Western Region Technical Attachment
No. 92-35
November 10, 1992

NMC'S MANUAL 6-10 DAY 500 MB HEIGHT PROG

Recently, a number of inquiries have been made regarding the production of the National Meteorological Center's (NMC) manual 6-10 day 500 mb height forecast. This Technical Attachment briefly summarizes the forecast methodology involved in creating this chart (AFOS graphic *96H*), which is produced three times per week. The product is centered on day 8 of the 6-10 day period, which is valid at 1200 UTC on Tuesday, Thursday, and Saturday. This product, *96H*, differs from the AFOS graphic *5ZH*, which is strictly an objective (i.e., numerical) 5-day (days 6-10) mean height field from the Medium-Range Forecast (MRF) model. The manual 6-10 day 500 mb mean height forecast combines both the dynamical model output and the forecaster's subjective input.

Output from two medium-range dynamical models, the European Center for Medium-range Weather Forecasts (ECMWF) model and the MRF, is used primarily to produce the manual 6-10 day forecast. Although the United Kingdom Meteorology (UKMET) office's medium-range model output is considered in the forecast, the most weight is usually given to the ECMWF and MRF. The forecaster compares and contrasts the output from the two models and develops a confidence level in each, accounting for the unique biases each incorporates. This step includes checking the run-to-run and model-to-model consistency. The forecaster usually "blends" the output from the two models, weighing the solution toward a correction field based on average errors of the 6-10 day mean height progs over the previous 60 days. It was found that 60 days provides the best results as it incorporates both a large sample size, which gives greater statistical reliability, and a smaller sample which reflects recent flow regime errors. This "blending" brings the subjective viewpoint of the forecaster into the methodology.

Also used in determining the amount of weight each model has on the forecast field (and forecaster confidence level) is the use of teleconnection patterns to check the internal consistency within the dynamical model itself. Teleconnection patterns developed by both O'Connor (1969) and Wagner and Maisel (1988) each provide useful data; they are calculated from 5-day anomaly samples and half-month means, respectively. The patterns are compared to the forecasted 6-10 day 500 mb height field (still being formulated) as well, whereby checking the hemispheric consistency of the anomalies produced by the forecaster. Therefore, the use of teleconnection patterns is two-fold: to examine the internal dynamic model consistency and to check the internal consistency of the 6-10 day forecasted height field.

Several other tools are used by the forecaster, all having less impact than those previously discussed. One is the use of the Barotropic model extended to 120 hours. Although the model is primitive in design, it does tend to provide good guidance through the medium-range in certain circulation patterns. Also considered is the compatibility of the day 3 MRF and ECMWF solutions with the day 2 output from the Limited-area Fine Mesh (LFM) model and the Nested-Grid Model (NGM). The confidence level in the dynamic model output is influenced by how well the evolution of short-range patterns are handled in the medium-range. A summary of the parameters used to determine the forecaster's confidence level (some not mentioned in the text) is illustrated in Figure 1.

Having made the 6-10 day 500 mb mean height prog, a temperature and precipitation forecast is made via objective statistical methods. The overall skill of the temperature and precipitation forecasts have increased over the years, with the temperature forecast skill higher than the precipitation skill level. Figures 2 and 3 illustrate the yearly averages of skill score for temperature and precipitation for the 6-10 day forecast through 1988. The Heidke skill score is calculated by the following formula:

$$\text{skill} = 100 \times \frac{\text{number correctly forecast minus number expected correct by chance}}{\text{total number of stations minus number expected correct by chance}}$$

Although the skill scores are generally lower for the precipitation forecasts (skill=12), the subjective forecast is better than the raw model output and climatology (skill=+4.5). These graphics, as well as a 6-10 day 500 mb height anomaly chart, are available on AFOS: *96T* (temperature anomaly), *96E* (precipitation), *96C* (500 mb height anomaly).

REFERENCES

O'Connor, J. F., 1969: Hemispheric teleconnections of mean circulation. Environmental Science Service Assoc. Tech. Report WB 10, Silver Spring, MD, iii+103 pp.

Wagner, A. J., 1989: Medium- and long-range forecasting. *Wea. Forecasting*, **4**, 413-426.

Wagner, A. J., T. N. Maisel, 1988: Northern Hemisphere 700-mb teleconnections based on half-monthly mean anomaly data stratified by season and by sign. *Proceedings of the 12th Annual Climate Diagnostics Workshop*, Salt Lake City, U.S. Department of Commerce, pp. 228-237.

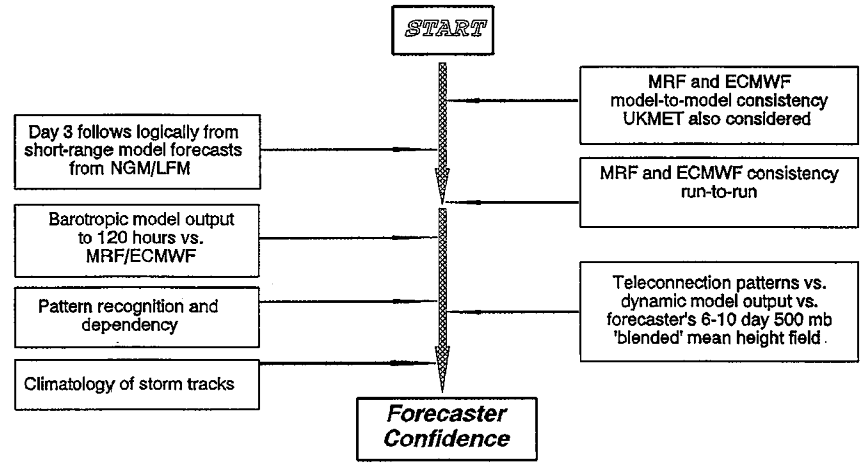

Figure 1. Summary of the input parameters influencing and leading to the forecaster's confidence level in the manual 6-10 day forecast.

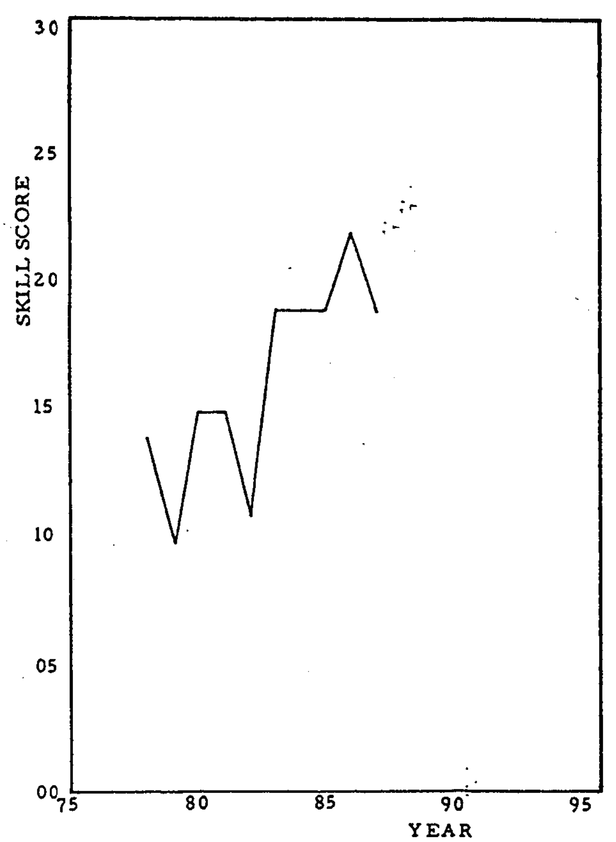

Figure 2. Yearly averages of temperature skill score for the 6-10 day extended outlook. The persistence skill score was 9 (from Hughes, 1988).

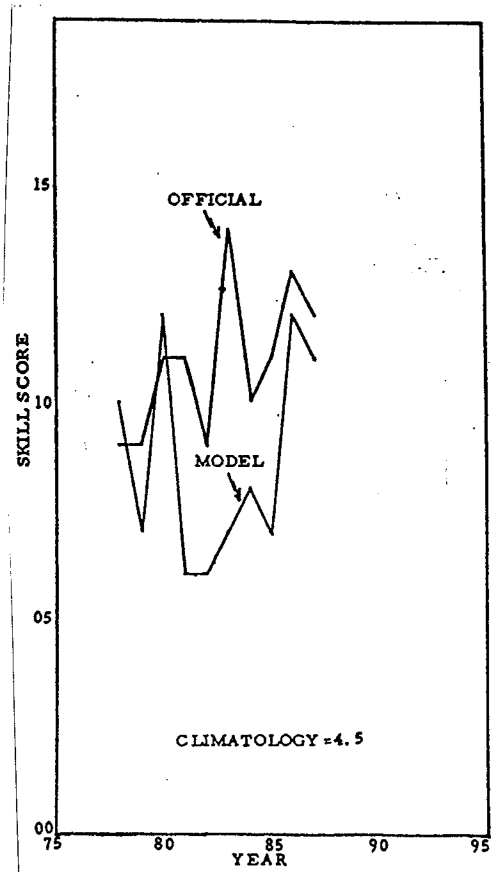

Figure 3. Yearly averages of skill score of the 6-10 day precipitation forecast for the MRF (model) and NMC (official). Climatology is +4.5.