Medium Range Forecasting at NCEP
(An Overview)

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ABSTRACT

The end to end medium range forecast process at the NCEP (HPC) is presented. Current and planned operational methodology and mechanical techniques of forecast production and issuance is discussed as well as current and future verification techniques. A very brief familiarization to United States (US) National Weather Service (NWS) and HPC will be initially addressed as well.

1. Introduction

The US NWS is a multifaceted organization tasked to protect the lives and property of the nations citizens by providing hydrometeorological information for the nations economic well being.

The core of the NWS consists of over 120 Weather Forecast Offices (WFOs) tasked with providing to the public detailed short term (0 to 48 hour) forecasts on the synoptic and mesoscale. One of many subsequent tasks of a WFO is to also provide "medium range" forecast guidance (3 - 7 day forecasts) of general weather elements (maximum and minimum temperatures, and precipitation type).

The role of the NCEP/HPC is to produce weather analyses and forecast products to the NWS WFOs and River Forecast Centers (and to other users in the meteorological community) in support of public weather forecasts. One of the specialities of the HPC is in the arena of medium range forecasting. HPC therefore, provides forecasts of the aforementioned general weather elements at selected locations along with forecasts of surface features (fronts and pressure systems) along with surface isobaric forecasts for the medium forecast range. These are provided to the WFOs for guidance, but are sufficient to be utilized verbatim in the case a WFO cannot donate adequate time to produce such forecasts if hampered by attending to local occurrence of severe weather.

2. Medium Range Forecasting at HPC

a. Current Product Suite

The current product suite of medium range products issued by the HPC includes the following:

- 3 to 5 day forecast of surface features (fronts, isobaric analysis, central pressures of isobaric maxima and minima)

- 3 to 7 day forecast of maximum and minimum temperatures and values of probability of precipitation (POP) values

- 1 to 5 day accumulated quantitative precipitation forecast (QPF)

b. Area of Responsibility

The above products incorporate the area over the contiguous 48 states (excluding Alaska and Hawaii). However, it should be noted that the forecasts of surface features incorporates a larger area (from 140E to 140W longitude south to the equator) in order to incorporate tropical systems that may potentially effect US interests.

c. Shift Aspects

The products are produced once a day every day of the year by 2 forecasters working in a single 8 hour period. The products have an issuance deadline of 18 UTC.

3. Utilized Models and Interpretation Techniques at HPC

Numerous models are interrogated by the medium range forecasters at HPC and include the MRF, ECMWF, UKMET, US Navy/NOGAPS, and the Canadian model. All of which are accessible to HPC in grid format except the Canadian which is view via the World Wide Web (WWW).

A variety of techniques are utilized to help the forecaster determine both which model is offering the most likely solution and where a model is offering a most likely solution. These techniques are discussed in more detail below, but include objective and subjective methods of model verification and continuity as well as incorporation of ensemble techniques. Ultimately, experience tends to be the most critical tool for HPCs medium range forecasters.

a. Model Verification

Model verification is performed both objectively and subjectively at HPC. Subjective methods include simple comparison of forecasts to initial analysis for a given model over a series of forecast hours. These can be looped in a given frame on a workstation to also give a sense of run to run continuity. Comparisons at given forecast hours between models are also utilized to assess timing and dynamical difference between model solutions. Currently the only objective method of model verification utilized by the forecasters at HPC is via mean 5 and 10 day bias of height, temperature, relative humidity at mandatory levels (300, 500, 700, 850, and 1000 HPa) as well as mean sea level pressure. These are provided to the forecaster utilizing locally developed software or by accessing pre generated images on the WWW at http://www.hpc.ncep.noaa.gov/mdlbias .

b. Ensemble Techniques

The only Ensemble Prediction System (EPS) that HPC has access to is its own. The NCEP EPS currently includes a 17 members at T62 resolution of geopotential heights, temperature, and mean sea level pressure. These are utilized primarily at 500 HPa and at the surface. Although clusters are available for interpretation, the limited number of members in the NCEP EPS limits the intrinsic significance of clusters, therefore the forecasters tend to utilize the ensemble mean.

4. Verification of HPC Medium Range Products

Currently, verification of HPC temperature and forecast POP values are available against observed values and MRF Model Output Statistics (MOS) of temperatures and POPs. The HPC has just begun producing its products in gridded format which will facilitate verification of other fields such as surface pressure and even frontal position. In the meantime, the verification of HPC against MOS indicates a bias to forecast too dry in situations where low POPs are forecast, and too wet with POPs greater than 60%. In most areas in the US, HPC shows significant improvement over MOS temperature forecasts except in the northeast and southeast US.

5. Future Efforts

HPC medium range forecast accuracy will increase as planned changes to the MRF model are implemented. These include the increase of MRF model resolution from T126/28L to T170/42L by mid winter of 2000 (including an increase of ensemble members to the MRF EPS). This will then be increased by mid 2000 to T254 resolution.

Model interpretation tools currently being developed will be completed and implemented by spring of 2000. These include tools to facilitate blending of a given fields from different models as well as software currently being developed to objectively accumulate bias statistics based on pattern classification. The latter will objectively identify by what magnitude a forecaster will be able to skillfully make modifications to model output for a given field at a given forecast hour.

Finally, more intuitive displays of verification will be made available for all forecasted parameters to facilitate optimal self calibration.

6. Contacts

Further inquiries and information can be obtained is available through the following venues:

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