MODEL DEVELOPMENT AND ENHANCEMENT RESEARCH TEAM
Monthly Report for May 2007
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Executive Summary

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

- Transfer underway to NCEP for RUC change package -- RUC analysis (including mesonet winds, radar reflectivity), model changes (RRTM longwave radiation and updated convection), and postprocessing enhancements (forecast radar reflectivity fields). Continues running in real-time 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 continues testing on full North American domain and CONUS domain (GSD)
- I/O with the /tg file system on the new GSD supercomputer (wJET) is significantly improved

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

- Work continued on use of hydrometeor background fields with merged GSI cloud analysis with RUC and ARPS components.

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 showing much reduced nighttime and daytime warm bias in experimental RUC versions at GSD with real-time surface verification.

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

- Retrospective cycled tests of combined RUC/ARPS cloud analysis (assimilating METAR cloud and GOES-cloudtop data) within GSI-WRF framework.

Detailed report – MDE – May 2007

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

NCEP
Dennis Keyser reports that Cooperative Agency Profiler (CAP) and RASS data are not yet available through an alternate ESRL MADIS feed.

GSD

In May (and early June), GSD began 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 3 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 upcoming RUC changes, NSSL on 3-d radar data, NCAR on radar assimilation, NCEP on radar data availability.

Subtasks worthy of special mention this month.

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

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

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, 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/ . (EMC Team and NCO)

07.5.1.4 Maintain access to model verification data.

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 Modeling Branch's website: http://www.emc.ncep.noaa.gov/mmb/research/meso.verf.html (Rogers, Manikin, Keyser)

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.

PLANNED EFFORTS: EMC is preparing to test updates to the Rapid Update Cycle during the spring and summer of 2007. The analysis code will be updated to assimilate radar reflectivity with potential to improve precipitation and moisture forecasts. Changes will also be made to improve quality control of mesonet observations, particularly winds. The snow model code in the forecast will be revised to improve nighttime treatment of temperatures over fresh snow; the model currently contains a significant cold bias in these situations. A few radiative changes will also be made to deal with both the bias of cold temperatures over fresh snow and a warm nighttime bias in the warm season. A few minor changes to the convective scheme will also be made to handle capped environments. Parallel testing will hopefully start in late June or early July, and retrospective tests on cold season cases will be run during the summer. (Manikin)

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 initialized with RUC over the CONUS domain and cycled with GSI over the RR domain on iJET. Significant progress has been made on the wJET computer issues, particular with respect to running GSI (see subtask 07.5.4.1).

Dennis Keyser at NCEP/EMC has begun 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.

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.

PLANNED EFFORTS: Complete the migration of the Rapid Refresh cycle from iJET to wJET, including 1) upgrade to WRF v2.2 model, 2) use of latest version of GSI, and 3) increase the cycling frequency from once per 12 hours.

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED:

I/O with the /tg file system on the new GSD supercomputer (wJET) is significantly improved due to strenuous efforts by Dezso Devenyi and Jacques Middlecoff. See subtask 07.5.4.1 for additional details.

INTERFACE WITH OTHER ORGANIZATIONS: DTC, NCEP, NCAR
Articles written for American Meteorological Society conference in late June 2007:
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

UPDATES TO SCHEDULE: None.

Subtasks worthy of special mention.

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: Continued strenuous efforts to improve the I/O with the Terragrid /tg filesystem on wJET have significantly improved the situation, so that the effort to migrate the Rapid-Refresh real-time cycle to wJET can begin again. The GSI analysis program has posed the most significant challenge for the new computer I/O system and two key problems have been identified and resolved through coordinated work between GSD scientists and computer personnel. These are: 1) sporadic corruption of files during copies from one node to another and 2) program crashes when multiple nodes tried to open a non-existent file. A minor issue remains (performing MPI2 parallel I/O to /tg filesystem on wJET fails sporadically for very large numbers of processors) that 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 and migrating the Rapid-Refresh (RR) real-time cycle from iJET to wJET. Cold-start 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 on wJET..

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: Delayed task is now completed

INTERFACE WITH OTHER ORGANIZATIONS: NCEP

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.

07.5.4.5 Ongoing (GSD)

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

CURRENT WORK: Tanya Smirnova completed modifying the 2.2 version of WRFpost so it can be used on wJET to generate grib output over the full RR domain. This is a necessary step toward cycling with WRF v2.2 (see

07.5.4.1 above).

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

The NCEP Verification System is now running on iJET and is being used to verify GSD's WRF and WRFRUC runs.

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 month.

INTERFACE WITH OTHER ORGANIZATIONS: NWS--Alaska Region

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 /

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

NCEP

Wan-Shu Wu made fixes to use the GOES 1x1 radiances, including changes to the gross check bounds and observational error variances, and filling up the bias correction files with numbers at all possible scan positions so that the angle update routine would perform the necessary corrections. She helped Lidia Cucurull with checking the usage of GPS occultation data. She also modified the observational error for MESONET data with adaptive tuning method, and adjusted the background error variances of the wind and temperature and performed NDAS experiments to check the impact.

Manuel Pondeca has started to 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.

GSD

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 improve the basic algorithm reported on earlier is now resuming following the intensive effort to resolve the GSI-related wJET computer issues.

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, substantial progress has been made in resolving the problems encountered in running GSI on wJET. Two key problems have been identified and resolved through coordinated work between GSD scientists and computer personnel. A minor issue remains (sporadic failures from MPI2 parallel I/O to /tg filesystem on wJET with a very large number of processors) but the resolution of the other issues now provides us with an environment in which we can proceed with the migration of the Rapid-Refresh (RR) real-time cycle from iJET to wJET. This migration is an extension of the work completed last winter to satisfy this task.

Deliverables

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

CURRENT EFFORTS: 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 & NCO Directors also approve. Consequently, this deliverable will be delayed until 30 September.

07.5.5E2 15 July 2007 (ESRL)
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 that 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 on the migration of the current RR-GSI cycle on iJT to wJet with a higher frequency cycle (using the new prepbufr files supplied by Dennis Keyser).

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

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

NCAR

07.5.6 31 March 2007 (NCAR/MMM)
WRF for Rapid Refresh

NCAR has organized the 8th WRF Users' Workshop, to be held June 11-15 in Boulder, CO. Working group meetings on June 11 will be followed by general sessions on June 12-14. On June 15 there will be instructional sessions on new WRF capabilities and on model-related utilities. Over 220 people have registered.

MMM continued to work with the DTC in the organization of the Summer 2007 WRF tutorial, to be held July 23-27. This tutorial will cover both the ARW and NMM cores. Approximately 60 people will attend.

Dudhia of NCAR worked on fixing a problem found with ice clouds that appeared when the newly-implmented CAM radiation scheme was used with WSM3 microphysics. Ice clouds from the WSM3 scheme were being neglected by the CAM radiation. The fix has been added to the repository.

NCAR participated in the Hazardous Weather Testbed Spring 2007 Experiment at the Storm Prediction Center (SPC) in Norman, OK. This involved evaluating WRF's use for convective-scale, real-time hazardous weather prediction. A 3-km ARW daily run was produced by NCAR. The evaluations showed some impressively-accurate predictions of convective lines. For the Greensburg, KS tornado event, the ARW gave a good prediction for a single supercell, as occurred, but it had the event a little north of observation. Experiment evaluators are finding that hazardous weather forecasts are being improved from such model runs.

Dudhia worked with Penn State to develop a bugfix for grid-nudging when the nudging is not turned off correctly. Normally for stopping grid nudging during a run, one should use a ramping function switch. But, if the switch is not used, it has been found that grid nudging does not cease. The fix is being implemented.

Dudhia developed a simple cumulus parameterization for use in an adjoint version of WRF. This is for the development of a 4D-Var system for WRF at NCAR/MMM. This cumulus parameterization was designed to be easily linearized and to represent sub-grid convective updrafts and rainfall processes on grids coarser than about 10 km.

UPDATES TO SCHEDULE: None.

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

GSD

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 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.

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, 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. In addition, the RUC LSM has shown weakness in surface temperature prediction in situations of strong low-level warm advection of above freezing air over snow cover. Tests to specifically address this latter failing in the RUC LSM are being planned by the DTC (under AWRP funding) and GSD for later this year.

Subtasks

07.5.8.5 30 June 2007 (GSD)
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.

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.

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

Reference paper by Benjamin et al noted under Task 07.5.4 and supplemental material provided 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 RUC model in preparation for its subsequent implementation in the RR WRF model. (name change requested)

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, a number of improvements and corrections were made: 1) reduce 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 sparse radar coverage), 2) allow for convective suppression where the GOES cloud-top pressure indicated that the entire column is clear, 3) fix bug that 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 (Steve Weygandt lead author). The paper title and link are:

"Radar reflectivity-based initialization of precipitation systems using a diabatic digital filter within the Rapid Update Cycle"

http://ams.confex.com/ams/pdfpapers/124540.pdf

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.

Deliverables

07.5.15.E2 15 July 2007 (GSD)
Report on progress of GSI cloud analysis code to NCEP to be part of FY08 Rapid Refresh.

Verbal summary of progress provided during bi-weekly GSI telcons 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 Cloud Observations within GSI for Initializing Rapid Refresh"

http://ams.confex.com/ams/pdfpapers/124496.pdf

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.

Coauthoring with Steve Weygandt and Stan Benjamin of GSD, Ming Hu and Ming Xue of CAPS prepared a conference paper that documents the details of the new generalized cloud analysis. The experiments of March 13, 2006 Central US squall lines are used to illustrate the impacts of each data type on the analysis of cloud cover, cloud species, and hydrometeors. This paper serves as a basic technical document for further development of the generalized cloud analysis scheme.

Ming Hu has incorporated the RUC scheme of cloud water and cloud ice analysis, which is more suitable for stable layer cloud, into the new cloud analysis package. The background information is also kept in the area that has no cloud observations.

The CAPS FY2006 fund has about 12K (including fringe and IDC) remaining, to be used up for salary on Ming Hu over June and July. We have submitted the paperwork requesting FY2007 funds to NSSL, but we have not received it yet.

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

NCEP

Dennis Keyser reports that in addition to items/work noted in Task 07.5.1 above, 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. NCEP is in the process of switching its processing to high-resolution BUFR JMA winds, following a period of testing.