HirlamVerification scores, 1st Quarter 2001.

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1 Introduction

As usual, the Project Leader has requested operational Hirlam verification scores for the period 1 January - 31 March 2001 for 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.) Ireland lacked 250 hPa wind scores. Sweden, Norway and Denmark did only have values for every 12 hours forecast range for the upper air verification (and Denmark actually every 12 hours for the other near surface variables as well). Apart from those exceptions the verifications are complete. The Netherlands provided wind vector values for 10 m winds rather than speed. They are not included in the comparison, although approximate conversion by $1/\sqrt{2}$ shows values very similar to other institutes.

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

Most of the centres have comparable mean sea level RMS errors. Denmark, Finland and Spain have the lowest error growth and Norway not so far behind. The Netherlands seems to have a higher error growth than the rest. Norway, Denmark and Finland have improved compared with last year (NL35) and one may speculate if it is due to the effects of 3D-VAR and the intermittent use of ECMWF analysis for the first two. However, Finland has not changed its operational practice during last year. This year Spain has not lower errors than the rest, but is among the lowest (the southerly area contributes to lower errors normally).

The bias is fairly small with a negative trend for a few countries (especially for the Netherlands and Ireland as during last year).

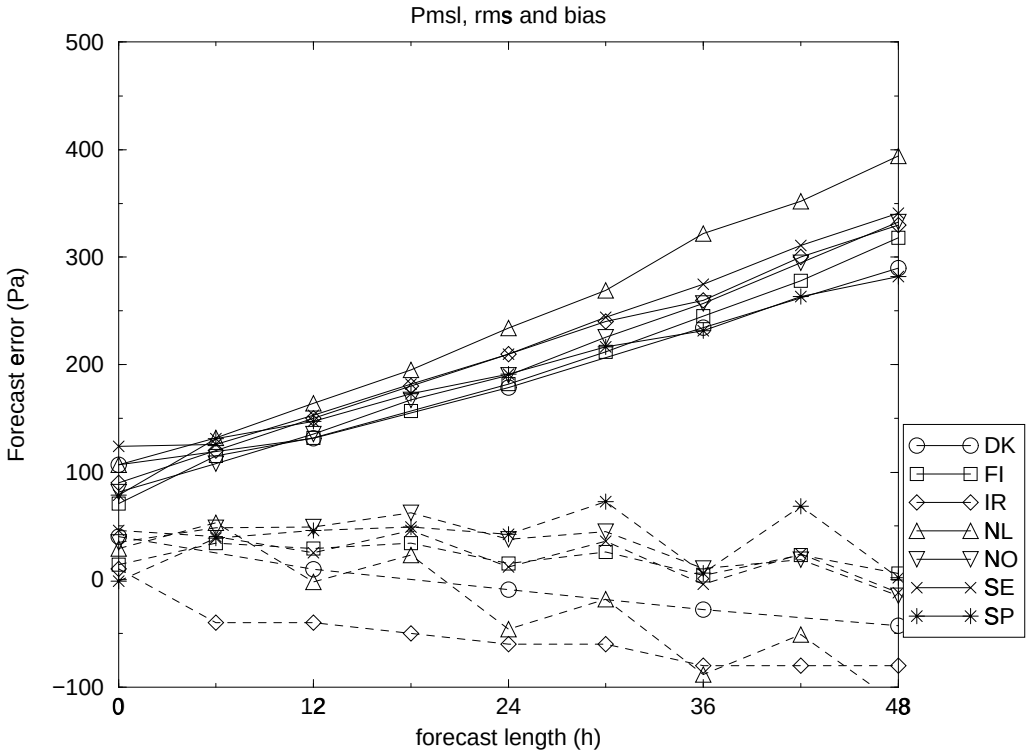

Figure 1: HIRLAM RMS errors and bias for mean sea level pressure forecasts.

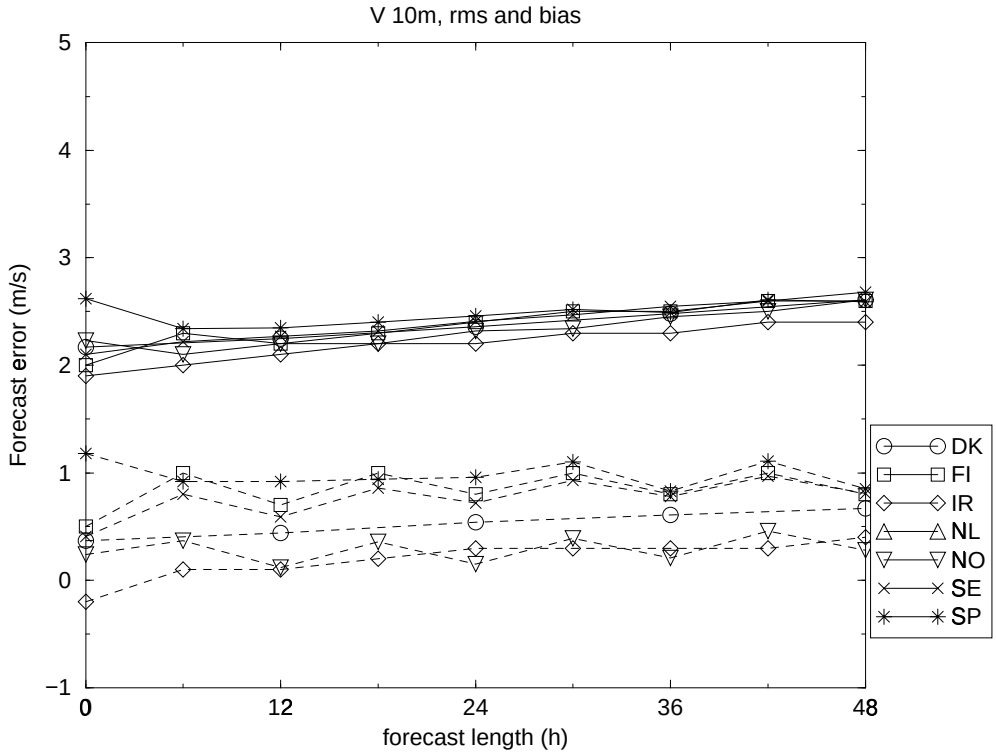

Figure 2: HIRLAM RMS errors and bias for 10 m wind speed forecasts.

3 10 m wind speed

The RMS errors of 10 m winds increase only slowly with forecast range. Most of the centres are extremely close to each other. Ireland has slightly lower errors than the rest (as last year, verification area smaller than others?). The RMS scores are much closer this year, and last year's larger errors for Finland and Denmark have been reduced this year.

Bias curves differ again much more than what can be seen in RMS. Ireland and the Netherlands have again almost zero bias, presumably to be attributed to the Holtslag turbulence scheme (Hirlam 4.3). Although Spain and Finland have a clear positive bias, it is not so large for Denmark (all three use CBR).

4 2m temperature

For this parameter there is an even slower increase of RMS error with time (than for 10 m wind). Ireland has somewhat lower errors than the rest and Denmark, Finland and Spain follow and are very close together (Hirlam 4.6).

Also this year the biases vary a lot between institutes. Most have a clear negative bias, with the Netherlands standing out again with their well-known bias of -1.5 to $-2°$. Surprisingly Ireland has almost no bias this year. Finland, Spain and Sweden also have a clear bias problem of around $-1°$ (even though they use different Hirlam versions).

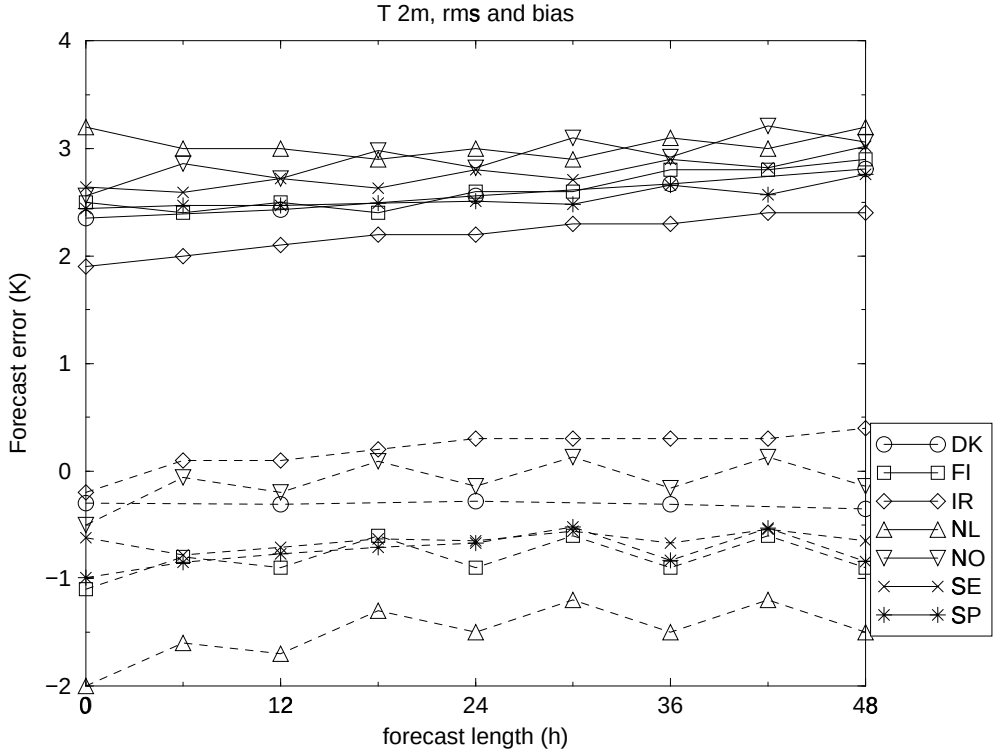

Figure 3: HIRLAM RMS errors and bias for 2m temperature forecasts.

5 Upper air verifications

The 850 hPa temperature RMS scores are fairly close to each other and are slightly lower than last year's. The biases show some separation, with a slight positive bias for most, except Denmark which has a very small negative one.

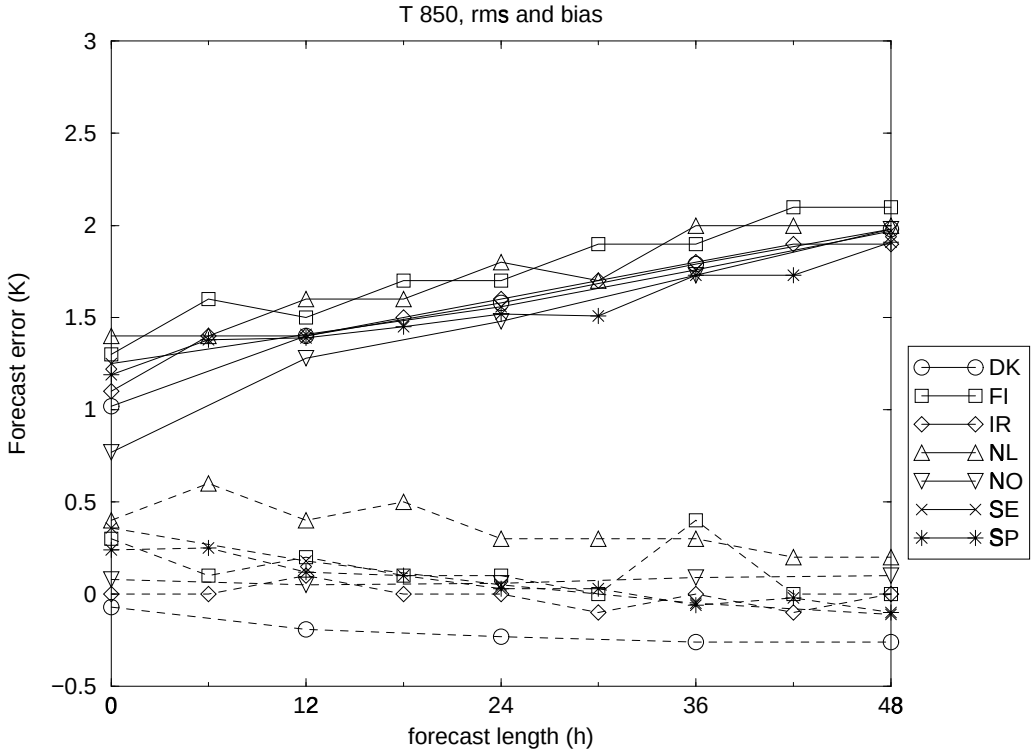

Figure 4: HIRLAM RMS errors and bias for 850 hPa temperature forecasts.

500 hPa geopotential RMS errors are fairly similar between the institutes, except higher error growth for the Netherlands. All show a negative trend in their biases, except Spain. Most end up with a negative bias towards the end of the forecast. Just as last year, the Netherlands and, particularly, Ireland, have more negative bias than the rest.

The 250 hPa wind RMS errors are not as similar to each others as last year. The spread is now about 1.5 m/s. Norway and Denmark have the lowest ones. Both have implemented 3D-VAR and all tests have shown that the advantage in scores increases with height in the atmosphere. Biases are just slightly negative for most of the centres. There is again a pronounced error growth over the first 6 hours of forecast time for all centres for the 250 hPa RMS errors of wind speed. It is a sign of initial inbalance or strong impact from the boundaries.

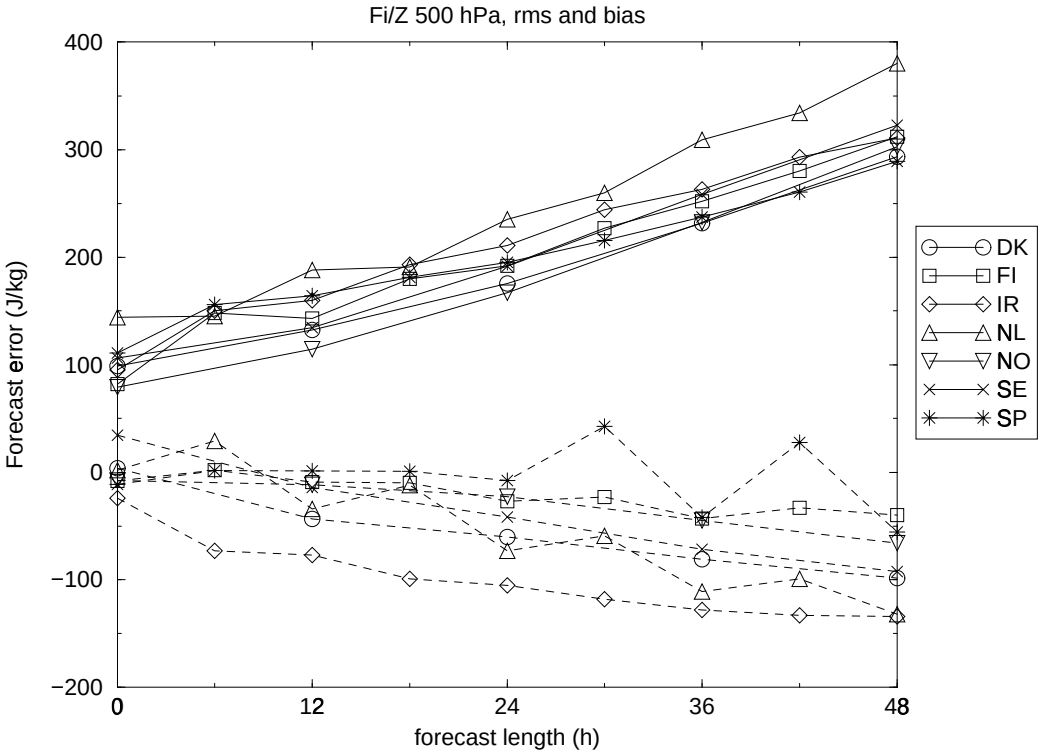

Figure 5: HIRLAM RMS errors and bias for 500 hPa geopotential forecasts.

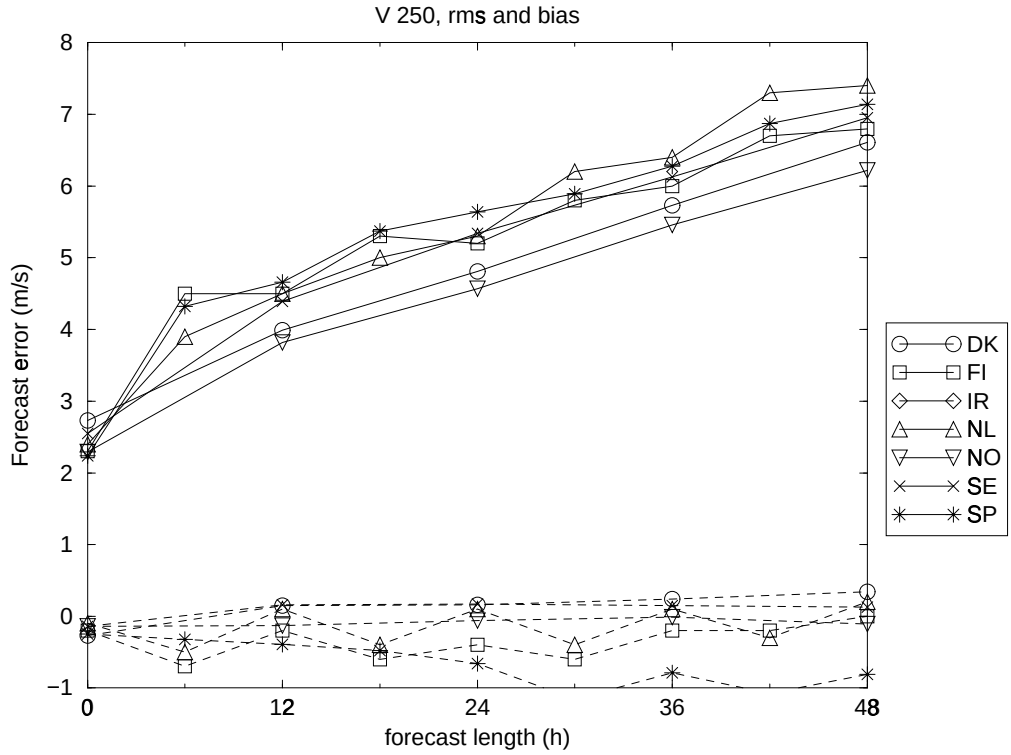

Figure 6: HIRLAM RMS errors and bias for 250 hPa wind forecasts.

6 Conclusions

Also this winter (2001) the 7 operational Hirlam centres have been running the same three different Reference system versions; 2.7, 4.3-4.3.2 and 4.5-4.6.2. Even though this material cannot be used for a clean scientific comparison, it is possible to draw a number of tentative conclusions:

- Most have a negative 2 m temperature bias problem, although only one of the 4.3 versions had a major problem this year.
- Most of the institutes show a positive 10 m wind speed bias, and particularly the ones using the 4.5/4.6 versions with CBR
- the 2.7 versions still compare relatively well with the most recent (4.6) installations

The main difference between the versions is in the turbulence parameterisation. The CBR scheme in 4.5/4.6 does not show the temperature problems of the Holtslag scheme in 4.3 and is at least as good as the Louis scheme. It does however show larger 10 m wind bias than the Holtslag scheme, but also one of the Louis scheme installations shows a positive wind bias. Modifications to the CBR formulation are available that cure the documented 10 m wind bias.