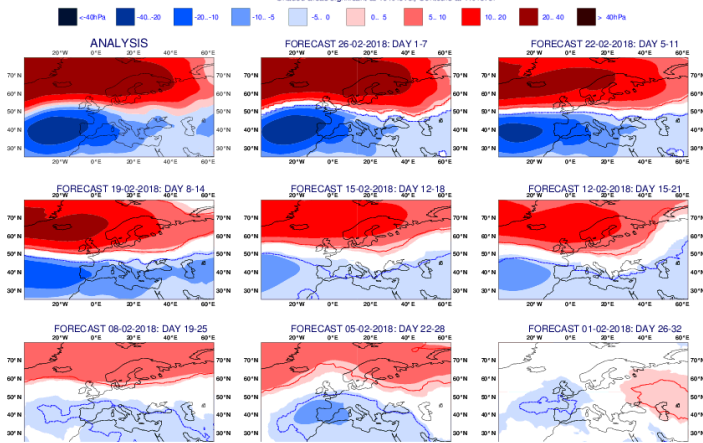
2-metre Temperature anomaly
Verification period: 26-02-2018 TO 04-03-2018
ensemble size = 51, climate size = 650
Shaded areas significant at 10% level, Contours at 1% level



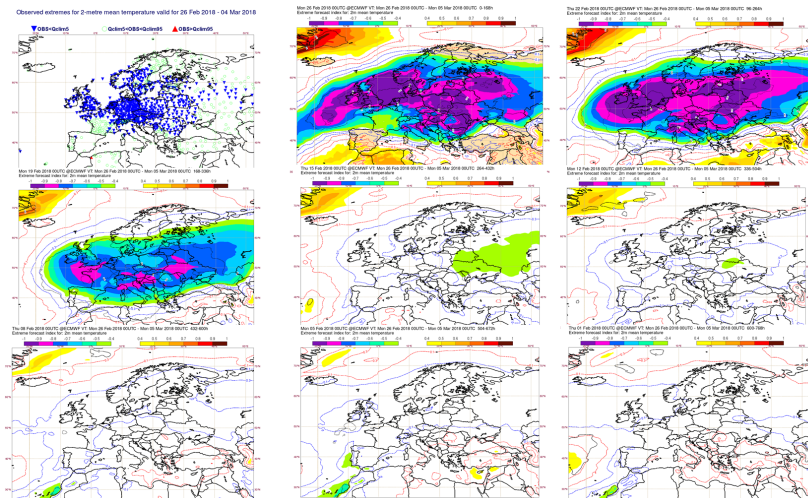
The plots below show weekly anomalies of mean-sea-level-pressure for 26 February to 4 March. The negative NAO pattern was captured from 5 February and onwards, which coincides with capturing the stratospheric warming as seen above.

Analysis and ECMWF ENS Forecasting System

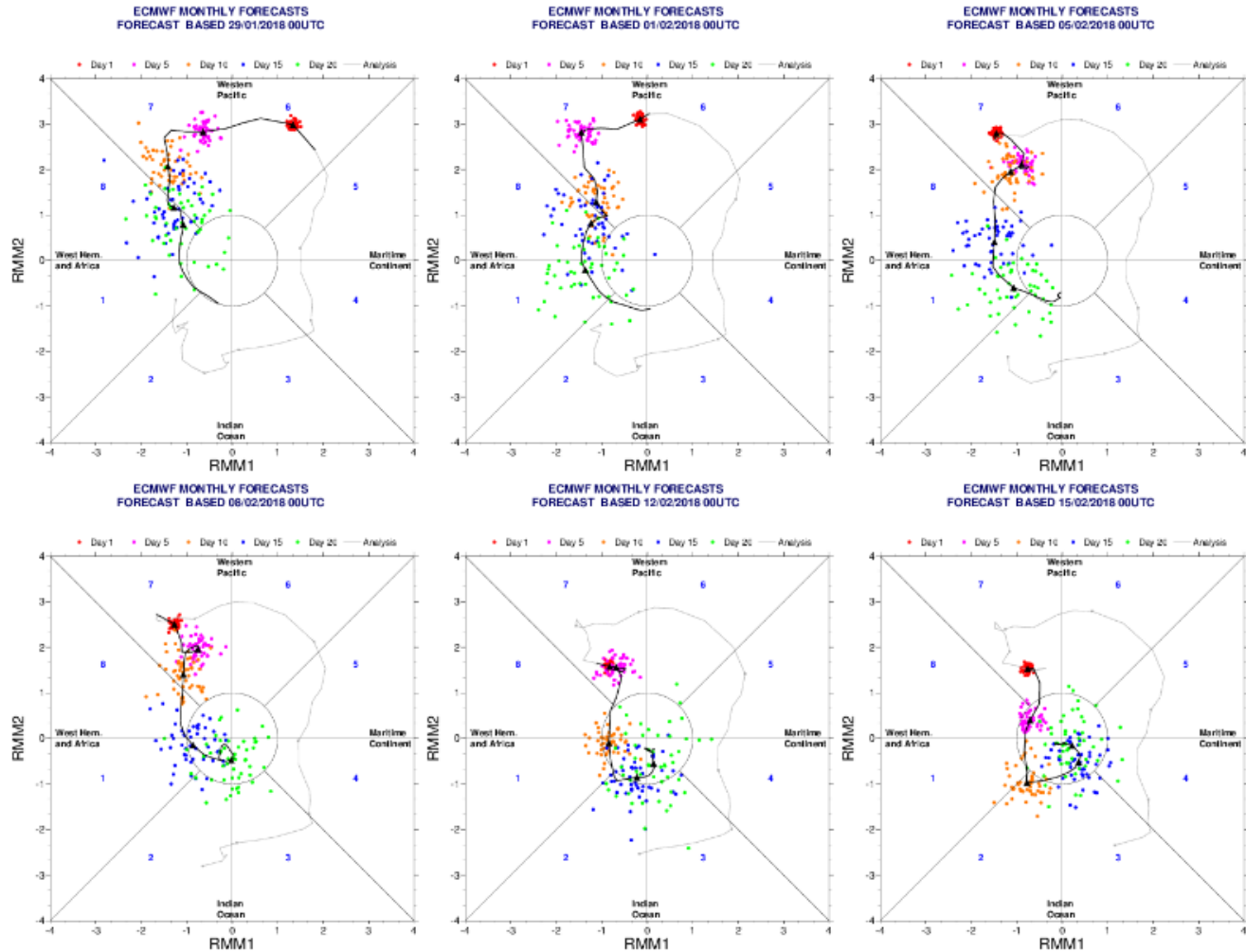
mean SLP anomaly
Verification period: 26-02-2018 TO 04-03-2018
ensemble size = 51, climate size = 650
Shaded areas significant at 10% level, Contours at 1% level



The figure below shows the EFI for the weekly mean of 2-metre temperatures.



The plot below show MJO forecasts from 29 January to 15 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

- Negative NAO captured in monthly forecasts from 5 February and onwards

6. Additional material