Application and Verification of ECMWF Products 2019

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1. Summary of major highlights

Verification results of ECMWF direct model outputs used operationally at the Royal Meteorological Institute of Belgium are presented for 2-metre temperature, 2-metre dew point, 10-metre wind speed and direction, total cloud cover and 6-hour accumulated precipitation. The scores often feature diurnal temperature-wind oscillations that can be easily removed through simple post-processing. Predictions of cloudiness and precipitation appear to be reasonably well calibrated. Forecasts from high-resolution and ensemble-mean products show comparable performances in most instances.

2. Verification of ECMWF products

The Royal Meteorological Institute of Belgium (RMIB) uses a combination of different NWP model outputs to produce fully automated forecast products out to 15 days (ModelBestGrid). ECMWF high-resolution (HRES) and ensemble (ENS) forecasts provide one of several NWP elements to build ModelBestGrid deterministic scenarios. HRES end ENS forecasts are also used extensively by RMIB forecasters in the short and medium range.

3.1 Objective verification

3.1.1 Direct ECMWF model output (both HRES and ENS), and other NWP models

The verification results presented here report on bias and accuracy of HRES and ENS-mean (ENSM) operational forecasts based on both 00-UTC and 12-UTC analyses out to 72 hours. Forecasts have been compared against hourly synoptic observations at 5 Belgian reference stations over one complete year (365 days from 01/06/2018 to 31/05/2019). The reference synoptic stations used are located at the main Belgian airports. They are listed in Table 1 together with their respective geographical coordinates.

WMO Code	Name	Latitude (N)	Longitude (E)	Elevation (m)
06407	Ostend/Middelkerke	51°12’	2°52’	5
06449	Charleroi/Gosselies	50°28’	4°27’	192
06450	Antwerp/Deurne	51°12’	4°28’	14
06451	Brussels/Zaventem	50°54’	4°32’	58
06478	Liège/Bierset	50°39’	5°27’	178

Table 1 List of the 13 Belgian synoptic stations that were selected for this report.

The following meteorological variables have been considered: 2-metre temperature, 2-metre dew point, 10-metre wind speed and direction, total cloud cover and 6-hour accumulated precipitation. Mean errors (ME) as well as mean absolute errors (MAE) have been computed to measure bias and accuracy, respectively – see e.g. Jolliffe and Stephenson (2012) for a thorough discussion of these scores. For assessing predicted 10-m wind direction, cases with light, variable surface winds (wind speed ≤ 4 ms^{-1}) have been censored.

The plotted scores are presented in Figs. 1 to 5 below (one figure per station). ME and MAE plots often show distinct diurnal cycles – more in particular in the cases of temperature, dewpoint and wind. Predicted total cloud cover and 6-hourly accumulated precipitation are rather well calibrated regardless of occasional sizeable errors. These points were discussed in last year’s contribution.

Except for station 6407 (Ostend/Middelkerke) where a sea-land gridpoint issue was identified, HRES and ENSM performances appear very similar for the majority of predicted variables. ENSM 10-m wind direction forecasts tend to show higher MAE than HRES forecasts. In contrast, ENSM total cloud cover forecasts show lower MAE than HRES, but this variable is extremely volatile and the apparent gain in accuracy is likely a statistical artefact resulting from the averaging.

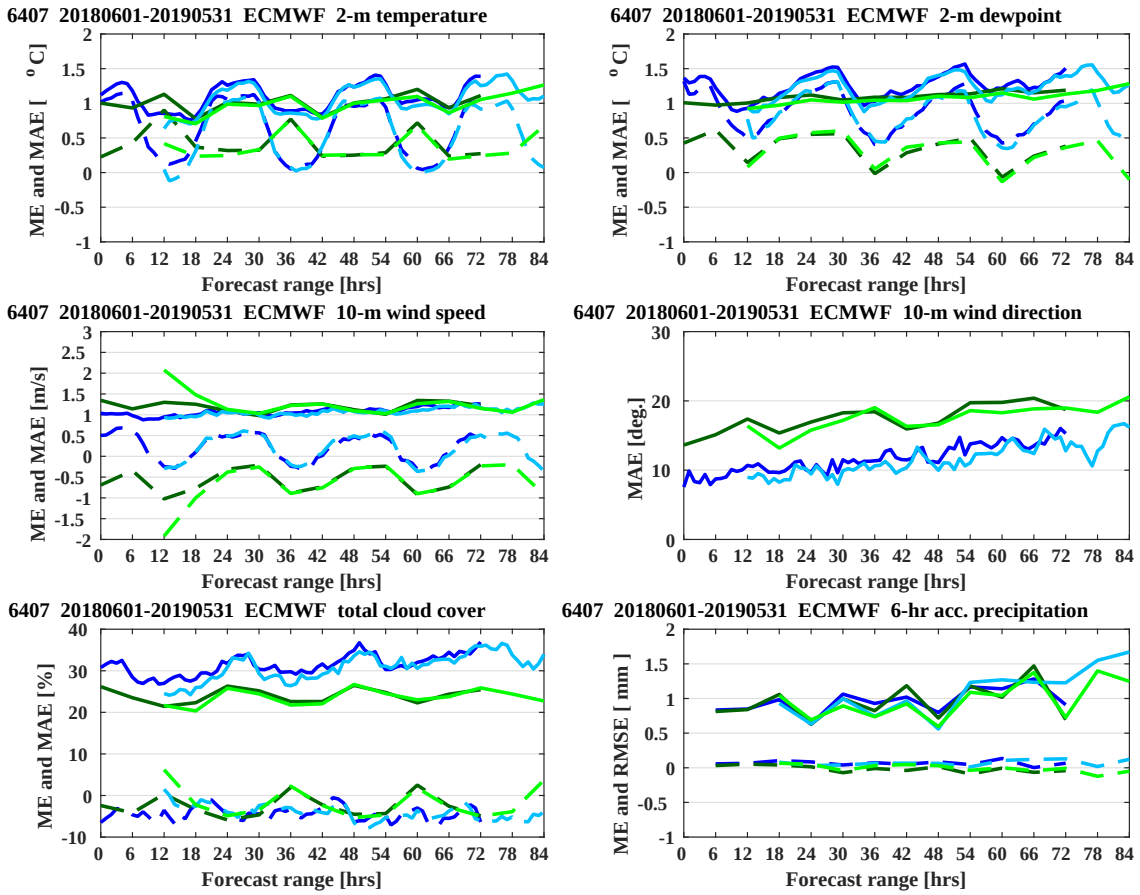

Fig. 1 Forecast bias and accuracy in Ostend/Middelkerke (6407). Mean errors (ME, dashed lines) and mean absolute errors (MAE, solid lines) of ECMWF HRES and ENSM forecasts based on 00-UTC (dark blue/green) and 12-UTC analyses (light blue/green). Variables considered are: 2-metre temperature (top left), 2-metre dew point (top right), 10-metre wind speed and direction (middle), total cloud cover (bottom left when available) and 6-hour accumulated precipitation (bottom right). For assessing predicted 10-metre wind direction, MAE scores only are shown. Forecasts from 01/06/2018 to 31/05/2019.

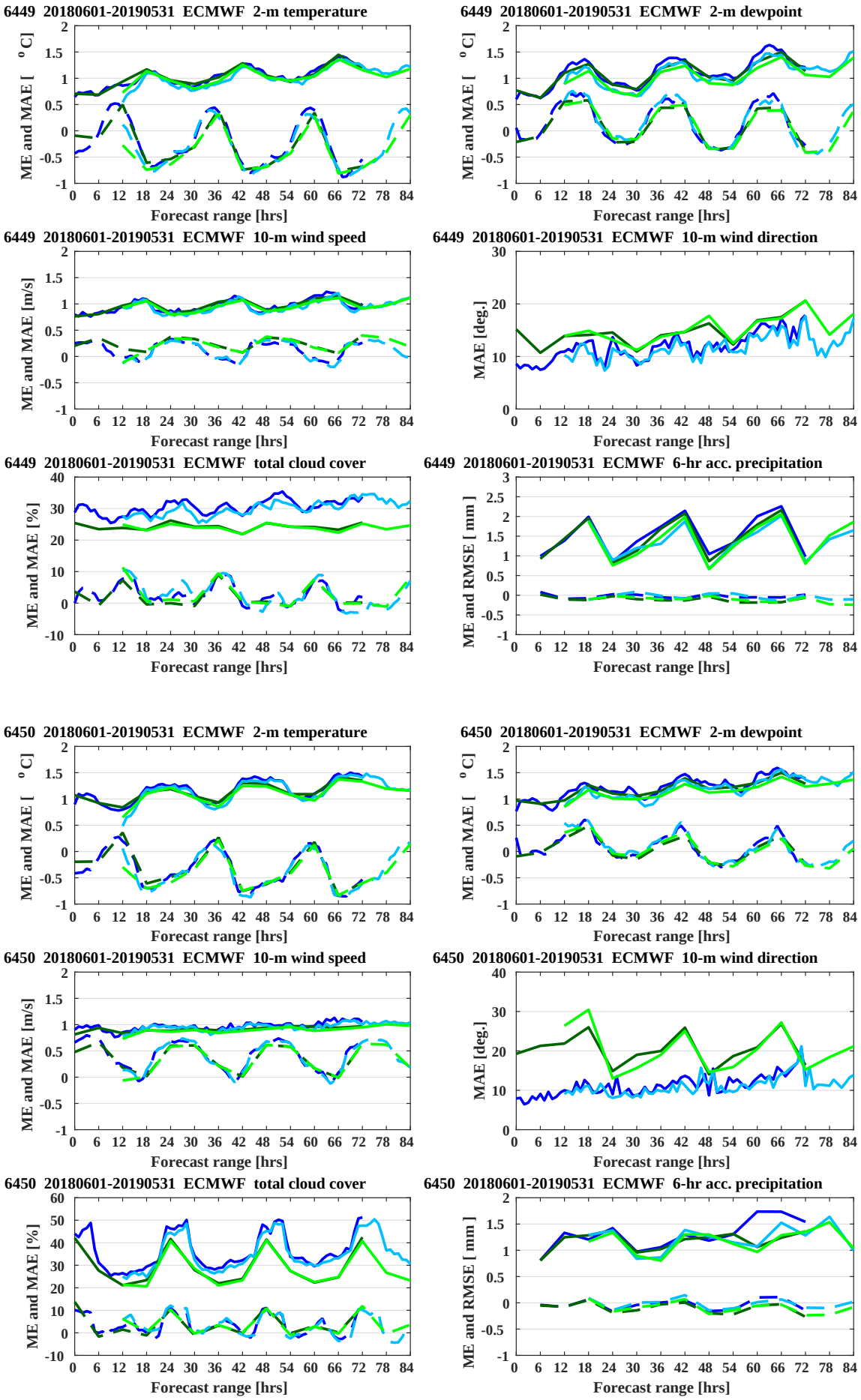

Fig. 3 Forecast bias and accuracy in Antwerp/Deurne (6450).

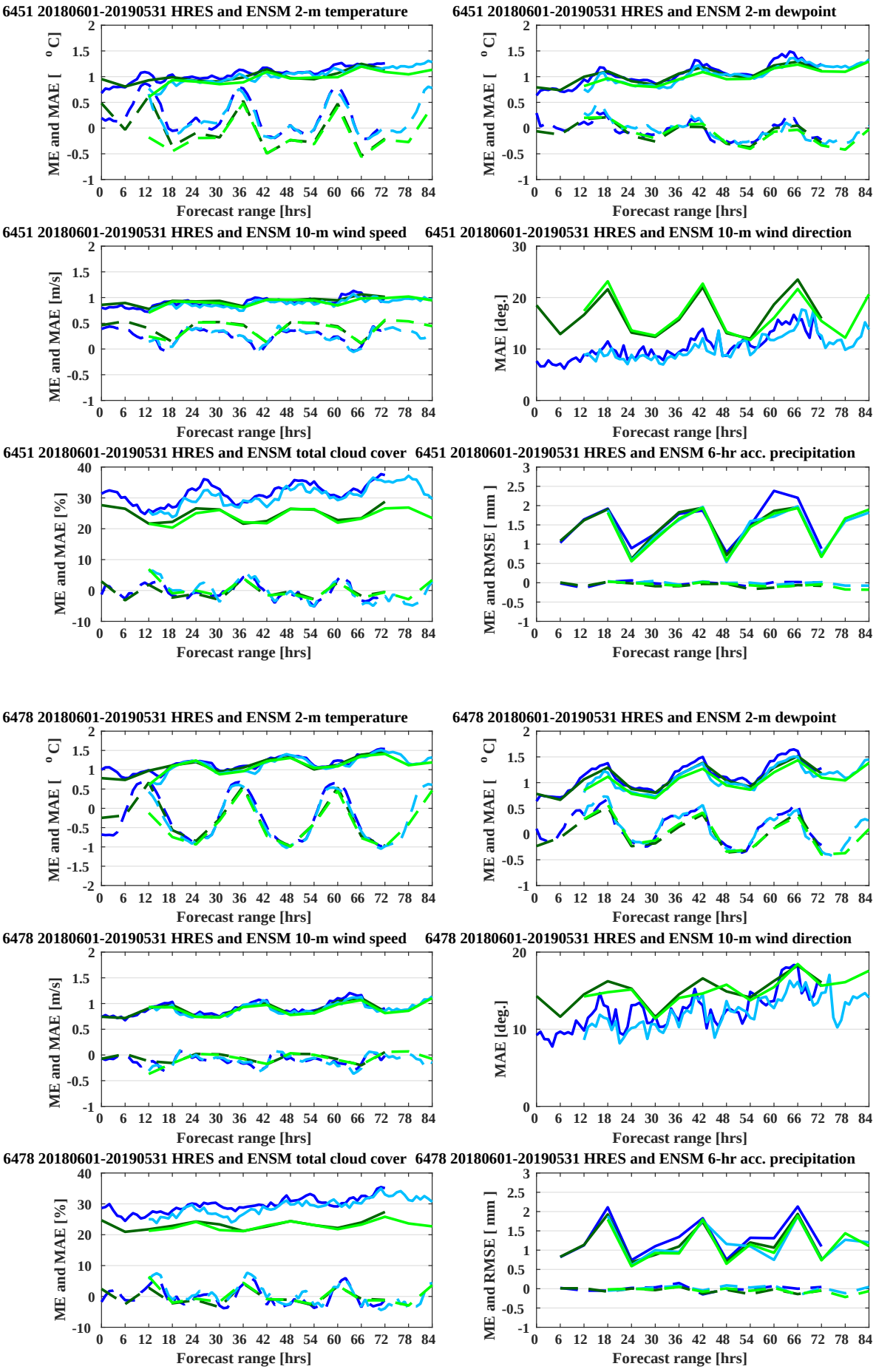

Fig. 5 Forecast bias and accuracy in Liège/Bierset (6478).

6. References to relevant publications

Jolliffe, I.T., and D.B. Stephenson, 2012: *Forecast Verification: A Practitioner's Guide in Atmospheric Science. 2nd Edition*. Wiley and Sons Ltd, 274 pp.