Western Region Technical Attachment
No. 91-44
October 15, 1991

SUMMARY OF RECENT CHANGES IN GLOBAL FORECAST MODELS

[Editor's Note: The following information was provided by Dr. Glenn White and Dr. Eugenia Kalnay, NMC Development Division.]

1) The European Centre for Medium-Range Weather Forecasts implemented a higher resolution version of their global forecast model on September 17. The new spectral model now has a triangular truncation of 213 waves (corresponding to a grid resolution of approximately 62 km), doubled from its former truncation at 106 waves, and has 31 layers in the vertical, compared to 19 previously. Most of the additional layers are between 100 and 850 mb, doubling the resolution between 100 and 850 mb.

Changes to the model's physics have also been made. The Gaussian grid used in the physics calculation is 30% coarser than the one corresponding to triangular 213 resolution. A new semi-Lagrangian time scheme is used and a del-6 horizontal diffusion has replaced a del-4. Changes have also been made to vertical diffusion, mass flux convection and cloud parameterization.

Dr. A. Hollingsworth of the European Centre commented that the changes improve the model's performance during the first four forecast days. The lower layers in particular appear more realistic. The model is more active than before. The model's forecasts appear quite realistic beyond 6 to 7 days; however, skill scores beyond day 6 are no higher than before.

2) The United Kingdom Meteorological Office introduced a higher resolution model with more elaborate physics on June 12. The new grid point model has a resolution of 0.833 deg. latitude and 1.25 deg. longitude. It has 20 vertical levels.

The U.K. model now includes an interactive radiation parameterization. Cloud water and ice are prognostic variables. The boundary layer is modelled in an implicit formulation with a hydrological cycle and an interactive scheme for soil moisture. Data assimilation uses the repeated insertion of observational increments with divergence damping. Improved quality control based on Bayesian methods are used on all types of observations. (From the Meteorological Office's Quarterly Report on Numerical Products from Bracknell for April-June 1991).

NMC forecasters and development personnel have found that the new U.K. model has less negative bias in height, less zonalization and stronger waves in the forecasts. Changes in the U.K. model physics make the model more similar to the NMC and ECMWF global models.

3) NMC introduced a T126 global model on March 6, 1991, with a new horizontal diffusion based on turbulence theory to replace del-4 diffusion, a higher resolution sea surface temperature analysis and more accurate mass conservation. The new model uses mean rather than enhanced orography and introduces a parameterization of marine stratus. (REF. NTIM 91-3, issued March 7, 1991.)

On June 25, 1991, a new spectral statistical interpolation analysis was introduced at NMC (REF. NTIM 91-7, issued June 19, 1991). The new analysis system is a major change from analysis systems used at other centers and formerly used at NMC. It eliminates the need for initialization, produces more balanced analysis increments, and can easily incorporate new, nonconventional observations.

The new analysis-forecast system at NMC improves the skill of 3-5 day medium-range forecasts and 1-day aviation forecasts, reduces systematic biases and produces better forecasts of synoptic-scale waves. A 28-layer version of the global model (which currently has 18) and improved convection are currently being tested.