MODEL DEVELOPMENT AND ENHANCEMENT RESEARCH TEAM
Quarterly Report for April-June 2007
Submitted 15 July 2007

**With contributions from Geoff DiMego and Mary Hart (NCEP/EMC);
Stan Benjamin, John Brown, Steve Weygandt (NOAA/ESRL/GSD);
Jordan Powers, Roy Rasmussen, and Bill Hall (NCAR);
Ming Xue (OU/CAPS)
Compiled and edited by Holly Palm and Stan Benjamin**

Executive Summary

Task 07.5.1: Infrastructure support related to operational running of the RUC and North American Mesoscale (NAM) operational modeling systems.

- Transfer complete to NCEP for RUC change package code, compiling almost complete. Change package includes mods to RUC analysis (including mesonet winds, radar reflectivity), model changes (RRTM longwave radiation and updated convection), and postprocessing enhancements (forecast radar reflectivity fields). All changes continue in real-time testing in hardened backup RUC cycle at ESRL/GSD.

Task 07.5.4: Develop, test, and implement Rapid Refresh configuration of the WRF modeling system.

- Real-time WRF-RR 12-h cycle now running on full North American domain and CONUS domain (GSD)
- I/O with the /tg file system on the new GSD supercomputer (wJET) resolved.
- Summary papers written/presented at June AMS NWP/WAF conference.

Task 07.5.5: Develop, test, and implement improvements to the operational WRF 3DVARs for Rapid Refresh and North American Mesoscale runs.

- Deliverable 07.5.5E2 complete. GSD reporting bi-weekly to NCEP on progress toward pre-implementation version via telecom at NCEP GSI group meeting.
- Continued progress with GSI assimilation experiments and observation evaluation at NCEP.

Task 07.5.6: Develop, test, and evaluate the performance of the nonhydrostatic WRF modeling system.

- NCAR organized 8th Annual WRF Users' Workshop held in June 2007.

Task 07.5.8: Improve model physics for aviation forecasts.

- RRTM longwave radiation implemented in GSD RUC with successful results for improving nighttime near-surface forecasts in warm and cold seasons. RRTM included in the RUC summer change package.
- Development of microphysics improvements at NCAR for possible application in the RR.

Task 07.5.15: Develop improved methods of cloud and moisture analysis for use in the WRF modeling system.

- Work continues on use of hydrometeor background fields with merged GSI cloud analysis with RUC and ARPS components. Presentation on this topic from CAPS/GSD at AMS meeting.

Detailed report – MDE – 3rd Quarter 2007 – April-June

Task 07.5.1: Infrastructure Support Related to Operational Running of the RUC and North American Mesoscale (NAM) Systems

GSD

GSD efforts during the April-June quarter have focused mainly on code transfer to NCEP after continued testing and final development for the 2007 change package for the RUC prior to its transfer to NCEP for pre-implementation testing.

This RUC analysis/model change package (implementation date hoped for later in 2007) is currently running in the 13km dev RUC (http://ruc.noaa.gov/pig.cgi?13km_D2) and as of 4 April, also running in the more-hardened 13km backup RUC (http://ruc.noaa.gov/pig.cgi?13km_BU). Further changes were made in May, as shown in http://ruc.fsl.noaa.gov/13km_RUC.changelog.html (development RUC). To summarize the changes made in the development and backup RUC at GSD:

- Improved diabatic assimilation of 3-d radar reflectivity via diabatic digital filter initialization and convective suppression.
- Correction to RH observation errors for in-situ and precipitable water moisture observations, resulting in more accurate RH forecasts.
- Addition of three reflectivity products in RUC post-processing (column max, 1-km, 4-km)
- Addition of lightning assimilation to complement the 3-d radar reflectivity assimilation. This adds building of convective areas where lightning strokes are evident and there is no 3-d radar reflectivity data (e. g. over oceans, outside of CONUS).
- RRTM longwave radiation package replacing current Dudhia longwave package. This change improves nighttime forecasts over snow cover (cold-season) and especially a long-standing warm bias in particularly moist areas.
- Land-surface model changes for improved 2m temperature over snow cover
- Change to Grell-Devenyi convective parameterization with improved (decreased) areal coverage for light convective precipitation.
- Analysis changes to:
    - Assimilate mesonet winds using a new “mesonet provider uselist”
    - Differentiate wind observation error between GPS rawinsondes and non-GPS rawinsondes
    - Assimilate TAMDAR aircraft observations, if they become available for operational use

In addition to the work on the RUC change package, GSD continued to monitor real-time RUC performance among the operational NCEP version and 4 different experimental GSD versions, using observations from rawinsondes, surface stations, GPS precipitable water, and precipitation.

INTERFACE WITH OTHER ORGANIZATIONS:
Discussion between GSD and NCEP/EMC and NCEP/NCO on RUC changes, NSSL on 3-d radar data, NCAR on radar assimilation, NCEP on radar data availability.
Discussions between GSD and RUC users in NWS and private sector on RUC performance.

Subtasks

07.5.1.1 Maintain hourly RUC runs and provide grids of SAV and AIV guidance products.

Manikin reported several bad 500 hPa RUC analyses were observed in late April, which GSD traced to bad data from a particular aircraft. The quality control checks should have flagged these values, but it was determined that the code was written such that the temperature bias check would only be invoked if a fairly high number of observations was available from a single source in a given hour. A fix was developed and tested at GSD and also tested at NCEP in which that threshold was lowered, and they resulted in elimination of the bad observations and significantly improved analyses. As a result, this code change was implemented as a crisis fix at 12Z 30 April.

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

The EMC team and NCO reports 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). (EMC Team and NCO)

07.5.1.3 Provide full grids from RUC runs on NCEP and NWS/OPS servers.

The EMC team and NCO reports NCEP maintained real-time availability of full resolution gridded data from the operational RUC runs via anonymous ftp access via the NCEP server sites. This includes hourly BUFR soundings, output grids which undergo no interpolation and, as such, are on the models' computational grids (so-called native-native grids). NCEP provides anonymous ftp access on ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/ .

07.5.1.4 Maintain access to model verification data.

Rogers, Manikin and Keyser report NCEP maintained its capability and provided access to routine verifications performed at NCEP of the operational RUC system forecasts. These include grid-to-station verifications (versus rawinsonde, surface, aircraft, Profiler, and VAD data) scores computed periodically at NCEP. Routine verifications have been performed and are accessible from NCEP's Mesoscale Branch's website: http://www.emc.ncep.noaa.gov/mmb/research/meso.verf.html . GSD also continued its similar modification as reported above.

Deliverables

07.5.1.E1 1 October 2006 - 30 September 2007 EMC (Rogers, Manikin, Keyser)
Perform observation ingest, quality control, and preparation in support of the operational RUC runs.

CURRENT EFFORTS: Keyser reports the following new networks were added to the mesonet feed received from NOAA/GSD MADIS and assimilated by the RUC: a mesonet collection under the provider name NJWxNet (New Jersey Mesonet, New Jersey Safetynet, and some Forest Service stations) (4 April), surface reports from GPS-IPW sites (under provider name DDMET) (12 April), and NERRS (National Estuarine Research Reserve System) (24 April). An implementation on 17 April modified the data dump processing codes to use dynamic memory allocation, preventing future data overflow issues as new or expanded data platforms are added to the processing. POES and GOES data received from NESDIS were unavailable from 0600 through 1200 UTC on 06 April due to a NESDIS power outage. On 12 April, the GTS feed of GPS-IPW data was switched back on (after a six month interruption) restoring redundancy between it and the existing NOAA/GSD LDM feed. The data dump processing removes all duplicate observations. On 6 June the LDM feed for GPS-IPW data was turned off, leaving only the GTS feed. No decrease in GPS-IPW data has been observed with the GTS-only feed. An implementation on 12 June eliminated variability in the RUC dump processing by removing a step prior to the dump which ingested GOES satellite PW and cloud data from a remote NESDIS server in the 01-11 and 13-23Z cycles. Several RUC dump cycles had recently been delayed due to ftp problems to the remote NESDIS machine. This ingest at the RUC dump time is now included in the schedule of runs in the regular satellite ingest job. An implementation on 19 June has allowed dropwindsondes coming in with a Biloxi bulletin header (KBIX) to be properly decoded as USAF drops. Prior to this they were decoded as unknown. Cooperative Agency Profiler (CAP) and RASS data are not yet available through an alternate ERSL MADIS feed.

Liu reports in May, codes designed to process Level II reflectivity data from WSR-88D Doppler radars were prepared for submission to NCEP/NCO's list of change request forms (JIFs) in preparation for their future operational implementation. This effort includes three codes from NSSL: an upgraded quality control code which now deals simultaneously with both radial wind and reflectivity (instead of separate codes), code to transform the coordinate of the reflectivity data from local polar to uniform Cartesian and code to produce a 3D national mosaic of the reflectivity. A mosaic is required every hour for a future RUC upgrade package.

PLANNED EFFORTS: Keyser plans to add a new aircraft quality control module based on code developed at Naval Research Lab. Increase time window for aircraft data in order to improve track checking. Change PREPBUFR processing to add report sub-type information so analysis can use different obs errors and develop bias corrections based on data sub-types (e.g., airframes and ascent/descent tag for aircraft data, providers and sub-providers for mesonet data, instrument type and on-site correction indicator for radiosonde data). Do impact tests in RUC for several new data types: TAMDAR and Canadian AMDAR aircraft, hourly WSR-88D 3-dimensional reflectivity, 6-minute wind profilers, "new-science" GOES (-11 and -12) cloud data (replacing current data).

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: None.

INTERFACE WITH OTHER ORGANIZATIONS: GSD & NCO.

UPDATES TO SCHEDULE: Complete 30 September 2007.

Task 07.5.4: Develop, test, and implement Rapid Refresh configuration of the WRF modeling system.

NCEP
NCEP has no scientific activity to report. Much discussion has taken place between NCEP and GSD concerning the RR Core testing and WRF core selection for the RR.

GSD

GSD continues to run WRF forecasts cycled with GSI over the RR domain on iJET. Uncycled WRF-RR runs are also being made on wJET using WRFv2.2 and WPS and progress is being made toward adding the GSI to complete the cycling loop.

The running of WRFPOST on the model output was deleted from the script, because the large opteron nodes were removed from iJET. Significant progress has been made on the wJET computer issues, particular with respect to running GSI (see subtask 07.5.4.1). However, some fresh compiling issues have been encountered on wJET with v2.2 of WRF-ARW.

During May, Dennis Keyser at NCEP/EMC began to produce hourly experimental prepBUFR files for the Rapid Refresh. GSD has tested these files at NCEP and some corrections will be made before ftp to GSD will begin to use these observation files in Rapid Refresh testing. GSD and NCEP/EMC will be discussing this more in July.

Discussions continued between GSD, NCEP/EMC, NCAR and the DTC regarding the RR core. The focus of these discussions was on conversion of WRF-ARW to run fully within the Earth System Modeling Framework at NCEP. As an outcome of these discussions, Stan Benjamin has written a draft report, Proposal for WRF – NCEP-ESMF intertransferability, which describes options for transferring the ARW dynamic core from WRF into the NCEP realization of ESMF. Discussions will continue on this in July. (Note: Tom Black of NCEP has been very helpful by showing how he is putting the NMM under the ESMF framework at NCEP.)

Tanya Smirnova began work in June toward transferring code written in late 2005 to implement a Digital Filter Initialization (DFI) into v2.2 of WRF-ARW and getting it to run on GSD's wJET computer.

Four papers dealing with various aspects of work toward the RR (overall review of RR status, the RR Core Test results from 2006, and GSI progress) were presented to the American Meteorological Society Conference on Weather Analysis and Forecasting/Numerical Weather Prediction held in June at Park City UT. An additional paper dealing with diabatic initialization using radar/lightning data in RUC (but having RR application) was also presented.

FROM THE RADAR-ENHANCED RUC TO THE WRF-BASED RAPID REFRESH
Stan Benjamin, Stephen S. Weygandt, John M. Brown, Tanya Smirnova, Dezso Devenyi, Kevin Brundage, Georg Grell, Steven Peckham, Thomas W. Schlatter, Tracy L. Smith, and Geoff Manikin. PDF copy available at http://ams.confex.com/ams/pdfpapers/124827.pdf

RAPID REFRESH CORE TEST: ASPECTS OF WRF-NMM AND WRF-ARW FORECAST PERFORMANCE RELEVANT TO THE RAPID REFRESH APPLICATION
John M. Brown, Stan Benjamin, Tanya Smirnova, Georg Grell, Ligia Bernardet, Louisa B. Nance, Randall Collander, and Chrstopher W. Harrop. PDF copy available at http://ams.confex.com/ams/pdfpapers/124822.pdf

PLANNED EFFORTS: Add the GSI analysis package to the wJET cold-start WRF-RR runs to complete the cycling loop and increase the cycling frequency from once per 12 hours.

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: Early in the quarter, efforts to migrate the RR real-time cycle to wJET were stalled while intensive efforts were made to fix critical problems with the Terragrid /tg file system. The GSI with its parallel I/O turned out to be particularly vulnerable. By late May these issues were sufficiently resolved to allow development work to resume. More details can be found below and in the May monthly report.

More recently, we have been informed that considerable maintenance work will be required on wJET over the next 2 months, with the potential to retard the pace of RR development work.

INTERFACE WITH OTHER ORGANIZATIONS: DTC, NCEP, NCAR

UPDATES TO SCHEDULE: None.

Subtasks

07.5.4.1 15 Nov 2006 (original due date), deferred to 15 Jan 2007. COMPLETE as of 10 Dec 2006. (GSD)

Begin real-time cycling of the RR model with GSI over RR domain at degraded resolution.

CURRENT WORK:
The wJET disk issues that have delayed the migration of the Rapid-Refresh real-time cycle to the new ESRL supercomputer (wJET) have largely been solved; however, a few wJET computer issues remain, including slow compiling of WRF. The GSI analysis program posed the most significant challenge for the new computer but now is compiling and running well. Dezso Devenyi and Jacques Middlecoff solved two key problems during the quarter: 1) sporadic corruption of files when then were copied from one node to another and 2) program crashes when multiple nodes tried to open a non-existent file. A minor issue (MPI2 I/O to /tg file system on wJET) inhibits the ability to run GSI with very large numbers of processors, but this does not pose a problem for our current real-time testing. This MPI2 I/O issue has been extensively evaluated by Dezso Devenyi and Jacques Middlecoff, who have shown that it causes intermittent hangs of the program when GSI is run with large numbers of processors (approaching 100). In addition, their timing tests have revealed that GSI does not scale especially well, with diminishing pick-up beyond about 40 processors. Timing diagnostics indicate that the job runtime is dominated by the minimization algorithm. Cold start runs RR runs (using WRF version 2.2 and the new WRF Preprocessing System) have been completed by Tanya Smirnova on wJET and we are working to add GSI to the workflow cycle.

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: See discussion on /tg file-system problems above. These are now resolved.

INTERFACE WITH OTHER ORGANIZATIONS: NCEP, NCAR

UPDATES TO SCHEDULE: This task for which we previously requested a 2-month delay (from 15 Nov 2006 to 15 Jan 2006) is now complete.

07.5.4.2 15 Jan 2007 (GSD, DTC) – Completed 5 Jan 2007

Build retrospective period capability including different seasons for testing of RR with cycling.

CURRENT WORK: The retrospective period chosen was the 10-day period 26 November to 6 December 2006. This period includes a good variety of weather, including a severe snow/ice storm and severe weather on 29-30

November over the Plains and Midwest. This retrospective period continues being used very productively for testing impact of various observation systems (including TAMDAR) under non-MDE funding. Based on this testing, the specification of moisture observation errors was modified for the 2007 RUC change package. It is also available for testing the 2007 RUC change package, if needed.

07.5.4.3 Build graphics and web viewing capability for display of ESRL RR real-time and retrospective runs.

07.5.4.4 Further enhancement of WRF-post version for Rapid Refresh application, including modifications to generation of RUC-specific fields.

Build graphics and web viewing capability for display of GSD RR real-time and retrospective runs.

CURRENT WORK: Web-viewing capability became available for real-time RR cycled runs over the CONUS domain in October, and is being extended to cover the full North American domain. Images and graphics from this can be viewed at http://www-frd.fsl.noaa.gov/mab/wrfruc (temporarily down as of 7/13 but normally up). Limited objective verification continues to be available, with new capabilities developed by Bill Moninger during the last quarter, including RR verification (against raobs) over North America (including Alaska).

07.5.4.5 Ongoing (GSD)

Further enhancement to WRFpost version for Rapid Refresh application, including modifications to generation of RUC-specific fields.

CURRENT WORK: Tanya Smirnova has modified the 2.2 version of WRFpost so it can be used to generate grib output over the full RR domain on wJET.

07.5.4.6 Ongoing (GSD, NCAR later)
Ongoing evaluation of real-time and retrospective runs of RR system for SAVs and AIVs

07.5.4.7 1 Nov 2006 (GSD) - ongoing

Start to solicit input from other AWRP Research Teams and NWS forecasters in Alaska and Puerto Rico regarding how they wish to use the RR and particular forecast challenges for which the RR might be able to provide guidance.

CURRENT WORK: No additional work this quarter (but see previous Q2 report on GSD visit to Alaska on the RR).

Deliverables

07.5.4.E1 15 October 2006 (GSD)
Complete a technical report describing the GSD preliminary real-time and retrospective testing of the WRF Rapid Refresh system.

Completed 1 September 2006. GSD report was sent to NCEP (see FAA-AWRP MD&E FY06 Q4 report) and made available on the web at http://ruc.fsl.noaa.gov/coretest2 /

07.5.4.E2 15 July 2007 (GSD) Completed 26 June 2007
Deliver report to NCEP on progress with WRF Rapid Refresh code toward FY09 Rapid Refresh implementation.

Two presentations pertaining to Rapid Refresh development were given at the 22nd Conference on Weather Analysis and Forecasting/18th Conf. on Numerical Weather Prediction at Park City UT, 25-29 June 2007:
Benjamin, Weygandt, Brown, Smirnova, Devenyi, Brundage, Grell, Peckham, Schlatter, Smith (all ESRL/GSD) and Manikin (NCEP/EMC): From the Radar-enhanced RUC to the WRF-based Rapid Refresh.
http://ams.confex.com/ams/pdfpapers/124827.pdf

Devenyi, Weygandt, Schlatter, Benjamin (all ESRL/GSD) and Hu (CAPS): Hourly data assimilation with the Gridpoint Statistical Interpolation for the Rapid Refresh. http://ams.confex.com/ams/pdfpapers/124535.pdf

These links give detailed reports on the status of RR development as of early June 2007. Two other papers describe results of the RR core test conducted in 2006:
Brown, Benjamin, Smirnova, Grell, Bernardet (DTC and GSD), Nance (DTC and NCAR), Collander and Harrop (both of DTC and GSD): Rapid Refresh Core Test: aspects of WRF-NMM and WRF-ARW forecast performance relevant to the Rapid-Refresh application. http://ams.confex.com/ams/pdfpapers/124822.pdf

Nance, Bernardet, Weatherhead, Noonan (both DTC), Fowler (NCAR), Smirnova, Benjamin, Brown, Loughe (GSD and DTC): Weather Research and Forecasting Core Tests

Task 07.5.5: Develop, test, and implement improvements to the operational WRF 3DVARs for Rapid Refresh and North American Mesoscale runs.

Subtasks

07.5.5.1 15 Oct 2006 (GSD and CAPS) – Completed 15 Oct 06
Report on testing of RUC-like cloud/hydrometeor assimilation (including GOES cloud-top data and METAR cloud/visibility/weather data) within WRF-GSI on the full Rapid-Refresh domain.

Collaborative work continues between GSD and Ming Hu of CAPS as reported in deliverable 07.5.15.E3.
Ming Hu was the lead author of a paper (also presented in the June AMS NWP/WAF conference in Park City UT) that documents the details of the combined cloud analysis.

"Development and testing of a new cloud analysis package using radar, satellite, and surface observations within GSI for initializing Rapid Refresh". Authors: Ming Hu, Ming Xue (CAPS), Steve Weygandt, Stan Benjamin (ESRL/GSD).

Ming Hu visited GSD in early June to continue discussions on various aspects of the combined cloud analysis. Issues include options for modifying cloud species and specifying in-cloud temperature adjustments, work needed to parallelizing the cloud analysis include it within the outer loop of the GSI solver.

For the AMS-NWP poster, Ming Hu produced a series of cross-section plots from the 13 March 2006 Central U.S. squall-line case. These plots depict the observation-based information concerning cloud and precipitation (yes, no, unknown). Based on examination of these plots, some further refinements to the combined cloud analysis were made to reflect features already in the constituent analyses. These include 1) ensuring that the addition of cloud information from radar reflectivity data does not extend below the cloud-based as determined from METAR observations or the background sounding, 2) ensuring that radar-based clearing is done only within regions of radar data coverage, ensuring that background hydrometeor fields are used within both the cloud and precipitation analysis.

07.5.5.2 Oct 2006 (NCEP/EMC) - Delivered Oct 2006
Based on parallel testing and refinement of the experimental code, deliver a "pre-implementation" version of WRF-GSI for 2007 upgrade to NAM /NDAS.

Parrish reports, at the beginning of the 2nd quarter, the strong dynamic constraint, already well tested with the GSI in global mode, was introduced into the regional mode of GSI and continues to run in parallel. COMPLETE

07.5.5.3 Dec 2006 (NCEP/EMC) – Delivered Dec 2006
Report on testing of 2DVAR WRF-GSI assimilation of high spatial and temporal mesonet surface data using analysis grids with 5km resolution and higher.

In collaboration with Sei-Young Park and Jim Purser, Manuel Pondeca has added the capability to generate 'space-filling Hilbert curve'-based subsets of data for cross-validation to the GSI. The subsets are not overlapping and tend

to be more evenly distributed in space than the complete data set. complete

07.5.5.4 15 January 2007 (CAPS/ NCEP)
Further refine the radial velocity analysis component of GSI in response to model resolution changes. Consider issues on data quality, super-obbing, and optimal decorrelation scales.

07.5.5.5 15 May 2007 (NCEP/EMC)
Development efforts will produce a "research quality" code for an upgrade package (improved covariance and use of WSR-88D, satellite radiances and covariances) to the WRF-GSI.

Manuel Pondeca put together a lower-resolution NAM assimilation-forecast system in order to test the use of the ensemble-based background error covariance matrices in the GSI in a time-efficient manner. He also reports to have successfully developed and tested code for generating dynamic lists of surface observations that are rejected by the quality control. (Pondeca) Complete

07.5.5.6 31 July 2007 (NCEP)
Based on case-study testing and refinement of the research quality code, deliver resulting an "experimental" code for an upgrade package (improved covariance and use of WSR-88D satellite radiances and covariances) to the WRF-GSI for the March 2008 change package to the NAM-WRF.

Parrish reported, a retrospective test was completed to test FGAT (first guess at appropriate time) and simplified 4DVAR, two features of GSI not currently used with the NAM. The test consists of 24 hours of assimilation followed by an 84 hour forecast. Results were negative impact for both features, but a bug was found which resulted in improper time extrapolation for both FGAT and S4DVAR. Preliminary tests were conducted with a simple form of digital filter--digital finalization, in which the forecast is run forward only, and time averaging is done centered around the analysis time to create a time smoothed background. Fit of observation to background is significantly improved when using the time smoothed background fields. Simple modifications have been made to WRF NMM to create and write out the time smoothed files with marginal additional cost.

A square root (sqrt) of the background operator was created for use in a full weak constraint 4dvar extension of GSI, recently finished by Yannick Tremolet during a 1 year visit to GMAO. This work should make full weak constraint 4dvar experiments with WRF NMM possible by late FY08. A forward operator, and its tangent linear and adjoint were created to obtain vertical velocity in meters/second from the GSI analysis variables. This is part of ongoing work with Shun Liu and visiting scientist Duk-Jin Wan to improve the assimilation of level II radar data.

07.5.5.7 15 Dec 2006 (ESRL) Completed 15 Dec 2006
Report on testing of RUC-like surface observation assimilation (including use of inferred PBL depth, terrain and land mask constraints, and soil temperature/moisture adjustment) within WRF-GSI on the full Rapid-Refresh domain.

Additional work to further refine the basic algorithm reported on earlier is now resuming following the intensive effort to resolve the GSI-related wJET computer issues. Devenyi's paper at the AMS-NWP conference showed examples of PBL effect on the analysis increment using the GSI anisotropy option.

07.5.5.8 15 Feb 2007 (ESRL/GSD) Completed 15 Feb 2007
Development efforts produce an 'experimental' version of the GSI suitable for Rapid Refresh application (e.g. includes RR-specific modifications for cloud hydrometeor and surface observation assimilation).

As reported in 07.5.4.1, GSI is now compiling and running well on wJET. Two key problems were identified and resolved during the quarter. A minor issue (MPI2 I/O to /tg filesystem on wJET) inhibits the ability to run GSI with very large numbers of processors. Current work is on adding GSI to the WRF-RR cold start real-time runs on wJET to complete the cycling loop.

Deliverables

07.5.5E1 30 September 2007 (original - 31 March 2007) EMC
Subject to NCEP Director approval, implement WRF-GSI in NAM/NDAS.

Implementation status as reported in May monthly report: NCEP management (EMC and NCO directors) have decided to move the NAM/NDAS upgrade into 4th Quarter due to delays with GFS/GSI implementation and the need to implement it, HYCOM and Hurricane-WRF before doing the NAM/NDAS upgrade. NCEP Director will not approve NAM/NDAS upgrade until both EMC and NCO Directors also approve. Consequently, this deliverable will be delayed until 30 September.

CURRENT EFFORTS: An analysis package for the next implementation of regional data assimilation in the NAM and its NDAS was prepared and tested. The package included the latest GSI code that could take first guess files with either IJK or IKJ format. The strong constraint was turned on and the following new data were included: AIRS, GOES 1x1 radiances, MODIS and EUMETSAT winds, Mesonet humidity and winds (only those on a USELIST provided by ESRL/GSD), and QUIKSCAT. To use the new satellite data, the bias correction files were expanded and spun up, the gross check bounds were tuned and observational error variances had to be changed. When the package was tested on the expended domain that covers the North Pole, little of the new satellite data was used. This problem was solved by fixing a bug in the data thinning program. ACARS moisture was also tested for this package but could not be included due to very poor guess fit and, more importantly, a very large bias (often above 50% and of the opposite sign to the mean rawinsonde guess fit). Finally, MESONET temperatures and surface pressures were tested and also found to have too large a guess fit. More work on the forward model is needed. MESONET humidity data were turned off for producing an excessive precipitation adjustment in the forecasts following the analysis. On analyzing a wet initial condition problem, it was found that by adding the conversion between sensible temperature and the virtual temperature, the latest GSI could produce a different humidity analysis from the previous versions.

PLANNED EFFORTS: Test the newly tuned background error in the parallel. (Wu)

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: None.

UPDATES TO SCHEDULE: Delayed until September

07.5.5E2 15 July 2007 (ESRL). COMPLETED 15 July
Based on real-time parallel and retrospective testing and refinement of the experimental code, report to NCEP on progress toward a 'pre-implementation' version of WRF-GSI suitable for Rapid-Refresh application (to replace RUC 3DVAR in FY09).

Based on significant progress has been made within the past month to produce a stable computer environment for GSI on wJET, (see 07.5.4.1), work is now resuming to add the GSI analysis to the WRF-RR real-time runs on wJET and begin cycling at a higher frequency (using the new prepbufr files supplied by Dennis Keyser). The cloud analysis capability and the anisotropic filtering will also be built into this version of the GSI.

Reports to NCEP on the progress toward the pre-implementation version of the GSI are being made on a bi-weekly at the NCEP GSI group meeting, in which GSD personnel participate via telecon.

Dezso Devenyi lead-authored a conference paper summarizing the GSI development work toward RR. The title and link are as follows: "Hourly data assimilation with the Gridpoint Statistical Interpolation for the Rapid Refresh" http://ams.confex.com/ams/pdfpapers/124535.pdf

INTERFACE WITH OTHER ORGANIZATIONS: NCEP
PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: None.

07.5.6 Develop, test, and evaluate the nonhydrostatic Weather Research and Forecasting (WRF) Model Incorporate physics improvements into the WRF software infrastructure 30 September 2007 (NCAR/MMM)

CURRENT EFFORTS: The funded work in NCAR/MMM was primarily performed by Jimy Dudhia. Physics addressed included microphysics, LSM, radiation, and the PBL.

Dudhia worked to improve a high surface moisture bias over snow cover seen in WRF forecasts of the Air Force Weather Agency. Working RAL scientists, Dudhia identified and implemented a fix in the Noah LSM involving the treatment of evaporation over snow cover as the ground temperature reaches the freezing point. The fix was committed to the WRF repository.

Dudhia worked with the DTC to determine the reason for failures in the ARW when the GFDL radiation scheme was combined with Thompson microphysics. A fix was developed and implemented in the GFDL scheme in the repository.

For high-resolution hurricane forecasts using the ARW, an improvement to adjust unrealistically weak surface fluxes was made using an MM5 method independent of convective velocity on wind speed instead of the Beljaars method of calculating a subgrid convective velocity.

Dudhia addressed a problem found with ice clouds appearing when the recently-implmented CAM radiation scheme is used with WSM3 microphysics. (Ice clouds from the WSM3 scheme were being neglected by the CAM radiation scheme.) The fix was added to the repository.

NCAR participated in the Hazardous Weather Testbed Spring 2007 Experiment at the Storm Prediction Center (SPC) in Norman, OK. The experiment involved evaluating WRF's use for convective-scale, real-time, hazardous weather prediction. Daily 3-km ARW runs by NCAR showed impressively-accurate predictions of convective lines. It was been found that hazardous weather forecasts could be improved from such high-resolution ARW runs.

Working with Penn State, Dudhia implemented a bugfix for grid (analysis) nudging (FDDA) when the nudging is turned off without the use of a ramping function. The fix was added to the repository.

PLANNED EFFORTS: Work will continue at NCAR through the end of the fiscal year on model physics capabilities and improvements.

UPDATES TO SCHEDULE: None.

Deliverables

07.5.6.E1 Conduct a WRF Users' Workshop and tutorials on the ARW core (NCAR) and the NMM core (DTC) for the user community -- 30 June 2007 (NCAR/MMM, DTC)

CURRENT EFFORTS: NCAR hosted an ARW tutorial on January 22-26, 2007. NCAR's work in that was completed in FY07 -Q2 and is described in the previous quarterly report (for FY07Q2).

The WRF workshop deliverable was completed this quarter. NCAR organized and hosted the 8th WRF Users' Workshop on June 11-15, 2007 in Boulder, CO. Working group meetings on June 11 were followed by general sessions on June 12-14. On June 15 there were instructional sessions on new WRF capabilities and on model-related utilities. Over 200 people attended the workshop.

PLANNED EFFORTS:
NCAR has begun planning a second WRF tutorial for 2007. This will be held July 23-27.

UPDATES TO SCHEDULE: None.

Task 07.5.8: Improve physics in the WRF model, especially including those that affect aircraft icing.

GSD

In addition to the efforts on the Grell-Devenyi scheme discussed below, GSD has also continued to evaluate the real-time performance in both WRF and RUC of a revised version of the RUC-Smirnova 2-layer snow model. The

RRTM longwave radiation scheme is also in the dev 13km RUC cycle at GSD. The RRTM has greatly diminished the summer nighttime warm bias that has plagued the RUC over the central and southeastern US for several years. The revised RUC LSM and the RRTM are both included in the planned 2007 RUC change bundle.

The paper by Benjamin et al referenced under task 07.5.4 briefly describes testing conducted on schemes that are candidates for use in the initial RR implementation. The following is a summary intended to supplement this material.

For microphysics, we are strongly committed to continued use of the NCAR-Thompson microphysics (developed largely under FAA AWRP funding). A more advanced version of this scheme than is used in the RUC has been running in WRF-ARW at GSD for several months and we have been pleased with its performance, both in terms of its predictions of supercooled liquid water and its predictions of precipitation type at the ground.

Regarding convection, NCEP's Storm Prediction Center has strongly urged us to continue to use the Grell-Devenyi scheme used in the RUC. Although it does not produce as high equitable threat scores for precipitation as does the BMJ used in the WRF-NAM, it is valued by the SPC because it does not create large perturbations in temperature and moisture stratification, making the RUC predicted soundings a very useful forecast tool for short-term predictions of storm initiation and storm mode. The Grell-Devenyi scheme has also proved useful in the RUC Convective Probability Forecast tool under test at the Aviation Weather Center. We also anticipate using this scheme in the RR. However, as noted under subtask 8.4 below, we will continue to work toward improving the scheme's performance.

As noted below under 07.5.8.5, we favor use of the MYJ over the only currently available alternative in WRF, the Yonsei University PBL scheme. The MYJ is also used in the WRF-NAM.

For radiation, we have tested both the GFDL long and short wave schemes used by the operational WRF-NAM, and the combination of Dudhia short-wave and RRTM long wave. The Dudhia short wave scheme has been used in the operational RUC since 1998. In the latest RUC change bundle, the RRTM replaces the current Dudhia long-wave scheme. We have confidence in both these schemes, but we also have observed no serious untoward behavior with the GFDL schemes. We do, however, need to investigate further if hydrometeors from the Thompson microphysics are being used properly in the GFDL shortwave scheme to reduce incoming solar radiation at the ground surface.

The chief uncertainty concerning the composition of the initial physics suite for the Rapid Refresh is the choice of Land-Surface Model (LSM). The RUC LSM is simple and has by and large served well in the RUC. It also has a more sophisticated treatment of snow than the alternative, the Noah scheme. It also has six computational levels in the soil instead of four, and is recommended by some in Alaska for use in the RR. Nevertheless, the Noah LSM, under continuing development at both NCAR and NCEP, is an attractive option because it will likely be implemented in the NAM in September 2007. Further, it has a large community of developers and users, with enhancements to the scheme likely over the next few years. Both the RUC LSM and Noah LSM have shown weakness in surface temperature prediction in situations of strong low-level warm advection of above freezing air over snow cover. Tests to isolate the possible improved snow melting in the RUC LSM with its 2-layer snow model are being planned by the DTC (under AWRP funding) and GSD during Q4.

Subtasks

07.5.8.4 30 January 2007 (GSD) COMPLETE
Carefully evaluate candidate convective schemes and their interaction with other physics for RR application.

CURRENT WORK: The Grell-Devenyi scheme was the subject of further investigation in June. The instantaneous composite reflectivity (actually log10 reflectivity) fields from the RUC (max reflectivity in each grid column) combine reflectivity from the grid-scale hydrometeors (computed consistently with the December 2003 version of the NCAR-Thompson microphysics used in the RUC) added to the reflectivity implied by the convective rainfall from Grell-Devenyi scheme, using $Z[mm^6/m^3] = 300R^{1.4}$, where R is rainfall rate in mm/h. It was noticed that these fields showed a surprising amount of small scale detail, much more than is apparent in the one hour accumulated precipitation in regions of convection. This indicates that the Grell-Devenyi scheme has a tendency to switch on and off frequently. Experiments with shortening the interval between calls to the Grell-Devenyi scheme below the

current 4 min used in the RUC resulted in reflectivity patterns having a slightly more coherent spatial structure and in precipitation fields showing slightly more realistic spatial character. Calling the scheme every time step also resulted in quieter model forecasts. However, this comes at a cost of additional run time, we estimate at about 10% when the Grell-Devenyi scheme is called once per minute (more than this if the scheme is called every time step) rather than every 4 min as at present. We will continue to look for ways to improve the scheme.

07.5.8.5 30 June 2007 (GSD). Complete 30 June 2007
Improve handling of moist processes in candidate PBL scheme for use in the RR-WRF.

While visiting the Storm Prediction Center, Norman OK, 30April – 4 May, J. Brown had opportunity to compare boundary-layer structures from high-resolution (4km horizontal grid spacing) ensemble runs being performed by CAPS of WRF-ARW v2.2 that were identical except for the boundary-layer scheme, either the Yonsei University (YSU) scheme, or the Mellor-Yamada-Janjic (MYJ) scheme (used in the operational WRF-NAM). These comparisons, for afternoon mixed layers over the Midwest and Southeast, indicated the MYJ scheme tends to produce shallower, more well-mixed and moister conditions in the mixed layer. This is a result that has also been seen in idealized 1-d comparisons by others. Overall, based on a small sample of days, the results with the MYJ scheme most often (but not always) more accurately resembled the boundary-layer structure as revealed by verifying raobs. This difference between the schemes, with slightly better performance by the MYJ, has been confirmed by a number of investigators using WRF, and makes the MYJ the scheme of choice for the initial version of WRF-RR.

This scheme does occasionally produce two or more contiguous model layers that are both saturated and exhibit a temperature lapse rate greater than the moist adiabatic. Various methods have been proposed to remedy this unrealistic behavior and some of these were discussed at the recently completed WRF workshop. The most direct approach is to mix total cloud condensate ($q_v + q_c + q_i$) and the approximately conserved thermodynamic variable, θ_{il}. However, considerable work is required to make this change and still maintain the integrity of the MYJ scheme itself. At this time we think the advantages to be gained do not justify the significant effort required to complete and thoroughly test such a modification.

07.5.8.6 1 August 2007 (NCAR)
Test and evaluate current stratocumulus parameterizations for the prediction of icing and if necessary develop a new parameterization for the formation of icing including freezing drizzle in stratocumulus clouds. This will involve comparison to observations of well observed cases such as January 31 case from Cleveland, Ohio as part of the NASA/Glenn in-flight icing field studies and the use of LES modeling with WRF to simulate the processes forming super-cooled liquid water and drizzle. This task will be linked to the aerosol task due to the finding that CCN concentration often plays a dominant role in the formation of drizzle in these types of clouds.

Greg Thompson visited Istvan Geresdi and worked with him to successfully implement the most recent version of the detailed microphysics into the most recent version of WRF. This detailed scheme will be used as truth to develop the stratocumulus scheme, especially the role of aerosol particles in controlling the formation of drizzle. During the summer, Ben Bernstein will analyze Cleveland stratocumulus cases to build further truth datasets. These truth datasets will be used to improve the simulation of stratocumulus icing in the bulk scheme, including possible modifications to the PBL scheme.

07.5.8.8 15 August 2007 (GSD, NCAR/RAL)
In collaboration with NCAR/RAL, investigate potential for RR application of existing physics schemes that combine PBL processes with prediction of PBL-driven stratocumulus or shallow cumulus.

GSD: J. Brown has begun to look into a class of schemes developed by Bretherton et al and discussed at the WRF workshop.

Deliverables
07.5.8.E2 15 June 2007 (GSD)
Report to NCEP and AWRP on testing of revised versions of microphysics and other physical parameterizations into WRF Rapid Refresh model. COMPLETE

See paper by Benjamin et al noted under Task 07.5.4 and supplemental material provided above.

07.5.8.E3 30 June 2007 (GSD)
Report on overall performance of physics parameterizations in pre-implementation version of RR at annual WRF Workshop in Boulder, CO.

See paper by Benjamin et al noted under Task 07.5.4 and supplemental material provided above.

07.5.8.E4 30 September 2007 (NCAR)
Deliverables
Report on development of a predictive capability in the NCAR microphysics for aerosol concentration and mixing ratio that can be used to determine CCN and IN as a function of cloud updraft velocity, temperature, pressure, and background aerosol concentration. Sources and sinks of aerosol particles will need to be taken into account. This task will be closely linked to the stratocumulus task given above.

Task 07.5.15 Develop improved methods of cloud and moisture analysis for use in the WRF Modeling System.

Subtasks

07.5.15.2 15 May 2007 (GSD)
Develop and evaluate performance of diabatic digital filter initialization (DDFI) in the RR WRF model for initial cloud and hydrometeor fields.

GSD has continued to refine the radar reflectivity assimilation code within the 13-km RUC DDFI, which serves as a prototype for a similar system in the WRF Rapid Refresh. Within the convective suppression algorithm, improvements and corrections were made: 1) reduce vertical echo-free depth required for convective suppression from 500 mb to 300 mb (in certain regions of the western U.S. suppression was never possible with a 500 mb depth, because of the distant spacing of the radars), 2) allow for convective suppression where the GOES cloud-top pressure indicated that the entire column is clear, 3) fix bug the was allowing GOES clear columns to be interpreted as radar no coverage zones. This radar assimilation algorithm is included in the code package that was transferred to NCEP to begin parallel testing. The algorithm and results were summarized in a conference paper to be presented at the 18th NWP conference. The paper title and link are:

"Radar reflectivity-based initialization of precipitation systems using a diabatic digital filter within the Rapid Update Cycle" (by Steve Weygandt and Stan Benjamin)
http://ams.confex.com/ams/22WAF18NWP/techprogram/paper_124540.htm

07.5.15.4 15 July 2007 (GSD and CAPS)
Develop a revised version of the GSI cloud assimilation treatment of satellite and METAR cloud data in its cloud analysis.

Collaborative work continues between GSD and Ming Hu of CAPS to evaluate and further refine the generalized cloud analysis (created from the ARPS and RUC cloud analysis) within the RR-GSI CONUS environment, using Chris Harrop's workflow manager (see subtask 07.5.15.E3 for additional details). Ming Hu visited GSD in early June to continue discussions on various aspects of the combined cloud analysis. Issues include options for modifying cloud species and specifying in-cloud temperature adjustments, work needed to parallelizing the cloud analysis include it within the outer loop of the GSI solver. Further discussions were held during the NWP conference.

For the NWP poster, Ming Hu produced a series of cross-section plots from the 13 March 2006 Central U.S. squall-line caser. These plots depict the observation-based information concerning cloud and precipitation (yes, no, unknown). Based on examination of these plots, some further refinements to the combined cloud analysis were made to reflect features already in the constituent analyses. These include 1) ensuring that the addition of cloud information from radar reflectivity data does not extend below the cloud-based as determined from METAR observations or the background sounding, 2) ensuring that radar-based clearing is done only within regions of radar

data coverage, ensuring that background hydrometeor fields are used within both the cloud and precipitation analysis.

Deliverables

07.5.15.E2 15 July 2007 (GSD)
Report on progress of GSI cloud analysis code to NCEP to be part of Rapid Refresh.

Verbal summary of progress provided during bi-weekly GSI telecons and a paper summarizing the algorithm has been written by Ming Hu. The paper title and link are: "Development and testing of a new cloud analysis package using radar, satellite, and surface observations within GSI for initializing Rapid Refresh".
Authors: Ming Hu, Steve Weygandt, Ming Xue, Stan Benjamin

07.5.15.E3 15 September 2007 (GSD and CAPS)
GSD
Complete further revisions and testing of the generalized cloud analysis package within GSI for stratiform cloud (using GOES cloud top and METAR cloud data) and initial treatment for convective cloud at parameterized scale assimilating radar reflectivity.

CAPS
Complete further revisions and testing of the generalized cloud analysis package within GSI for stratiform cloud (using GOES cloud top and METAR cloud data) and initial treatment for convective cloud at parameterized scale assimilating radar reflectivity.

Ming Hu updated the cloud analysis packages to the September 2006 version of GSI on WJET of GSD using file system /p70 and wrote a technical report that documents the steps of incorporating the cloud analysis into GSI. Several new components were added into the generalized cloud analysis package, which include the precipitation species retrieval based on the new Thompson microphysics scheme, the calculation of stable layer cloud water and cloud ice based on RUC scheme, the updating of background based on the cloud and hydrometeors analysis, and the clearance of spurious precipitation based on radar reflectivity.

Each component of the new cloud analysis package has been carefully tested with the March 13, 2006 Central US squall line case. The results are documented in a conference paper coauthored with Steve Weygandt and Stan Benjamin of GSD and presented at the 18th NWP Conference of AMS in late June. This paper also documents the details of the new generalized cloud analysis and serves as a basic technique document for further development of the generalized cloud analysis scheme.

Task 07.5.17 Infrastructure support for running operational WRF model in Rapid Refresh, North American Mesoscale and HiResWindow modes at NCEP.

Subtasks
07.5.17.1 Maintain four-per-day North American Mesoscale runs and provide SAV and AIV guidance.

At the request of NWS Western Region, two WRF-NMM model physics changes were implemented on 19 June to alleviate NAM model biases:

1. The minimum canopy resistance was increased for evergreen needleleaf forest (doubled from 125.0 to 250.0, units of s/m) and for mixed forest (from 125.0 to 150.0). This change reduced large latent heat fluxes and high 2-m dewpoint temperatures over the northwest in the summer 2006 retrospective runs (esp. FVS subregions NWC and NMT). The change will also reduce moisture fluxes and 2-m dewpoint temperatures over the southeast.

2. Under stable conditions, modify roughness length for heat so that it is a function only of surface-layer bulk Richardson number, removing the dependence on surface elevation. This change will tend to decrease surface heat flux and the 2-m warm bias. (Rogers)

07.5.17.2 Maintain four-per-day North American Mesoscale runs and provide SAV and AIV guidance (NCEP/EMC and NCEP/NCO)

NCEP maintained operational 4/day ~5 km nested runs of the HiResWindow (HRW) suite of both WRF-ARW and WRF-NMM configurations. Daily HiResWindow runs of both the WRF-NMM and the WRF-ARW are made on a daily basis for large domains covering Alaskan (00z) and western (06z), central (12z) and eastern (18z) CONUS plus small domains covering Hawaii (00&12z) and Puerto Rico (06&18z).

An upgrade package to the HiResWindow has been submitted to NCO driven largely by the requests of the Storm Prediction Center but benefiting all users. It includes the latest WRF code representing an upgrade from v1.3 to v2.2, the new IJK storage and loop ordering which is 10-15% faster than the IKJ code, plus all the WRF-NMM updates which have occurred in the last two years, expanded domains and increased resolution. NMM grid-spacing will go from 5.1 km to 4 km and ARW grid-spacing will go from 5.8 km to 5.1 km – both will continue to use 35 levels in the vertical. Daily HiResWindow runs of both the WRF-NMM and the WRF-ARW will be made for expanded large domains covering Alaskan (18z), West-Central CONUS (06z) and East-Central CONUS (00z & 12z) plus small domains covering Hawaii (00z & 12z) and Puerto Rico (06z & 18z).

In addition (and ahead of schedule),NCEP has maintained twice-per-day runs of six WRF-based members (3 running NMM and 3 running ARW) of the Short Range Ensemble Forecast (SREF) system with aviation guidance available from http://wwwt.emc.ncep.noaa.gov/mmb/SREF/SREF.html which now includes Alaska and Hawaii (eastern Pacific). (EMC and NCO)

07.5.17.3 Provide vendors with gridded NAM model data via Family of Services and the FAA Bulk Weather Data Telecommunications Gateway.

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). (EMC Team and NCO)

07.5.17.4 Provide full grids from NAM, and the HiRes Window on NCEP and NWS/OPS servers.

NCEP maintained real-time availability of full resolution gridded data from the operational 4/day NAM and the 5 km nested runs of the HiResWindow (HRW) suite of WRF-ARW and WRF-NMM runs via anonymous ftp access via the NCEP server sites. This includes hourly BUFR soundings and output grids which undergo no interpolation and, as such, are on the models' computational grids (so-called native-native grids). NCEP provides anonymous ftp access on ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/. GRIB and BUFR output are sent to the NCEP ftp server (ftp://ftpprd.ncep.noaa.gov/mmb/mmbpll/ in the directories east08.t18z, central08.t12z, west08.t06z and alaska10.t00z). HRW run output remains on the standard 8 km Lambert grids #243-254. NWS FTP Services: Both GRIB1 to GRIB2 data are currently available on the new gateway system (http://tgdata.nws.noaa.gov). To conserve bandwidth, GRIB2 data is being transferred to tgdata and then converted to GRIB1. For that reason, GRIB2 data will be available one to two minutes earlier on average than GRIB1. Both sets of data will remain on the TOC FTP server for a minimum of 180 days after the system is declared operational. (EMC Team and NCO)

07.5.17.5 Maintain access to model verification data. (see subtask report under Task 07.5.1.4)

07.5.17.6 Provide assistance to In-Flight Icing, Turbulence, Convective Weather, C&V and Oceanic Weather MDE research team when their algorithms and product generation systems are ready to transition into NCEP's operational production suite. UNFUNDED under Option A

NCEP's George Trojan has begun examining the AWRP algorithms now running at AWC with the eventual goal of transitioning them to run on NCEP's CCS. This is in anticipation of final decisions by upper management at NWS and FAA on the precise path & funding for this effort.

Deliverables

07.5.17.E1 1 October 2006 - 30 September 2007 EMC (Parrish, Derber, Wu, Keyser)
Perform observation ingest, quality control and preparation in support of the operational North American Mesoscale WRF runs.

CURRENT EFFORTS: In addition to work noted in Task 07.5.1 above, the 0600 and 1800 UTC t-00 NAM data cutoff times were both changed from T+1:19 to T+1:15 on 3 April to bring them into alignment with the 0000 and 1200 UTC t-00 NAM data cut-off times. The NEXRAD Level II data dump processing for the t-00 NAM runs at 0000, 0600, 1200 and 1800 UTC was moved back 5 minutes (from T+1:15 to T+1:10) on 10 April to account for an increase in Level II data, resulting from both increased springtime convection and faster ingest of the data into the BUFR tanks (as a result of a 20 March implementation). This change was necessary to keep the overall NAM network run within its defined time limit. EUMETSAT replaced METEOSAT-8 with METEOSAT-9 as the operational "west" satellite on 11 April (these MSG winds are not yet assimilated). A change was made to the WSR-88D NEXRAD Level II dump duplicate-checking code on 15 May to correct an error introduced on 17 April which prevented some reports from being processed during the hour closest to cycle time in the t-03 NDAS and t-00 NAM. On 29 May, NCEP stopped processing JMA satellite-derived winds, some of which are at the very edge of the NAM domain, because JMA terminated their processing of winds in low-resolution SATOB format. Although JMA temporarily resumed transmission of low-resolution SATOB winds on 6 June, NCEP will switch its processing to high-resolution BUFR JMA winds, following a period of testing. On 12 June, a random but persistent problem connecting to NESDIS' DDS polar server was finally corrected via using "passive" ftp. Parallel testing of the following new data types is currently underway in preparation for the Fall 2007 GSI update: GOES-11 and -12 single field-of-view radiances over water (replacing current 5x5 field-of-view GOES-12 radiances), AIRS every f-o-v radiances, QuikSCAT 0.5 deg. scatterometer wind superobs, mesonet winds filtered by provider via NOAA/GSD's "uselist", MODIS IR and water vapor satellite winds, and dropwindsonde moisture from NOAA (P-3 and Gulf Stream) and USAF. All data here are processed within the new, expanded NAM domain, using a new domain mask developed by Eric Rogers (this mask allows only those observations within the exact domain to be selected for dumping). (Keyser)

PLANNED EFFORTS: In addition to items noted in Task 07.5.1 above, do impact tests in NAM for several new data types: METOP-2 1B HIRS-4, AMSU-A and MHS radiances; TAMDAR and Canadian AMDAR aircraft; aircraft moisture; mesonet mass and roadway data; new mesonet data feeds (including "hydro", "snow", modernized COOP and UrbaNet); RASS; JMA and CAP profiler winds; 3.9 micron and visible satellite winds; high-resolution BUFR JMA IR and visible satellite winds; WindSat and ERS scatterometer wind data; GPS radio occultation data; and METEOSAT-9 IR and visible satellite winds. Tap into additional mesonet data from non-MADIS sources (e.g., LDAD and/or MesoWest). Explore efforts to speed up the dump processing of NEXRAD Level II data. (Keyser)

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED:

INTERFACE WITH OTHER ORGANIZATIONS: GSD & NCO.

UPDATES TO SCHEDULE:

7.5.17.E2 1 October 2006 - 30 September 2007 EMC (Parrish, Derber, Wu, Keyser)
As requested by other MDE research teams, incorporate new AIV calculations into Operational WRF Model post-processor and product generator.

CURRENT EFFORTS: No requests were made by other PDTs during this period.

NWS Eastern Region and NCEP's SPC have requested that simulated radar reflectivity be added to the WRF-post which has been completed for the NAM. This field was also generated by the HiResWindow parallel and special Matt Pyle runs for the NSSL/SPC Spring 2007 program. In addition, NWS Eastern Region and NCEP's AWC,

HPC and SPC have requested that simulated GOES imagery be added to the WRF-post which has been completed by Hui-Ya Chuang by incorporating the Community Radiative Transfer Model (CRTM) into the post. This is planned to be included in the Fall 2007 (September) NAM update. Ferrier et al have been evaluating it and iterating on the proper conversion from brightness temperature to 8-bit brightness values (0-254).

PLANNED EFFORTS: Refine forward model for simulated reflectivity and satellite channels.

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: None

INTERFACE WITH OTHER ORGANIZATIONS: NESDIS, GSD & NCO

UPDATES TO SCHEDULE: None