MODEL DEVELOPMENT AND ENHANCEMENT RESEARCH TEAM
Monthly Report for August 2007
Submitted 15 September 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.

- Testing has started NCEP for RUC upgrade package code, shakedown almost complete. Implementation now planned for 1/2008. Change package includes mods to RUC analysis (including radar reflectivity, mesonet winds,), 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.

- Diabatic digital filter initialization now working in WRF-ARW (not with radar assimilation yet, but this prerequisite code is now working).
- GSD/NCEP agreement to use ARW code for initial Rapid Refresh, with ensemble RR using both ARW/NMM in ESMF by 2012.

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

- Progress toward WRF v3 planned for Janyar.

Task 07.5.8: Improve model physics for aviation forecasts.

- New evaluation of RRTM longwave radiation implemented in GSD RUC -- reconfirms successful results for improving nighttime/daytime near-surface forecasts in warm and cold seasons.
- Non-local subsidence temperature tendencies tested in Grell-Devenyi scheme feedback for improved convection forecasts..

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

- Coding to parallelize the combined cloud analysis for GSI nearly complete.

Task 07.5.17: Infrastructure support for running operational WRF model in North American Mesoscale and HiResWindow models at NCEP. (Rapid Refresh to be added in FY09)

- NAM upgrade implementation delayed until 2Q FY08.

Detailed report – MDE – August 2007

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

GSD

GSD assisting with NCEP on testing new software for RUC upgrade package (see paragraphs below from NCEP).

This RUC analysis/model change package (implementation date now tentatively planned for early 2008) is currently running in the 13km dev RUC (http://ruc.noaa.gov/pig.cgi?13km_D2) and the hardened 13km backup RUC (http://ruc.noaa.gov/pig.cgi?13km_BU). Some more experiments were made in August regarding the Grell-Devenyi (GD) scheme (new non-local application of temperature change from subsidence). 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.
- Post-processing changes
    - Addition of three reflectivity products in RUC post-processing (column max, 1-km, 4-km) (all in RUC isobaric files – ruc_presm or pgrb)
    - Fix to tropopause level problem identified in July 2007.
    - Additional new products in RUC isobaric/pgrib files - 500 hPa vorticity, total accumulated convective and non-convective precipitation from initial time.
- 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 and improved coherence in mesoscale organization for convective storms.
- 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.

NCEP

Dennis Keyser reports that the reason why moisture data from MDCRS-ACARS UPS units is unreasonably high in the BUFR feed from ARINC is due to their being one order of magnitude too large. ARINC is responsible for coding these obs into the BUFR form that NCEP receives and they have been contacted. Comparison with GSD data not coded in BUFR helped with this solution. On 13 August, the number of satellite ingest jobs run each day was greatly expanded. This change will ensure that as much data as possible will be available for the early RUC

cut-off times. Testing of both "new science" GOES 1x1 f-o-v cloud data and GOES 1x1 f-o-v PW data (replacing current 5x5 f-o-v products) is underway. Cooperative Agency Profiler (CAP) and RASS data are not yet available through an alternate ERSL MADIS feed.

Geoff Manikin reports that GSD has delivered code to NCEP to prepare for the next RUC upgrade. The primary change is to incorporate the use of radar reflectivity data with smaller changes to improve other data ingest, particularly with respect to the mesonet providers. Work is underway to prepare the radar mosaic data in a format that can be used by the model (help with Steve Weygandt – GSD), and it is hoped that the new code will be running in parallel by the middle of September. Preliminary planning of FY2008 implementations by NCO call for code delivery 12/18/2007. Code delivery must be preceded by a period of stable testing within EMC.

In July, Shun Liu filed JIFs for the updated radar quality control (QC) which includes reflectivity as well as radial wind and included the processing required to produce reflectivity mosaics required for the RUC upgrade. This new QC performs more work and is taking longer to run and will take more resources (CPUs) to complete in the same time. Another complicating factor is the fact that the volume of Level II data arriving at NCEP will more than double in FY2008 with the implementation of the so-called super-resolution data feed. EMC is working with NCO to come up with a strategy (to be implemented in Q2 FY2008) to allow the Level II processing to be performed with a minimum (affordable) number of processors and in the required time.

Subtasks

07.5.1.1 Maintain hourly RUC runs and provide grids of SAV and AIV guidance products.
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.
07.5.1.4 Maintain access to model verification data.

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.

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.

Following the WRF Executive Oversight Board meeting in Boulder on 31 July 2007, a proposal was drafted by EMC concerning the future of RR and the matter of core choice and use of the WRF and ESMF model infrastructures. After discussion, this plan was put in final form and signed in early September by Lord and DiMego (EMC), Koch (GSD and DTC) and Benjamin (GSD). Under this plan, the GSD and EMC will work together to implement the RR in two phases. In Phase 1, to be ready for NCEP implementation by September 2009, and toward which GSD has been working since 2004, the initial RR operational implementation will use the WRF-ARW under the WRF infrastructure, together with GSD physics and GSI-based data assimilation including diabatic Digital Filter Initialization (DFI). In Phase 2, to be implemented in 2012, an ensemble-based RR capability will operate under the NCEP Earth System Modeling Framework (ESMF) Modeling System, or NEMS, currently under development by EMC. The RR ensemble will include, depending on the available computing, members with NMM and ARW dynamics and various combinations of EMC and GSD physics as well as perturbed initial conditions. Phase 2 will feature advanced data assimilation techniques to provide digitally filtered background and forecast fields, the ability to ingest and analyze time-varying (at least hourly) surface, aircraft and Doppler radar observations and an ensemble

initialization technique. The Phase 2 RR will be built on a NAM-based hourly assimilation cycle under ESMF, totally independent of the WRF code architecture.

GSD

In early August, GSD had to discontinue running WRF forecasts cycled with GSI over the RR domain on iJET due to removal of the large-memory opteron nodes necessary for the Standard Initialization. WRF-RR runs without cycling continue on wJET using WRFv2.2 and WPS. Integration of cycling into the GSD-developed Work-Flow Manager continues, but some remaining matters must be resolved before this is fully working.

Further progress was made with the digital filter initialization (DFI) in the WRF-ARW model during August (Tanya Smirnova, Steven Peckham and Stan Benjamin). The GSD-developed backwards-forward diabatic DFI for WRF-ARW, similar to that in the RUC model, is now working on the 13-km RR grid using GFS data processed through WPS as input. Some further tuning of the DFI is anticipated to optimize its effectiveness, once cycling over the RR domain using WRF-ARW begins in earnest. Thanks to NCAR (Tom Henderson, Xiang-yu (Hans) Huang) for their assistance.

PLANNED EFFORTS: Add cycling with 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. Execute a new diabatic Digital Filter Initialization prior to starting the free forecast to control initial noise.

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: The wJET computer and file systems are likely to continue to require periods of down time over the next 2 months for installation of additional security patches and to address file-system performance issues. One of these security patches installed in mid-August caused problems reading large files. Workarounds are being developed.

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. Completed 10 Dec 2006. (GSD)

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

CURRENT WORK: Work continues toward establishing a 1-h cycle using WRF-ARW on the full RR domain. GSI can now work with netcdf files from WRF v2.2 and the new WRF Pre-processing System (WPS). A recently installed security patch on wJET has caused problems with reading of large files, affecting the GSI read of the large RR North American domain background files, but not the read of the smaller RR CONUS domain files. Cycling work has proceeded with the reduced CONUS configuration while this large file reading issue is being resolved.

For effective 1-h cycling it is important to have a 1-h forecast that is free of spurious features. As has been noted many times over the years, the use of digital filter initialization (DFI) has been a key to the success of the RUC. As noted above, Tanya Smirnova is successfully running the diabatic DFI (first backwards adiabatically, then forward diabatically) to initialize the WRF-RR using GFS initial data. Problems with the backwards phase have been solved (though some tuning of the filter parameters appears necessary). In addition to the benefit provided by diabatic DFI to the 1-h forecast, it will permit diabatic initialization of the WRF-RR runs after coupling with the GSI generalized cloud analysis (See Task 07.5.15).

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: See comment on wJET above.

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 continues to be used very productively (continuing in August) for testing impact of various observation systems, including effectiveness of the RUC hourly assimilation and its analysis code.

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

CURRENT WORK: NCL scripts have been added to produce graphics for all RR tests with cold-starting and 12-h cycling in spring 2007.

PLANS: Previous web pages for experimental RR graphics will be re-aimed at new directories forced by disk storage limitations.

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: Bill Moninger's grib viewer has been extended to allow viewing RR GRIB data covering the full North American RR domain.

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: No work during August.

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

CURRENT WORK: (From July report) GSD has extended a rawinsonde verification system to include Rapid Refresh forecasts from preliminary real-time tests.

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 in August (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.

No additional work in August.

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 studied local ensemble Kalman filters and tested this method on a small regional domain. She also did impact studies on the bug-fixed strong constraint and the latest GSI code. The cycling tests were done with the ijk format of the forecast model. The short term (3-hour) forecast impact was neutral to slightly positive and the changes are now being tested in a regional parallel. In response to a field complaint, she checked the height report from a station in the Bering Sea. No significant deviation from the report was found in the analysis fields.

Dave Parrish reports that work continues to try and understand what is causing the poor performance of the regional implementation of the strong dynamic constraint in GSI. The error found by John Derber had no significant effect on cycling experiments. Another small error has been found in the computation of horizontal derivatives of vector wind, but the impact of this error is also expected to be small. At the end of August, work was started on embedding the regional domain in a global domain and then applying the global version of the strong constraint. The regional implementation assumes a constant coriolis and map factor for the tangent linear model used to define the balance increments. Due to the very large domain of the WRF-NAM, this assumption may cause significant problems. Using the global version will allow evaluation of this possible problem.

Shun Liu and Duk-Jin Won continue tests with addition of a vertical velocity variable to GSI to help in the assimilation of radar radial wind observations. Initial results remain encouraging.

GSD

Dezso Devenyi continued his work to optimize the specification of the anisotropic errors covariances that will allow for horizontally varying vertical length scales within the planetary boundary layer. This provides an alternative to the use of 'pseudo-observations' as has been done in the RUC. Additional work (in conjunction with Jacques Middlecoff) has focused on parallel I/O issues related to wJET and on cycling issues (with WRF version 2.2, the new WRF Postporocessing System and the workflow manager). Ming Hu has completed coding work to parallelize the GSI general cloud analysis and is now evaluating tests with different observation sources (comparing results with single-processor runs) to resolve any remaining issues and verify that the parallel version is working correctly within the GSI framework.

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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.

07.5.5.2 Oct 2006 (NCEP/EMC) - Completed 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.

07.5.5.3 Dec 2006 (NCEP/EMC) – Completed 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.

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.

07.5.5.6 31 July 2007 (NCEP) (Delayed per NCEP paragraphs above).
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.

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.

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).

Deliverables

07.5.5E1 **31 March 2008** (original - 31 March 2007) EMC
Subject to NCEP Director approval, implement WRF-GSI in NAM/NDAS.

CURRENT EFFORTS: Work on GSI 3DVAR for strong constraint – see earlier discussion.

UPDATES TO SCHEDULE: Delayed until Jan-Mar 2008.

07.5.5E2 15 July 2007 (ESRL). Completed 15 July 2007
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).

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)

NCAR/MMM

Dudhia of NCAR helped to finalize the unified Noah land-surface scheme code and resolved some issues of consistency in the use of mixing ratio and specific humidity within that scheme. The unified Noah was committed to the WRF repository in August. This represents joint work by several scientists at NCAR and NCEP.

Dudhia worked with DTC and NCEP to resolve an issue with occasional bad values in the diagnostic 2m (shelter) temperature. This was caused by low-wind situations where an exchange coefficient used in a denominator became unrealistically small. This fix was added to the WRF repository in August.

Dudhia developed an ozone capability for the Dudhia shortwave radiation scheme which is computationally cheaper than the Goddard scheme. He also developed some physics tuning parameters for an ensemble application. These parameters are controllable with the namelist: (i) an entrainment constant in the YSU PBL scheme, (ii) the rain intercept parameter in the WSM5 and WSM6 microphysics schemes, and (iii) the sub-grid cloud radius in the KF cumulus scheme.

Dudhia also addressed physics issues in the context of global WRF testing that benefit WRF in general. These issues pertained to checking that the radiation scheme can handle ozone effects in the upper stratosphere, the initialization of moisture in low-pressure and low-RH conditions, the initialization of sea ice and soil moisture from ECMWF data, and the use of the new damping-w (vertical velocity) technique to prevent unrealistic reflection from the model top above high-latitude mountains.

Lastly, in high-resolution, real-time ARW applications, NCAR tested some new formulations for the moisture exchange coefficient in hurricane conditions. Hurricane verification is used in guidance for these formulations, since there is little observation in high-wind conditions over water.

UPDATES TO SCHEDULE: None.

Deliverables

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

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

GSD

GSD continues to evaluate real-time performance in both WRF and RUC of versions of the Grell-Devenyi convective scheme with various new features. The RRTM longwave radiation scheme is also in the dev-13km RUC cycle at GSD. In August, the dev-13km cycle continued to show dramatic improvement in nighttime and daytime warm bias over the central and southeastern US as compared to the operational RUC. The revised RUC LSM and the RRTM are both included in the planned RUC change bundle, along with changes (not yet fully determined) in the Grell-Devenyi convective scheme.

Subtasks

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

CURRENT WORK:
The Grell-Devenyi scheme continues to be the subject of additional experimentation in August. The small-scale detail and absence of sufficient mesoscale organization noted in instantaneous RUC reflectivity fields and discussed in the FY07 Q3 report continues to be addressed by testing in the developmental 13km RUC at GSD. In the current operational RUC, as well as the backup RUC13 at GSD, the subsidence outside of cloud necessary to compensate the saturated updrafts within (parameterized) clouds is assumed to occur entirely within the individual grid column where the convection is occurring. Georg Grell has developed for WRF a version of the Grell-Devenyi scheme that spreads this subsidence into nearby grid columns, and has implemented this scheme into the 13km developmental RUC at GSD. Various assumptions concerning the spatial distribution of subsidence in adjoining grid columns are being tested in the dev13 RUC and evaluation is continuing. One conclusion so far is that the proportion of grid-scale precipitation in areas of convection can be increased by a more uniform spreading of the subsidence into adjoining grid columns rather than having most or all of it occur in the same grid column as the convection which it compensates.

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.
No further work on this subtask in August.

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.

Ben Bernstein is writing up his preliminary analysis of the Cleveland stratocumulus cases in preparation for the final report. 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 continues to look into a class of boundary-layer mixing schemes developed by Bretherton et al and discussed at the WRF workshop. These schemes are not yet in the WRF repository.

Deliverables

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

See paper by Benjamin et al noted in July report under Task 07.5.4 and supplemental material provided in FY07 Q3 report.

07.5.8.E3 30 June 2007 (GSD) Completed 30 June 2007
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 in July report under Task 07.5.4 and supplemental material provided in FY07 Q3 report.

07.5.8.E4 30 September 2007 (NCAR)
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.

Ben Bernstein and Greg Thompson are starting to work on this report.

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.

August: The radar reflectivity assimilation code within the 13-km RUC DDFI has continued to yield impressive results in real-time parallel test at GSD. Code for this package has been transferred to NCEP for real-time and retrospective testing in advance of the planned January 2008 operation upgrade. Related collaborative work between GSD, EMC, and NSSL has yielded progress on the related task of generating at NCEP real-time quality-controlled radar reflectivity tiles. Tanya Smirnova has successfully coded the diabatic DFI for the WRF-ARW (see task 07.5.4), This is an important accomplishment that surmounts the main obstacle to porting the radar assimilation package (including the use of lightning data) to the WRF-based Rapid-Refresh system. Scientific information about the radar algorithm and results are summarized in a conference paper presented at the 33rd Conference on Radar Meteorology in early August. The paper title and link is:

Radar-based assimilation of precipitation systems using a diabatic digital filter

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

Deliverables

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

Verbal summary of progress has been provided during bi-weekly GSI telecoms. 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)
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

The main efforts have focused on the parallelization of the generalized cloud analysis using MPI. New codes needed to parallelize the cloud analysis are added into GSI, which include those for ingesting the cloud species and precipitation hydrometeors into background fields, distributing background and observations to each processor, and the generalized cloud analysis itself. Initial test shows that the parallel version of the analysis runs smoothly but thorough tests of the correctness and efficiency of the parallelized version are still needed.

One August 31, Ming Hu completed his employment with CAPS. He started working for GSD on September 4th. CAPS hired a new scientist, Aimei Shao, to continue the FAA-supported work. She started on 28 August.

GSD
GSD has tested new experimental GOES cloud-top data from NESDIS using the RUC cloud analysis. GSD found errors in the cloud-top temperature in this data, resulting in poorer stratus initialization over marine regions. NESDIS has subsequently corrected this problem, and it appears that the new GOES cloud-top data will be appropriate for the operational RUC. Additional related testing was conducted in August for use of single-field-of-view (SFOV) precipitable water (PW) data in the RUC. Current operational GOES PW data is from 5x5 FOVs, not the new 1x1 FOV information.

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 the reason why moisture data from MDCRS-ACARS UPS units is unreasonably high in the BUFR feed from ARINC is due to their being one order of magnitude too large. ARINC has been contacted. On 7 August, NCEP began pulling GOES 1x1 f-o-v sounding data from NESDIS' gp12 machine (24x7 support) rather than from their gp16 machine (8x5 support). On 7 August, NESDIS began sending NOAA-18 data to an additional ground station in Sweden. This has eliminated the "blind orbit" problem and has increased/stabilized the number of data available in the 0000 UTC runs. On 13 August, the number of satellite ingest jobs run each day was greatly expanded. This change will ensure that as much data as possible will be available for the early NAM cut-off times. NCEP is in the process of switching its processing to high-resolution BUFR JMA winds, following a period

of testing. Parallel testing of the following new data types is currently underway in preparation for the FY08/Q2 NAM-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. 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). By early fall of 2007, dropwindsonde moisture from NOAA (P-3 and Gulf Stream) and USAF will start being used by the GSI, and aircraft turbulence and icing data will be available for verification. Efforts to speed up the dump processing of NEXRAD Level II data are being explored.