Western Region Technical Attachment
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NMC MODELS UPDATE

[The following information was provided via conversations with Drs. Ralph Petersen and Kenneth Mitchell, NMC Development Division.]

Medium Range Forecast (MFR) Model

As reported in last week's minutes, the conversion of the MRF model from the Cyber to the CRAY YMP-8 is now complete. Both the MRF and AVN runs are now routinely processed on the CRAY, completing the runs about four times faster than the Cyber. During this conversion, the grid spacing in the optimum interpolation step was halved, otherwise, there were no other significant changes. However, by the end of this year, NMC is planning to increase the horizontal resolution from 80 to 120 waves, the vertical resolution from 18 to 24 levels, and improve boundary layer physics.

Regional Analysis and Forecast System (RAFS)

Within the last year, several changes to the RAFS, and its associated NGM model, have been tested in parallel runs with the operational RAFS. NMC presented these changes to the Committee on Analysis and Forecast Techniques Implementation (CAFTI) on June 8, 1990, and they were approved. Implementation is scheduled for early October. A brief description of these changes follows:

- 4th order finite differencing - This will implicitly improve the horizontal spatial resolution of the model.

- Expansion of the innermost C grid southward to Panama - This change will shift the impact of boundary perturbations well south of the U.S border.

- Improvement in the representation of orography - By modestly increasing the horizontal resolution of the model's topography, greater detail will be realized in both the horizontal and vertical scales. Since the implementation of the RAFS, the topography over the continental U.S. has been more realistic than over the remainder of the North American domain. Therefore, with this change, major improvements in orographic representation will be obtained across Mexico, Canada, and Alaska. There will also be significant improvements in the West, particularly in California, the Columbia River Basin, and in the lee of the Rockies.

- Improvements to the subsoil temperature specification - This has been shown to improve morning minimum temperature forecasts at low levels.

- Correction to soil wetness along the coastlines

- Addition of stability-dependent surface fluxes over water - This already exists over land, but by including it over water, improved forecasts of ocean cyclogenesis are anticipated.

- Improved radiation calculations (mainly in the upper troposphere and stratosphere)

- Changes in the Regional Data Assimilation - Currently, the RAFS uses the 6-hour MRF forecast from the Final Global Analysis for initial conditions. Under the proposed system, the RAFS will use its own NGM forecast as the first guess for the RAFS analysis over the innermost C grid. This regional assimilation configuration will operate from T-12 hours (where T = 00 or 12Z) over two 6-hour cycles forward to the on-time analysis at T. Use of the higher resolution RAFS initial conditions is expected to improve frontal structure, divergence patterns and reduce model spin-up time, i.e., improving precipitation forecasts in the first 12 hours.

One of the major concerns regarding these proposed changes is their cumulative effect upon NGM MOS guidance. There are no plans to redevelop the existing NGM MOS equations. NMC conducted a four-week parallel test in April 1990, during which the NGM MOS guidance resulting from the operational and experimental runs were compared. Although some minor differences were noted, it was concluded that there was no significant degradation of the NGM MOS guidance.

The current RAFS continues to run on the Cyber. Now that these proposed changes have been approved by CAFTI, these changes and the remainder of the RAFS code will be converted to run on the CRAY, with implementation scheduled for early October.

Model Backup

Once both the MRF and RAFS are running on the CRAY, the Cyber will continue to function as a backup for both models. However, the backup versions of these models will not include any of the changes proposed in this Technical Attachment. In other words, the backup versions of the MRF and RAFS will be the current versions of these models.