THE 1953 NORTH SEA GALE IN PERSPECTIVE OF HISTORICAL NWP EFFORTS.

H. M. van den Dool, R.E. Kistler and S. Saha

Corresponding author:
H. M. van den Dool
Climate Prediction Center / NCEP
WWB, W/NP51 Rm 604
5200 Auth Road
Camps Springs MD 20746
U S A

email:huug.vandendool@noaa.gov

phone 301 763 8000X7570
fax 301 763 8395

Introduction and summary

The Jan, 31/Feb,1, 1953 storm, which killed about 2500 people around the North Sea basin, did, as far as we know, not play a large role in the early history of NWP. The only exceptions are a few well-hidden calculations made at the UK-Met Office (Hinds 1981). It was not until the initiative was written for a ECMWF to be, i.e. early 1970ies, that storms like the 1953 one, were placed on a list of memorable events that the European countries would like to have a longer lead warning for. The 1953 storm, at the time it occurred, had <= 18 hours warning. Lest we forget, an embroidered carpet of the 500mb map of Feb, 1, 1953 has since been hanging on the wall of the council meeting room at ECMWF. Fig.1 shows a rendition of the hand analysis made at the time at the Dutch Weather Service (KNMI).

It was not until Re-Analysis and Re-Forecasting took place, i.e. 1990ies, that we could investigate the question at what lead the 1953 storm could have been foreseen. The first Re-Forecast was made by NCEP-MRF in 1997, using vintage 1995 technology but, obviously, 1953 data coverage. NCEP found the storm to be more or less predictable out to 4 days ahead, see Fig. 2 (Kistler et al 2001). The 50 year memorial of this disaster in 2003 led to similar (or renewed) attempts by the ECMWF, as well as the European HIRLAM, and US ETA, and GFS (a.k.a MRF) models. With broadly similar conclusions, namely that on the synoptic scale the 1953 storm was predictable several days ahead of time.

The purpose of this presentation is to briefly review these forecasts. However, to add to the historical NWP flavor, we have expanded the study in two ways. First we have ran a global 'barotropic' model (Qin and Vanden Dool 1996) on this situation. We found very good forecast skill out to about 30 hours, especially for the later half of the storm, see Fig. 3. (The bomb-like development on Jan 30/31 is impossible to forecast for a barotropic model and remains the hard part for baroclinic models as well.) This barotropic technology, in primitive form, did already exist in 1953 and its operational implementation (on a limited area) was just around the corner in Sweden. Still, the extensive report written about the 1953 storm, published in 1960 in The Netherlands, did not indicate that modeling would have helped. Operational meteorologists at that time were not convinced that forecast methods were the main problem. Instead they blamed lack of data, in general over the NH, and especially over the North Sea. The 2nd expansion of historical interest is that we digitized by hand the original SLP and 500mb height maps of this storm. This allows us to compare the a-posteriori machine and contemporaneous hand analyses. Assuming the latter are better(!), we can estimate the initial error for 1953 Reanalyses and found them to be 2-3 times larger than what we have come to expect nowadays.

Modern conclusions are quite the opposite of conclusions then. Lack of data was not the main problem in 1953. Given forecast technology, NWP or even a barotropic model, would have helped greatly. That the initial error in NWP has decreased only by a factor of 2-3, comparing data coverage in 1953 to what we have today, may be disappointing to some. But it is not inconsistent with certain insights that the atmosphere has only order 100-1000 effective degrees of freedom. Therefore with 1000 observations (if not too poorly placed and not too inaccurate) one should be able to make a semi-decent analysis. More data helps (if one can keep

track of co-linearity and redundancy) but only incrementally so, as the analysis error asymptotes to minimal values.

A certain modesty should be applied to successful forecasts made after the fact. It is easy to conclude that we could have done a better job for the 1953 situation. But there is no substitute for forecasts made in real time. In recent years (with far better methods and data) there have been stunning failures in forecasting strong winter storms (Christmas 1999 in Europe, France in particular; and the Jan 25 2000 east coast snow storm in the US) that give one a moment of pause.

Acknowledgment: Anders Person pointed us to the UK Met Office calculations regarding the 1953 storm.

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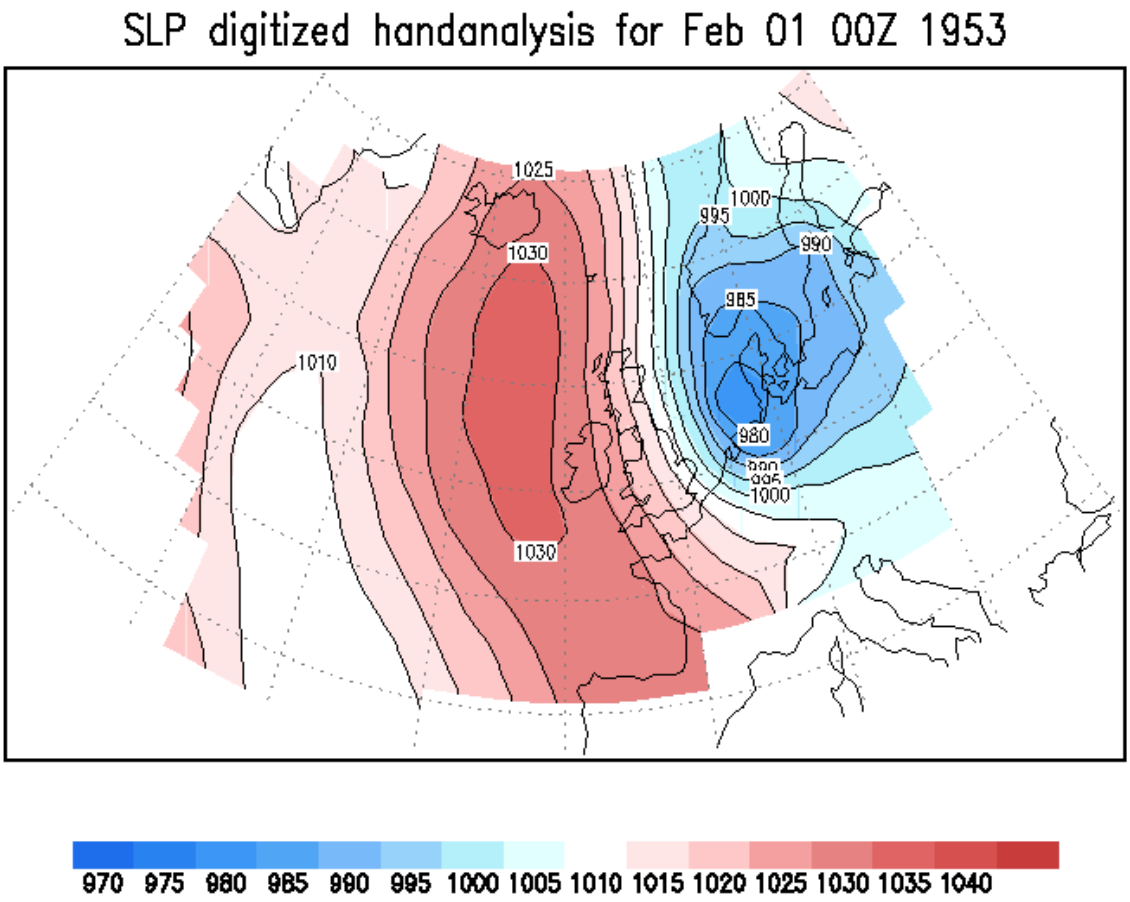

Fig. 1: The hand-analysis of the mean sea-level pressure made in 1953. The author digitized the original map at a 2.5x2.5 grid, entered the gridded values and produced this grads analysis.

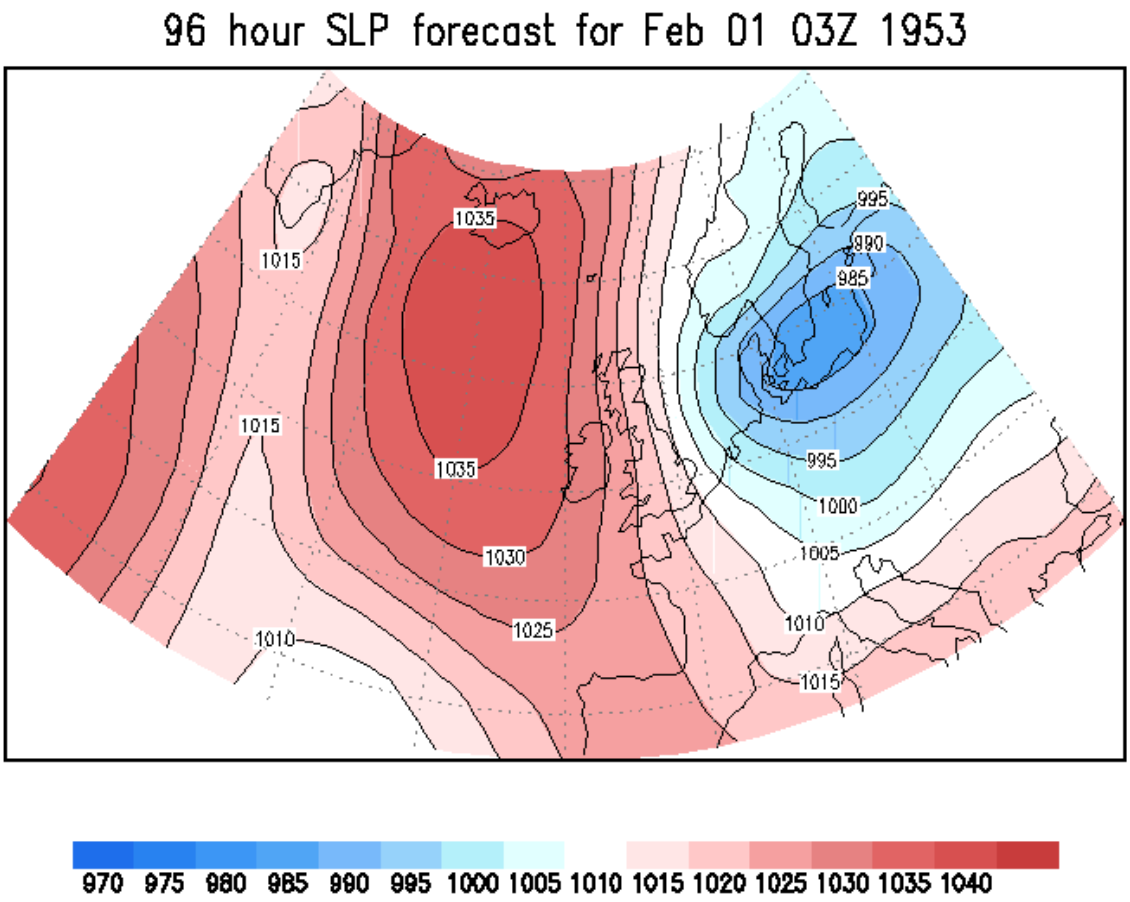

Fig. 2: The 96 hour forecast made by Reanalysis - ReForecasting (Kistler et al 2001). The verification in Fig. 1.

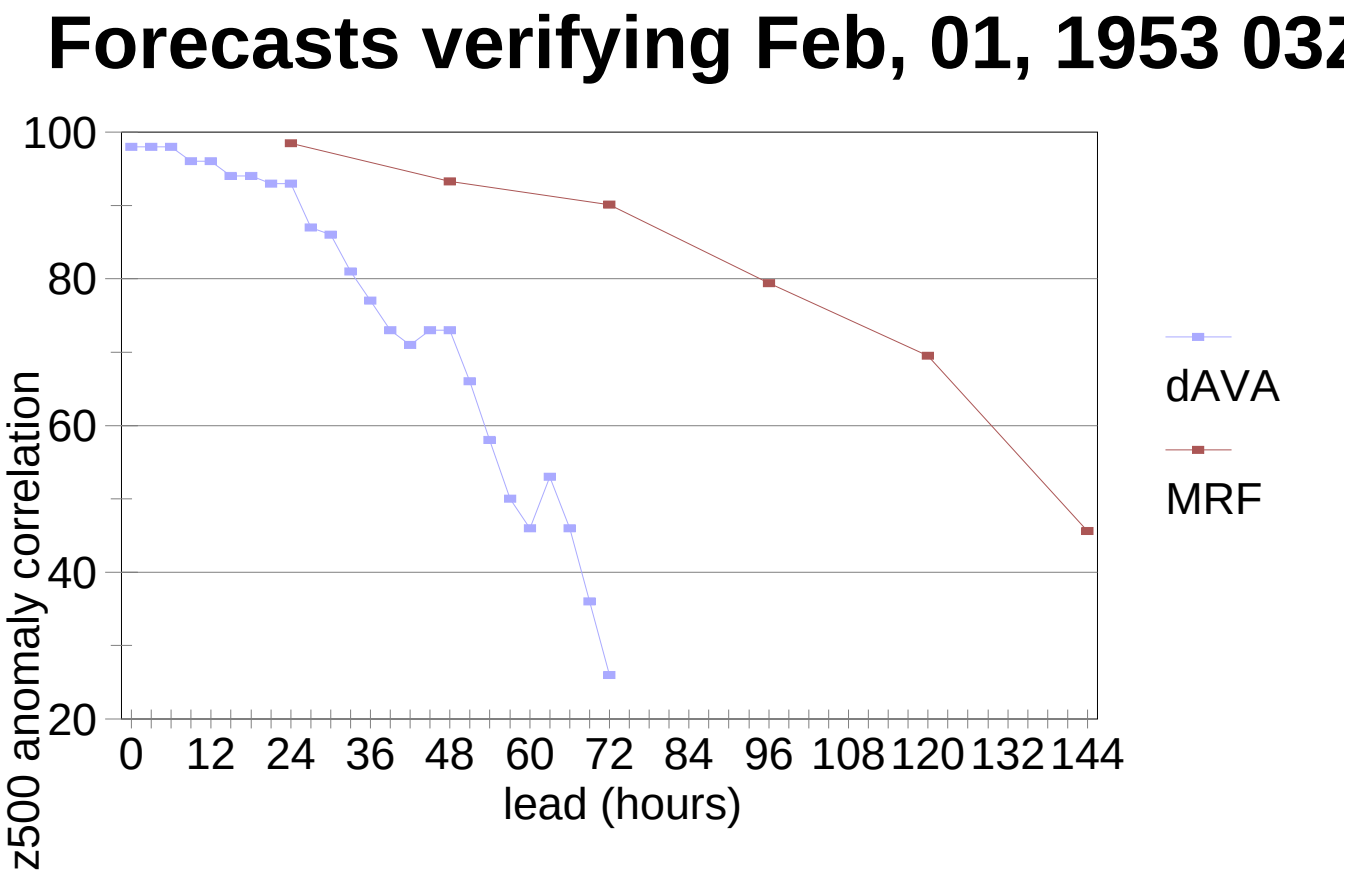

Fig. 3 Anomaly correlation for forecasts of 500mb height verifying Feb, 1, 1953, 0Z, in the North Sea area by a) the MRF (= global NCEP model used in conjunction with Reanalysis), and b) the dAVA (a modern Barotropic model). The dAVA made forecasts better than .90 correlation out to 30 hours, the MRF out to 72 hours.