**MDE Product Development Team**
**June 2010 3rd Quarter 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.**

- NCEP RUC forecast skill much improved in May and fully comparable with ESRL experimental RUC versions after degraded performance from 2 March – 20 April due to implementation error.

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

- RR test cycle at NCEP using new versions for WRF (v3.2) and GSI (latest NCEP repository + cloud analysis) nearly complete after Geoff Manikin weeklong visit to GSD to work with Ming Hu
- Switch from WRFPOST to UNIPOST for model post-processing in GSD RR cycle
- New RR domain using rotated lat-lon horizontal grid now covering all Aleutian Islands, is now set and will be implemented in mid-July (pending AWC approval).
- Shallow cumulus option in RR cumulus parameterization scheme enabled to correct mid-level temperature bias

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

- Changes for initial cloud analysis package within GSI approved within NCEP SVN repository
- SVN repository version-based GSI running within hourly updated experimental RR cycle at NCEP

**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**

- Very good HRRR reliability since start of CoSPA evaluation (98.9% for gaps up to 3h)
- A very minor modification made to the WRF ARW namelist option to eliminate the CFL violation-related crashes that were occasionally occurring in the HRRR.
- Additional dedicated computer resources for a HRRR partial shadow system included in recent NOAA HPC procurement. Tests of HRRR improvements currently being evaluated from single extra run per day.
- New HRRR reflectivity forecast verification package developed and being applied in real-time to HRRR forecasts

**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 at ESRL and NCEP verification websites. NCEP RUC forecast skill much improved in May and fully comparable with ESRL experimental RUC versions after degraded performance from 2 March – 20 April due to implementation error.

**NCEP**

Testing is complete for a major upgrade to the NCEP BUFR library that is scheduled for implementation in FY2010/Q4 or FY2011/Q1. 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. GOES-13 cloud and precipitable water retrievals continue to be not used (as is the case since the switch from GOES-12 to GOES-13 on 14 April). On 26 May, 15 oil rig METAR reports were added to the NCEP database. These reports were added to the NCEP reject list due to uncertainties in their quality. A bug was later discovered in the data processing that has resulted in their surface pressures being available for assimilation in the RUC and NAM. An RFC has been submitted to correct this error. (Dennis Keyser)

***Subtasks***

**10.5.1.1 Maintain hourly RUC runs and provide aviation guidance grids. (30 Sept 10)**

The RUC experienced problems with two model cycles during this quarter. In each case, the model forecast simply stopped (or "hung") after several hours with no obvious error. In each event, a rerun of the entire cycle a few minutes later [perhaps with extra observational data available] was completed successfully. Efforts are underway with GSD, NCO, and IBM to understand the cause of the problems. ESRL/GSD has tested these cases with identical initial conditions on the ESRL supercomputer without any problem (i.e., implying possible yet not understood tie to NCEP environment). Thus, only minimal progress has been made and with the RUC to be retired within one year, only so many resources can be devoted to this issue. Work is being done to at least cause the model to actually generate an error with an exit in this situation, so that NCO becomes aware of the failed run more quickly. (Manikin)

**10.5.1.2 Provide vendors with gridded model data via Family of Services (FOS), and the FAA Bulk Weather Data Telecommunications Gateway (FBWDTG). (30 Sept 10)**

NCEP maintained real-time availability of SAV and AIV guidance to all vendors from the operational hourly RUC on pressure surfaces on the 80-km AWIPS grid #211 via the NWS Family of Services (FOS) data feed and the FAA Bulk Weather Data Telecommunications Gateway (FBWDTG). (DiMego)

**10.5.1.3 Provide full grids from RUC runs on NCEP and NWS/OPS servers. (30 Sept 10)**

NCEP maintained real-time availability of full resolution gridded data from the operational RUC runs via anonymous ftp access via the NCEP server site at **ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/ruc/prod/** and at the NWS/OPS site at **ftp://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/** in hourly directories named MT.ruc_CY.00 through MT.ruc_CY.23. This includes hourly BUFR soundings and output grids which undergo no interpolation. Both sites now contain only grids packed into GRIB2 format, see **http://www.nco.ncep.noaa.gov/pmb/docs/GRIB1_to_GRIB2.shtml** . A limited set of fields from the RUC runs (and other NCEP models) can also be viewed at **http://www.nco.ncep.noaa.gov/pmb/nwprod/analysis/.** (DiMego)

**10.5.1.4 Maintain access to model verification data. (30 Sept 10)**
NCEP maintained its capability and provided access to routine verifications of the operational RUC analyses and forecasts. These include grid-to-station verifications versus rawinsonde, surface, aircraft, Profiler, and VAD data computed periodically at NCEP and accessible via NCEP's Mesoscale Modeling Branch (MMB) website: **http://www.emc.ncep.noaa.gov/mmb/research/meso.verf.html** (DiMego)

***Deliverables***

**10.5.1E1 (30 September 2010) (Keyser, Liu)**
**Perform ingest, quality control and preparation of both existing and new observations in support of the operational RUC runs.**

**CURRENT EFFORTS:** Testing is complete for a major upgrade to the NCEP BUFR library that is scheduled for implementation in FY2010/Q4 or FY2011/Q1. 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 remained down. The Wisconsin DOT mesonet provider was down over the last half of April. GOES-13 replaced GOES-12 as the Eastern satellite on 14 April. GOES-13 winds are used, but GOES-13 cloud and precipitable water retrievals have not been used since the switch. On 26 May, 15 oil rig METAR reports were added to the NCEP database. These reports were added to the NCEP reject list due to uncertainties in their quality. A bug was later discovered in the data processing that has resulted in their surface pressures being available for assimilation in the RUC and NAM. An RFC has been submitted to correct this error. (Keyser)

The radar processing update bundle was implemented on 6 April. This update includes improving the radar data QC package, dumping VAD winds from the QC package, converting 3D mosaic products to GRIB format and inclusion of the PBL estimation algorithm. The fix files were updated to process radar data from 4 new stations in Hawaii. While not affecting NCEP's processing fortunately, a bug was found in the Level 2 raw data where wrong radar station location information is delivered by the LDM system. This bug applies to all sites sending out legacy radar data. The bug was reported Radar Operations Center (ROC) and the ROC developed a fix. (Liu, Keyser)

NSSL reported that the new VAD wind processing can not generate enough VAD profiles during precipitation scan mode. A few bugs were fixed and will be tested in parallel at NCEP. The ref2grb package will be modified to use GRIB2 format as required by NCO. (Liu)

**PLANNED EFFORTS:** See also PLANNED EFFORTS listed under Task 10.5.17.E1 below for aircraft quality control issues. Implement new BUFRLIB and NRL quality control package. Obtain all TAMDAR data from AirDAT as alternate to MADIS feed and add airframe type and company code to allow improved bias corrections to be developed. (Keyser)

**PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED:** A severe backlog has developed in the implementation schedule on the NCEP computers.

**INTERFACE WITH OTHER ORGANIZATIONS:** NCO, NSSL.

**UPDATES TO SCHEDULE:** None.

**10.5.1E2 (30 September 2010) (Manikin, ESRL)**

**Perform configuration management for RUC, including thorough documentation, and respond promptly to any code malfunctions or performance issues.**

**CURRENT EFFORTS:** The RUC experienced problems with two model cycles during this quarter, where the model simply stopped (or "hung") after several hours with no obvious error. Work is being done to cause the model to actually generate an error with an exit in this situation, so that NCO becomes aware of the failed run more quickly. (Manikin, IBM and ESRL)

**PLANNED EFFORTS:** Work with NCEP Central Operations to set up a contingency plan to handle random RUC crashes. (Manikin)

**PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED:** None anticipated.

**INTERFACE WITH OTHER ORGANIZATIONS:** NCO & ESRL.

**UPDATES TO SCHEDULE:** None.

**10.5.1E3 (30 September 2010) (Manikin, ESRL)**
**Monitor RUC performance, respond to any problems detected by ESRL, NCEP, or any RUC users, diagnose cause, develop solution to RUC software, test changes and coordinate with NCO on implementation.**

**CURRENT EFFORTS:** The RUC experienced problems with two model cycles during this quarter, where the model simply stopped (or "hung") after several hours with no obvious error. Work is being done to cause the model to actually generate an error with an exit in this situation, so that NCO becomes aware of the failed run more quickly and can restart the model. (Manikin and NCO/PMB)

**PLANNED EFFORTS:** Continue monitoring.

**PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED:** None.

**INTERFACE WITH OTHER ORGANIZATIONS:** NCO.

**UPDATES TO SCHEDULE:** None.

**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 has reported that parallel tests of the NEMS/NMMB model in the EMC NAM parallel system continue on the CCS, with two parallels being run; one a control run (NAMB) and the other an experimental run (NAMX) with model and/or analysis changes for inclusion in the control run. On 17 May the number of rows along the model boundary, upon which the lateral boundary conditions were specified, was increased from 1 to 5 in the control run after being tested in the parallel NAMX run since early April. Also on this date the NAMX parallel

began testing a modified 60 level vertical level distribution, with a doubling (from 8 to 15) of the number of vertical levels above 200 mb.

On 17 May routine high-resolution forecasts started running, nested inside the NAMX 12km forecast. At 00z the 6 km Alaska nest is run and at 12z the 4 km CONUS nest is run. Both nests run out to 60 hours.

Since many obs-processing activities listed under Task 10.5.1 and 10.5.4 also pertain to the NAM, they are not duplicated here. For the NAM specifically, Dennis Keyser reports most Alaskan radiosondes have now moved up their launch time so they are available for use by the NAM-GSI. The exception is Shemya (70414) where a later launch time at 12Z, likely due to staffing issues, results in no data availability until the GFS cutoff time. We will contact Alaska Region to get more information on this issue. The drop out team's investigation on the effect of: 1) removing U.S. (and Alaska) synoptic surface data from the GFS-GSI, and 2) updating the latitude, longitude and elevation for many Canadian and U.S. METAR sites and many Canadian synoptic sites based on the latest METAR and synoptic dictionaries, found a neutral to slight positive impact. This investigation was done because many U.S./Alaskan synoptic sites have incorrect elevations and thus erroneous surface pressures, but most U.S. synoptic sites are coincident with METAR sites having correct surface pressures. An RFC is being prepared by NCO to put these changes into production. The following data types are monitored by the NAM-GSI: RASS virtual temperature profiles (NPN and MAP), Mesonet mass data, and MDCRS moisture data. NOAA-19 1b radiances will soon be monitored. Reduced Level 2 88D radar data dump counts on the IBM P6 (vs. the P5) are being investigated. 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. These changes to obs monitoring are being tested in Eric Rogers' real-time parallel NDAS/NAM. Replacing the current synthetic wind data bogus with 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 being tested. 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 is continuing work begun in April on CIP transition, starting from datasets.

***Subtasks***

**10.5.17.1 Maintain hourly RR and four/day North American Mesoscale runs and provide aviation guidance grids. (30 Sept 10)**

Four-per-day NAM runs have been maintained. 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 inclusion in the control run. During this quarter several changes were made to improve performance. In May the number of blending rows along the model boundary, upon which the lateral boundary conditions were specified, was increased from 1 to 5 in the control run after being tested in the parallel NAMX for April. In May a test in the experimental run also began with a modified 60 level vertical level distribution, doubling (from 8 to 15) of the number of vertical levels above 200 mb. Also during this quarter, a new version of the GSI analysis was placed into both parallels, which included the assimilation of GPS radio occultation (COSMIC) data. Daily runs of the high-resolution one-way nested domains started in the experimental NMMB parallel. Currently, one nest is run per cycle: the 6-km Alaska domain at 00z and the 4-km CONUS nest at 12z. (Rogers)

**10.5.17.2 Maintain four/day HRW runs and provide aviation guidance grids. (30 Sept 10)**

NCEP maintains 4/day runs of WRF-NMM at 4 km and WRF-ARW at 5 km when there are no hurricane runs. Five domains are run with three large domains – East-Central CONUS (00z & 12z), West-Central CONUS (06z) and Alaska (18z), and two small domains - Hawaii (00z & 12z) and Puerto Rico (06z &18z). (Pyle and NCO) A major upgrade to the HRW has been prepared and tested but is not scheduled for implementation until Q1 FY2011 (Oct-Dec 2010).

NCEP also maintains twice-per-day runs of six WRF-based members (3 running NMM and 3 running ARW) within the Short Range Ensemble Forecast (SREF) system. Aviation guidance prepared from the SREF is available from **http://www.emc.ncep.noaa.gov/mmb/SREF/SREF.html** which now includes specific output for Alaska and Hawaii (eastern Pacific). (Du, Zhou)

**10.5.17.3 Provide vendors with gridded model data via Family of Services and the FAA Bulk Weather Data Telecommunications Gateway. (30 Sept 10)**
NCEP maintained real-time availability of SAV and AIV guidance to all vendors from the operational 4/day NAM on pressure surfaces on the 80-km AWIPS grid #211 via the NWS Family of Services (FOS) data feed and the FAA Bulk Weather Data Telecommunications Gateway (FBWDTG). Higher resolution grids (40-km grid #212 and 12-km grid #218) are also made available to FOS (and NOAAPORT) users. (DiMego)

**10.5.17.4 Provide full grids from RR, NAM, and the HRW on NCEP and NWS/OPS servers. Maintain access to model verification data. (30 Sept 10)**
NCEP maintained real-time availability of full resolution gridded data from the operational 4/day NAM and HiResWindow (HRW) suite of WRF-NMM and WRF-ARW runs via anonymous ftp access via the NCEP server site at **ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/nam/prod/** (on numerous **grids**) and at the NWS/OPS site at **ftp://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/**. At the NWS/OPS site, the NAM data are in 4/day directories named MT.nam_CY.*hh* where *hh*=00,06,12 or 18; while the HRW data are in 4/day directories named MT.hires_MR.*mmm*_CY.*hh* where *mmm*=arw or nmm and *hh*=00,06,12 or 18. This includes hourly BUFR soundings (NAM only) and output grids which undergo little or no interpolation. Both sites now contain only grids packed into GRIB2 format, see **http://www.nco.ncep.noaa.gov/pmb/docs/GRIB1_to_GRIB2.shtml**. HRW output will become available to NWS forecast offices with AWIPS OP9. A limited set of fields from the NAM and HiResWindow (HRW) runs (and other NCEP models) can also be viewed at **http://www.nco.ncep.noaa.gov/pmb/nwprod/analysis/** (DiMego)

**10.5.17.5 Maintain access to model verification data. (30 Sept 10)**
NCEP maintained its capability and provided access to routine verifications of the operational RUC analyses and forecasts. These include grid-to-station verifications versus rawinsonde, surface, aircraft, Profiler, and VAD data computed periodically at NCEP and accessible via NCEP's Mesoscale Modeling Branch (MMB) website: **http://www.emc.ncep.noaa.gov/mmb/research/meso.verf.html** (DiMego)

***Deliverables***

**10.5.17.E1 30 September 2010 (Keyser, Liu)**
**Perform ingest, quality control and preparation of both existing and new observations in support of the operational RR, NAM & HRW WRF runs.**

**CURRENT EFFORTS:** In addition to the items reported in 10.5.1E1, the radiosonde at Shemya (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. The Level 2 88D decoder was updated on 6 April to include an improved radial wind QC package. GOES-13 replaced GOES-12 as the Eastern satellite on 14 April. GOES-13 winds are used but GOES-13 radiances will be monitored until fall. NESDIS applied a spring temperature patch

to GOES sounder radiances on 7 April which is expected to increase the radiance biases. GOES data were missing for 4 hours on 17-18 June due to an antenna configuration problem. GOES and MODIS satellite data amounts were reduced 1-7 June due to NCO production ftp issues in the ingest processing. AIRS radiances and MODIS winds were missing for 15 hours on 6-7 April and again on 5-6 June due to NASA/GSFC hardware problems. 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. The METAR site PGUM (Guam) lat/lon was corrected on 1 April so it is not rejected as over water. The drop out team's investigation on the effect of: 1) removing U.S. block 72 and 74 (and Alaska block 70) synoptic surface data from the GFS-GSI and 2) correcting the latitude, longitude and elevation for many Canadian and U.S. METAR sites and many Canadian synoptic sites using the latest METAR and synoptic dictionaries, found a neutral to slight positive impact. NCO implemented these changes in production on 22 June. The following data types are monitored by the NAM-GSI: RASS virtual temperature profiles (NPN and MAP), Mesonet mass data, and MDCRS moisture data. Reduced Level 2 88D radar data dump counts on the IBM P6 (vs. the P5) are being investigated. NAM/NDAS and RTMA PrepBUFR files are being generated in parallel with 50 km ASCAT and WindSat scatterometer wind data (both non-superobed) and production NAM/NDAS dumps of METOP IASI radiances, GPS-RO data and SBUV-2 data are being created. These changes to obs monitoring are being tested in Eric Rogers' real-time parallel NDAS/NAM. 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 for the region around Guam, and is testing the use of low-level satellite-derived winds. Experimental Rapid Refresh (RR) PrepBUFR files containing WindSat data (non-superob) and 50 km ASCAT from NCEP are copied to a private ESRL directory on the NCEP ftpprd server. RR dumps of expanded (time-window) Level 2 and Level 2.5/3 88D radial wind data and hourly lightning data are 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. NCO began ingesting GOES single-pixel cloud data from NASA/Langley (which cover Alaska) into the developmental BUFR database on 17 June. Hourly RR dumps of these data will begin in July and will be copied to a public ftp directory for RR parallel testing. EMC and GSD have requested the ROC 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 radial wind data is the Level 2.5/3 because of no funding for Alaskan Level 2 data. Level 2 data from 4 DOD Hawaiian radars were added to the BUFR database as part of the 6 April decoder update. (Keyser)

**PLANNED EFFORTS:** In addition to the items reported in 10.5.1E1, add use of AIRS AMSU-A radiances to the next NAM-GSI update. Add a new NRL aircraft quality control module once NCO BUFRLIB update is implemented. Change PrepBUFR processing to add report sub-type information for development of bias corrections based on data sub-types. Develop a "uselist" in order to control what incoming data is allowed into the assimilation. Complete NAM and RR impact tests for TAMDAR (AirDAT feed); mesonet mass and roadway data, and new mesonet data feeds (including "hydro", "snow", modernized COOP, UrbaNet, wind energy and late-arriving mesonet data); MDCRS aircraft moisture (including WVSSII instrument on Southwest aircraft); NPN and MAP as well as European RASS virtual temperature profiles; JMA, Hong Kong, European, Canadian, MAP, and 6-minute NPN profiler winds; GOES 3.9 micron, GOES visible, and AVHRR POES satellite winds; WindSat and ASCAT scatterometer wind data; METOP IASI radiances; ozone from NOAA-series SBUV-2 and METOP GOME-2; GPS radio occultation data; SSM/IS wind speed and total precipitable water products; SSM/IS and TRMM/TMI rain rate; METEOSAT-9 IR and visible satellite winds; NOAA-19 AMSU-A, MHS and HIRS-4 radiances; RARS 1c radiances (to fill in gaps in NESDIS 1b ATOVS radiances); VAD winds from QC'd NEXRAD Level II data; GOES-13 and -14 radiances and winds; wind speed from JASON satellite altimetry data; lightning data from BLM

network over Alaska and W. Canada. Coordinate with the field to speed up more Alaskan RAOB processing. Maximize Alaska data retrievals (especially mesonet, aircraft and coastal surface). Add GSI events to NAM PrepBUFR files. Let GSI use the actual or estimated anemometer, barometer and thermometer heights on ships. Generate and QC high vertical-resolution aircraft profile data near airports. Work with NCO to bring in new radar data sources (TDWR, Tail Doppler Radar from hurricane hunter P3 aircraft, Canadian, CASA, additional DOD sites). Examine possible use of mixed-satellite (Aqua and Terra) MODIS winds which have better coverage and timeliness than the current single-satellite MODIS winds. (Keyser)

**PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED:** A severe backlog has developed in the implementation schedule on the NCEP computers.

**INTERFACE WITH OTHER ORGANIZATIONS:** ESRL/GSD & NCEP/NCO & NWS/Alaska Region & NESDIS

**UPDATES TO SCHEDULE:** None.

**10.5.17.E2 30 September 2010 (Manikin, ESRL/GSD)**
**Perform configuration management for RR, including thorough documentation, and respond promptly to any code malfunctions or performance issues.**

**CURRENT EFFORTS:** RR problems were not detected during the last quarter.

**10.5.17.E3 30 September 2010 (Manikin, ESRL/GSD)**
**Monitor RR, NAM & HRW performance, respond to any problems detected by ESRL/GSD, NCEP, or any users, diagnose source/cause of the problem, develop solution, test changes and coordinate with NCO on implementation.**

**CURRENT EFFORTS:** No RR problems were detected during the last quarter.

**10.5.17.E4 30 September 2010 (DiMego Manikin, Chuang)**
**As requested by other RT's, incorporate new AHP calculations into Operational WRF Model post-processor and product generator.**

**CURRENT EFFORTS:** No requests from other RT's were received during the last quarter.
CIP Translation: the code for a few library-level modules and code for ingesting METAR data (one of the six data sets) was finished. (Mao) FIP code adapted to the GFS is coming soon from Frank McDonough.

**PLANNED EFFORTS:** Respond to requests as received. Begin compiling and debugging codes. (Mao)

**PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED:** None.

**INTERFACE WITH OTHER ORGANIZATIONS:** NCAR, AWC.
**UPDATES TO SCHEDULE:** None

**NCAR**

**CURRENT EFFORTS:** NCAR organized and conducted the 11$^{th}$ WRF Users' Workshop on June 21–25. The first day featured a new format of lectures on a chosen topic, microphysical modeling. The main three days presented lectures, panel discussions, and a poster session. The final day offered short instruction sessions on selected model-related topics. Workshop attendance was approximately 240.

NCAR/MMM is currently planning the next WRF tutorial, which will be held July 26–August 6. The first week will present the main WRF tutorial, while the second will cover WRFDA, WRF-Chem, and MET.

NCAR issued this year's major release of WRF this quarter. This was Version 3.2 and was released in April.

Jimy Dudhia of NCAR/MMM worked on various WRF physics components and issues during the quarter. In microphysics, he added fixes to the WSM, WDM, and Morrison schemes to work at low pressures, where the relative humidity computation was causing problems.

In cumulus physics Dudhia finished work on code from Yuqing Wang (U. Hawaii) for the Tiedtke cumulus scheme for future inclusion in WRF. Dudhia and Wei Wang (NCAR/MMM) also provided a fix to enable the Simplified Arakawa-Schubert (SAS) cumulus scheme to work with WRF-ARW. Dudhia is working with Ming Chen (NCAR/MMM) on adding a new trigger for the Kain-Fritsch scheme. The trigger involves a new method to obtain the thermal perturbation from local variability and advective forcing in moisture. Initial results are promising in reducing widespread tropical convection.

Dudhia is working with Peggy Lemone (NCAR/MMM), Songyou Hong (Yonsei Univ., Korea), and Changhai Liu (NCAR/MMM) to improve the YSU PBL scheme's surface-layer treatment. The goal is to make it less sensitive to the thickness of the lowest model layer and to enhance the scheme's vertical mixing. Dudhia also worked with NCAR visitor Pedro Jimenez (Univ. Complutense Madrid) on evaluating the effect of different stability functions on the surface wind in seasonal statistics at 2-km grid size in Spain. They are considering how to improve these functions by removing arbitrary limits.

In ongoing investigation, Dudhia worked with Mukul Tewari (NCAR/RAL) to resolve cooling issues between WRF V3.1.1 and V3.0. Surface cooling effects can be traced to several factors. One is an ozone fix for the RRTM longwave radiation scheme in 3.1.1. In addition, snow albedo changes and a new method of using monthly vegetation fraction to update various parameters (leaf-area index, emissivity, albedo, roughness, and length) lead to cooler results.

Dudhia worked with Dave Gill (NCAR/MMM) and Julie Schramm (NCAR/MMM) on sea-ice initialization. It was found that the use of inputs from different sources of skin temperature, SST, and sea-ice fraction may cause problems for initial conditions. Skin temperature is taken as a weighted combination of the open water and ice temperatures, and the retrieved ice temperature may be wrong due to the extrapolation.

Dudhia modified the Goddard shortwave radiation scheme to allow for clear-sky scattering, as the scheme ignored aerosol effects unless provided by WRF-Chem. A simple method of specifying a scattering parameter via the namelist is being tested.

**PLANNED EFFORTS:** The next WRF Tutorial will be held July 26–August 6 in Boulder. The development and implementation of new physics will continue.

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

**ESRL/GSD**

Good progress was made on all fronts toward the RR implementation at NCEP. In early June, Geoff Manikin visited Boulder for several days to work on and discuss various issues related to the RR implementation (see below). The RR continues performing similarly or (mostly) better than the RUC for most forecast fields, although

since May we saw a warm bias at middle levels in the RR forecasts that was not present in the RUC. The mid-level warm bias has been reduced significantly by enabling shallow convection (via a namelist option in WRF) within the G3 (3d Grell-Devenyi) convective scheme.

Rapid Refresh primary and dev 1-h cycles continue to run on wJet/hJet at GSD. A change log on the primary RR 1h cycle is maintained at **http://ruc.noaa.gov/internal/RR_runs/RR_1h_info.txt** .

**Upgrades to RR cycles at GSD:**
During the quarter we upgraded both the primary and dev RR 1-h cycles at GSD to WRF-ARW V3.2 (released by NCAR on 2 April) and (in stages—this was more complicated) to the top of the NCEP repository trunk version of Gridpoint Statistical Interpolation analysis (GSI) plus the generalized cloud-analysis code developed at GSD and CAPS. During June at GSD we also added code to adjust surface temperature and pressure observations to account for the difference between the actual observation-site elevation and the model terrain elevation at the observation location. We also performed various tests to diagnose and lessen the mid-level warm bias in temperature noted above (see Task 8).

**RR at NCEP:**
We have been working increasingly closely with Geoff Manikin and others at NCEP/EMC on details necessary for implementing the RR at NCEP. Geoff's visit to ESRL/GSD for 1 week in June was extremely productive: all of the updated RR components are now compiled and a 1-h cycle is now running on NCEP's computers (cirrus and stratus). Ming Hu, Steve Weygandt, Curtis Alexander, and others from ESRL worked with Geoff closely during this week. Since this visit we have initiated weekly telecon between Geoff and the RR development group at GSD to review current progress and to define remaining tasks necessary toward the implementation. Prominent among these are converting to use of binary instead of NetCDF for lateral boundary-condition files, including I/O from the WRF utility *update_bc,* and for model output from WRF.

**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 [In repos yet? I gather not.] Post-processing of GSD primary and dev 1-h cycles was switched from the WRF Postprocessor to the NCEP generalized Unified Postprocessor ("UniPost") in June. 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.

**Rotated lat-lon projection for RR:**
At the end of FY10Q3 this transition from the current Lambert conformal to the rotated latitude-longitude grid is the top priority major change to the RR prior to implementation. During the quarter, wrfout files from the rotated lat-lon grid were read successfully as background fields for GSI, and it appears that switching to cycling with the rotated lat-lon grid from the present Lambert Conformal should be straightforward. The UniPost incorporates recently developed NCEP enhancements to post process wrfout files or 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 (e.g., Grid 130, the current native RUC horizontal 13km grid); we are planning to use their PRODGEN code rather than copygb. This will be more efficient and faster and will bypass the insufficient functionality of copygb to handle the rotated lat-lon projection.

As of 14 July 2010, a decision has been made (pending AWC approval) to move to a slightly different RR domain using the rotated lat-lon projection as discussed in previous months. Per a request from the Alaska Aviation Weather Unit (AAWU) and Anchorage NWS WFO on 29 June, this domain covers all of the Aleutian Islands and forecast area for AAWU and NWS-WFO-ANC. The new domain is shown in the figure below.

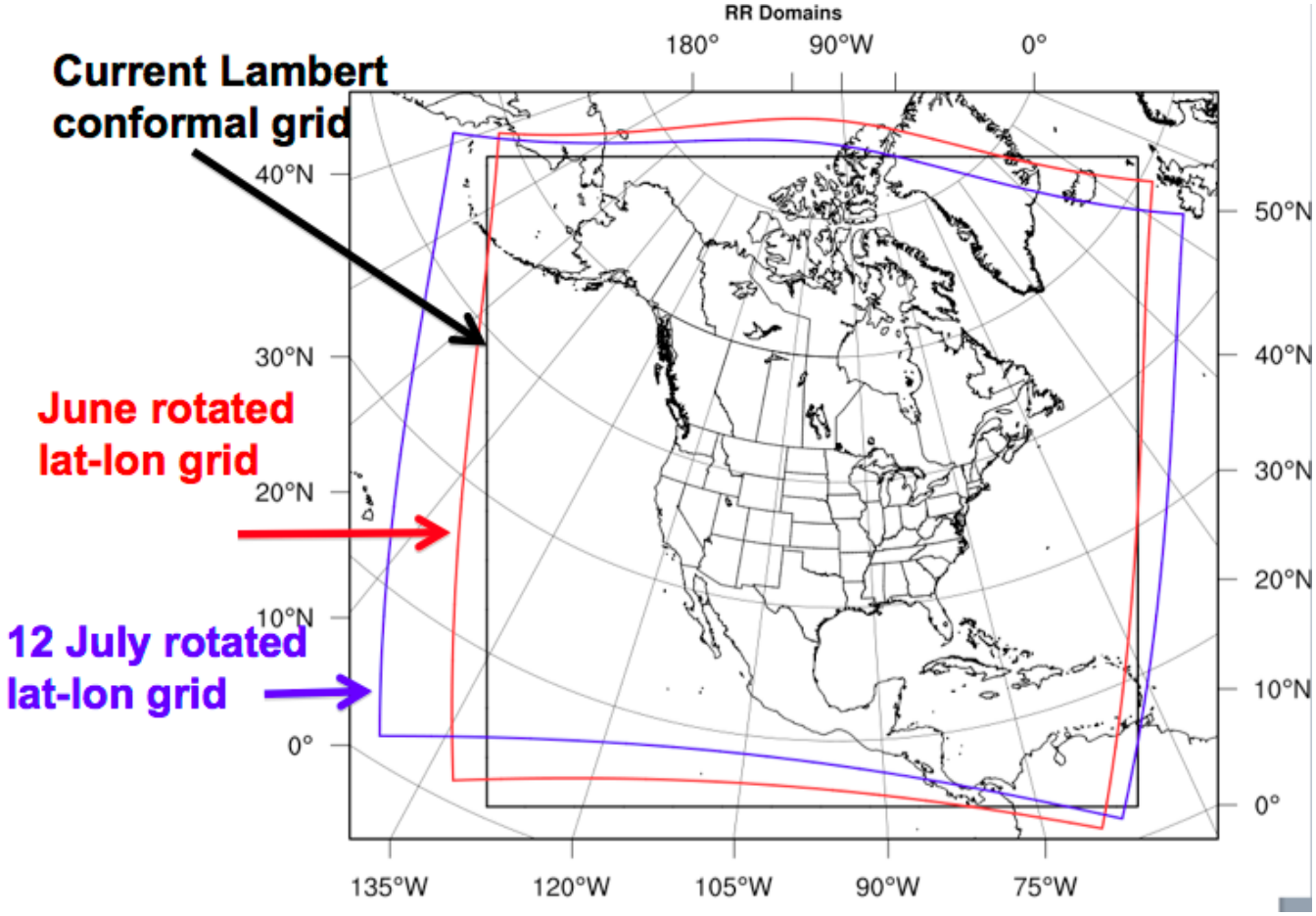



*Fig.1. Rapid Refresh domain – current (black) and future (blue) versions. The red grid was an initial rotated lat-lon grid proposed in June before the Alaskan request to include all of the Aleutians in the RR domain.*

**NCEP**

***Subtasks***

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

Significant progress on the Rapid Refresh was made this quarter. Geoff Manikin of EMC visited GSD in Boulder during the week of June 7 to work on the RR. As a result of this visit, the boundary condition and partial cycling jobs of the Rapid Refresh are now running routinely in the EMC parallel environment, and the full hourly cycle will likely be running by early July. It is anticipated that final modifications to the codes will be made during July so the real-time statistical evaluation can begin after that. (Manikin)

**10.5.4.4 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. (31 March 2010)**

EMC plans to begin the real-time statistical evaluation in early August. (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.**

**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**

During May, warm temperature biases began appearing at mid levels during the forecasts. Efforts to better understand the causes, particularly their possible relation to the convective parameterization, were undertaken as soon as the bias was confirmed. They 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.

A systematic cool bias in 2-m temperatures along the coasts of Canada and Alaska has also been noted and is under investigation currently.

**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.**

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.

**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**

Ming Hu completed the submission of initial RR cloud analysis related changes to the NCEP GSI SVN repository. An additional change related to account for terrain height differences between the surface observations and the background terrain height was also submitted and approved. Geoff Manikin visited GSD for a week in early June to work intensively with Ming Hu and Curtis Alexander on getting the RR cycle running on cirrus at NCEP. Based on the work that week and follow-up work, Geoff began cycled RR runs, including the GSI, at NCEP in early July. Work with NCEP continues on establishing real-time hourly feeds of the NASA Langley satellite cloud data and the level II radial velocity data.

Ming Hu has also coded changes needed in the GSI cloud analysis to accommodate cycling of the RR in binary as opposed to netCDF. These changes to the hydrometeor I/O need to be tested, and then submitted to the NCEP GSAI repository. We anticipate a final update from the NCEP GSI repository to Geoff manikin's real-time cycle in mid August, then the code will be frozen and Geoff will begin a 2-month parallel test cycle of the RR.

**NCEP**

***Subtasks***

**10.5.5.1 Refine the radial velocity analysis component of GSI and determine the optimal decorrelation scales for different analysis passes. (30 Nov 09)**

The 7 Dec 2009 precipitation case was rerun with and without assimilating radar radial wind and with a refined analysis scheme. After examining the results, it appears that short-term forecast in storm scale was improved with refined radial wind assimilation. However, the improvement on forecast score is slight. The radar radial wind will be assimilated three times with hourly intervals in future version. This has been completed.

**10.5.5.3 Report on testing of 2DVAR GSI assimilation of high spatial and temporal mesonet surface data using analysis grids with 2.5-km resolution. (31 May 10)**

RFCs were submitted to NCO to implement a slight shift of the Hawaii-RTMA domain as requested by NWS Pacific Region. The 5km-resolution CONUS-RTMA datasets were added to the NOMADS server. Improvements

were made to the algorithm that blends the RTMA first guess winds with the HWRF winds in the vicinity of tropical storms. (Pondeca, Manikin) COMPLETE

**10.5.5.4 Establish hourly cycled NDAS-like assimilation system on NOAA R&D computer at NCEP (machine called "vapor") using GSI and NMMB within NEMS to be adapted to a NEMS- and ARW-based RR by ESRL/GSD. (30 Jun 10)**

The hourly cycled assimilation system has been built and is functional. The digital filter option in NMMB is nearing completion and is essential in light of the lack of a strong constraint in the GSI. (Rogers, Wu) COMPLETE

**10.5.5.5 If authorized by NCEP Director, implement initialization of HiResWindow runs using CAPS/Shun Liu improved techniques for radial velocity analysis in GSI together with Diabatic Digital Filter use of 88D reflectivity Mosaic. (31 Jul 10)**

While the work reported in 10.5.5.1 was marginally positive, it has not been possible to complete integration of the refined radar radial wind version of the GSI into an initialization option for the HiResWindow at this time although work is progressing slowly (Liu). HiResWindow upgrade scheduled implementation is now Q1 FY2011 (Oct-Dec 2010)

**10.5.5.6 Based on case-study testing and refinement of the research quality code, deliver result in an 'experimental' code for an upgrade package (e.g. strong constraint, improved satellite channel bias correction, improved use of WSR-88D radial wind and/or satellite radiances and/or retuned covariances to the GSI for FY2011 change package to the NAM. (31 Jul 10)**

Work was done to include regional ozone analysis in the NDAS. The observational error of ozone data was adjusted to account for the representativeness error of the regional model grid. To prevent a negative mixing ratio caused by an over-adjustment of the ozone fields, ozone background error variances were set to be 10% of the zonal mean values of the first guess field. The horizontal scales were set to 400km below 350mb and increased to 800km at the model top. Since mixing ratio (instead of layer ozone) was used as the analysis variable, the vertical scales were set to a small value (0.6 of grid spacing). The ozone data observational error adjustment was done in a fix file. There were also changes to the input parameters and the analysis scripts. After tuning the ozone background errors, the ozone analysis worked properly and the code was merged to a version of the trunk. The regression tests were successful and the code was submitted to the GSI_SVN trunk. (Wu)

WindSat, ACARS moisture, NOAA-19 hirs & amsu/a, IASI radiances, AQUA amsu/a, GPS-RO and mesonet mass & moisture data have all been tested for inclusion in the next NAM upgrade and are running in Eric Rogers' parallel. MAP so-called boundary-layer profilers are still being worked on after initial results were negative. (Wu)

Consideration is being given to using the RTMA's quality control measures in the NAM GSI as part of an effort to test surface mesonet temperature and moisture observations (mesonet winds and pressure are used I NAM today). RTMA uses a network and station use-lists from ESRL/GSD, station reject-lists gathered by/from NWS regions and a dynamic reject list based on recent history of GSI diagnostic files containing fit to guess and analysis among other things. (DiMego, Pondeca, Wu)

Preliminary coding started at end of quarter for a test to see the impact of different resolutions on the regional strong constraint. Jim Purser provided the code for a new anisotropic recursive filter normalization. (Parrish)

***Deliverables***

**10.5.5.E3 28 Feb 2010 (Manikin)**
**Pending EMC, and NCEP Center initial recommendations, Request for Change forms (RFC's) 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. GSD changes to the GSI for the RR have been submitted to NCEP GSI SVN repository and the updated GSI (version FY10+ with cloud analysis) is running at GSD and in Geoff Manikin's NCEP RR test system. Full real-time parallel RR testing by Geoff Manikin at NCEP began in early July as scheduled.

**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 is 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.

WRFv3.2 official code release was made by NCAR on 2 April 2010. WRFv3.2 includes improvements in efficiency in generation of lookup tables for the Thompson microphysics (from NCAR) and prediction of temperature in sea ice and accumulation and ablation of snow on sea ice in the RUC land-surface model (from GSD).

A concern that appeared during the quarter and that affects mainly the HRRR is a tendency for the latest version of the Thompson scheme (released as part of the V3.1.1 of WRF) to fail to produce long-lived convective systems with a classic leading-line / trailing-stratiform structure. There appears to be too much generation of snow at middle and high levels that is then carried out ahead of the leading convective line by upper-level flow, making it difficult to maintain long-lived convective systems of leading-line / trailing-stratiform character. Systematic differences in mesoscale character of forecast convective systems by CAPS ensemble members having different microphysics options but otherwise identical initial and lateral boundary conditions and physics configurations were also noted during the Hazardous Weather Testbed Spring Program during May and June. The Thompson scheme exhibited the same tendencies in these runs as for the HRRR. Curtis Alexander and John Brown of GSD and Geoff Manikin of EMC participated in this evaluation. All this has initiated investigation at GSD and elsewhere. We will be alert for possible impacts on RR forecasts.

**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.**

The new version of the RUCLSM with the explicit prediction of sea ice temperature and its effects on sea ice albedo, as well as accumulation and ablation of snow on the sea ice, continues to run in the RR at GSD. Performance remains satisfactory. These enhancements were included in of the WRF v3.2 release on 2 April 2010. Tanya Smirnova presented a poster on the RUC LSM including these sea-ice enhancements at the CIRES (Cooperative Institute for Research in the Environmental Sciences) Rendezvous in Mid-April. She, along with Curtis Alexander and Ming Hu received CIRES Science Awards at the Rendezvous for their contributions to development and implementation of the RUC diabatic radar initialization and being used also in the RR.

**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:** A new case study was developed based on the April 28 2010 dust in snow event. High winds in the Nevada and Four Corners region led to snow in the Front Range of Colorado with lots of dust residue. This case is currently being used to test the dust modules in the microphysics scheme (emission and wet deposition). Analyses of the results show that the dust did not affect total precipitation much, but the location of precipitation changed. The modeling also show that the dust was transported up to the Front Range area and wet deposited, as observed.

Trude Eidhammer and Roy Rasmussen gave an invited one hour presentation at the WRF Users Workshop in June entitled: “The Role of Aerosols in Microphysical Parameterizations” that was attended by over 200 attendees.

NCAR and NOAA/ESRL scientists conducted a half-day meeting in April on development of aerosol-microphysics interaction in model parameterizations. Attendees included Roy Rasmussen, Trude Eidhammer, Greg Thompson, and Hugh Morrison from NCAR, and John Brown, Stan Benjamin, Georg Grell, and Tanya Smirnova from NOAA/ESRL.

**PLANNED EFFORTS:** Continue 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 will submit them following some checkout tests.

***Subtasks***

**10.5.15.E2 16 Sept 2010 (revised date, previously requested) (GSD)**
**Complete testing of GSI generalized cloud analysis for Rapid Refresh and deliver code to NCEP as part of Rapid Refresh package delivered to EMC, pending availability of NCEP testing capability.**
The hydrometeor background field ingest code and special observation ingest code in now part of the NCEP GSI repository and is now being run by Ming Hu in the GSD real-time RR cycle and by Geoff Manikin on cirrus at NCEP.

**10.5.15.E3 30 Aug 2010 (GSD)**
**Complete testing of revised cloud analysis for part of FY11 change package to Rapid Refresh.**
Initial testing of ideas for this, including use of cloud residuals to create relative humidity innovations, are currently being testing in the development RUC at ESRL and will be moved over to a test version of the RR over the next few months. This capability will require substantial modifications in GSI (much in the RUC 3dVAR), and will be deferred to the FY11 change package for the RR. Preliminary results from testing of this capability in the RUC were presented at the GOES-R Annual Review on 10-11 June 2010 by Steve Weygandt.

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

***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.**

The HRRR has had very good reliability since the start of the CoSPA real-time assessment (June 2), 98.9% (allowing for gaps of up to 3h). There are 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.

Additional dedicated computer resources for a HRRR partial shadow system have been included in recent NOAA HPC procurement. These additional JET supercomputer cores will become available around 1 Sept. and will be used for a combination of parallel real-time runs (1 every other hour) or rapid completion of retrospective experiments.

A very minor modification was made in the WRF ARW namelist option file to limit the amount of heating per time step coming from the explicit microphysics scheme, which has eliminated the CFL-related occasional HRRR crashes that had been occurring. Comparison experiments indicated extremely small differences in the forecast fields and negligible differences in the statistical skill scores.

Patrick Hofmann of ESRL completed coding of a new HRRR verification package that is now running in real-time to provide statistics on HRRR performance as a function of valid and lead time, and threshold. In addition to verification on the native 3-km HRRR grid, a key feature is the inclusion of interpolation of HRRR forecasts and

NSSL reflectivity data to 10-km, 20-km and 40-km grids for “upscaled” verification. This upscaled verification allows the determination of “neighborhood” skill – the ability of the HRRR to depict regions of convection, even if the storms are not exactly in the right location. A recent GSD hire, Eric James, has been subjectively evaluating HRRR forecasts.

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

**NCAR**

**CURRENT EFFORTS:** NCAR/MMM carried out 3-km WRF simulations initialized with radar-enhanced, 13-km Rapid Refresh (RR) grids. This year’s convection-permitting forecasts were from April–June. Dudhia will be collaborating with Morris Weisman (NCAR/MMM) on evaluating the initial spin-up. Thus far Weisman has noted the difference made by including diabatic DFI in the 13-km RR, compared to last year's use of non-diabatic DFI.

**PLANNED EFFORTS:** The analysis of the convection-permitting forecasts will continue into the new 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

As of early July 2010, the HRRR systems is running with high reliability (98.9 % allowing for gaps up to 3-h). Factors in this include the hardware enhancements (dedicated cores, redundant files systems, expanded capacity internal file transfer, and redundant ftp server for external file transfer) as well as the analysis of various failure modes leading to the coding of automated detection and amelioration procedures (where possible) and creation of manual diagnosis and remediation procedure plans (where needed).

Curtis Alexander and Eric James have conducted a series of HRRR re-runs for problematic cases to test possible improvements. One set of experiments has focused on cases with spurious convection, by running the HRRR off of the developmental version if the RUC which includes a provision to extend the radar observation-based temperature tendency to the top of the boundary layer. Results indicate that this did not significantly reduce the spurious convection. Another set has focused on cases where the HRRR is unable to maintain the intense leading line of convective systems. A number of different microphysics and boundary layer schemes have been tested. Some improvement over the HRRR real-time control (Thompson with 2-moment rain and MYJ) was noted, but the problem still persists. Additional work has been completed by NCAR scientists to evaluate these issues.

**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 meets every 2-4 weeks 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**

In recognition of the need for a HRRR partial shadow test system, in which possible improvements to the HRRR forecast system can be systematically tested and evaluated, additional dedicated computer resources were included in recent NOAA HPC procurement. This action to obtain the partial shadow system capability is critical for advancing the HRRR component of the CoSPA system and was made possible through a revision to the GSD RWI tasking for FY10. The action was completed in late May, just ahead of a NOAA HPC deadline that would have delayed the procurement of additional dedicated HRRR cores by 9-12 months. The new computer cores should be available in August 2010. Prior to that time, GSD is using existing resources to fit in one additional HRRR run per day, initialized at the convectively active time of 00z. We are currently evaluating a change package with reduced latent heating ("1/3 TTEN") and improved convective suppression.

**NCEP**

Shun Liu tested the impact of the DFI time window on a forecast. DFI is applied to the background field to first eliminate the imbalance caused by interpolation. After assimilating radar radial wind, DFI is applied again to remove imbalances due to wind field changes and to establish a balance between the wind and other model variables. The experiments showed that with an increase in DFI time window, relatively large temperature increments can be obtained. However, a larger cold bias is shown in short-term forecasts. Also, the longer DFI time window can help improve 18 to 36 hour forecasts, but not the very short-term forecasts, in HiRes domain. Shun is also working on merging GSI codes from old version into the current Subversion trunk version in order to test the assimilation of radar data using the NMMB.

***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:***

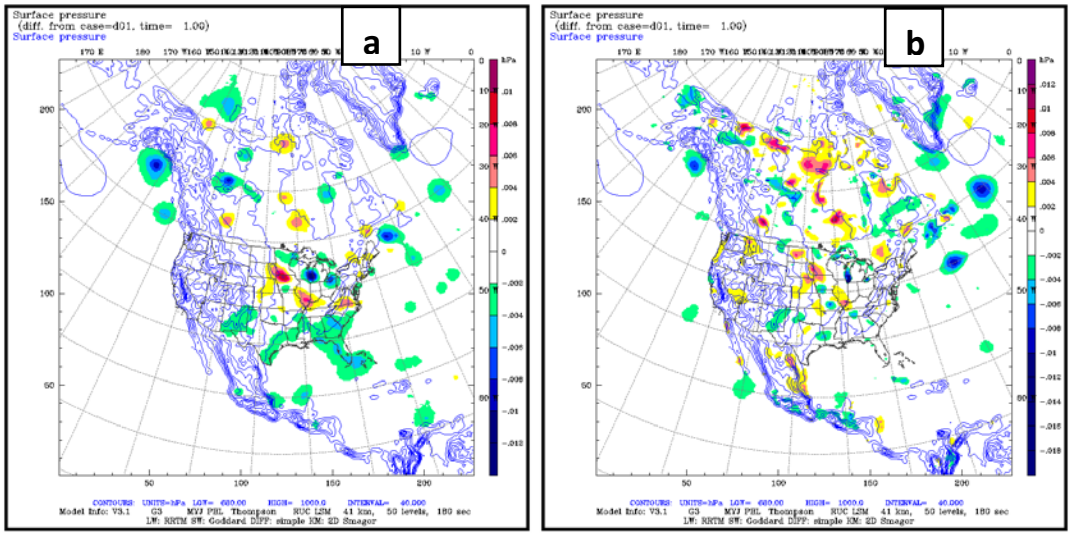
**10.5.19.E5 15 Sept 2010 (CAPS, NCEP and GSD)**
**GSD**
We continue with bi-weekly meetings involving ESRL GSD and PSD personnel and OU CAPS. Kefeng Zhu visited Boulder for the GSI tutorial and met in person with GSD and PSD personnel, for initial EnSRF filter experiments with 1 3-h forecast cycle. 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.

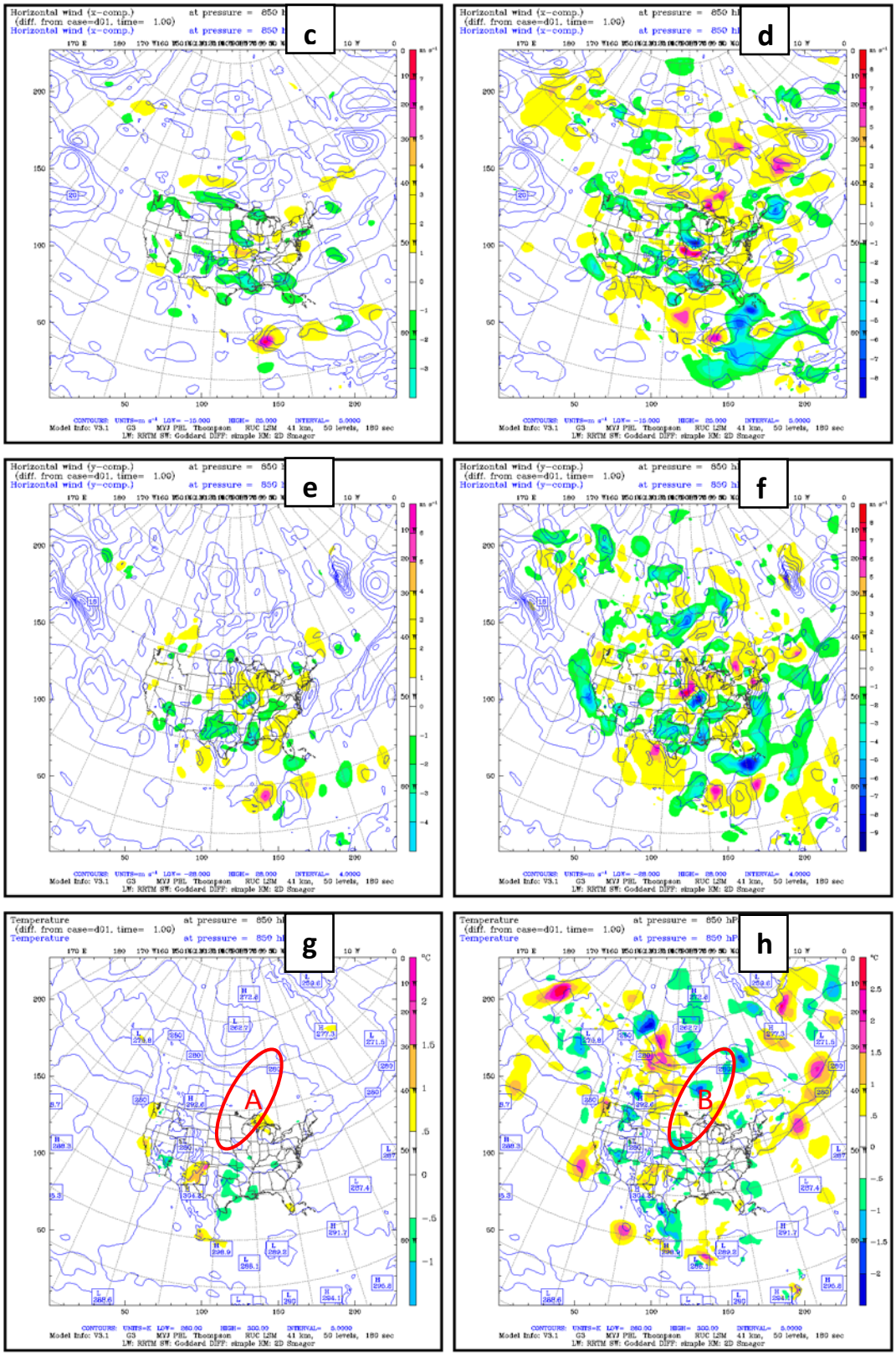
**CAPS**
During this quarter, CAPS obtained and modified the global EnKF code from Dr. Jeff Whitaker of ESRL and linked the package with the version of GSI that CAPS has been testing for RR applications. Initial EnKF analyses

without cycling (using covariance sampled using the random-cv method from the NMC-method-derived covariance statistics which also serves as the initial covariance from which EnKF cycles are started) were compared to GSI analysis and the agreement was close enough to confirm the correctness of the initial implementation. The results were discussed with the ESRL scientists (Whitaker, Benjamin, Weygandt and others) during a visit by Ming Xue from CAPS to ESRL in June. Further results with cycled EnKF were obtained after Xue's visit.

The EnKF test domain has 227 x 227 grid points at about 40 km grid spacing (3 times the grid spacing of RR) which covers the entire RR domain. Tests were carried out on the GSD WJET machine with components from WRF WPS 3.1, WRFDA 3.1, the GSI version as of Aug, 2009, WRFV 3.1 and several newly-developed interface programs. As an initial test, only conventional observations were assimilated. The state variables updated were temperature, U and V winds, dry surface pressure, and water vapor mixing ratio. Cloud hydrometeor species are not updated yet.

Two software packages were developed: one for generating the initial ensemble and the perturbed lateral boundary conditions, by sampling the NMC-method-generated covariance using the random-cv method; one for carrying out self-cycling - each member uses the latest available forecast and newly updated boundary condition tendency files. The EnKF analyses were performed at hourly intervals as the standard RR. The standard TDFI option in WRF-ARW was turned on during the WRF forecast. Figure 1 show the increments of the GSI (left column) and EnKF (right column) analyses. The initial start time was at 1500 UTC June 15, 2009 and the final analysis was at 1800 UTC June 15, 2009; the EnKF analyses were therefore performed 4 times total. For all the state variables, the EnKF increments are generally larger than those of GSI except for the water vapor mixing ratio. For example, the EnKF shows larger increments over the north Atlantic while the GSI shows much smaller increments (see region marked by A in Fig.1g and region B in Fig.1h). The single time analysis from EnKF compared much closer to that of GSI. Innovation statistics as well as the ensemble spread will need to be examined to understand the differences; configuration details of the EnKF analysis, including inflation and localization, will be examined and tuned. To gain more confidence on the regional EnKF analysis, we will configure the regional and global EnKF systems as closely as possible; including the data used, and performs more controlled comparison with the global EnKF analysis run by Jeff Whitaker.

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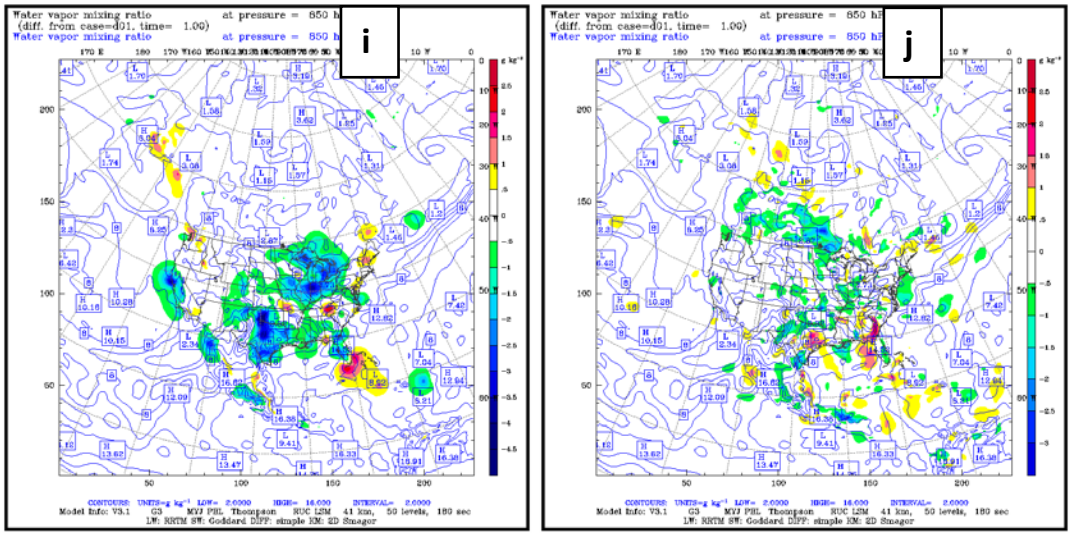


*Fig.2. GSI (left column) analysis increments versus EnKF (right column) analysis increments (shaded), and the analyzed fields (blue contours), valid at 1800 UTC June 15 2009, for surface pressure (1st row), and 850 hPa x-component of velocity (2nd row), y-component of velocity (3rd row), temperature (4th row), and water vapor mixing ratio (5th row)*

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

**GSD**

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.

GSD group members Steve Weygandt, Curtis Alexander, and Eric James initiated contact with Binbin Zhou (NCEP EMC), who has created the VSREF, to discuss 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.

**NCEP**

Jun Du reports that the work of building a new NEMS-based ensemble component for the 2011 operational SREF system upgrade continues. The NEMS-component ensemble can now successfully run and its job scripts have also been built into the operational SREF scripts, for easier implementation in the future. The plan is to use the NEMS-NMMB model to replace the Eta and RSM models currently used in the SREF system. 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 working with NWS' Thomas Hultquist (Science and Operations Officer) and the forecasters at the Chanhassen, MN, WFO [twin cities area Minneapolis / St. Paul] to try to put VSREF data into their AWIPS, so they can have access to VSREF output for their local airport responsibilities which including Chicago airports.

Binbin also generated a 2 member ensemble made up of the High-Res NMM and ARW models, so comparisons could be performed to verify that an ensemble mean of just two members does indeed yield better forecasts than either of the individual members.

***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.