MDE Product Development Team
July FY10 Monthly Report – FY 2010
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(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.

- No problems with RUC, investigation of rare hang state on NCEP IBM, no occurrences in July. Good performance by ESRL backup RUC (used for initialization of HRRR) and NCEP operational RUC.
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Task 10.5.4 Develop, test, and implement Rapid Refresh configuration of the WRF modeling system.

- RR test cycle at NCEP running 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.
- Speed of ARW model increased significantly at NCEP, guaranteeing equal speed in Rapid Refresh as for current RUC.
- Continued equal or better verification in RR vs. RUC.
- Switch from WRFPOST to UNIPOST for model post-processing in GSD RR cycle
- Shallow cumulus option in RR cumulus parameterization scheme enabled to correct mid-level temperature bias
- Completion of RR pre-Request-for-Change evaluation has been slipped to 25 October.

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**
- **Latest NCEP version of GSI with (significant array structure changes) being adapted for RR**

Task 10.5.17: Infrastructure support for NAM, future RR, future HRRR, support for community WRF model

- WRFv3.2 released 2 April 2010. Contributions from NCAR to WRF model, especially on WRF physics, and from GSD on DFI and land-surface model. WRFv3.2 now used in HRRR and RR applications.

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

- Continuing very good HRRR reliability since start of CoSPA evaluation
- Installation of computer resources for a HRRR partial shadow system ongoing at GSD
- HRRR reflectivity verification package running, being expanded to include VIL verification
- Case study tests being conducted to evaluate HRRR MCS propagation issues

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 July at NCEP or at ESRL (of special interest since the backup RUC at ESRL is used to initialize the HRRR (**http://rapidrefresh.noaa.gov/hrrr**).

NCEP

Testing is complete for a major upgrade to the NCEP BUFR library that is scheduled for implementation in FY2010/Q4 or FY2011/Q1. BUFR is a critical piece of all observational ingests 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 following new mesonet providers have been added over the past several months: Pennsylvania Dept. of Environmental Protection, AIR Now (met variables at ozone/PM sites), California-Hydro, Delaware Environmental Observing System and Lower Colorado River Authority. GOES-13 cloud and precipitable water retrievals continue to not be used (since the switch from GOES-12 to GOES-13 on 14 April). The station pressure for 15 oil rig METAR reports added in May continue to be 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. The radiosonde station table for lat/lon/elev was updated on 27 July. (Dennis Keyser).

The cause of the RUC cycles that hung prior to completion in operations in May and June has not yet been found, but work was done with IBM and NCO to have the code generate a clean exit in such an event instead of hanging. This allows NCO to notice the problem much sooner and initiate the rerun which has so far always run to completion. No RUC cycles experienced problems in July, and this code upgrade will be implemented in August to deal with this type of event if it occurs again. [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

Eric Rogers reports that 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 control run and the other an experimental run with model and/or analysis changes for potential inclusion in the control run. During July, twice per day runs of all four nested domains (CONUS, Alaska, Hawaii, and Puerto Rico) began in the experimental NMMB parallel. The modified 60 level vertical level distribution, (increasing the number of vertical levels above 200 mb from 8 to 15), which was being tested in the experimental run since May, was also put into the control NMMB parallel on 26 July. Additionally, the use of the RTMA dynamic reject list for mesonet data was turned on in both parallels this.

For the NAM specifically, Dennis Keyser reports the radiosonde at Shemya, AK (70414) still has a later launch time than the other Alaskan sites, and is too late for the NAM-GSI. We will contact Alaska Region to get more information on this issue. GOES-13 radiances are monitored but will not be used until fall (a result of the 14 April switch from GOES-12 to GOES-13). 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 proposing several 24 hour tests in the next few months where the corrupted navigation data will not be sent to NCEP. METOP 1B radiance data were not available for five hours on 9 July. METEOSAT-7 satellite wind data were not available for three hours on 21 July. 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 the t-12 hour NDAS is also being tested in Eric's parallel as a replacement for the current synthetic wind data bogus. 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 parallel RTMA for Guam is using the expanded set of observations generated from a geographical domain which includes the region around Guam. It is also testing the use of low-level satellite-derived winds.

Yali Mao completed the compiling and debugging of METAR data ingest for CIP, and has started work on the code for the PIREP observations subsystem.

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 (taught largely by ESRL scientists – Georg Grell and Steven Peckham), and MET. Attendance for the WRF tutorial was over 60.

NCAR has been working on a minor WRF release, which will be V3.2.1. The previous major release was V3.2 in April. Due out by early Sept., the minor release will contain bug fixes.

Jimy Dudhia of NCAR/MMM worked on various WRF physics components and issues. In cumulus physics he obtained code from Pacific Northwest Nat'l Laboratory (Bill Gustafson and Jerome Fast) that adds CCSM physics options for deep and shallow convection into the WRF physics framework. The shallow scheme is one by Park and Bretherton (Univ. of Washington), and the deep scheme is a Zhang-McFarland scheme, as modified by Rich Neale (NCAR/CGD). These are also being prepared for the next major WRF release, V3.3 (2011).

Dudhia continued work with Changhai Liu of NCAR/MMM on various modifications to the YSU PBL scheme to determine the effect of sub-grid-scale vertical fluxes on resolved fluxes in 1-km idealized PBL growth tests. This is motivated by the fact that the YSU PBL allows resolved large eddies to develop, while the MYJ PBL does not, and it is believed that the MYJ behavior is preferable.

Dudhia visited Numtech Co. in France to collaborate with Julien Pergaud, who is working with Boris Galperin and Semion Sukoriansky in merging the QNSE stable boundary layer method with the eddy-diffusivity/mass-flux (EDMF) sub-grid scheme for unstable conditions. The latter scheme is used at Meteo-France. The merger of the two schemes is progressing and may become part of WRF V3.3.

Lastly, NCAR/MMM hosted a short visit by Fernando de Sales (UCLA) who has delivered a preliminary version of the SSiB land-surface model. This may also eventually go into V3.3.

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. This includes

- 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).
- 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 will definitely run in the same run-time currently resulting for the RUC at NCEP.
- Replacing NetCDF with binary formats for all input/output and intermediate files needed for the RR cycling.

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 and to define remaining tasks necessary toward the implementation.

The RR 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 namelist 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).

Rapid Refresh primary and dev 1-h cycles continued to run on wJet/hJet at GSD. A major operating-system change for hJet/nJet late in July necessitated recompiling WRF and GSI on these systems. This is in preparation for the availability of tJet, the large extension of nJet that will be dedicated to the Hurricane Forecast Improvement Project. With the decommissioning of wJet in early September, all the Boulder High-Performance computing systems will be 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 .

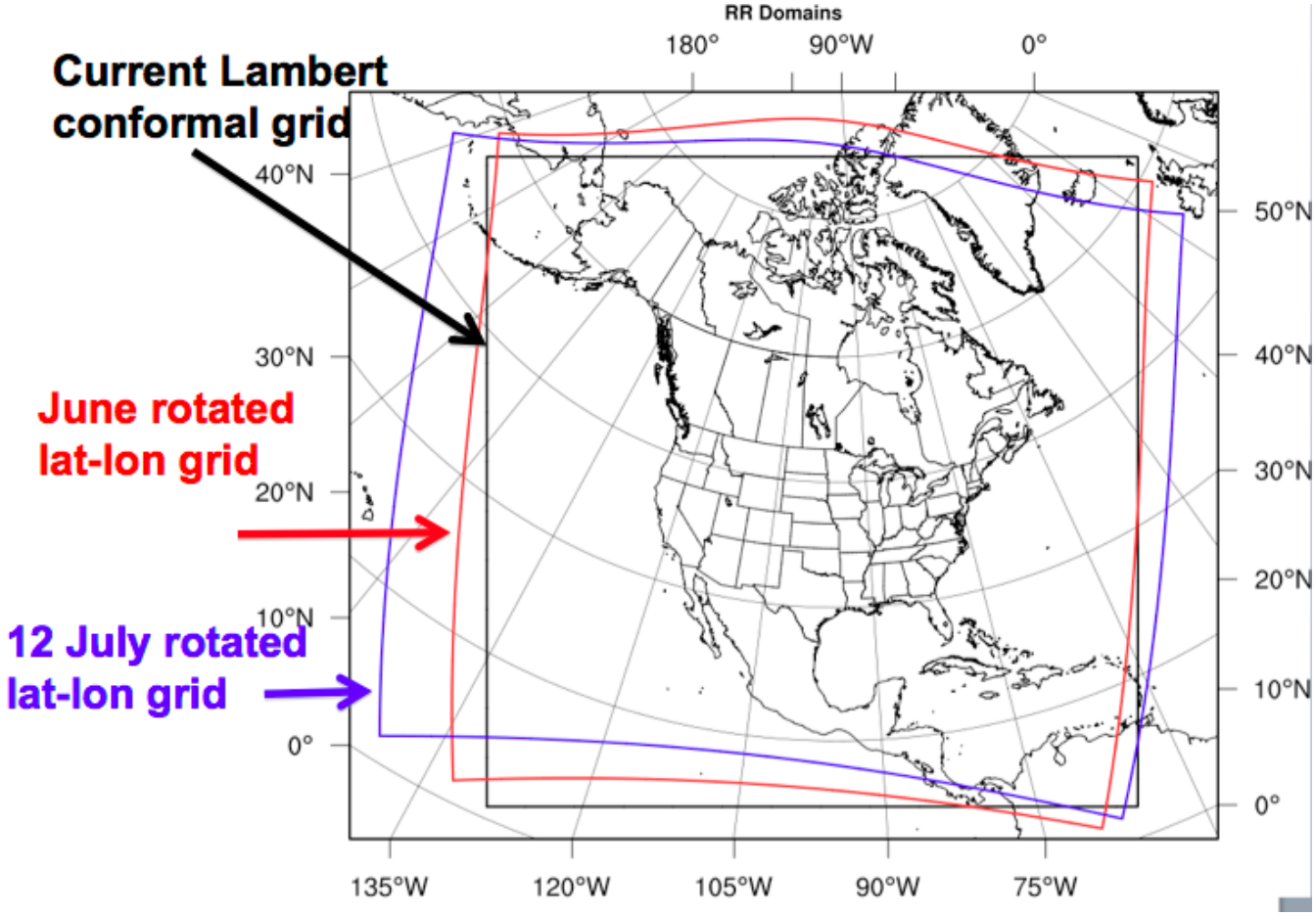

Fig.1. Rapid Refresh domain – old Lambert conformal (black) and future (purple) rotated lat-lon version. The red grid was an initial rotated lat-lon grid proposed in June before the Alaskan request to include all of the Aleutians in the RR domain.

More details below on specific changes:

Binary I/O in place of NetCDF:
A major effort this month was 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 the month. 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), we are planning to use their PRDGEN code rather than copygb. This will be more efficient (pre-calculation of interpolation weights from one grid to another), much faster, and will bypass the insufficient functionality of copygb to handle the rotated lat-lon projection.

(At this writing, the GSD RR1h primary cycle is still on the Lambert Conformal domain, but on 10 August the RR1h dev cycle was switched over to run on the RLL domain.)

RR at NCEP:

We are working closely with Geoff Manikin and others at NCEP/EMC on details necessary for implementing the RR at NCEP. This includes

- the switch to binary I/O,
- the RLL grid and necessary work to specify interpolation parameters for Prdgen to convert from Grid 83 to other required output grids (this task is complete),
- assuring that the UniPost is configured to produce RUC look-alike output files for the same fields as produced by the current RUC,
- timing issues on the NCEP Central Computing System (also now successful addressed).

Regarding the last bullet, Jim Abeles of IBM was able to achieve a run time of 10min for a full-domain 6-h forecast on the NCEP CCS using only 256 IBM tasks. Thus it now appears that run time with the present RLL RR configuration will not be an issue.

RR Post-processing:

UniPost upgrades developed at GSD during FY10Q2 and 3 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 extensive GSD enhancements for RUC look-alike fields) for the past 2 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 are working 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 Prdgen code, and that the fields are all present and computed consistently with what is currently operational in the RUC.

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]

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 (since July) GOES single-pixel cloud data from NASA/Langley (which cover Alaska) are also being copied to a public ftp

directory. These are being tested in ESRL's experimental RR runs, along with early (T+0:26 minute) parallel dumps for 0000 and 1200 UTC. Future data tests will include Multi-Agency Profiler winds and METOP-2 radiances. EMC and GSD have requested the Radar Operations Center (ROC) to start their 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. The first step toward this goal occurred on 27 July when NCO acted on the EMC request to add two new ingest times for these data at 22 and 50 minutes past the hour, allowing these data to be available for the late cutoff time 0000 and 1200 UTC RR runs. Level 2 data from 8 DOD CONUS sites are expected to become available in November 2010. [Dennis Keyser]

Significant progress has been made in getting a Rapid Refresh parallel running at NCEP. The hourly cycle is now running at NCEP, although some updates to the code are still needed. Code is being written to develop a product generator for the Rapid Refresh to interpolate the output to the existing RUC output grids, as the intent is to maintain all of the grids/parameters currently available in the RUC to assist with user transition to the new system. [Geoff Manikin]

Deliverables

10.5.4E3 (30 September 2010) (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.

PLANNED EFFORTS:

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED:

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 equal or be 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.

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 [correct?]. To partially compensate for the westward extension necessary to include the Aleutians, the south boundary of the domain was moved slightly north.

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
25 October 2010 is our best current estimate for completion of the pre-RFC evaluation.

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

Work continued to make final changes to the GSI portion of the RR system and finalize a frozen code version at NCEP for the final skill evaluation. A key area was testing the rotated latitude-longitude (RLL) version of GSI. This was successful and Geoff Manikin is now running a fully cycled RLL Rapid Refresh in his real-time parallel at NCEP. A second key area was conversion from cycling with NetCDF format to cycling with binary format, both at NCEP and GSD. Work is first being done on the GSD Linux cluster (the more challenging environment). At GSD, this enhancement was made possible by a recent operating system upgrade that allowed Ming Hu get MPI2 I/O working, thought only for little endian, which forced a recompiling of all the RR codes. As reported under 5.4, a binary test cycle of RR modules (GSI, WRF-real, WRF-ARW, uni-post) has been conducted at GSD. Small differences between the netCDF cycle and binary cycles have been noted and are being investigated. Once this issue is resolved (expected within a few days), the GSD and EMC test RR cycles will be switched to binary.

It is important to note that final output grids (produced by UniPost for the full RR #83 domain and prdgen for the subset CONUS RUC #130 domain and the subset Alaska #249 domain) will still be in GRIB(2). A third focus area has been updating the RR GSI to the latest NCEP SVN trunk version. A significant GSI code update was recently made by NCEP, in which structures (referred to as "bundles") were defined to modularize the treatment of analysis variables. This code version has been downloaded and modified to run on various non-NCEP platforms by DTC and the minor non-repository RR aspects are being added.

NCEP

Dave Parrish completed work with Ricardo Todling and Russ Treadon on initial installation of gsibundlemod. While this allows for very general specification of analysis variables, it has only been introduced into the core GSI code. It will be up to users to use this new feature in I/O modules. As part of tests to understand poor performance of the regional strong constraint, coding for dual resolution capability for the global strong constraint was started. This will allow testing the impact of using different analysis grid than that used by the model being updated, which is a feature of the regional GSI but not the global. For the hybrid ensemble option in GSI, the ensemble localization length scales in horizontal and vertical were generalized to be a function of vertical level. Regional tests of the hybrid ensemble will begin with direct insertion of GEFS perturbations in the 12km NEMS-NMMB. This is easily done by extending the existing code that was recently added to directly read ozone from GFS sigma files. An abstract was prepared and submitted for the January AMS meeting to report on the results of this initial use of ensemble information in an NCEP regional model.

Wan-Shu Wu worked on using RASS from the NOAA Profiler Network (NPN) or Multi-Agency Profiler (MAP) Network - virtual temperature and Multi-Agency Profiler (MAP) - winds in NDAS. The objective tuning method was used to estimate the observational error for each observational type. A new off-line parallel was set up to test the forecast impact. She worked on debugging the GSI for a segmentation violation when running with the high resolution window and worked on using the RTMA's quality control measures in the NAM GSI with the reject lists of the surface observations. She also estimated the computer resources of the 4 km high resolution CONUS run with various nodes/tasks combination and worked with the regional land-surface group and the CRTM radiation group on using the new IGBP vegetation types in the regional analysis. Changes were made to the GSI to allow inputs from both new and old vegetation types.

Manuel Pondeca worked with NCO to finalize preparations for the implementation of the 2.5km CONUS RTMA, which is scheduled for September 28, 2010. All aspects related to the RTMA product distribution via AWIPS, the NCEP ftp server, and NDGD were finalized. He also began work on configuring the RTMA system to run for a new, small domain that extends northward of the CONUS domain, into British Columbia, Canada. The new RTMA domain is intended to support operations at the Northwest River Forecast Center.

Deliverables

10.5.5.E3 28 Feb 2010 (Manikin)
Pending EMC, and NCEP Center initial recommendations, Request for Change forms (RFCs) are 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 2011.

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

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

10.5.5.E3 16 Sept 2010 (revised date, previously requested) (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.

On schedule although some slip to early October is possible.. 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 recent 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-levels, 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.

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.

A 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. There have been some unavoidable planned HRRR downtimes for upgrades to the JET supercomputer system related to HFIP. GSD personnel have used the CoSPA group notification to alert users with as much lead time as possible. Patrick Hofmann has coded a scale-dependent HRRR reflectivity verification system. Data have been collected to evaluate HRRR reflectivity forecast skill as a function of reflectivity threshold, horizontal scale, forecast lead time, and forecast valid time. The system has recently been expanded to include comparisons of HRRR with RUC and RR and to verify HRRR forecast VIL.

GSD personnel have participated in CoSPA status meetings and blitz recap meetings. Information from these meetings indicates considerable use of CoSPA and has identified some issues that GSD personnel are investigating. Primary among these are: 1) the inability of the HRRR / CoSPA to maintain certain MCS / bow echo systems and 2) a pattern of low HRRR bias for runs initialized early in the morning, with bias increasing for successive model runs. With regard to issue 1), a common theme is that the actual MCSs occur in region with strong inhibition for surface based convection, but suggestions of poorly observed mid-level moisture and indications that the observed convection is mostly elevated. To address this issue, Curtis Alexander and Eric James have conducted some retrospective sensitivity experiments for the 18 June case. Variations of the microphysics scheme (from the present Thompson 4-class, 2-moment rain) did not result in appreciable differences. Modification of the environmental mid-level moisture (consistent with the hypothesis that poorly observed mid-level moisture is leading to elevated convection) lead to more vigorous model storms. The leading edge of the convective system was still too weak and the propagation still too slow. Additional experiments, including use of a 1-km nest) are planned, with the expectation of implementing improvements after the summer convection evaluation period. An acceleration of this work is expected when the new computer hardware for the HRRR partial shadow system is in place (expected Sept. 2010). GSD HRRR personnel continue to meet ~ monthly with NCAR personnel to discuss HRRR issues (including the MCS propagation problem) and design experiments to improve the HRRR.

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, NCAR/MMM carried out 3-km ARW simulations initialized with radar-enhanced, 13-km Rapid Refresh grids from NOAA/ESRL. Jimy Dudhia has begun working with Morris Weisman (NCAR/MMM) on evaluating the initial spin-up of the forecasts from these grids. The write-up of the analysis will begin next month.

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 will 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
Shun Liu worked with NCO to implement REF2GRB package on 29 July, which was modified to generate the mosaic fields in GRIB2 format. The bug in generating new VAD wind during precipitation mode was fixed and tested in parallel. Deliverable 10.5.1E1 has been met.

Shun Liu tested impact of radial wind assimilation on NMMB forecast in HiRes domain. The test results are under evaluation. Shun Liu also worked on fixing a bug in GSI that was causing the initial penalties of radial wind to be different with different MPI task counts. Deliverable 10.5.5.5 has been met.

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 can 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
Continuing the assessment of the EnKF (based on the EnSRF algorithm) analysis results, the RMSEs (strictly, the RMS difference from the observations or RMS difference of observation innovations) of the background and analysis, calculated against all conventional observations, as well as their ensemble have been examined at CAPS (Fig. 2). The EnKF analysis cycles started at 15 UTC, June 15 2009 and ended at 21 UTC, June 15 2009, as hourly intervals using the same conventional data set of RR (but without radar data). The posterior RMSE is found to be smaller than the a priori for each EnKF analysis cycle and the ensemble spread decreases steadily during the EnKF analysis cycle (not shown). Both indicate that the observations are active during the EnKF analyses. Further, in order to compare the performance of the EnKF and GSI systems, two experiments using GSI were performed. The first one used the same ~40 km resolution domain for the GSI analysis, and the same prediction model configuration during the assimilation cycles as the EnKF experiment. This allows for a fair comparison between the two systems. Figure 1 shows the RMSEs during the first six cycles against of all conventional observations, for the EnKF and GSI analyses. The RMSEs of the EnKF analyses are smaller than those of GSI analyses for the temperature. However, for the u and v wind components, those of EnKF are larger than those of GSI. The reason for this will be examined. The RMSEs of the moisture fields are almost the same for EnKF and GSI analyses. The other GSI experiment was run at the standard ~13 RR resolution, using the standard RR data assimilation procedure but excluding radar data (which were not used in EnKF either). Twelve-hour forecasts were launched at the end of each analysis cycle. The forecast reflectivity fields at the 3-km height were then compared with the 13-km forecasts starting from the EnKF ensemble mean analyses interpolated to the 13 km grid. Although both cases failed to catch the main features of the MCS of the case, the forecasts initialized from the EnKF analyses were better than those initialized from the standard GSI procedure.

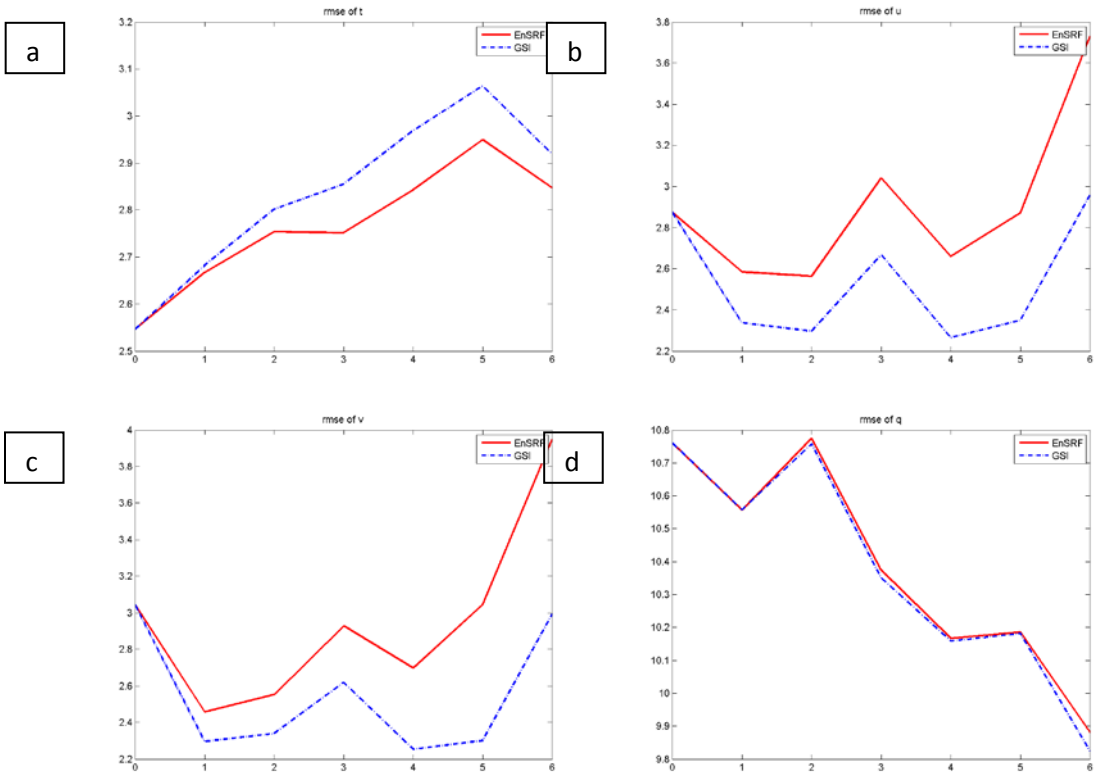

Fig.2. RMSE of EnSRF and GSI analyses, for (a) Temperature, (b) u velocity, (c) v velocity, and (d) water vapor mixing ratio q. The horizontal axis is hour. The first analysis was performed at hour 1.

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

As part of the 2011 operational SREF upgrade, Jun Du and Dusan Jovic have started to update the versions of the three SREF models: WRF_NMM, WRF_ARW and NEMS_NMMB. But some problems have been encountered. The plan is to add the NEMS-NMMB model, to drop the legacy Eta and RSM models, to update the WRF-NMM and WRF-ARW model versions and to increase resolution from 32-35 km to about 22-25 km. The new

SREF system will continue to have 21 members composed of 7 NEMS-NMMB, 7 WRF-NMM and 7 WRF-ARW members.

Binbin Zhou is maintaining the VSREF daily run and its website. He helped ESRL/GSD to understand the entire VSREF system of programs by holding several teleconferences. He is working on adding new precipitation products to the VSREF.

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. These 11 members will be replaced by 2 additional WRF-ARW members and WRF-NMM plus 7 NEMS-NMMB 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).

The experimental VSREF web site is now used by many WFO forecasters 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 (1) 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.