Ongoing Improvements to the NCEP Real Time Mesoscale Analysis (RTMA) and UnRestricted Mesoscale Analysis (URMA) and NCEP/EMC

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NCEP's Real Time Mesoscale Analysis (RTMA) [1] system is designed to provide the highest quality gridded surface analysis for National Weather Service operations. Recent feedback from NWS forecasters has indicated that RTMA has been ineffective in resolving surface mesoscale features. In order to resolve these forecaster complaints, RTMA is being substantially changed. The use of new, higher-resolution NWP model background fields (i.e. HRRR, local NAM nests) and changes to the quality control of observations allow for a more detailed analysis that closely matches available surface observations whenever possible. New analysis variables are also being added to match those forecasted in the National Digital Forecast Database. A new analysis product (UnRestricted Mesoscale Analysis/URMA) has also been added to allow for the use of latent data in the analysis.

Background Field Improvements

Over the continental US (CONUS), RTMA's background has been a downscaled RAP 1-hour forecast [2]. The relatively coarse resolution of the RAP (13 km) with respect to the analysis grid (2.5 km) and assumptions used in the downscaling process often result in a background field that does not accurately reflect current conditions, especially over areas of complex terrain. The new RTMA's background field is a blend of a short term forecast from the new HRRR (3 km) and CONUS NAM nest (4 km) models. Downscaling effects are much less extreme when working with fields from these higher-resolution models. These models are also better able to resolve mesoscale terrain-induced features.

Quality Control Improvements

Many surface observations have previously been rejected by the RTMA due to failing the 'gross error' check that compares observations with the background field. This led to an analysis that did not match local observations, which forecasters consider inaccurate. As a remedy, two routines were added to relax the gross error check in certain situations. A terrain-aware feature relaxes the gross error check in areas of complex terrain, where the background field/model may not properly resolve the terrain. A buddy check system was also added to enable the assimilation of observations that are spatially consistent, but potentially be quite different from the background field. Obsolete, field-provided reject lists were also removed. These changes increased the number of surface observations being used in RTMA by up to 30% in some cases. Work is also beginning on a variational quality control approach, in which observations from a given station will be given a varying weight based on their differences from the current analysis solution during the minimization procedure of the variational analysis. Additional work is needed to identify and flag unrepresentative observations, which are common from some mesonet networks set up by amateur weather enthusiasts.

New Analysis Variables

Three new analysis variables have recently been added to the RTMA: total cloud cover, visibility and wind gust [3]. The total cloud cover analysis uses thinned observations of total cloud cover from the GOES 13 and 15 Imagers along with surface METAR observations of cloud cover. Wind gust and visibility analyses use available surface observations and a downscaled HRRR forecast as a background. Tests showed that blending wind gust and/or visibility background led to important mesoscale phenomena being washed out by the two models. Plans are also in place to add significant wave height (based in part on JASON-2 altimetry observations) and minimum/maximum temperature analyses. Minimum and maximum temperature analyses will only be produced once a day for the entire day.

T*he UnRestricted Mesoscale Analysis*

The UnRestricted Mesoscale Analysis (URMA) is the RTMA run six hours later in order to incorporate observations that arrive too late for the RTMA. URMA runs currently for the CONUS domain only, but will be implemented also for the Alaska, Hawaii, Puerto Rico, and Guam NDFD domains in December 2015. URMA was recently chosen to be the "truth analysis" for the National Weather Service's National Blend of Models project.

Field Feedback

A NOAA-only internal website has been set up to allow forecasters to instantly compare RTMA/URMA analyses to previous versions of RTMA/URMA, background fields and other analyses schemes such as BDCG and LAPS. An email listserv (aor-rtma@infolist.noaa.gov) is used to keep forecasters in the field abreast of updates to RTMA and to take questions about the product, provide examples of inconsistencies or problems with the analysis.

References:

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