Western Region Technical Attachment
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SUMMARY OF RECENT CHANGES AT NMC (1991/1992)

This Technical Attachment (TA) is an update on changes that have taken place at NMC since our last update (WRTA 91-12) in March of 1991. A few significant improvements have occurred since that time, and more are coming soon, including the phase-out of one operational model and the implementation of another. Currently, NMC still uses three different models to produce all the operational runs we see each day.

The Early (ERL) Run

The purpose of this particular run has been, and continues to be, to provide a quick look at the forecast for North America through 48 hours. The model used for this run is still the Limited-area Fine-mesh Model (LFM) which remains frozen since it is responsible for our primary MOS guidance. This model, and the MOS associated with it, will be phased out late this year or early next year. It will not be phased out, however, until MOS is fully converted to the Regional Analysis and Forecast System (RAFS), which is based on the Nested Grid Model (NGM).

Regional (RGL) Run

The purpose of this run is to provide the best possible 48-hour forecast for North America. This run is still served by the NGM and its analysis, collectively known as RAFS. Several major improvements to the RAFS and the NGM were implemented on August 6, 1991. The first is the elimination of the outer 322 km resolution A-grid (Northern Hemisphere), the expansion of the middle 170 km B-grid to the area of the old A-grid, and the expansion of the inner 83 km C-grid to slightly larger than the area of the old B-grid. In other words, the NGM is now a 2-grid model rather than a 3-grid model, with better resolution over a larger area. This was done to reduce the influence of the lateral boundary conditions and reduce the errors introduced from the lower density grids that affected forecasts over Alaska and the west coast of the U.S.

Other significant changes that took place last August all had to do with implementation of the new Regional Data Assimilation System (RDAS) and the transfer of the RAFS to the Cray YMP/8. The change to the Cray also allowed the expansion of the grids and the runtime to be sped up. The RDAS scheme includes the addition of "off-time" data every three hours (rather than every six) for a 12-hour period preceding normal model initiation. These off-time data include profiler winds, automatic aircraft observations (ACARS data), and surface data (pressure, temperature, and moisture). The RDAS scheme also uses the NGM's own first guess from the previous run, rather than the first guess from the spectral model. See WRTA 91-31 for more details on the August 1991 changes.

Since implementation of RDAS, first guess upper-level analyses have fit conventional observations much better than before, especially near the levels where ACARS data are available. Additional detail has been added in low-level temperature fields, upper-level jets, and vorticity centers. In addition, the RAFS precipitation "spin-up" time has been greatly reduced, due mainly to the fact that the NGM is now using its own first guess.

The NGM will remain frozen from now on since it will be supporting the only operational MOS guidance, once the LFM is phased out.

Aviation (AVN) Run

The main purpose of this run is to provide guidance in support of NMC's international aviation requirements. It also provides valuable guidance for field forecast operations. The model serving this run is the spectral Medium Range Forecast (MRF) model, and is run out to 72 hours twice per day for the AVN run. Specifics of the MRF model are discussed in the next section.

Medium Range Forecast (MRF) Run

The MRF model is also run once per day (00Z cycle only) out to 240 hours, to provide extended guidance beyond day 3. In addition, the MRF model is run four other times per day, just out to 6 hours, using the latest data possible to provide a first guess to other model runs in the next cycle; these are called Final (FNL) runs.

The MRF model (a global spectral model) has undergone several significant improvements in the last year or so. WRTA 91-12 described the improvement in horizontal resolution from an 80 wave model (Triangular Truncation-80 modes, or T80) to a 126 wave model (T126); this occurred in March of 1991 when the model was transferred to the Cray. The other significant change was the replacement of the objective analysis technique with the spectral statistical interpolation (SSI) method in June of 1991. With SSI, the variables are analyzed in spectral space rather than in grid space. Many parameterizations were also improved, and a new parameterization for marine stratus was added.

As a result of changing to the SSI analysis method, the precipitation "spin-up" time has been greatly reduced. However, the model still produces too much rainfall over the mountains. On the positive side again, record skill levels for 6-10 day forecasts of U.S. temperature and precipitation were achieved during several months in 1991.

The Eta Model

The new Eta model continues to be tested at NMC and is now used operationally by NMC forecasters for comparison with other models. One version (30 km horizontal resolution and 30 vertical levels) has been run once per day since the spring of 1991 in a non-operational test mode. Another version (80 km horizontal resolution and 16 vertical levels) was implemented in October of 1991 "quasi-operationally". It was only available to forecasters in the NMC Meteorological Operations Division, and used as an early run with output available at the same time as LFM output. So far, the initial conditions have come from the RAFS 83 km grid.

NMC forecasters have noted significant improvements in precipitation forecasts (vs. the current operational models), especially in the shorter range forecasts. However, they also noted some deficiencies as well; for instance, the Eta model tended to over-develop cyclones along the East Coast. Based on this feedback, the problem has already been fixed by the addition of a thin surface layer. Test runs of the 30 km - 30 layer Eta model have shown that this version has correctly doubled QPFs compared to forecasts from the 80 km RAFS in a number of cases. The Eta model has also shown a better ability than the NGM to forecast cold-air damming events along the Rockies and East Coast.

Future Plans

When the LFM is phased out sometime in 1993, the NGM will likely move into the ERL run slot, while the Eta model will become the new RGL run. The plan is to run the Eta model out to 36 hours, with no MOS expected. Offices in the MARD area may have access to limited output from the Eta model before the end of 1992. In the meantime, testing of the 30 km version of the Eta model will intensify.

Plans are still underway to increase the number of vertical levels in the MRF model. A T62 version is already being tested with 28 vertical levels (the current version has 18 levels). Test results with this particular version indicate little improvement to forecasts of the troposphere, but significant improvements at 100 mb. In 1993, the horizontal resolution will likely be increased to T160, and the AVN run may be processed four times per day instead of two. In 1994, we may be using a version of the MRF model with a T210 resolution and 40 vertical levels.

Testing of the Mesoscale Analysis and Prediction System (MAPS) (refer to WRTA 91-12) will be moved to the Cray at any time now. This system will provide the foundation for a future Rapid Update Analysis Cycle, which will eventually provide hourly updates of upper-level analyses to field offices using all available data (i.e., profiler, ACARS, etc.). Products from the system, which include detailed analyses and 6-hour forecasts, will initially be available every three hours within 30 minutes of data collection, and only to modernization risk reduction offices. The resolution of the system is currently 60 km in the horizontal with 25 isentropic and 5 sigma levels in the vertical. As the volume of data increases, the resolution of the system will increase to 20-30 km and 40+ levels.

° RUN	PREDICTION MODEL	DOMAIN	ANALYSIS	DATA CUT-OFF	RESOLUTION HORIZ	RESOLUTION VERT	FORECAST PROJECTION	500 MB HEIGHT AND VORTICITY PRODUCTS AVAILABLE ON AFOS
°EARLY LOOK (ERL)	LIMITED-AREA FINE MESH (LFM)	REGIONAL (N.A.)	GRIDPOINT CRESSMAN SUCCESSIVE CORRECTION 2-DIMENSIONAL	1+15	GRIDPOINT 190 KM @60°N	7 LAYERS	48 HRS	50(6,7) 52(6,7) 54(6,7) 56(6,7) 58(6,7)
REGIONAL (RGL)	NESTED GRID MODEL (NGM)	HEMISPHERIC	GRIDPOINT 3-DIMENSIONAL OPTIMUM INTERPOLATION (OI)	2+15	GRIDPOINT GRID B 166 KM GRID C 83 KM 45°N	16 LAYERS	48 HRS	50(H,V) 52(H,V) 54(H,V) 56(H,V) 58(H,V)
AVIATION (AVN)	MEDIUM RANGE FORECAST MODEL (MRF)	GLOBAL	SPECTRAL STATISTICAL INTERPOLATION (SSI)	2+45	SPECTRAL 126 WAVES (105KM)	18 LAYERS	72 HRS	5A(H,V) 5C(H,V) 5E(H,V) 5G(H,V) 5I(H,V) 5J(H,V) 5KH
HURRICANE (HCN)	QUASI-LAGRANGIAN (QLM)	REGIONAL (51X51 GRID)	GRIDPOINT (51X51 GRID) (OI)	3+45	GRIDPOINT 60 KM	10 LAYERS	72 HRS	NONE
MEDIUM RANGE (MRF)	MEDIUM RANGE FORECAST MODEL (MRF)	GLOBAL	SPECTRAL STATISTICAL INTERPOLATION (SSI)	6+00	SPECTRAL 126 WAVES (105KM)	18 LAYERS	240 HRS	5TH 5UH 5ZH 5VH 5ZC 5WH (00Z ONLY) 5XH 5YH
FINAL (FNL)	MEDIUM RANGE FORECAST MODEL (MRF) (GDAS)	GLOBAL	SPECTRAL STATISTICAL (SSI) RUN 4 TIMES A DAY	00Z 6+00 06Z 9+30 12Z 8+30 18Z 9+30	SPECTRAL 126 WAVES (105KM)	18 LAYERS	FOUR 6 HR SEGMENTS	NONE