MDE Product Development Team
August FY10 Monthly Report – FY 2010
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With contributions from Geoff DiMego and Mary Hart (NCEP/EMC);
Stan Benjamin, John Brown, Steve Weygandt (NOAA/ESRL/GSD);
Jordan Powers, Roy Rasmussen (NCAR);
And Ming Xue (OU/CAPS)

(Compiled and edited by S. Benjamin and B. Johnson)

Executive Summary

Task 10.5.1: Infrastructure support related to operational running of the RUC and NAM operational modeling systems.

- Investigation of occasional crashes on RUC warmed up again in August after a crash case. GSD found that an increase in sigma layer depths near surface solved the crash. No changes made yet in operational RUC, but this test provides a strategy if required by NCEP/NCO. (Note: RR ran without problem in all of these cases.)

Task 10.5.4 Develop, test, and implement Rapid Refresh configuration of the WRF modeling system.

- *Completion of RR pre-Request-for-Change evaluation has been slipped to 1 December.*
- *Anticipated RR implementation date at NCEP has now been moved back to April-May 2011.*
- RR test cycle at NCEP continues to run in real-time with new rotated lat-lon grid/domain covering all of the Aleutian Islands per requests from the Alaska Aviation Weather Unit (AAWU) and NWS Alaska Region.
- Major computer transition at ESRL requiring major rewrites to all RR scripts and significant testing.
- Speed of ARW model increased significantly at NCEP, guaranteeing equal speed in Rapid Refresh as for current RUC.
- Switch from WRFPOST to UNIPOST for model post-processing in GSD RR cycle

Task 10.5.5: Develop, test, and implement 3DVARs for RR and NAM

- Code modifications for RR GSI with binary I/O complete and submitted back to NCEP

Task 10.5.15: Develop methods for improved cloud/hydrometeor analysis in RR

- Modifications to GSI for ingest of background hydrometeor fields and new observations accepted in NCEP GSI SVN repository
- Testing of METAR-cloud-based RH observations in variational humidity analysis in development RUC.

Task 10.5.24/19: Development/testing of HRRR

- Additional case study tests being conducted to evaluate HRRR MCS propagation issues, including initial tests of 1km nest inside HRRR and mid-level moistening
- Continuing very good HRRR reliability since start of CoSPA evaluation
- Installation of computer resources for a HRRR partial shadow system has been completed at GSD
- HRRR reflectivity verification package running, being expanded to include VIL verification

Task 10.5.1 Infrastructure Support Related to Operational running of the non-WRF Rapid Update Cycle System in NCEP Operations

ESRL/GSD

ESRL continues to monitor operational RUC (and two ESRL versions of RUC with some differences in radar and cloud assimilation). Performance of the operational RUC is monitored at both ESRL and NCEP verification websites (see **http://ruc.noaa.gov/stats**). Intercomparison of verification between the NCEP and ESRL versions of the RUC continue to be monitored by ESRL at **http://ruc.noaa.gov/stats** -- no unexpected differences occurred during July. No RUC performance problems occurred in August at ESRL (of special interest since the backup RUC at ESRL is used to initialize the HRRR (**http://rapidrefresh.noaa.gov/hrrr**).

After two August crash cases with the RUC model at NCEP in a down slope wind case, ESRL worked with NCEP-EMC to test variations in the vertical coordinate. A modest increase in the maximum sigma thickness specification in the RUC hybrid coordinate from 10 hPa back up to 12 hPa was successful to avoid the crash in this case. While these crashes are rare, ESRL and EMC now have a likely strategy to take if required by NCEP/NCO should additional crashes occur in RUC before the RR implementation. (Note: The Rapid Refresh has been rock-solid in all of these cases – no crashes at all.)

NCEP

Testing is complete for a major upgrade to the NCEP BUFR library scheduled for implementation in FY2011/Q1, which is critical to all observational ingest and impacts both RUC and NAM. Work continues on issues like radiosonde sites that report an invalid instrument type; late arrival of GOES 1x1 field-of-view cloud data; bringing in new SSM/IS data from DMSP F-16, F-17 and F-18 satellites to replace discontinued SSM/I products; use of TAMDAR data from AirDAT as a MADIS alternative; and the NRL-based aircraft QC code. The Florida and Georgia DOT and Aberdeen PG mesonet providers have been down for several months. The Colorado E-470 mesonet provider (down since 27 July) returned on 6 August. The LSU-JSU mesonet provider (down since 26 July) returned on 29 August. GOES-13 cloud and precipitable water retrievals continue to be unused (since the GOES-12 to GOES-13 switch on 14 April). The station pressure for 15 oilrig METAR reports added in May are still available for assimilation in the RUC and NAM even though they were added to the reject list. An RFC has been submitted to correct this error. (Dennis Keyser)

The cause of the RUC model cycles that “hung” prior to completion in May and June is now likely linked to a modification in the vertical coordinate back in January to avoid a crash of different origin in that case. Work was done with IBM and NCO to make the RUC model code generate a clean exit in such an event. This allows NCO to notice the problem much sooner and initiate the rerun. There were no RUC cycle ‘hangs’ of this type in August, and this code upgrade was implemented on 24 August to deal with this event if it occurs again. The operational RUC experienced two failures due to CFL instability on 14 and 15 August, apparently associated with mountain waves in the west forming on the east side of a strong upper level trough. After considerable effort, these failures were finally reproducible at NCEP but not at ESRL/GSD. Since the RUC experienced several of these failures earlier this year, experiments were conducted showing that a slight increase in RUC sigma thickness from 10 hPa to 12 hPa avoid these crashes and is a strategy if necessitated by additional future crashes. Discussions continue. (Geoff Manikin)

Task 10.5.17 Infrastructure support for operational running of Rapid Refresh, North American Mesoscale, and HiResWindow (and future HRRR) at NCEP, including support for community WRF model

ESRL/GSD

Progress in Rapid Refresh development during May toward operational implementation at NCEP can be found under Task 5.4 report.

NCEP

Parallel tests of the NEMS/NMMB model in the EMC NAM parallel system continue on the CCS. Two NMMB parallels are being run: one a 12 km control run and the other a 12 km experimental run with model and/or analysis changes being tested for inclusion in the control run. The experimental parallel is also running all four nested domains (4 km CONUS, 6 km Alaska, 3 km Hawaii, 3 km Puerto Rico). During August, several changes were made to the experimental run: 1) The Puerto Rico nest domain was enlarged to cover all of Hispaniola; 2) changes to various microphysics parameters were put into the experimental 12 km run and all 4 nests, which leads to more realistic simulated reflectivity; 3) the nested domains (previously run with no parameterized convection) are now being run with an experimental version of the BMJ convection with moister profiles, in an attempt to induce behavior like the regular BMJ shallow convection. (Eric Rogers)

For the NAM specifically, the radiosonde at Shemya, AK (70414) still launches too late for the NAM-GSI. We will contact Alaska Region to get more information. Since 1 August, nearly half of the Canadian radiosonde stations no longer provide wind information, as sites are now alternating between using Loran and GPS navigation signals and the Loran signals only are used to generate wind data at this time. There was a loss of polar satellite data for 7 hours on 25 August. GOES-13 radiances are monitored but will not be used until fall (because GOES-13 replaced GOES-12 on 14 April). NOAA-18 has on-going gyro issues that could lead to the demise of the gyros and unusable products within 6 months. NESDIS engineers are conducting several 24-hour tests where the corrupted navigation data will not be sent to NCEP. The first was on 10 August and the second was on 17-18 August. After the second test, NOAA-18 MHS data was not available for another 20 hours due to problems related to the gyro-less test. METOP 1B radiance data were not available for 4 hours on 20 August. Due to fall eclipse season, there are gaps in GOES data around 0600 UTC. MTSAT-2 replaced MTSAT-1R for JMA satellite-derived winds on 11 August. The following data types are monitored by the NAM-GSI: RASS virtual temperature profiles (NPN and MAP), Mesonet mass data, AIRS AMSU-A radiances and MDCRS moisture data. All but RASS of these are being tested in Eric Rogers' parallel. NOAA-19 1b radiances and 10 meter wind speed from JASON-1 and -2 altimetry data will soon be monitored. NAM/NDAS and RTMA PrepBUFR files are being generated in parallel with 50 km ASCAT and WindSat scatterometer wind data (both non-superob) and production NAM/NDAS dumps of METOP IASI radiances, GPS-RO data and SBUV-2 data are being created. Use of the GFS tropical cyclone relocation procedure (for medium to strong tropical cyclones) to update the global first guess fields input to NDAS is also being tested in Eric's parallel as a replacement for the current synthetic wind data bogus but this can only be done at the t-12 hour start time of the NDAS. Pseudo surface pressure increments at the storm center (derived from the global guess and max wind information in the tcvitals file) along with a saturated moisture profile are being tested in the parallel. A legacy restriction (that only surface data with a reported pressure is processed) will be removed to allow many new surface observations (land, marine and Mesonet) to be assimilated in the RTMA and possibly NAM/NDAS. The RTMA is testing the use of low-level satellite-derived winds. (Dennis Keyser)

As part of the CIP transition-to-CCS project, code for PIREP ingest is done and has been successfully compiled. Debugging work is nearly done. (Yali Mao)

NCAR

CURRENT EFFORTS:

NCAR organized and conducted a WRF tutorial and assisted with related tutorials, held July 26-August 6. The first week featured the main WRF tutorial, while the second covered WRFDA, WRF-Chem, and MET. Attendance for the WRF tutorial was over 60. ESRL scientists (Georg Grell and Steven Peckham) conducted the WRF-Chem component.

NCAR prepared and issued a minor WRF release, Version 3.2.1. Released on August 18th, this contains bug fixes and miscellaneous improvements. Jimy Dudhia of NCAR/MMM contributed to the following fixes: (i) a minor

YSU PBL scheme correction to a V3.2 modification in the Prandtl number calculation; (ii) reversion to the RRTMG long wave package from V3.1 while errors in the V3.2 package are investigated; and (iii) a minor fix to initialize a variable in the BEP urban model option. Details of V3.2.1 may be found at **http://www.mmm.ucar.edu/wrf/users/wrfv3.2/updates-3.2.1.html**.

Dudhia of NCAR/MMM worked on various WRF physics issues. He continued work with Changhai Liu (NCAR/MMM) on trying modifications to the YSU PBL scheme to determine the effect of sub-grid vertical fluxes on resolved fluxes in 1-km idealized PBL growth tests. One problem was identified to be due simply to the idealized set-up of the surface fluxes. Since corrected, the YSU PBL behavior is more reasonable, but differences from LES are still being investigated.

NCAR/MMM hosted graduate student Marcela Ulate (U. Miami) working on the sensitivity of the MJO to model physics in tropical channel WRF simulations. The runs included the nudging of water vapor in order to obtain an MJO. This is being investigated in terms of the physics required to produce an MJO, particularly deep and shallow convection.

Lastly, Dudhia resolved a problem in WRF V3.2 RRTMG long wave radiation scheme. This was due to not updating the RRTMG data files when the V3.2 code was added.

PLANNED EFFORTS: The development and implementation of new physics will continue through the end of the quarter.

UPDATES TO SCHEDULE: NONE

Task 10.5.4 Develop, test, implement, and improve the Rapid Refresh.

ESRL/GSD

Good progress continues toward the RR implementation at NCEP, with most effort this month toward meeting specific NCEP requirements for the RR. Tasks that are complete or very close to completion are

- Expansion of the RR domain slightly to include all of Alaska including the entire Aleutian chain, and to convert to the rotated latitude-longitude grid/domain (see Fig. 1 below). The NCEP RR cycle ("RAPx") is currently running on the rotated lat-lon domain shown on this figure.
- GRIB grid #83 has been designated for the Rapid Refresh using this rotated latitude-longitude domain.
- Speed-up of ARW model at NCEP – after help from NCEP/IBM consultants, the run-time was decreased by over 2x, and now is running in the same run-time currently being used by the RUC at NCEP.
- Upgrading GSI to the latest top-of-trunk version, necessitating significant effort to get it working correctly on n/hJet at GSD.
- Replacing NetCDF with binary formats for all input/output and intermediate files needed for the RR cycling.
- Upgrading of UniPost to produce 13 additional 2-d fields available from the RUC, but not heretofore available from UniPost.
- Generalization of Prdgen to produce products on specified AWIPS grids from the Rotated lat-lon grid at NCEP.

Close communication with NCEP is maintained via regularly scheduled weekly telecons (and unscheduled telecons as needed) between the GSD RR developers and Geoff Manikin at NCEP to review current progress. Examine forecast performance, and to define remaining tasks necessary toward the implementation. Subjective and objective evaluation of forecasts from RR cycles at both GSD and NCEP has revealed some remaining issues that are being addressed and solved on a near-daily basis.

The RR at GSD continues performing similarly or (mostly) better than the RUC for most forecast fields, although with some warm bias at low and middle levels. The mid-level warm bias noted in the FY10Q3 report is reduced significantly by enabling shallow convection (via a name list option in WRF) within the G3 (3d Grell-Devenyi) convective scheme. We performed limited testing toward lessening the low-level warm bias (see Task 8). The parallel RR 1-hour cycle ("RAPx") cycle at NCEP is just now beginning to be rigorously verified.

Rapid Refresh primary and dev 1-h cycles were shifted to run on hJet at GSD (a major effort). A major operating-system change for hJet/nJet late in July necessitated recompiling and some reconfiguring of WRF and GSI on these systems. With the decommissioning of wJet in early September, all the Boulder High-Performance computing systems are now using essentially the same operating system.

A change log on the primary RR 1h cycle is maintained at
http://ruc.noaa.gov/internal/RR_runs/RR_1h_info.txt.

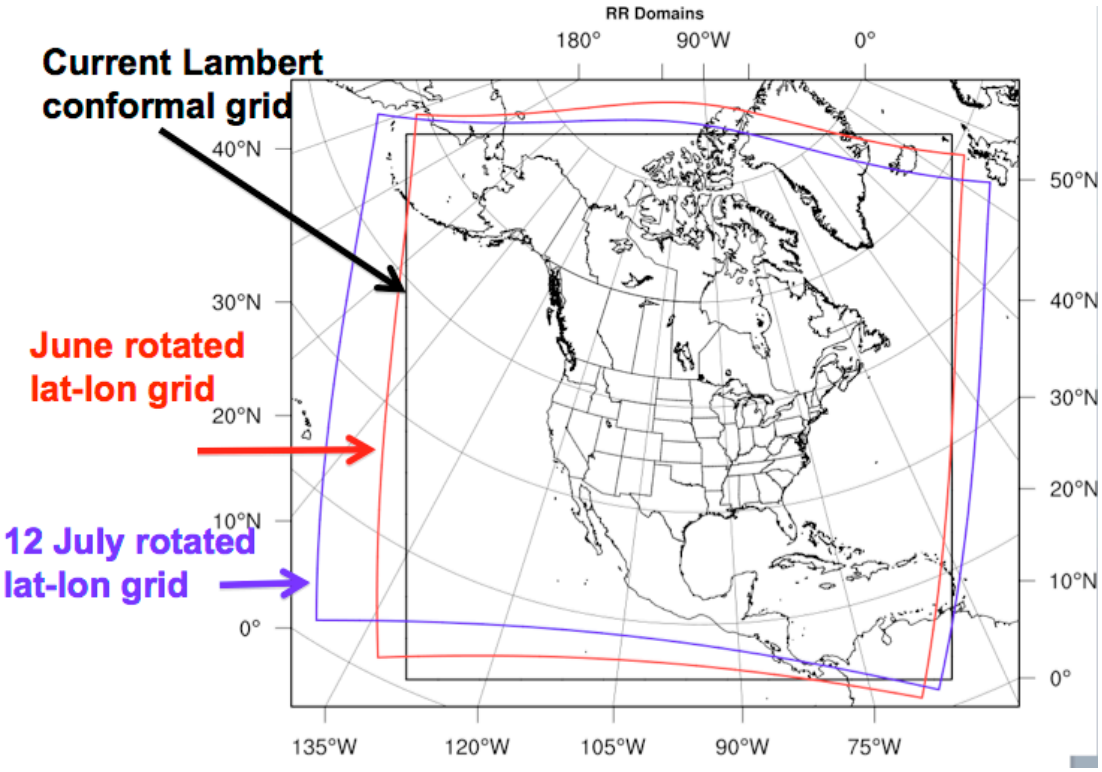

Fig.1. Rapid Refresh domain – old Lambert conformal (black) and future (purple) rotated lat-lon version. The red grid was an initial rotated lat-lon grid proposed in June before the Alaskan request to include all of the Aleutians in the RR domain.

More details below on specific changes:

Binary I/O in place of NetCDF:
A major effort this month continued to be replacing NetCDF format files with flat binary files for model output and for output from the WRF Preprocessing System used in the RR partial cycling. A major component of this was the adaptation of the NCAR routine *update_bc* to permit use of binary files for input and output from this code instead of NetCDF. All this was a requirement for NCEP implementation and is now essentially complete. A benefit of this change is that reading and writing files now takes about half as long as before. Geoff Manikin is putting these changes in place at NCEP, and we are in final testing at GSD.

Rotated lat-lon projection for RR:
Based on the groundwork laid in Q3FY10, and having received a final word from various functionaries in the National Weather Service, and particularly from the Alaska Aviation Weather Unit (AAWU), the Anchorage NWS WFO, and the Aviation Weather Center (AWC) in Kansas City concerning the desired domain coverage by the Rapid Refresh, we made the final decision on switching to the rotated latitude-longitude (RLL) horizontal grid early in July. Figure 1 (above, repeated from the Q3FY10 MDE report) shows the old Lambert conformal domain (in black) and the now final (purple) RLL grid. The purple RLL grid contains about 2.5% more grid points over a slightly bigger domain than the previous Lambert conformal grid that had been used at GSD for the past 20 months, but at the same nominal 13km horizontal grid spacing. This grid (or, more precisely, the de-staggered A-grid instantiation of this grid, which is used by UniPost output on the horizontal native grid) has been assigned as AWIPS Grid # 83. (Parameters for this grid can be found at **http://rapidrefresh.noaa.gov/RR.rlldomain.txt**.) The UniPost incorporates recently developed NCEP enhancements to post-process binary files from the ARW when the ARW is run using the rotated lat-lon grid option. Heeding advice from EMC, for grids that require interpolation from the native RR horizontal Grid 83 to specialized domains (e.g., to Grid 130, the current native RUC horizontal 13km grid), at EMC we are using their PRDGEN code rather than copygb. This is more efficient (pre-calculation of interpolation weights from one grid to another), much faster, and bypasses the insufficient functionality of copygb to handle the rotated lat-lon projection. Efforts are ongoing to port Prodgen to GSD's Linux clusters, but until this is complete, we don't have the capability to objectively verify the RR running in RLL at GSD. Thus, the RR primary cycle continues to run the RR on the Lambert Conformal grid.

RR Post-processing:
UniPost upgrades developed at GSD during the past 3 quarters, including 13 new fields added in August, have been passed on to NCEP for testing and eventual inclusion into the NCEP repository. Post-processing of GSD primary and dev 1-h cycles has used the UniPost (with these extensive GSD enhancements for RUC look-alike fields) for the past 3 months. A small glitch in generation of the 3-d native grid fields was fixed in early July; the UniPost is now generating output grids on the native sigma surfaces of the WRF instead of on isentropic (theta) levels. We worked closely with Geoff Manikin at NCEP to ensure in particular that the Grid 130 RUC look-alike fields are indeed being rendered correctly in GRIB by NCEP's Prodgen code, and that the fields are all present and computed consistently with what is currently operational in the RUC.

Subtasks

10.5.4.1 Ongoing evaluation of performance of real-time and retrospective runs of RR system. (30 Sept 2010)

GSD
Overall, GSD RR performance continues to about equal or is better than that of the GSD RUC backup for most variables. Warm temperature biases at mid levels noted in the Q3 report were significantly reduced but not eliminated by activating the shallow convection option in the Grell convective parameterization. This decreased the overall cloud cover, presumably enhancing long-wave radiative cooling at middle levels.

An experiment was performed (see Task 5.8) on whether a small physics change could reduce a warm bias at low levels over the eastern CONUS.

NCEP
NCEP continues to generate experimental Rapid Refresh (RR) PrepBUFR files containing WindSat data (non-superob) and 50 km ASCAT, which are copied to a private ESRL directory on the NCEP ftpprd server. RR dumps

of Level 2 and expanded (time-window) Level 2.5/3 88D radial wind data, hourly lightning data, and GOES single-pixel cloud data from NASA/Langley (covering Alaska) are also being copied to a public ftp directory. These, along with early (T+0:26 minute) parallel dumps for 0000 and 1200 UTC, are being tested in ESRL's experimental RR runs. ESRL reports that the Langley cloud data from NCEP cover a much smaller geographical area than expected, so NCEP is investigating. Future data tests will include Multi-Agency Profiler winds and METOP-2 radiances as well as "tcvitals" records for tropical cyclones. EMC and GSD have requested the Radar Operations Center to initiate radar sites' hourly processing of Level 2.5 88D data 15-30 minutes earlier so more data will arrive before the RR cutoff. This is critical for the Alaska portion of the expanded RR domain, where the only source of radial wind data is the Level 2.5/3 because of no funding for Alaskan Level 2 data. Level 2 data from 8 DOD CONUS sites are expected to become available in November 2010. (Dennis Keyser)

The hourly Rapid Refresh cycle is now running at NCEP, although some updates to the code are still needed. Code has been written to develop a product generator for the Rapid Refresh to interpolate the output to the existing RUC output grids, to maintain all of the grids/parameters currently available in the RUC to assist user transition to the new system. This has proven to be a difficult task, as the RUC generates different precipitation accumulation time periods than in the WRF code used by the Rapid Refresh. (Geoff Manikin)

Subtasks

10.5.4.3 Ongoing evaluation of performance of real-time and retrospective runs of RR system. (30 Sept 2010) [NOTE: This has always been 10.5.4.1. The correct 10.5.4.3 (Per Stan's "Status of FY10 MDE PDT Deliverables") is given below and is the RR under NEMS – ESMF subtask]

Deliverables

10.5.4E3 new requested date: 1 Dec 2010 (Manikin)
Pending EMC, and NCEP Center initial recommendations, Request for Change (RFC) forms are filed to submit Rapid Refresh software to NCO.

With discovery of a few RR implementation oversights at NCEP and evaluation-related questions arising on the effectiveness of the data assimilation in the RR, we request for a slip to 1 December.

CURRENT EFFORTS: Recommendations are pending since system testing isn't complete yet.

PLANNED EFFORTS:

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED:
Currently, there has been difficulty in getting sustained resources at NCEP to avoid interruption in the RR cycle running on cirrus/stratus. We will keep you posted on this issue.

INTERFACE WITH OTHER ORGANIZATIONS: ESRL.

UPDATES TO SCHEDULE: None.

Subtasks:

10.5.4.1 Ongoing (GSD, NCEP)
Ongoing evaluation of performance of real-time and retrospective runs of RR system for SAVs, AHPs.

GSD
Overall, GSD RR performance continues to about equal or is better than that of the GSD RUC backup for most variables. Warm temperature biases at mid levels noted in the Q3 report were significantly reduced but not eliminated by activating the shallow convection option in the Grell convective parameterization.

10.5.4.2 Continue to solicit input from In-flight Icing, Turbulence, National Ceiling/Visibility, and Convective Weather PDTs and NWS forecasters in Alaska and Puerto Rico, on performance of pre-implementation Rapid Refresh. (ESRL, NCEP)

During July, discussions with the Alaska Aviation Weather Unit (AAWU) and the Anchorage NWS WFO concerning the desired domain coverage by the Rapid Refresh disclosed that the Alaska folks wanted to see the *entire* Alaska portion of the Aleutian Island chain included within the RR domain. This resulted in the purple domain on the rotated lat-lon grid shown in Fig. 1, and was approved by the Aviation Weather Center (AWC) in Kansas City in early July. To partially compensate for the westward extension necessary to include the Aleutians, the south boundary of the domain was moved slightly north. In order to display the full extent of the new Rotated lat-lon grid in Alaska localization, the AAWU and Anchorage NWS WFO asked that we produce products on AWIPS grid #242, which encompasses the entire Aleutian chain, instead of #249.

10.5.4.3 Updated report on status of tactical planning for making RR-WRF ARW model code for 2013 in compliance with Earth System Modeling Framework (ESMF) in agreement with the Sept 2007 Rapid Refresh MOU between NCEP and GSD. Work in this area will commence in FY11 (ESRL, NCEP, NCAR)

ESRL/GSD continues to prepare its global FIM model (**http://fim.noaa.gov**) for becoming part of the Global Ensemble Forecast System at NCEP using ESMF and the NCEP configuration for ESMF, NEMS. Initial testing of FIM running under NEMS at NCEP was conducted earlier this year. The process of putting FIM under NEMS has entailed close collaboration between GSD software engineers and the NEMS developers at NCEP. This has provided valuable experience for ESRL software engineers in use of NEMS and GSD software engineers have even contributed substantially to the design of the NEMS configuration at NCEP. The FIM experience for NEMS prepares ESRL well for the upcoming adaptation of the WRF-ARW dynamic core toward NEMS in the 2013 version of the Rapid Refresh. Work specifically toward putting the ARW core under NEMS will commence in 2011.

10.5.4.4 31 Mar 2010 (GSD, NCEP)
Complete pre-RFC evaluation of Rapid Refresh in accordance with NCEP pre-implementation checklist for major implementations. Respond to evaluation questions; present information on Rapid Refresh pre-implementation testing and evaluation results in various forums, as required.

GSD
1 December 2010 is now our best current estimate for completion of the pre-RFC evaluation. Some implementation problems have been discovered for the RR test cycle running at NCEP, forcing a delay in the freezing of the code.

NCEP
An NCEP Charter document for the Rapid Refresh implementation was completed on 10 Dec 2009 and submitted to NCO via Geoff DiMego. An update to the RR Charter was written on 14 May and sent to Geoff DiMego.

Deliverables:

10.5.4.E1 20 Dec 2009 (GSD)

Report on Rapid Refresh testing at annual NCEP Production Suite Review meeting.
Stan Benjamin, Steve Weygandt and Ming Hu attended the NCEP Production Suite Review 8-10 December and gave an update on RR progress. This presentation can be found at
http://www.emc.ncep.noaa.gov/annualreviews/2009Review/presentations/Benjamin-Weygandt-RUC_C.ppt

10.5.4E3 (30 September 2010) NCEP
(Manikin)
Pending EMC, and NCEP Center initial recommendations, Request for Change (RFC) forms are filed to submit Rapid Refresh software to NCO.

With the modification to the domain and effort to correctly use binary I/O and reduce ARW run-time at NCEP (now successful), we request for a slip to 25 October.

CURRENT EFFORTS: Recommendations are pending since system testing isn't complete yet.

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: A schedule backlog has developed for implementations on the new P6 computers.

INTERFACE WITH OTHER ORGANIZATIONS: ESRL.

UPDATES TO SCHEDULE: None.

Task 10.5.5 Develop, test, and implement improvements to the operational data assimilation supporting Rapid Refresh and North American Mesoscale runs.

ESRL/GSD
Good progress on GSI toward NCEP RR implementation with code nearly frozen for EMC real-time parallel version run by Geoff Manikin. Work on GSI-base analysis portion of RR system has been performed in conjunction with work on other portions of the system, including key design changes of switching to rotated lat-lon horizontal grids configuration and switching to cycling using binary format for output files instead of NetCDF.
As part of the final code shakedown, a number of GSI and other analysis issues were found and resolved including:

- Additional scripts to properly cycle Rapid Refresh land surface model fields for the 9z and 21z cycle, where background atmospheric fields come from the partial cycle.
- Correction to scaling factor in radar reflectivity processing code in EMC GSI (associated with use of binary radar reflectivity tile files at EMC as opposed NetCDF files at GSD)
- Correction to EMC GSI script regarding use of background error covariance file
- Correction to EMC GSI script regarding use of files containing all (including restricted) observations.

Close scrutiny and comparison of both the EMC real-time RR cycle (run by Geoff Manikin) and the GSD real-time RR cycles (run by Ming Hu and Curtis Alexander) continue to resolve any outstanding issues. Particular emphasis has been on comparison of the analysis increment fields between the two systems, which has been helpful in uncovering the issues listed above. We are still seeing some minor differences in the analysis increments and forecast fields, that require further investigation before the code can be frozen. We anticipate freezing the GSI and other RR codes at NCEP by 1 October 2010.

NCEP

Additional progress has been made towards a regional application of the hybrid ensemble (hybens) option in GSI. First, an addition to the GSI by Arthur Mizzi (NCAR-MMM) allows ensemble perturbations of the ARW model to be used. His changes were transmitted to the NCEP machines and merged with the current GSI trunk, and a test case he provided was successfully run. Second, the random internal ensemble perturbation generator that wasn't working properly for the regional hybens application was fixed. Finally, some progress was made in reading global ensemble sigma files directly into the NMMB GSI, in preparation for the 1st series of regional tests with hybens using the parallel NMMB over the NAM domain. A temporary fix was provided for an error that appeared in the rotation of wind observations from the earth to model grid in the high resolution Hawaii and Puerto Rico nests, so Eric Rogers could continue with a parallel test running GSI simultaneously for the 4 high-resolution nests alongside that of the NAM parent. Work is underway on a permanent fix. (Dave Parrish)

Radio Acoustic Sounding System (RASS) virtual temperatures from the NOAA Profiler Network and Multi-Agency Profiler (MAP) Network and MAP winds were tested in the NDAS. While some stations report every 10 minutes and others report every hour, only the data nearest to the analysis time were used. Since large biases were found, gross check limits were set to tighten the quality control. The adaptive tuning of observational error was applied to the data after these QC adjustments and the parallel tests showed almost neutral (improved from previously negative) impacts on the forecasts. Satellite bias corrections were spun up in support of the official parallel test using the GFS coefficients to produce cold start files in the NDAS. The simultaneous GSI analyses for Eric's NMMB parallel nests were also checked. Work was done with the regional land-surface and CRTM radiation groups to include the new IGBP vegetation types in the regional analysis. These changes were reviewed and committed to the GSI trunk repository. (Wan-Shu Wu)

Deliverables

10.5.5.E3 New requested date: 1 Dec 2010 (Manikin)

Pending EMC, and NCEP Center initial recommendations, Request for Change forms (RFCs) is filed to submit GSI code as part of Rapid Refresh software to NCO.

CURRENT EFFORTS: Geoff Manikin of EMC visited GSD in Boulder during the week of June 7 to work on the RR. As a result, the boundary condition and partial cycling jobs of the Rapid Refresh are now running routinely in the EMC parallel environment. (Manikin)

PLANNED EFFORTS: Get the full hourly RR cycle running in July. (Manikin)

PROBLEMS/ISSUES ENCOUNTERED OR ANTICIPATED: None.

INTERFACE WITH OTHER ORGANIZATIONS: NCO

UPDATES TO SCHEDULE: DELAYED INTO FY2011.

10.5.5.E5 31 Aug 2010 (Wu, Rogers)

Subject to NCEP Director approval implement NEMS/NMMB version of GSI (e.g. strong constraint, revised bkgs+obs errors) in NAM/NDAS.

CURRENT EFFORTS: Testing the RTMA station reject-lists and use lists in NDAS. A new version of GSI that uses the latest satellite radiative code is also re-evaluated after a bug fix in the CRTM. (Wu)
Preliminary coding started at the end of June on test to see impact of different resolution on regional strong constraint. (Parrish)

PLANNED EFFORTS: Revise the background error and observational error covariances in NDAS. Apply the launcher tool on analysis related impact study. (Wu)

Determine why regional strong constraint impact is always negative and test impact of different analysis grid with the global dual resolution code, which has been developed for more efficient hybrid ensemble and 4dvar applications. New strong constraint is not ready to implement in Sept. 2010. (Parrish)

PROBLEMS/ISSUES ENCOUNTERED OR ANTICIPATED: The analysis grid is different from model and the generic tangent linear model differs too much from WRF/NAM and NMMB.

INTERFACE WITH OTHER ORGANIZATIONS: GSD, NCO, ESRL (on possible use of the HRRR for RTMA background)

UPDATES TO SCHEDULE: NAM upgrade to use have NEMS/NMMB and improved GSI scheduled implementation is now Q2 FY2011 (~March 2011)

Deliverables:

10.5.5.E3 New requested date: 1 Dec 2010 (GSD, NCEP)
Pending EMC, and NCEP Center initial recommendations, Requests for Change (RFCs) are filed to submit GSI code as part of Rapid Refresh software to NCO.

See discussion above on final modifications (rotated lat-lon domain, binary I/O, upgrade to latest NCEP GSI version with "bundle" structures for analysis variables being completed.

10.5.5.E4 30 Sep 2010 – deferred to FY2011 in previous reports - NCEP (Wu, Rogers)
Subject to NCEP Director approval implement NEMS/NMMB version of GSI (e.g. strong constraint, revised bkgs+obs errors) in NAM/NDAS.

CURRENT EFFORTS: Upgraded the GSI code to a latest SVN trunk version. The new features of the GSI include importing ozone field in NAM/NDAS from the global system for use in radiance assimilation via the CRTM, updating the 10m winds, 2m T, and 2m q fields in the NEMS/NMMB. Test the impact of the latest version and turn on GPS RO (Radio-Occultation) data on the short-term forecasts. Small positive impact on temperature and humidity fields was observed from the GPS RO data. (Wu)

PLANNED EFFORTS: Work on ozone analysis in NAM/NDAS and fixing the negative ozone-mixing ratio imported from the global system. (Wu) Test sensitivity of results to differences between the analysis grid and the model grid and between the regional models (WRF/NAM and NEMS-NMMB) and the generic tangent linear model using global dual resolution GSI code which has been developed for more efficient hybrid ensemble and 4dvar applications. (Parrish)

PROBLEMS/ISSUES ENCOUNTERED OR ANTICIPATED: A schedule backlog has developed for implementations on the new P6 computers.

INTERFACE WITH OTHER ORGANIZATIONS: GSD

UPDATES TO SCHEDULE: Due to issues with slow progress on strong constraint and NMMB physics tuning and due to implementation schedule backlog, we must request this milestone be moved into FY2011.

Task 10.5.8 Improve physical processes in the WRF (RR and HRRR) and NAM models, especially including those that affect aircraft icing.

Subtasks:

10.5.8.1 30 Nov 2009 (GSD)
Complete systematic GSD evaluation of physics performance in GSD 1-hour RR cycles for initial RR implementation.
The overall performance of the RR WRF physics configuration was completed as part of the November (GSD Tech Review) and December (NCEP model review) meetings. The behavior of the physics (a critical component of the RR) appears to overall be very good, with the RR model through the fall, winter and early spring producing at least equal results to the RUC in key areas (upper-level wind/temp – better, surface wind/temp/Td – about equal overall, precipitation – better for CSI, perhaps too high for bias, ceiling – better for MVFR and IFR conditions). Additional evaluations, such as the examination of a warm temperature bias at mid levels that developed during May, will be conducted up to the transfer of RR code to NCEP/NCO, but these results including the physics now appear adequate. Regarding this warm bias at mid-level, we believe that this was caused by excessive middle and high cloudiness preventing sufficient longwave radiation cooling. The bias is reduced, but not eliminated, by activating the shallow convection in the Grell scheme, which decreases the cloud cover. Until activated this June, RR forecasts had been made with this option turned off.

During July, a test was initiated to examine a low-level afternoon warm bias that seems most pronounced over grassland areas. In the WRFV3.2 release of 2 April 2010, an option was added to the MYJ surface layer scheme to reduce the strength of coupling between the land and atmosphere over grassland and increase coupling over forested areas. We tested this option (iz0tlnd=1) in the development RR1h cycle between 20 July and 6 August, comparing against the primary RR1h cycle, and found no discernable benefit toward reducing the warm bias.

10.5.8.2 30 July 2010 (NCAR/RAL)
Report on research and testing on addition of the new explicit aerosol variable(s) in initiating cloud water and ice. Computer storage and run time considerations will be considered as a constraint on the development.

10.5.8.3 1 April 2010 (GSD)
Test and evaluate upgrades of RUCLSM to handle sea ice and snow cover on sea ice under wintertime conditions for FY11 Rapid Refresh upgrade.

10.5.8.4 1 Aug 2010 (GSD)
Continue exploring possibilities for enhancing treatment of sea ice and tundra (including albedo changes and spring-time ponding) in Rapid Refresh domain toward a FY11 Rapid Refresh upgrade.
Discussions have commenced with Ola Persson and other Arctic experts in ESRL's Physical Sciences Division. They point out that the major uncertainty in the surface energy budget over snow in the Arctic is the emissivity of low clouds. Ice clouds have much lower emissivity in the infrared wavelengths than water clouds. These investigators have collected high-quality data that may be of use to us in diagnosing model issues in the far north.

To incorporate these effects will require enhancements to the existing coupling between microphysics and radiation in the RR, and will not be incorporated in the initial RR implementation.

10.5.8.5 30 July 2010 (NCAR-RAL)
Evaluate the new aerosol based ice initiation scheme that was implemented into WRF during the previous year using available case studies, including ICE-L and IMPROVE II.

10.5.8.6 30 Aug 2010 (NCAR-RAL)
Develop a scheme to explicitly predict the number of cloud droplets based on an assumed aerosol/CCN spectrum. This includes testing various droplet activation schemes in the recent literature based on updraft, general turbulence characteristics, super saturation, and aerosol properties. These changes will enable improved prediction of the size distribution of water droplets, including when freezing drizzle will occur.

10.5.8.10 30 Sept 2010 (GSD, NCAR)
Begin testing at GSD of latest version of microphysics for Rapid Refresh upgrade in FY2011.

Deliverables:

10.5.8.E2 1 May 2010 (GSD)
Pending EMC, and NCEP Center initial recommendations, Requests for Change (RFCs) are filed to submit upgraded WRF model physics code as part of Rapid Refresh software to NCO.

10.5.8.E3 30 July 2010 (NCAR-RAL)
Provide an improved microphysics scheme to GSD for evaluation toward the FY11 Rapid Refresh upgrade.

CURRENT EFFORTS: Trude continued working on the April 28, 2010 case to test the updated dust modules. One of the main issues was to correct for areas of predicted dust where there should not have been any emission. Another issue is to determine if resolution has a large impact on wet deposition modeling.

PLANNED EFFORTS: Continue developing and testing the new aerosol scheme.

PROBLEMS/ISSUES ENCOUNTERED OR ANTICIPATED: None

INTERFACE WITH OTHER ORGANIZATIONS: GSD

UPDATES TO SCHEDULE: None

NCEP

CURRENT EFFORTS: A report was delivered on July 30 to Stan Benjamin (available under **http://ruc.noaa.gov/faa-mde/10.5.8.E3_aerosols.pdf**) regarding current progress on the new aerosol scheme in the NCAR microphysics scheme. Trude is preparing to combine the dust modules (emission, deposition and ice nucleation scheme) with the aerosol/CCN activation modules developed by Greg Thompson. The emission and deposition modules are mostly modified modules from the WRF-Chem model.

PLANNED EFFORTS: Continue developing and testing the new aerosol scheme.

PROBLEMS/ISSUES ENCOUNTERED OR ANTICIPATED: None

INTERFACE WITH OTHER ORGANIZATIONS: GSD

UPDATES TO SCHEDULE: None

Task 10.5.15 Develop improved methods of cloud and moisture analysis for use in the Rapid Refresh and NAM Modeling Systems.

GSD

All elements for the initial RR cloud analysis package have been submitted to the NCEP SVN repository and approved. Ming Hu has coded additional modification for binary I/O of the cloud hydrometeor fields and submitted them to the NCEP SVN repository.

An issue with the processing of the radar reflectivity tiles for the EMC parallel RR cycle was uncovered and corrected by Ming Hu. We are also close to resolving a cloud analysis issue – the loss of some of the NASA Langley data coverage in the southern part of the RR domain in the pre-processing steps before the RR is run. Investigation of this issue has involved Ming Hu, Dennis Keyser at NCEP, and Rabi Palikonda at NASA Langley.

Variational moisture based on METAR-cloud RH innovations from ceiling observations developed in spring 2010 continues to run in the development RUC at ESRL. This technique will be evaluated further and revised toward a 2011 update to the Rapid Refresh.

Task 10.5.24 Develop, test, and improve the 3-km WRF-based High-Resolution Rapid Refresh

The HRRR continues to have very good reliability since the start of the CoSPA real-time assessment. The installation of the additional HFIP related cores are now complete. Other than the planned outage on August 27-28, computer outage was minimal. Latest runtime statistics indicate the HRRR reliability (99.3% for unscheduled outages of 6+ hours for 4 weeks ending 7 Sept.) continues to meet project goals. We have also identified a scripting change that should reduce the HRRR latency by ~ 30 min. We will implement this following the completion of the summer evaluation period.

Curtis Alexander and Eric James have completed additional case study work on case of poor HRRR performance in the propagation of mesoscale convective systems. Encouraging results have been obtained by running a 2-way interactive 1-km nest over a portion of the HRRR domain. See Fig. 2.

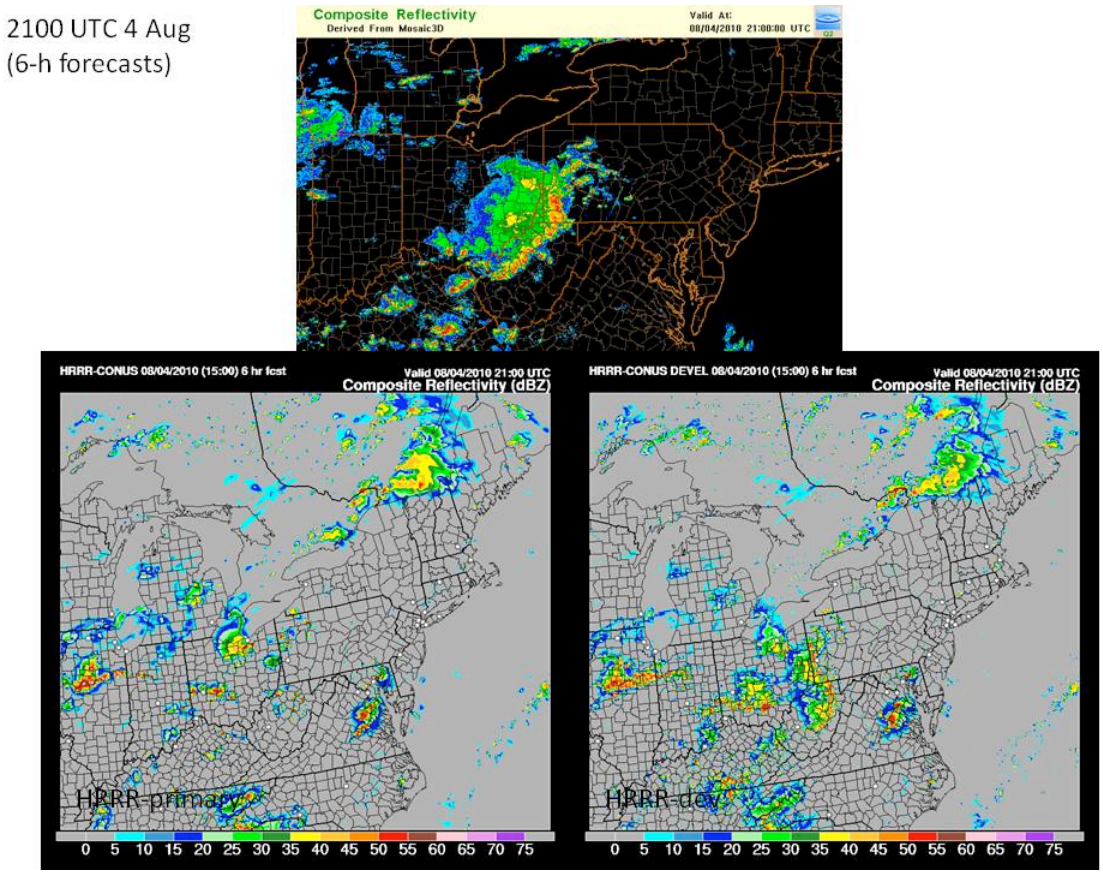

Fig. 2 Comparison of real-time (lower left) and experimental (lower right) 6-h HRRR forecast maximum reflectivity valid 2100 UTC 4 August 2010 with verification radar mosaic. Experimental HRRR includes a 2-way interactive 1-km nest.

Subtasks:

10.5.24.1 15 Jan 2010 (GSD, NCAR/RAL, NCAR/MMM)
Design the assimilation/modeling configuration for the HRRR during the 2010 summer convection forecasting (CoSPA) exercise.
Complete with frozen code since May 14, 2010

Task 10.5.24 Evaluate convection permitting forecasting by the ARW core for ultimate application in the HRRR

NCAR

CURRENT EFFORTS: In spring 2010, NCAR/MMM carried out 3-km ARW simulations initialized with radar-enhanced, 13-km Rapid Refresh grids from NOAA/ESRL. Jimy Dudhia continued working with Morris Weisman (MMM) to evaluate the model spin-up in the ARW runs. A meeting was held with the ESRL group (with whom NCAR is collaborating), and Dr. Weisman's updates and the focus on the simulations were discussed. The MMM work involves analyzing the effect of changes to the Thompson microphysics scheme, which were presented at the meeting. These changes showed some degradation from the version used in last year's forecast experiment.

PLANNED EFFORTS: The analysis of the convection-permitting forecasts will through the end of this quarter.

UPDATES TO SCHEDULE: NONE

Deliverables:

10.5.24.E1 30 Sept 2010 (GSD)
Complete FY10 test (likely with full CONUS domain) with 3-km High-Resolution Rapid Refresh running every 1 h.

- Conduct real-time summer 2010 HRRR forecasts using 3-km WRF initialized with radar-enhanced Rapid Refresh over full CONUS domain, monitor performance, modify code/scripts as needed, maintain high reliability working with ESRL computer facility
- Coordinate with other AWRP users and other collaborators, including coordination of HRRR grid transfers
- Provide project management
- Lead writing of report on summer 2010 HRRR experiments

GSD HRRR personnel continue maintain the HRRR for the 2010 CoSPA evaluation, including real-time hurly HRRR run generation, file-transfer, outage notification, and interaction with co-developers and users. Interest in the HRRR continues to grow, with numerous requests for products.

INTERACTIONS: ESRL/GSD scientists Curtis Alexander and John Brown have visited SPC to participate in the Spring Program, evaluating HRRR performance for aviation, severe weather, and hydro-meteorological applications. ESRL and NCAR scientists continue to meet every 2-4 weeks (most recently on Thurs 22 July 2010) to discuss issues related to HRRR and HRRR-like convection resolving simulations and share results of different sensitivity experiments designed to find improved formulations.

Task 10.5.19 Develop and refine techniques to assimilate radar radial velocity and reflectivity data through GSI and Rapid Refresh toward the HRRR.

GSD
Additional testing of the radar assimilation capability for the HRRR forecast system would be conducted as soon as the new HRRR partial shadow system is in place (expected Sept. 2010). The focus will be on: 1) variations in the strength of the radar reflectivity-based latent heat temperature tendency, 2) further comparison of HRRR forecasts initialized from RR vs. RUC (including the radar assimilation), 3) impact from the addition of 3-km radar assimilation to the RUC/RR 13-km assimilation. An updated version of the GSI, incorporating the latest NCEP modifications is essential for this testing, and is being updated for RR use. This GSI version will also be used for the 3-km tests (in conjunction with the DFI package in the WRF-ARW run at 3-km resolution).

NCEP
A set of subroutines were completed that read old VAD wind BUFR files, new VAD wind bufr files and the PREPBUFR file. Efforts were also made to convert the new VAD wind BUFR file to the new format and append it to the PREPBUFR file. Subroutines were also completed to co-locate the old VAD wind observations in temporal and spatial dimensions to compare the two observations. Wind profiles were generated for the two observations at all co-located stations. An examination of the impact of assimilating radial wind on NMMB forecast was completed, with mixed results. A positive impact was found for large-scale precipitation ETS skill; however, a slightly negative impact was found in the upper air verification. Work continues with John Derber and Russ Treadon to fix a bug in GSI where the initial penalties of radial wind are different with different MPI tasks. (Shun Liu)

Deliverables

10.5.19.E2 30 September 2010 (Liu, Pyle, Parrish)
Report on the design and initial development of hybrid ensemble-3DVAR system

CURRENT EFFORTS: All work on the hybrid ensemble option this quarter was focused on maintaining existing capability while massive changes were introduced to GSI to allow nearly complete generalization of state and control variables. (Parrish)

PLANNED EFFORTS: Add interface to read existing regional ensemble perturbations from SREF. (Parrish)

PROBLEMS/ISSUES ENCOUNTERED OR ANTICIPATED: This is a new and relatively immature capability so expectations should be tempered.

INTERFACE WITH OTHER ORGANIZATIONS: CAPS, ESRL/GSD

UPDATES TO SCHEDULE: None.

10.5.19.E4 15 September 2010 (Liu, Pyle, Parrish)
Demonstrate mini-NDAS data assimilation system using HRRR-like design constructed to precede HiResWindow runs or Matt Pyle's SPC runs using hourly updates with GSI.

CURRENT EFFORTS: Modified digital filtering aspects within the NEMS/NMMB code so it would correctly generate a more balanced initial state of the atmosphere. As in WRF, the most dramatic noise reduction is in the first forecast hour, with more modest noise reductions extending beyond three hours into the forecast. Noise here is defined as domain averages of absolute surface pressure tendency. An initial emphasis was placed on getting the so-called TDFI (Twice Digital Filter Initialization) working properly, as it has desirable properties such as efficient noise reduction and is the most likely candidate to use in future testing. The DDFI (Diabatic Digital Filter Initialization) filter also appears to be working properly now, while the DFL (Digital Filter Launch) filter still needs work. Future work will look at the impact of filtering on a data assimilation cycle and inclusion of 88D mosaic fields of reflectivity during the forward integration step. Initial testing likely will be in the three-hourly NDAS cycle, where the impact is anticipated to be modest. Later testing will be done in an hourly data assimilation cycle, where the positive impact of having a more balanced first guess may be more significant. (Pyle)

Tests of assimilating radar radial wind with DFI version of WRF were completed. In the HiRes initialization, the first test examined if cross-relationship between wind and other model variables can be established through DFI. It was found that temperature increment is small after DFI and the moisture increment was relatively large. The second test examined the impact of DFI time window on the forecast. DFI is first applied to the background field to eliminate the imbalance caused by interpolation. After assimilation of radar radial wind, DFI is applied again to remove imbalances due to wind field change and to establish balance between wind and other model variables. The experiments showed that with an increased DFI time window, relatively large temperature increments could be obtained. However, a larger cold bias occurs in the short-term forecast. The longer DFI time window can help improve 18 to 36 hour forecasts but not the short-term forecast in the HiRes domain. GSI codes of radial wind assimilation were merged into current trunk version in order to test assimilation of radar data with NMMB, and tests to determine the impacts on HiRes forecasts were begun. (Liu)

PLANNED EFFORTS: Examine the forecast performance of the new VAD winds and test radial wind assimilation in the NMMB with more cases. (Liu)

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: None.

INTERFACE WITH OTHER ORGANIZATIONS: GSD, University of Oklahoma

UPDATES TO SCHEDULE: None

Deliverables:

10.5.19.E5 15 Sept 2010 (CAPS, NCEP and GSD)
GSD
We continue with bi-weekly meetings involving ESRL GSD and PSD personnel and OU CAPS. Kefeng Zhu visited Boulder for the GSI tutorial and met in person with GSD and PSD personnel, for initial EnSRF filter experiments with 1 3-h forecast cycle. He is currently selecting a new case study period from this spring, so he can use global ensemble files from Jeff Whitaker for initial / boundary conditions.

CAPS
In August, CAPS received a new version of the GSI package from Ming Hu of GSD. In this version, the cloud analysis package is invoked after the 3DVAR analysis step rather before. Together with the new version of GSI, and regional EnKF system was updated to work with WRF version 3.2.

Earlier, we established and tested an initial version of the regional EnKF system for a single case, with hourly cycles over a 12-hour period only. It was decided to test the regional EnKF in fully cycled mode, over a 1-2 weeklong period. With the help of Steve Weygandt of GSD, the May 8 to 16, 2010 testing period was selected. During this period, convective weather was rather active over the CONUS, with short wave troughs continuously passing over the CONUS.

The week featured a wide variety of weather, including the May 10th OK tornado outbreak -- intriguing at the mesoscale (strong forcing, but strong cap), a difficult MCS case at the night of the 11th with significant mishandling by RUC that affected the HRRR, a cold season type Front Range upslope event, and some southeast propagating MCSs across Texas. A key characteristic for this period is the existence of propagating baroclinic disturbances and associated surface phenomena. This period is also within the spring 2010 CAPS storm-scale forecasting experiment when 26-member 4-km CONUS-scale ensemble and 1-km forecasts were produced in real-time, initialized with radar data, providing an opportunity for inter-comparison.

The figure below shows one example case during this period. Cycled EnKF experiments are being designed and will be carried out over the next couple of months. The EnKF will first be initialized using the random_CV perturbations and later using EnKF perturbations from global analysis cycles run be Jeff Whitaker of ESRL.

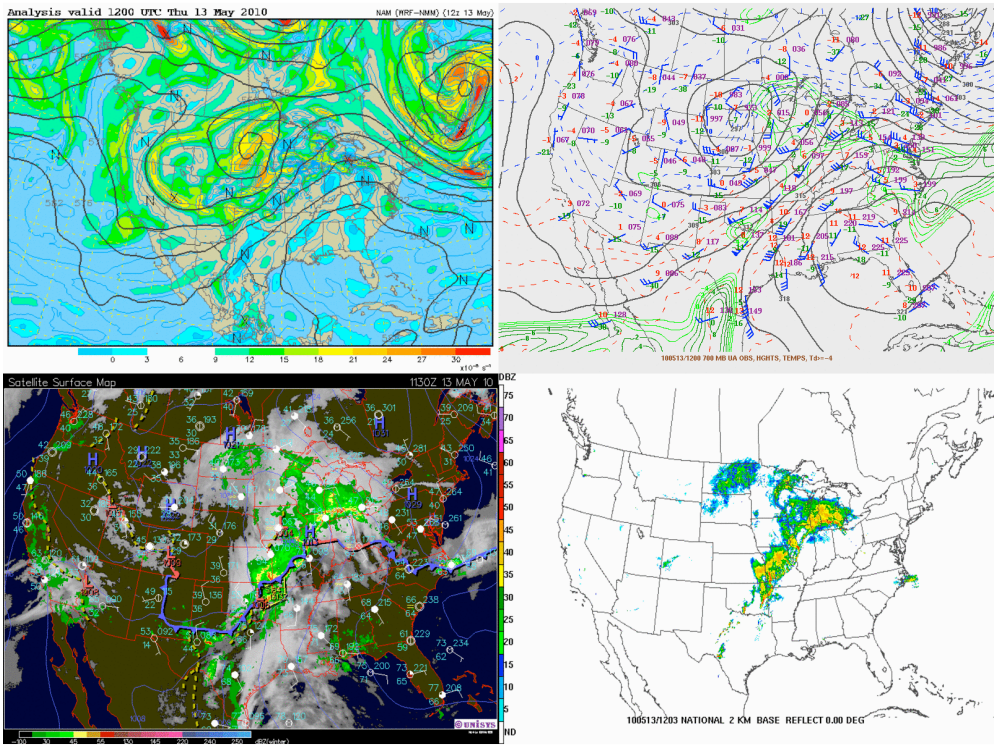

Fig.3. (a) Geopotential height of 500 hPa (contour) and absolute vorticity (shaded) of Eta analysis (b) Geopotential height of 700 hPa (black line), the temperature (dashed line, red represent >= 0 °C and blue < 0 °C) and the dew point temperature (green line) >= - 4°C (c) the satellite surface map (grey) and sea level pressure (blue line) (d) 2 km height observed reflectivity valid at 12UTC May 13, 2010 (from ***http://w1.spc.woc.noaa.gov/exper/archive/events/searchindex.html*** *and* ***http://locust.mmm.ucar.edu/imagearchive/****.*

Task 10.5.20 Develop ensemble-based probabilistic products for aviation users.

GSD

GSD group members Steve Weygandt, Curtis Alexander, and Eric James have obtained VSREF code from Binbin Zhou (NCEP EMC), who has created the VSREF. This follows previous discussions in June on collaboration and ways to further incorporate GSD strategies into the VSREF. Binbin supplied a VSREF Tarball to GSD and provided a code walkthrough to the GSD group at a subsequent telecon. Eric James is further examining the code and will work to get it running on the GSD supercomputer.

Doug Koch coded a logistic regression-based weighting procedure for the HRRR Convective Probability Forecast (HCPF) that ensures statistical reliability. Initial evaluation reveals that it significantly reduces the maximum realized probabilities when verified against single-time NCWD fields. He has demonstrated that expanded the spatial window of the verification field increases the maximum realized probability as expected. He is currently examining the analogous dependency for the spatial filtering kernel and will then finalize verification field and probability weights.

NCEP
Work on bias correction for the SREF precipitation forecasts continues. Three presentations were prepared: one for the AMS Summer Community meeting on how to communicate and use forecast uncertainty information; two others for the DTC Ensemble Testbed Mesoscale Ensemble Workshop, with one on SREF status and plans (an oral presentation given by Geoff DiMego) and a poster presentation on the Very Short Range (VSREF) and High Resolution (HREF) Ensemble Forecast Systems at EMC. (Jun Du)

The VSREF web site is maintained daily. Precipitation probability products have now been added to the VSREF. Work was completed to help Central Region WFOs display most of the VSREF products within AWIPS. A cron job is being prepared to routinely send VSREF GRIB2 data to EMC's anonymous FTP site to be used by Central Region WFOs and other future users of VSREF. (Binbin Zhou)

Subtasks

10.5.20.1 Complete 'research quality' version of upgrade to SREF for consideration in November 2010 SREF upgrade package. (15 Jan 10)

A research quality version of the SREF has been constructed and work begins to put it through its paces as it matures for next year's major upgrade. The 'research quality' version reflects a change in strategy as we move towards a strictly NEMS-based suite of runs for SREF and everything else in NCEP's Production Suite, to reduce the number of models at NCEP. While we are depending on a multi-model approach to achieve success in the short range, EMC has decided to drop the two legacy models used in the SREF, namely the 6 Eta members and the 5 Regional Spectral Model (RSM) members. 2 additional WRF-ARW members and WRF-NMM plus 7 NEMS-NMMB members will replace these 11 members. Dusan Jovic wrote the code necessary to perform the NEMS-NMMB control member breeding cycle. Jun Du tested the codes in an ensemble framework, incorporated NEMS ensemble run into the current WRF ensemble job structure and verified the NEMS-NMMB model performance. The research quality version will continue to have 21 members with 7 each coming from the three models. A major upgrade in resolution is also planned with the horizontal spacing moving from the current 32-35 km to 22-25 km. This will completely fill SREF run slot on the current P6 computer platform. (DiMego and Du) Completed

10.5.20.2 Visit AWC to conduct continued training and education on SREF applications, receive feedback on existing guidance, and to acquire new requirements, if funding available. (15 Feb 10)

Jun Du, BinBin Zhou, Geoff DiMego and Yali Mao visited AWC on 16-19 November to discuss SREF aviation products. Geoff DiMego attended the AWC Testbed meeting on R2O Issues. Completed.

10.5.20.4 Based on case study testing and refinement of the research-quality code, deliver the upgrade SREF codes to NCO for November 2010 SREF upgrade package. (30 Apr 10)

A 4km hybrid ensemble system was set up. The production standard scripts were written and tested. It will be implemented at NCEP production as part of the Hires-Window package later this year. The system will have 44 members, hourly output for the first 36hrs then 3-hourly to 48hrs, output includes individual members, mean, spread and probabilities for three domains - east CONUS, west CONUS, and Alaska in grib1-2 formats. (Du) Completed

The November 2010 target for this implementation slipped along with many other 2010 implementations because of a backlog in NCO. (DiMego)

10.5.20.5 Improve preliminary (developed in FY09) procedure appropriate for aviation users from Very Short-Range Ensemble Forecast (VSREF) system using high-resolution RR and NAM existing runs toward a future High-Frequency Probabilistic Forecast (HFProb) generator to be used in NextGen, including common post-processor, obs-based statistical post-processing, optimized member weighting. (31 Mar 10)

Working with Thomas Hultquist (NWS Science and Operations Officer) and the forecasters at the Chanhassen, MN, WFO and Central Region, VSREF data was added into AWIPS so forecasters can access VSREF output for their local airport responsibilities, which includes Chicago O'Hare. A 2-member ensemble made up of the High-Res NMM and ARW models was generated. The comparisons show that an ensemble mean of just two members does indeed yield better forecasts than either of the individual members (Zhou).

Many WFO forecasters now use the experimental VSREF web site as an additional source of guidance for aviation weather:
http://www.emc.ncep.noaa.gov/mmb/SREF_avia/FCST/VSREF/web_site/html/conv.html
Positive feedback was received from several WFOs related to VSREF forecast timing and location of a June fog event in the NE panhandle and several cases of improved TAF forecasts when using the VSREF guidance. (DiMego and Zhou)

The VSREF package developed at EMC has been delivered to GSD for cooperative research and improvements, particularly in the convection product. (Zhou)

10.5.20.6 Further calibrate probabilities and potential echo-top (improve statistical reliability) ensemble cumulus information. (1 Jul 10)

A grid-to-grid verification of simulated reflectivity from the RUC, NAM, operational Hires NMM, and Hires ARW against the MOSAIC radar dataset was built. The whole package is finished and is being readied for implementation. Results from the Grid-to-Grid verification of echo-tops and reflectivity from both the old and new SREF versions show that the scores of both the control NMM and ARW in the new SREF for echo tops and reflectivity significantly increased, to an almost 100% increase in Equitable Threat Score (ETS). The new SREF ensemble probability scores for both echo tops and reflectivity are also significantly improved over all the ensemble probability thresholds (Zhou).

A performance-ranking method has been developed for predicting an individual ensemble member's relative performance, which might potentially improve ensemble mean and probabilistic forecasts via improved post-processing. (Du)

Deliverables

10.5.20.E1 30 June 2010 (Du, Zhou, Mao)
Subject to NCEP Director approval, implement initial VSREF product generation as part of 2010 RUC/RR upgrade package [products not operational but generated routinely within the RUC script as part of NCEP's Production Suite.

CURRENT EFFORTS: The probabilistic verification of SREF composite reflectivity and echo-tops using Shun Liu's implementation of NSSL's 88D national mosaics continues. (Zhou)

PLANNED EFFORTS: Complete the work on VSREF convection products by adopting GSD's convection code. Add an echo-top ensemble product as well as other aviation and convection products using the ensemble product generator. (Du, Zhou)

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: The November 2010 target for this implementation slipped along many 2010 implementations because of a backlog in NCO.

INTERFACE WITH OTHER ORGANIZATIONS: AWS, GSD

UPDATES TO SCHEDULE: None.

10.5.20.E2 30 August 2010 (Du, Zhou, Mao)
Demonstrate products from experimental VSREF probabilistic forecasts updated hourly.

CURRENT EFFORTS: An experimental VSREF is now running and is updated hourly. Results can be seen at **http://www.emc.ncep.noaa.gov/mmb/SREF_avia/FCST/VSREF/web_site/html/vsref.html.** (Zhou)

PLANNED EFFORTS: We will develop and include the aviation products listed in the AWC's short-term request for the Nov. 2010 implementation. SPC convection products such as Probability of Thunderstorm (also requested by AFWA) will be added into the SREF ensemble product generator as resources become available. (Du, Zhou)

PROBLEMS/ISSUES ENCOUNTERED OR ANTICIPATED: No ceiling/cloud amount is available from ARW SREF members, and no reflectivity is available from the Eta members and some RSM members.

INTERFACE WITH OTHER ORGANIZATIONS: AWS, GSD

UPDATES TO SCHEDULE: None.