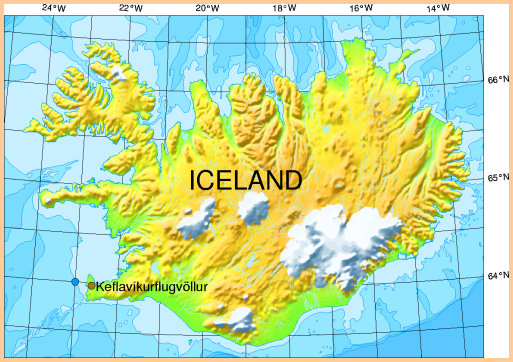
Cases of large forecast errors over Iceland

Þórður Arason[1] and Haraldur Ólafsson[2]
(1) Veðurstofa Íslands - Icelandic Meteorological Office
(2) University of Iceland, Icelandic Meteorological Office, and Institute for Meteorological Research
Reykjavík, ICELAND
arason@vedur.is, haraldur@vedur.is

Abstract

Forty-eight hour numerical forecasts during a period of 5 years are studied with emphasis on cases of false alarms and missed windstorms at 850 hPa. The overall performance of the forecast system is very good. Windstorms from the southwest are very well predicted, there are a few false alarms in southeasterly winds and northeasterly windstorms tend to be underestimated by the forecast model. The false alarms are in many cases associated with fronts, where a slight shift of a position of the weather system in time may give a large difference in the forecasted and observed winds. Yet, the true value of the forecast may be high. We attribute an underestimation in the wind speed in northeasterly windstorms to non-resolved orography, leading to an underestimation of the corner effect SW-Iceland, and possibly to winds that are generated by a pressure gradient at the western side of the Iceland wake.



DISCUSSION

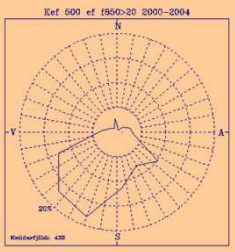
The wind-roses reveal that changes of wind direction with height during low-level windstorms is quite common. These windstorms are associated with baroclinic weather systems, where the low-levels winds at the fronts are typically from the southeast, while the upper flow is from the southwest. The false alarms include almost exclusively winds from the southeast at 850 hPa, but in most of these cases, the wind at 500 hPa is from the south or southwest. The source of the error here lies most likely in the limited horizontal extension and rapid movement of the windstorms. A windstorm that is well forecasted in intensity 48 hours ahead, but passes over the weather station a few hours too early or too late appears on the bottom left panel in the two figure boxes below, but the forecast may yet have been quite successful. It is of particular interest to see that there are practically no false alarms during a period of 5 years when it comes to southwesterly windstorms. Yet, these windstorms count up to about 30% of the total of 420 windstorm observations. The pattern of missing windstorms is quite different. Here, easterly and northeasterly wind directions are overrepresented. A very plausible explanation for this is systematic underestimation of the corner effect in SW-Iceland during northeasterly flow. The wake of Iceland in such flows is also inevitably underestimated by the model, and that should lead to an underestimation of the pressure gradient in SW-Iceland and immediately downstream.

Output from other NWP systems have not yet been evaluated in a manner similar as we do here for the Arpège system, but the nature of the errors is such that a similar character of the error pattern should be expected in a system with similar horizontal resolution.

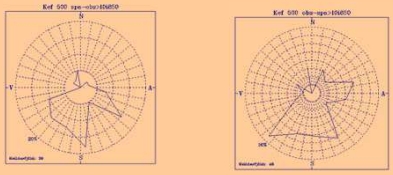
CONCLUSIONS

The forecast error analysis presented here indicates strongly that improved representation of orography with higher horizontal resolution than 40-50 km would lead to substantial improvement in windstorm forecasting. Such efforts have already started with the HRAS project (http://www.vedur.is/~haraldur).

Results at 500 hPa

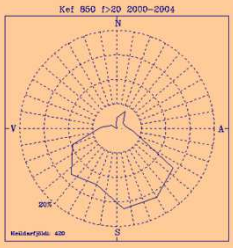


Frequency of wind directions at 500 hPa over Keflavíkurflugvöllur, SW-Iceland when the wind speed at 850 hPa is greater than 20 m/s (2000-2004).

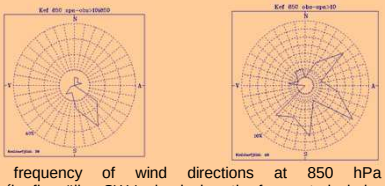


Left: frequency of wind directions at 500 hPa over Keflavíkurflugvöllur, SW-Iceland when the forecasted wind speed at 850 hPa is greater than 20 m/s and the forecasted winds are at least 10 m/s faster than observed winds (false alarms). Right: frequency of wind directions at 500 hPa over Keflavíkurflugvöllur, SW-Iceland when the observed wind speed at 850 hPa is greater than 20 m/s and the forecasted winds are more than 10 m/s weaker than the observed winds (missed storms).

Results at 850 hPa



Frequency of wind directions at 850 hPa over Keflavíkurflugvöllur, SW-Iceland when the wind speed at 850 hPa is greater than 20 m/s (2000-2004).

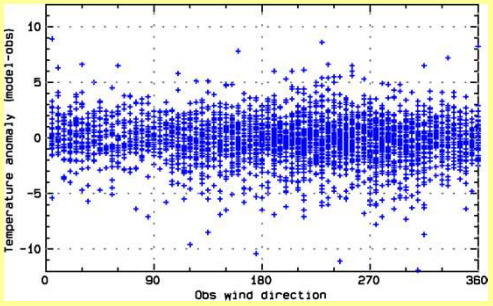


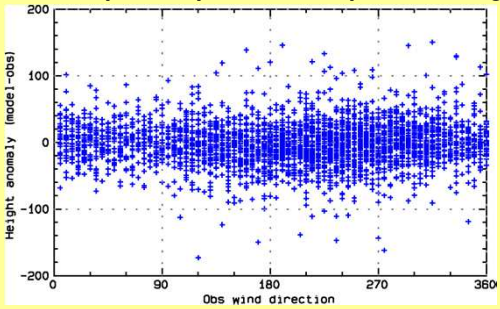
Left: frequency of wind directions at 850 hPa over Keflavíkurflugvöllur, SW-Iceland when the forecasted wind speed is greater than 20 m/s and the forecasted winds are at least 10 m/s faster than observed winds (false alarms). Right: frequency of wind directions at 850 hPa over Keflavíkurflugvöllur, SW-Iceland when the observed wind speed is greater than 20 m/s and the forecasted winds are more than 10 m/s weaker than the observed winds (missed storms).

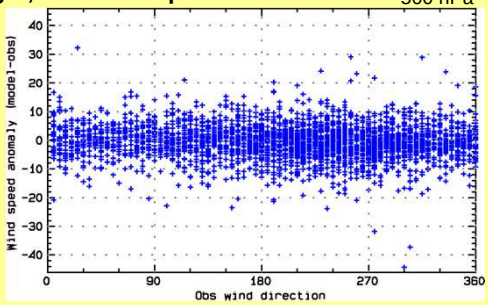
Analysis of Forecast Errors in a NWP Model (2)

5 Directional Variation of Anomalies (model-observed) of Temperature, Geopotential Height, and Wind Speed

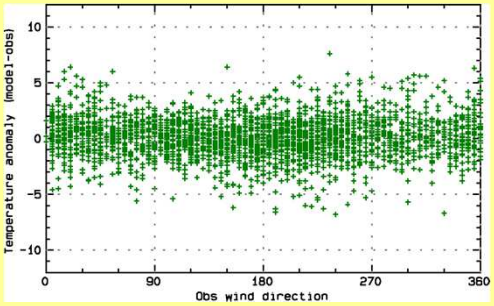
500 hPa

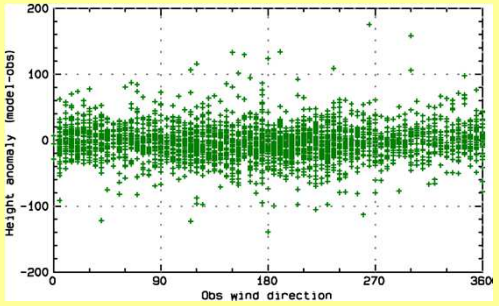


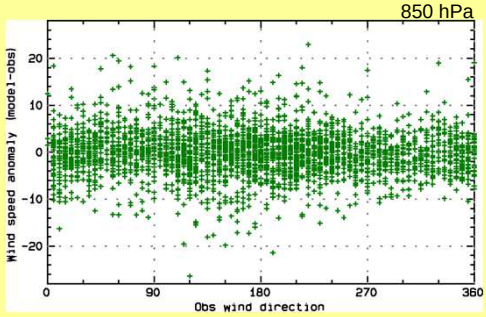




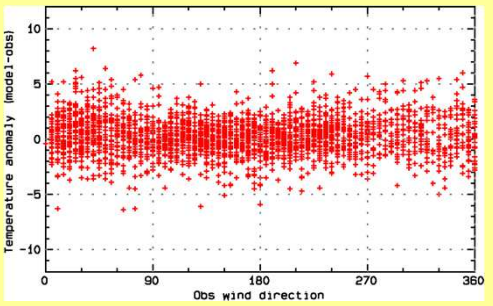
850 hPa

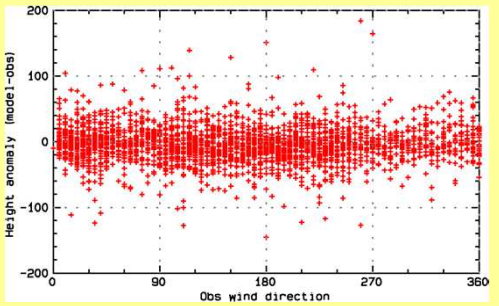


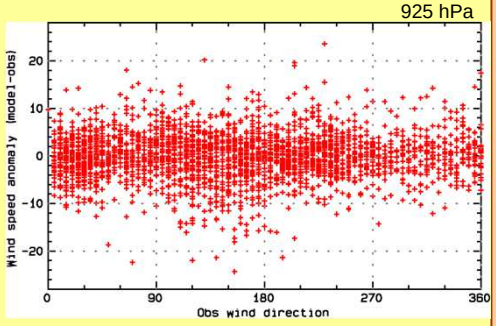




925 hPa

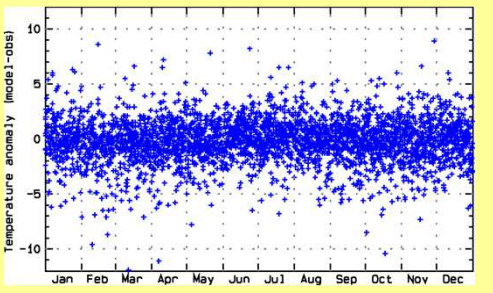


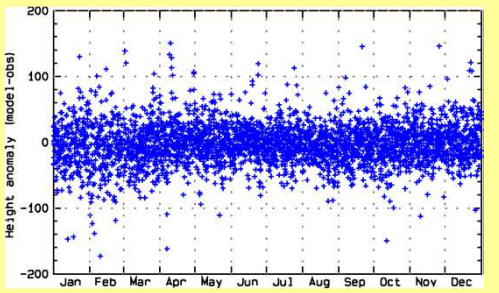


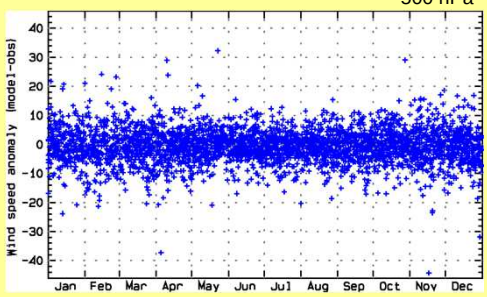


6 Annual Variation of Anomalies (model-observed) of Temperature, Geopotential Height, and Wind Speed

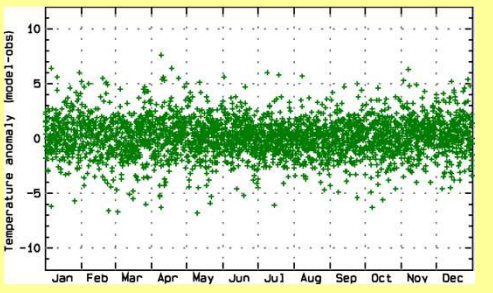
500 hPa

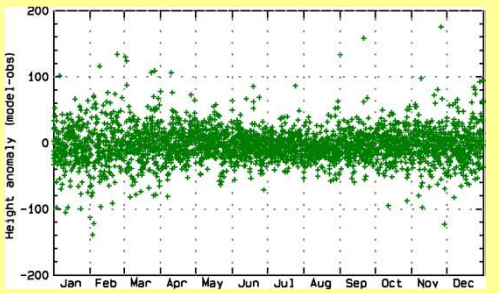


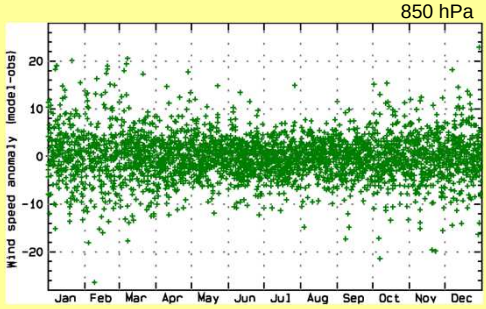




850 hPa







925 hPa