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EXTENDED GUIDANCE PREDICTABILITY

Now that field forecasters routinely receive extended range numerical output, one of the most difficult and frustrating problems associated with using this guidance is the situation where there is little run-to-run continuity. This lack of continuity may be from run-to-run for an individual model, e.g., two successive runs of the MRF, or it can be between two different models, e.g., the MRF and ECMWF. Beyond day five, only a 6-10 day 500 mb mean chart and an associated departure from normal field from the MRF are available to field forecasters via AFOS. Run-to-run comparisons of this five day mean field, which should be fairly consistent due to the four days of overlap in the means, also frequently show enormous differences. A current area of extensive research is aimed at identifying the situations in which extended range (days 3-10) model guidance will likely be good or poor (see WRTA 90-26). This area of research is usually referred to as predictability, in other words, predicting the quality of the predictions. Field forecasters do not issue forecasts beyond day five, but even in the 3-5 day period, confidence in model output can be quite low during periods of high run-to-run variability. When are the models likely to be poor? When are they more likely to be accurate? The answer to these questions would be very useful to forecasters.

One situation in which the models have a great deal of difficulty is in forecasting the onset of blocking. An article by Dr. M. Steven Tracton, Climate Prediction Branch, NMC, entitled Predictability and Its Relationship to Scale Interaction Processes in Blocking, appeared in the August 1990 issue of *Monthly Weather Review*. In this article, Tracton attempts to determine the relative contributions of the planetary-scale, medium-scale, and short-scale circulation to the formation of a block in the 500 mb pattern that was poorly forecast by the MRF. He also attempts to isolate the contribution to the blocking by barotropic processes (advective) and baroclinic processes (developmental).

What Tracton shows is that the model can have great difficulty in forecasting the onset of blocking, even within three days of the occurrence. In general, when looking at the quality of numerical extended range forecasts, they do not randomly bounce back and forth between high skill on one day and low skill on the next. The models tend to do very well for a period, then very poorly for a period, and so forth. One of the periods in which they consistently do poorly is in forecasting the onset of blocking. Once the block has formed, the model does relatively well. The results of Tracton's study suggest that it is the interaction of the shorter scale features (synoptic-scale troughs and ridges) with the planetary scale circulation that contributes to blocking. It appears that even relatively small model errors forecasting the synoptic-scale systems, which are typically highly baroclinic, can lead to errors in the planetary circulation and particularly blocking patterns. A number of researchers have noted an apparent link between increased baroclinic wave activity, i.e., strong short waves, bombs, etc., upstream and prior to the onset of blocking. Increased model resolution helps this situation, but, in general there is still considerable difficulty in prediction of the onset of blocking within all the current operational models (ECMWF included).

Research underway is looking at whether the models have a general problem with forecasting during changes in the large-scale flow regime. The onset of blocking, as just discussed, would be an example of a change in regime. Likewise, the demise of a block would also represent a change in regime. The transition from a high amplitude pattern to a more zonal flow would be a change in regime.

Most field forecasters may already have an opinion on this issue. The big swings in run-to-run solutions seem, subjectively, to be associated with changes in the large-scale flow pattern. If Tracton's results, which indicate the correct prediction of the synoptic-scale features are vital to the accurate forecast of the onset of blocking, then accurate predictions of other changes in the planetary flow regime may also depend on correctly forecasting the smaller systems. This situation would present a considerable challenge to the numerical models, since accurate predictions of even the short-term, small-scale systems becomes an essential element to extended range forecasts.

Reference:

Tracton, M. S., 1990: Predictability and its relationship to scale interaction processes in blocking. *Mon. Wea. Rev.*, 118, 1666-1695.