Hirlam Verification scores, 1st Quarter 2004.

Per Undén

1 Introduction

The operational Hirlam verification scores from the first quarter of this year have been requested and compiled. The period is 1 January - 31 March 2004 with 00 and 12 UTC forecasts combined. All the Hirlam operational institutes have kindly provided me with the requested scores, RMS and bias for mean sea level pressure, 10 m wind speed, 2 m temperature, 850 hPa temperature, 500 hPa height and 250 hPa wind speed. (The institutes are the ones in Denmark, Finland, Ireland, the Netherlands, Norway, Sweden and Spain.) Denmark did only have values for every 12 hours forecast range for all their variables (and consequently look a bit smoother than the rest). The Netherlands provided wind vector values for 10 m rather than speed and those numbers have not been included. Apart from those exceptions the verifications are complete.

Finland has made a significant change in that the Reference version and RCR was implemented on 2 February. The verifications here refer to that version (6.2.1- 6.2.2) for the whole period.

The data has been compiled and processed for plotting. The results are commented below. It should be pointed out that the displayed scores cannot be used to compare or rank the forecast quality of the various Hirlam installations and operations. The model domains are all different and proximity of the verification stations to boundaries varies between installations. Furthermore, a somewhat different sample of verification stations has been employed at each institute due to the area, reception (and possibly quality control) all being individual.

2 Mean sea level pressure

There is this year some more variation in the growth rate mean sea level RMS errors, compared to last year (2003, NL43). Still Denmark and Ireland have the lowest and Norway, Finland (RCR!) and the Netherlands the highest error growth.

The average (00 and 12 UTC) bias is fairly low for a number of countries but with a negative trend for a few countries (the ones with the largest RMS errors, Norway, Ireland, Finland and the Netherlands).

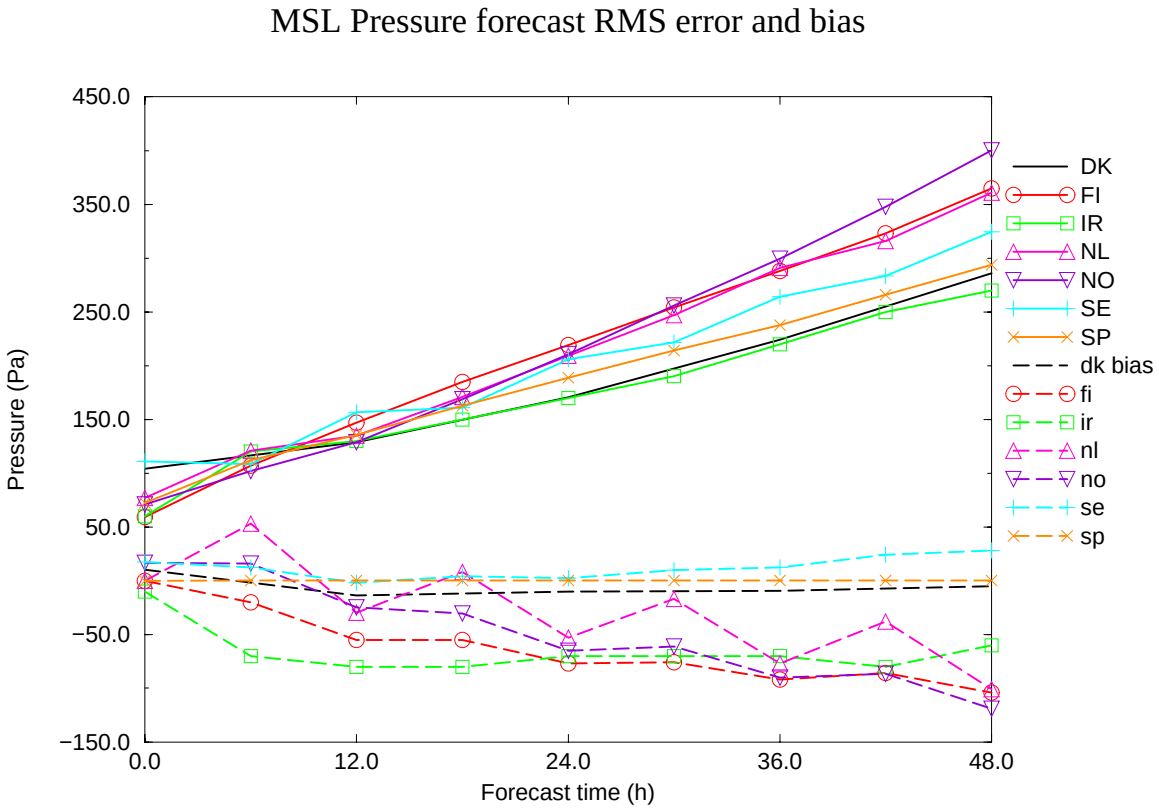

Figure 1: HIRLAM RMS errors and bias for mean sea level pressure forecasts.

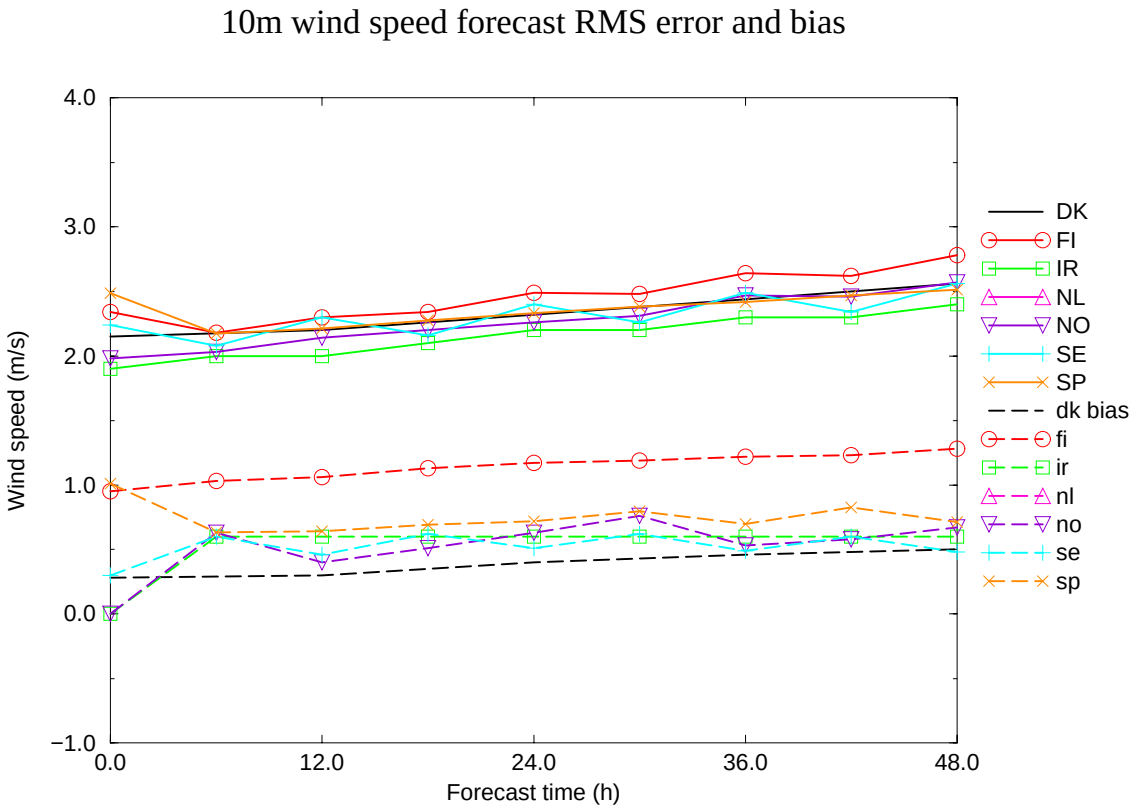

Figure 2: HIRLAM RMS errors and bias for 10 m wind speed forecasts.

3 10 m wind speed

The RMS errors of 10 m winds are similar to last year' and fairly close together. They increase only slowly with forecast range. Most of the centres are close to each other except Finland which this year has larger RMS. Bias curves are also quite close, with a small positive bias. Finland and RCR stands out this year with a much larger positive bias of around 1 m/s. Last year Sweden had that position; since then modifications of both the stable part of CBR and of roughness (both orographic and vegatational) were introduced there. The problems in the Reference and RCR are documented in this volume (NL45).

4 2m temperature

The RMS errors are fairly similar to last year's, except that Norway has had a major improvement since last year (due to the upgrade to the Reference and ISBA). Finland (RCR) has noticably lower errors than the rest. Also the Finish biases are (on the average) quite close to zero. There are varying biases, some are a bit cold and a couple are close to zero or weakly positive. The diurnal cycle in temperature bias are probably the cause for the zig-zag pattern for Sweden and Norway.

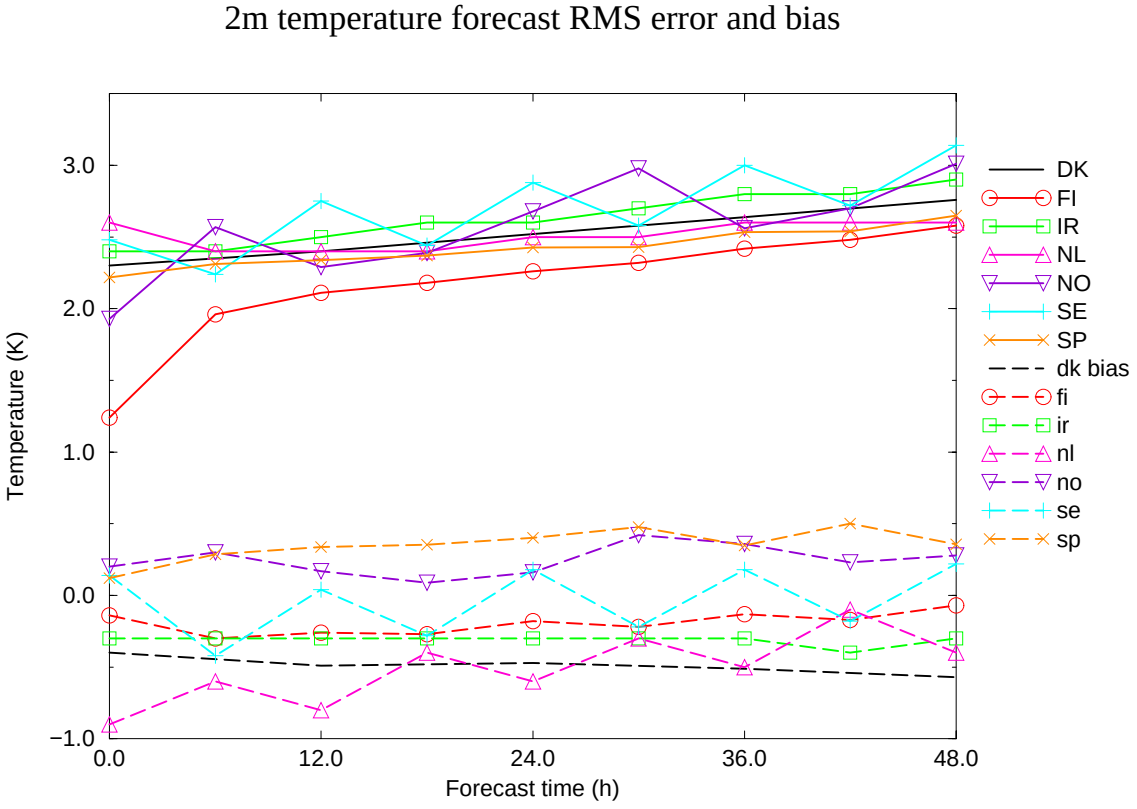

Figure 3: HIRLAM RMS errors and bias for 2m temperature forecasts.

5 Upper air verifications

The 850 hPa temperature RMS errors are similar to last year but not as close together. The biases are very similar to last years and scattered around zero. Just as last year Sweden has a negative trend whereas Norway has a positive one.

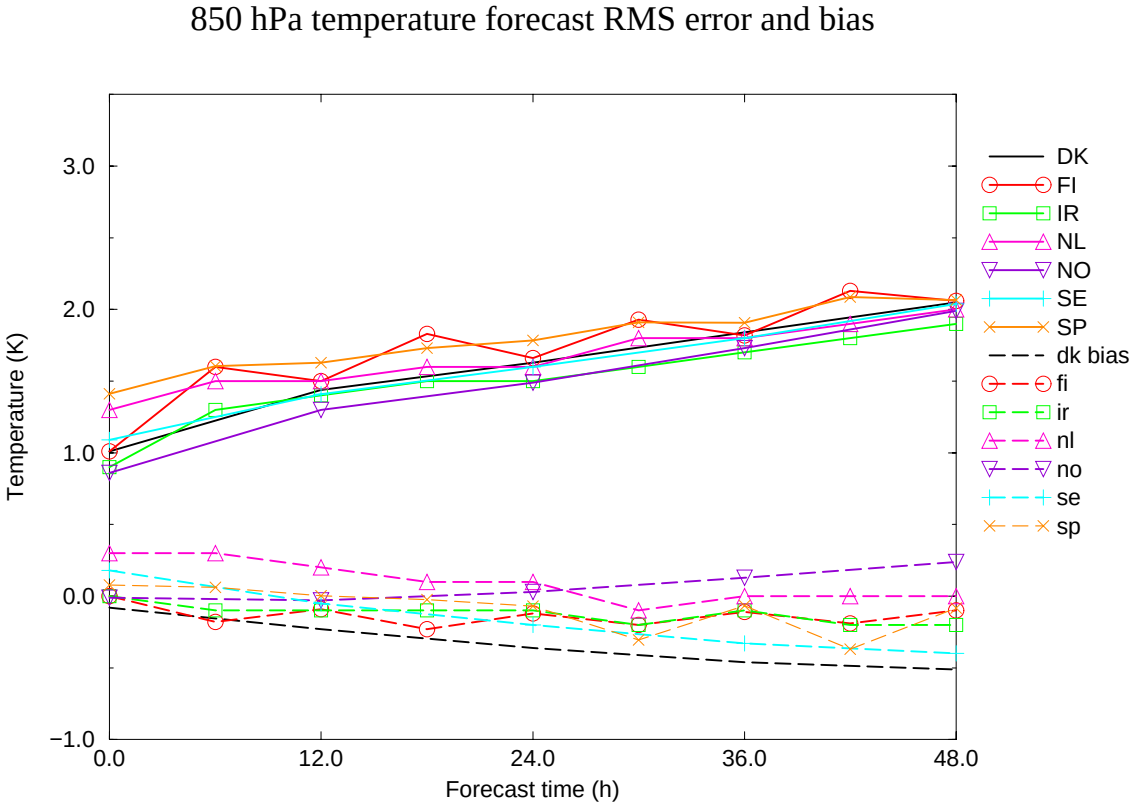

Figure 4: HIRLAM RMS errors and bias for 850 hPa temperature forecasts.

500 hPa geopotential RMS errors lie in two groups; Netherlands, Norway and Finland a bit larger than the rest. The rest are very close together. The biases are very similar to last year and have a negative trend.

The 250 hPa wind RMS errors are close together except for Spain and Netherlands, which show a bit larger errors. (They still use OI which is known to be worse for upper air). The biases are quite small and slightly negative.

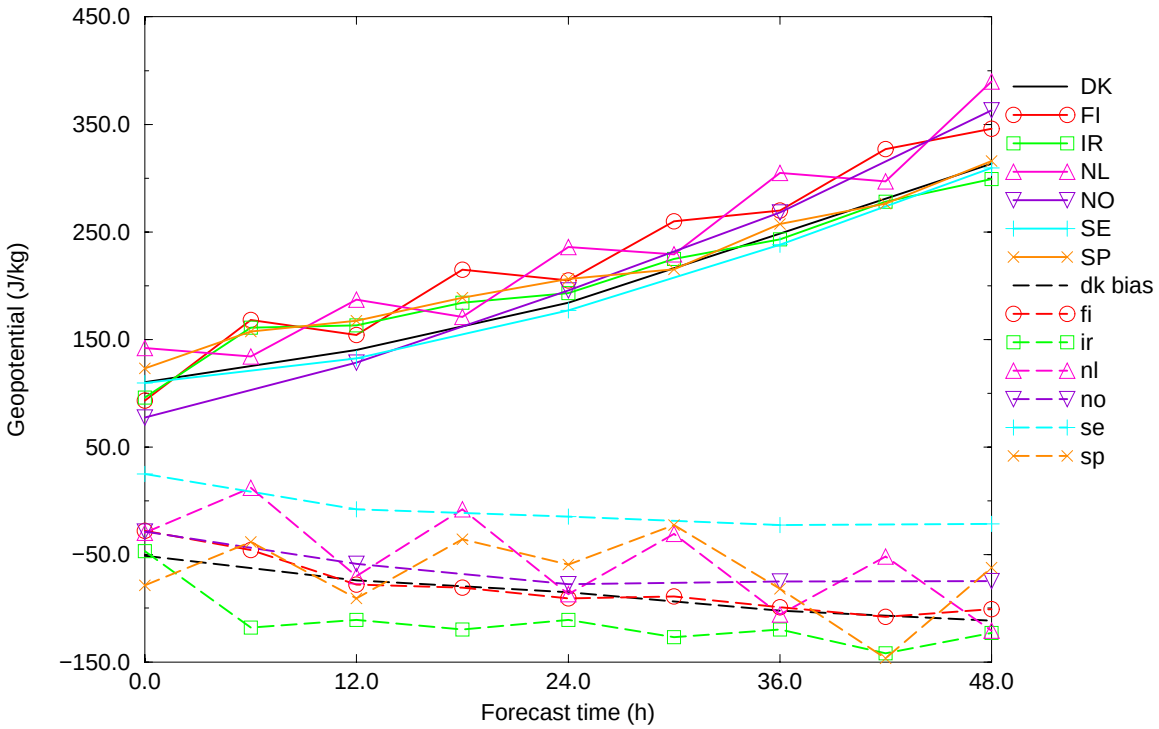

Figure 5: HIRLAM RMS errors and bias for 500 hPa geopotential forecasts.

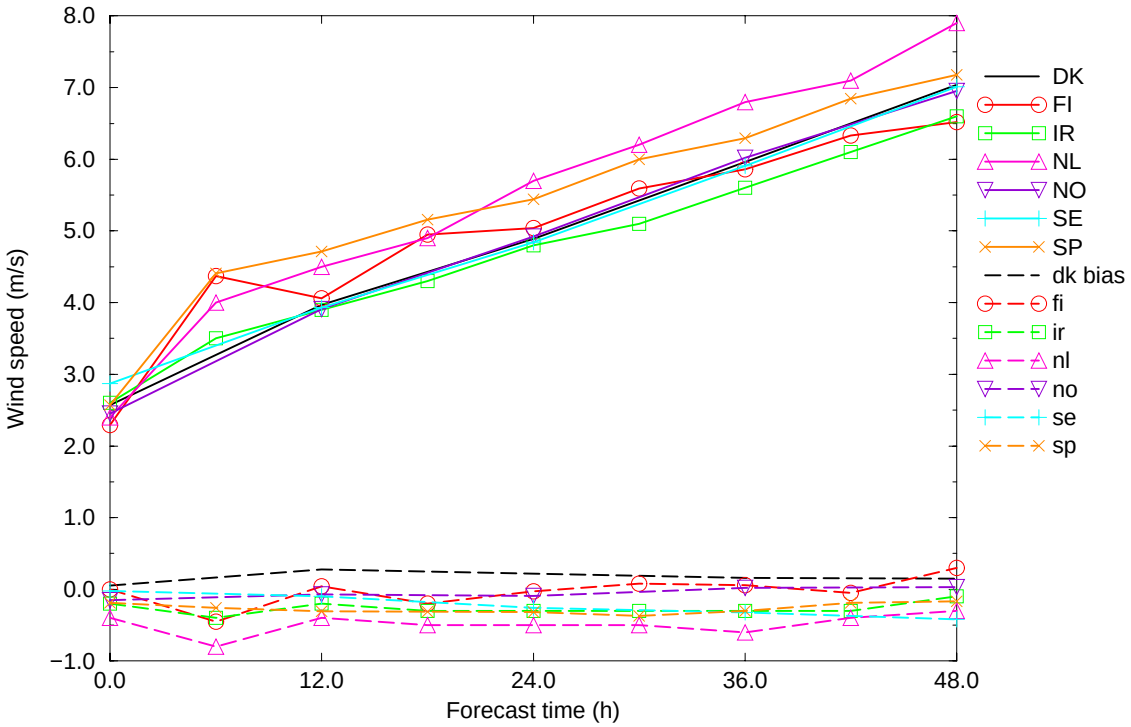

Figure 6: HIRLAM RMS errors and bias for 250 hPa wind forecasts.

6 Global models

Although the global (and non-Hirlam) models are not part of this comparison, results of ECMWF forecasts (12 UTC) have been compiled in Norway, Denmark and Sweden. UK forecasts have been verified by Norway and Denmark. One reservation about comparing these forecasts is that ECMWF and particularly UK forecasts are disseminated on a somewhat coarser resolution and then interpolated, and probably some errors arise from this, but it reflects the way the products are used/can be used in the Hirlam countries.

The RMS errors for mean sea level pressure are lower for the global UK model (although marginally in the beginning of the forecasts) and particularly for ECMWF, which has much lower RMS than UK (not shown).

The comparison that is shown here is based on the verification in Denmark, since all both UK, ECMWF and Hirlam at .45° and .15° are verified by DMI.

For 10 m winds, the differences are much smaller. The RMS errors are very similar in the beginning of the forecast length, and then the DMI Hirlam has a bit larger errors than UK and ECMWF. It is interesting to include the .15° DMI Hirlam in the comparison, since for this resolution, the errors are the lowest up to about 30 h forecast length. UK has the lowest bias of of the four compared here (Fig. 7).

UK has significantly larger RMS 2 m temperature forecast errors than the rest, probably mainly related with a strong negative bias of 1 K. The .45° Hirlam has higher error than ECMWF, but again the .15° DMI Hirlam has lower error than ECMWF (except at initial time). It shows that the higher resolution is important for the forecasts of the near surface parameters.

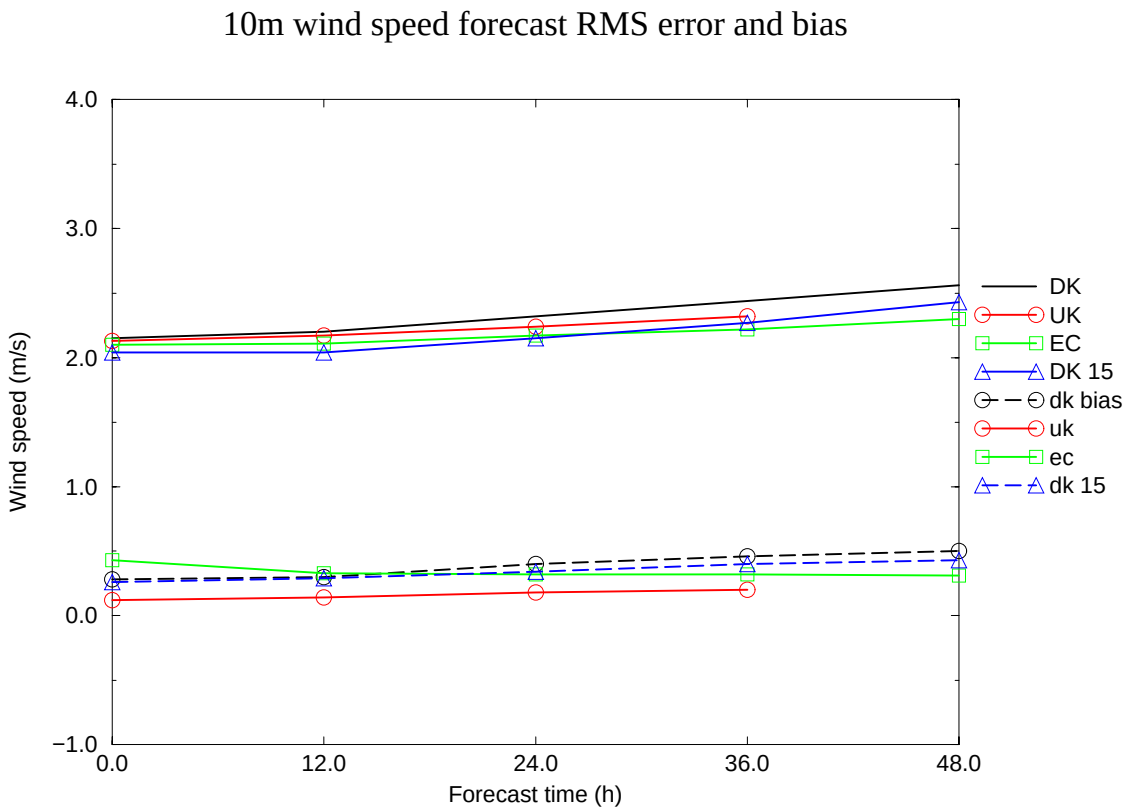

Figure 7: DMI HIRLAM G (50 km), Met Office, ECMWF and DMI E (17 km) RMS errors and biases for 10 m wind forecasts.

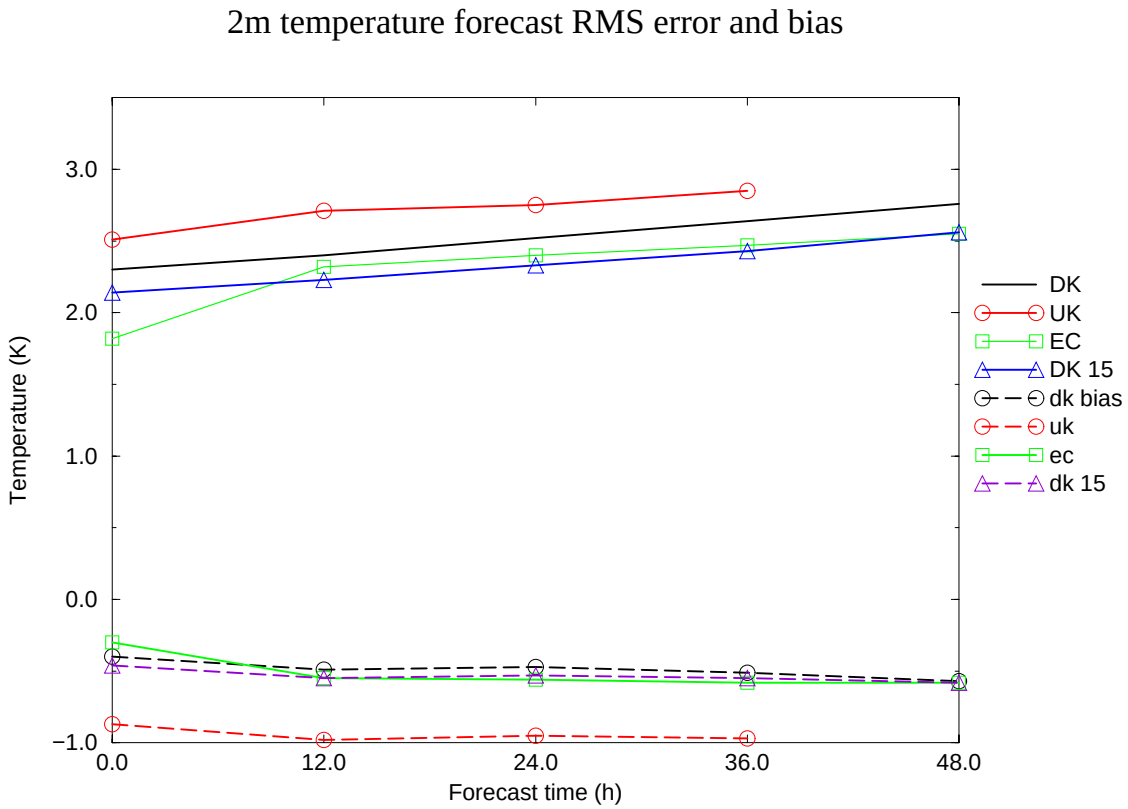

Figure 8: DMI HIRLAM G (50 km), Met Office, ECMWF and DMI E (17 km) RMS errors and biases for 2 m temperature forecasts.