MODEL DEVELOPMENT AND ENHANCEMENT RESEARCH TEAM

Monthly Report for February 2008
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Executive Summary

Task 08.5.1: Infrastructure support related to operational running of the RUC and North American Mesoscale (NAM) operational modeling systems.

- Testing continues at NCEP for RUC upgrade package code (radar reflectivity assimilation, TAMDAR, radiation, Grell/Devenyi upgrade), very good results (surface, convection, ceiling/vis, precip) evident for Jan. Implementation now planned for May-June 2008. See real-time comparisons in http://wwwt.emc.ncep.noaa.gov/mmb/ruc2/para . Summary from AMS Conference (late Jan) available here: Implementation of the radar-enhanced RUC.

Task 08.5.4: Develop, test, and implement Rapid Refresh configuration of the WRF modeling system.

- New Rapid Refresh summary at http://rapid.refresh.noaa.gov .
- Web-page comparing cold start and hourly cycled RR at http://rapidrefresh.noaa.gov .
- Disk I/O issues largely resolved, other improvements leading to much more reliable RR 1-h cycle

Task 08.5.6: Develop, test, and evaluate the performance of the nonhydrostatic WRF modeling system.

- Continued progress toward WRF version 3.0 planned for spring 2008.

Task 08.5.8: Improve model physics for aviation forecasts.

- Non-local subsidence temperature tendencies tested in Grell-Devenyi scheme now producing a significant further improvement for convection forecasts in both NCEP parallel RUC and in GSD dev RUC13. This important modification to the Grell-Devenyi convective scheme will also be included in WRFv3.0.

Task 08.5.15: Develop improved methods of cloud and moisture analysis for use in the WRF modeling system.

- Cloud analysis for GSI incorporating METAR cloud and GOES cloud-top data (similar to the RUC cloud analysis) has been tested in a 1-h cycle with the Rapid Refresh.

Detailed report – MDE – February 2008

Task 08.5.1: Infrastructure Support Related to Operational Running of the RUC and North American Mesoscale (NAM) Systems

GSD

RUC upgrade for model, assimilation, and post-processing continues in parallel testing at NCEP through February. GSD (Steve Weygandt, Stan Benjamin) and NCEP (Geoff Manikin, Shun Liu) were successful in diagnosing problems with radar reflectivity availability for the parallel RUC discussed briefly in January report.

BACKGROUND on RUC upgrade:
Please see the October report for more details on RUC upgrade. Key components:

- Assimilation of new observations: radar reflectivity, TAMDAR aircraft, mesonet winds
- Model physics changes – RRTM radiation (new), Grell-Devenyi convection with non-local subsidence warming, snow density in land-surface model.

Effect of changes:

- Much improved precipitation, new reflectivity products.
- Elimination of 2m temp warm bias in summer and cold bias in winter.
- Improved lower tropospheric temps, winds, RH, clouds (TAMDAR, physics)

A new update on the RUC upgrade is available from the 11 Dec 2007 presentation at http://www.emc.ncep.noaa.gov/research/NCEP-EMCModelReview2007/RUC-NCEP-OperReview-Dec07-RRb.pdf

NCEP

Dennis Keyser reports that tests 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) are underway. Parallel testing of TAMDAR aircraft data is also currently underway. Cooperative Agency Profiler (CAP) and RASS data are not yet available through an alternate ESRL MADIS feed.

Geoff Manikin reports that EMC began running a parallel version of the RUC model last fall; the primary feature of this code is the use of radar reflectivity data in a diabatic digital filter initialization. Geoff Manikin worked to integrate hourly reflectivity mosaic files generated by Shun Liu into the parallel RUC. The mosaic data are linked to the digital filter initialization via specification of the 3-d profile of latent heating. Other changes include the assimilation of TAMDAR data and mesonet wind data from a list of approved providers, a change in the longwave radiative scheme from Dudhia to RRTM, a modification to the snow component of the land-surface model to decrease excessively cold 2-meter temperatures over fresh snow at night, and a modification to the convective scheme to decrease widespread coverage of light precipitation. Daily comparison of operational and parallel forecasts continues, and statistical evaluation of the new version of the model is underway. Problems were discovered early in January where the code that processes radar data was unable to distinguish several somewhat common radar modes; Shun Liu obtained a newer version of the QC code from NSSL which can identify those modes. Occasionally, mosaic files were not produced in time for use in the RUC parallel, so EMC requested Shun Liu be granted use of the devhi queue which will nearly guarantee reliable and timely generation of the mosaic - missing reflectivity and this is now running. With some critical radars absent from the testing prior to this month and the inconsistent availability of mosaics, the evaluation of the radar data assimilation is somewhat behind schedule. Implementation of this package is now scheduled for late summer or early

fall 2008.

The operational RUC assimilated erroneous RASS temperature data in central Kansas for several cycles on 25 February. The data were close enough to the first guess such that the operational quality control programs did not flag the observations. Data from the site in question was removed from the data stream to NCEP by ESRL on 26 February. It is worth noting that the parallel version of the model did successfully eliminate the data in question for several of the impacted cycles.

INTERFACE WITH OTHER ORGANIZATIONS:
Extensive interactions with NCEP and NOAA/MDL.

NCEP

Subtasks

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

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

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

08.5.1.4 Maintain access to model verification data.

Deliverables

08.5.1.E1 1 October 2007 - 30 September 2008 EMC (NCEP, GSD)
Perform observation ingest, quality control, and preparation of both existing and new observations in support of the operational RUC runs.
CURRENT EFFORTS: Ongoing for both NCEP and ESRL/GSD.

08.5.1.E2 1 October 2007 - 30 September 2008 (GSD)
Perform configuration management for RUC, including thorough documentation, and respond promptly to any code malfunctions or performance issues.
CURRENT EFFORTS: Ongoing for both NCEP and ESRL/GSD.

08.5.1.E3 1 October 2007 - 30 September 2008 (GSD, NCEP)
Monitor RUC performance, respond to any problems detected by GSD, NCEP, or any RUC users, diagnose cause, develop solution to RUC software, test changes and coordinate with NCO on implementation.
CURRENT EFFORTS: Ongoing for both NCEP and ESRL/GSD.

Task 08.5.4: Develop, test, and implement Rapid Refresh configuration of the WRF modeling system.

ESRL/GSD

During the month of February, several changes were made by Ming Hu to increase the robustness of the

RR 1-h cycle. Major changes include: 1) switching to a wjet disk partition that has less competing I/O activity (resultant in faster and more reliable runs times), 2) automating the scripts to automatically utilize older RR forecasts as the GSI background in the event that the cycle misses an hour, and 3) automating a 6-h down-scaling WRF forecast, initialized off of each GFS run to provide a set back-up cold start grids for each hour (thereby allowing cold start at any time with minimal model latency), and 4) several additional minor changes. The result from these enhancements has been that the 1-h RR cycle has run with few interruptions for the past few weeks. In addition, Ming Hu and Dezso Devenyi worked together to add the assimilation of satellite radiance data, with full use of the cycling bias correction module (with assistance from Wan-Shu Wu and others at NCEP) to the GSI portion of the 1-h RR cycle. With these latest improvements, the 1-h RR cycle is now fully functioning with most of the key major components, and we are turning our attention to detailed evaluation of the analysis and forecast skill.

NCEP

PLANNED EFFORTS: Increase the cycling frequency to 1-h.

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: See discussion under subtask 4.1 below.

INTERFACE WITH OTHER ORGANIZATIONS: DTC, NCEP, NCAR

UPDATES TO SCHEDULE: None.

Subtasks

08.5.4.1 30 December 2007 (GSD, NCEP) COMPLETE
Begin real-time hourly cycling of RR model with GSI over RR domain with availability at GSD of hourly prepBUFR files from NCEP having begun on 12 October 07.

CURRENT WORK:
See discussion above for description of recent enhancements to the Rapid Refresh real-time 1-h cycle.

PROBLEMS / ISSUES ENCOUNTERED OR ANTICIPATED: A coordinated effort by RR and JET personnel has largely overcome the previous wjet I/O speed issues that were hampering the RR 1-h cycle.

INTERFACE WITH OTHER ORGANIZATIONS: NCEP, NCAR

UPDATES TO SCHEDULE: None

08.5.4.2 1 March 2008 (GSD) [COMPLETE]
Begin collaborative evaluation with planned NOAA Rapid Refresh users, including AWC, SPC, NWS in Alaska and Puerto Rico. Arrange to have GSD RR grids available to examine and solicit feedback on RR performance.

As reported in January, Stan Benjamin briefed the NWS Alaska Region Science and Operations Officers (SOOs) and other NWS Alaska Region staff on 15-16 Jan 2008 in Anchorage on Rapid Refresh status and progress (and TAMDAR impact studies with RUC) and encouraged feedback from the NWS offices on RR performance over Alaska once output from the hourly cycle becomes available. The Rapid Refresh web site offers an Alaska-window (based on AWIPS grid 249) display to facilitate evaluation of RR products over that area, and beneficial feedback has been received from Alaska Region forecasters. We anticipate that interactions with Alaska forecasters will increase once they begin receiving grids from the

GSD 1-h cycle. Graphical products from various parallel cycles of the Rapid Refresh continue to be available via the Rapid Refresh web-page and work has commenced to create an R/T transfer of RR files to the ESRL/GSD ITS branch for dissemination to other FAA AWRP Research Teams and NWS.

08.5.4.3 1 March 2008 (GSD)
Begin collaborative evaluation of Rapid Refresh with Inflight Icing, Turbulence, National Ceiling/Visibility, and Convective Weather RTs. Arrange to have GSD RR grids available to examine and solicit feedback on RR performance.

GSD has made the necessary information available to these AWRP-RTs (see FY08Q1 report) so that they can commence specific code and script preparations for obtaining and processing RR-domain output from GSD. See comment on recent activities on 08.5.4.4.

08.5.4.4 30 May 2008 (GSD, NCAR, NCEP)
Report on status of tactical planning for making RR-WRF code for 2012 in compliance with Earth System Modeling Framework (ESMF) as specified in the Sept 2007 Rapid Refresh MOU between NCEP and GSD.

Tom Henderson (formerly NCAR, now with ESRL/GSD) is working toward putting the ESRL FIM (Flow-following Icosahedral Model, under development, test and evaluation within GSD) into the ESMF framework, a necessary step if it is to contribute members to NCEP's Global Ensemble. In the process of doing this, Tom is working closely with Tom Black of EMC, but also with Stan Benjamin and others in GSD. Experience so gained will facilitate the process of putting the RR under ESMF.

08.5.4.5 Ongoing (GSD)
Further enhancement to WRFpost version for Rapid Refresh application, including modifications for generation of RUC-specific fields.

Output from the full-domain RR 6-h cycle, as well as that from the full-domain cold-start runs continue to be available. Refinement of the presentation style (e.g., color tables) of these plots has been made to facilitate comparison with output from the various RUC hourly cycles running at GSD and NCEP. As noted under subtask 2 above, a separate Alaska window display (based on AWIPS grid #249) has been added to facilitate evaluation of RR over Alaska. Visibility, ceiling, and cloud-top height plots have proven helpful in evaluating the cloud analysis performance (see tasks 08.5.5 and 08.5.15). Some minor grib table parameter setting problems have been identified in our version of WRFpost and are being corrected.

08.5.4.6 Ongoing (GSD, DTC later)
Ongoing evaluation of performance of real-time and retrospective runs of RR system for SAVs, AHPs.

The availability of the web displays noted above is now facilitating this evaluation. This enabled recognition that skin temperature was being initialized to 271K in areas of sea ice coverage by the module that sets the initial fields in WRF. A fix to this problem has been proposed by GSD to the NCAR WRF developers and has been implemented into the GSD cold start runs and just recently in the RR cycled runs.

Deliverables

08.5.4.E1 30 Aug 2008 (GSD)
Have available for delivery to NCEP initial 'experimental level' WRF Rapid Refresh code for start of EMC testing toward 2009 Rapid Refresh implementation.

Task 08.5.5: Develop, test, and implement improvements to the operational WRF 3DVARs for Rapid Refresh and North American Mesoscale runs.

NCEP

Wan-Shu Wu worked on the NDAS cycling strategy. Prompted by several seasons of results where reruns of poor NAM forecasts using GFS initial conditions consistently showed much improved performance, she tested the effect of using GFS forecasts instead of NAM forecasts as the first guess for the NAM analysis at a) the TM12 starting point of the NDAS and b) at the TM00 ending point of the NDAS – because land-states were still cycled these test approaches are called partial cycling. Testing was conducted for a 30-day period in summer 2007 using a 32 km NDAS test system. A control run using operational codes and runs using partial cycling modes a) and b) above were conducted and 84 hr forecasts followed at 00z and 12z times. Tests with both modes a) and b) were improved over the control but the amount of improvement for mode b) were 2-3 times the improvement for mode a). She tested the impact of using the humidity from aircraft data with an off-line parallel system. The adaptive tuning was used to tune the observational error for the TAMDAR and Canadian AMDAR data. She learned to use the diagnostic files generated by the analysis for the adaptive regression study.

Shun Liu continued running and monitoring the radar reflectivity mosaic package in parallel and generating reflectivity mosaic hourly files for the parallel RUC. Reflectivity at different levels, which GSD is interested in, is also displayed on a web page. He also modified the radar reflectivity ingest code and reflectivity mosaic package to handle new radar scan modes. Current radar wind QC can't properly process radar wind data from new radar scan modes. He started to look into a few of cases and work with the radar data QC group at NSSL to find a potential solution for improving the current radar wind QC package. In addition, with Brad Ferrier's help, the verification package has been setup for the small test domain. This package will be used to further examine the performance of radar wind assimilation in the GSI.

GSD

With assistance from EMC (Wan-Shu Wu and others), work was completed by Dezso Devenyi and Ming Hu to add the cycling satellite radiance bias correction module to the GSI within the 1-h RR cycle Feb. Again, with some assistance from Wan-Shu Wu, Dezso Devenyi is currently working on adding "Q-option 2" (normalized RH) to the ARW module of GSI. Also, Dezso Devenyi has been working with the JET supercomputer team (Craig Tierney, Chris Harrop, Leslie Hart) to implement a method (developed by the JET team) to significantly speed up the parallel I/O for the GSI.

Subtasks

08.5.5.1 31 December 2007 (GSD and CAPS) COMPLETE

Progress report on testing and evaluation of the generalized cloud/hydrometeor assimilation (including GOES cloud-top data and METAR cloud/visibility/weather data) within a cycled GSI on the full Rapid-Refresh domain.

At ESRL/GSD, Ming Hu's work to fully incorporate the updated and parallelized cloud analysis into the latest version of GSI that is being used for the cycling Rapid Refresh runs is complete. Real-time cycled runs with the cloud analysis are ongoing on the GSD wJET computer. Analysis of results is ongoing and has revealed issues that have been corrected. Recently, visibility, ceiling, and cloud-top height plots have been added for the RR cycled runs and have proven helpful in the evaluation of the cloud analysis performance. A progress report on the cloud analysis was presented at the AMS ARAM conference and can be found at: http://ruc.noaa.gov/GSI_cloud_analysis_report.pdf

08.5.5.2 31 December 2007 (NCEP and GSD)
Report on testing of 2DVAR GSI assimilation of high spatial and temporal mesonet surface data using analysis grids with 5-km or finer resolution.

08.5.5.3 31 January 2008 (NCEP and CAPS)
Further refine the radial velocity analysis component of GSI in response to model resolution changes. Examine data impact at higher assimilation frequencies and higher spatial resolutions. Consider issues on data quality, super-obbing, and optimal decorrelation scales.

08.5.5.4 28 February 2008 (GSD) Complete
Report on statistical evaluation of Rapid Refresh forecasts initialized with the GSI, including examination of upper-level winds, surface fields, and precipitation.

Recent work (described under Task 08.5.4) has made the Rapid Refresh 1-h cycle much more reliable on wjet, and suitable for statistical verification (along with the 6-h RR cycle and the cold start runs. In addition, work has recently commenced to begin statistical precipitation and surface field verification for the RR forecasts. These efforts are summarized in the short report available at: http://ruc.noaa.gov/RR_preliminary_verification_report.pdf and indicate that the RR runs show some skill degradation compared to current operation forecasts. This is to be expected as efforts, so far, have focused on optimizing the procedures for completing the hourly cycled RR forecasts. With the real-time hourly RR cycle now running successfully with all major components, we are now focusing efforts on calibrating GSI parameters (error variance and correlation length scales, cross correlations, etc.) to optimize forecast skill.

08.5.5.5 31 July 2008 (NCEP)
Based on case-study testing and refinement of the research quality code, deliver result in an 'experimental' code for an upgrade package (e.g. improved use of WSR-88D data and satellite radiances and covariances) to the WRF-GSI for FY2009 change package to the NAM-WRF.

Deliverables

08.5.5.E1 30 March 2008 (NCEP)
Subject to NCEP Director approval implement upgrades to WRF-GSI used in NAM/NDAS.

CURRENT EFFORTS:

PLANNED EFFORTS:

08.5.5.E2 30 August 2008 (GSD)
Rapid Refresh code delivery date to NCEP/EMC for initial testing of RR version of GSI.

08.5.5.E3 30 September 2008 (NCEP and CAPS)
Deliver enhancement package for radial velocity data analysis for further implementation testing.

CURRENT EFFORTS:

PLANNED EFFORTS:

Task 08.5.6 Develop, test, and evaluate the performance of the nonhydrostatic Weather Research and Forecasting (WRF) modeling system.

NCAR/MMM

NCAR continues to work on the preparation of release of WRF Version 3.0. The WRF repository was frozen to new features until after the release, planned for Spring 2008.

WRF physics work was done by Jimy Dudhia of NCAR/MMM. The focus was largely on getting code items into the repository for V3.0. Dudhia introduced a number of bug fixes as a result of the pre-release testing: (i) correction of a problem in the new version of the YSU PBL by improving its pressure computations; (ii) fix for the new Goddard microphysics scheme where testing showed a problem with generating numbers too small for some platforms; (iii) correction to the Noah LSM's surface pressure use; (iv) fix to the new Pleim-Xiu LSM for non-nudging cases where code needed to be bypassed; and (v) a fix to a limit in an exponential function in the WSM6 microphysics scheme that appeared in extreme cold conditions.

A further minor fix to the diffusion reported by a visitor was added to the repository. This improves the spatial averaging in a term and corrects the argument order in a call, both with minor effects on results.

In new development, Dudhia worked with Tewari (NCAR-RAL) on improving the treatment of surface emissivity over snow cover. Dudhia also worked with Songyou Hong (Yonsei Univ., S. Korea) in implementing code and global data for a new gravity-wave drag capability. Lastly, the capability to get terrain-specific fields for orographic drag terms in the WPS Geogrid program was added.

ESRL/GSD

As reported previously, ESRL/GSD has also worked with MMM toward WRF v3.0 to introduce the digital filter initialization, improved versions of the Grell-Devenyi scheme and the RUC/Smirnova land-surface scheme, and improvements to the WRF Real program to allow community use of RUC native-grid initial conditions including hydrometeors.

Task 08.5.8: Improve physics in the WRF model, especially that bearing on prediction of aircraft icing.

GSD

The planned 2008 RUC change bundle continues in parallel testing at NCEP (see discussion under Task 08.5.1).

Subtasks

08.5.8.1 31 Dec 2007 (GSD)

Begin systematic GSD evaluation of physics performance in GSD 1-hour RR cycle and address issues that arise in preparation for 2009 RR implementation. Particular attention will be given to microphysics and interactions between microphysics and the other parameterized physical processes.

Initial qualitative and quantitative evaluation of the RR cycled runs has begun, revealing specific issues that are being addressed, including a fix for the update of Arctic Ocean sea-ice.

08.5.8.2 15 May 2008 (NCEP)
Development efforts produce a 'research quality' code of physics upgrades for consideration in the 2009 NAM-WRF change package.

08.5.8.3 May 2008 (NCAR)
May '08: Expand the current one moment microphysical scheme to two moments and add a variable for aerosol particles in order to improve forecasts of freezing drizzle and icing. Computer storage and run time considerations will be considered as a constraint on the development. (NCAR)

Observational cases in support of the above development continue to be developed. Work also continues on expanding the current scheme to two moments and adding an aerosol variable. We plan to participate in the WMO Cloud Modeling Workshop this July in order to compare our results with other schemes.

Deliverables
08.5.8E3 May '08: Status of improved microphysics scheme to ESRL for evaluation in WRF Rapid Refresh. (NCAR)

08.5.8.4 15 July 2008 (NCEP)
Based on case-study testing and refinement of the research quality code, deliver an "experimental" code of physics upgrades for the 2009 NAM-WRF change package.

08.5.8.5 31 Mar 2008 (DTC, GSD)
Report on GSD-DTC RR retrospective testing of land-surface model formulations for snow, and, as appropriate, other physics.

Previous reports on GSD investigation about the performance of both RUC and RR in situations of strong low-level warm advection of air at temperatures well above freezing (e.g., 10 deg C) over snow-covered areas.

08.5.8.6 1 August 2009 (GSD)
Begin to explore possibilities for enhancing treatment of sea ice and tundra (including spring- time pooling) in Rapid Refresh domain.

NCAR (from January)
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.

08.5.8.7 1 September 2008 (NCAR) Option B
Upgrade the microphysics and boundary layer scheme to appropriately simulate freezing drizzle and icing in stratocumulus clouds.

NCAR
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.

Deliverables

08.5.8.E1 30 March 2008 (NCEP)
Subject to NCEP Director approval, the physics upgrades become Operational at NCEP as part of the 2008 change package for WRF-NMM. (Will supplement physics progress toward Rapid Refresh.)

08.5.8.E2 30 Aug 2008 (GSD, NCEP)
Have available for delivery to NCEP initial 'experimental level' WRF Rapid Refresh code, including physics routines, for start of EMC testing toward 2009 Rapid Refresh implementation.

08.5.8.E3 May 2008 (NCAR)
Status of improved microphysics scheme to ESRL for evaluation in WRF Rapid Refresh.

Task 08.5.15: Develop improved methods of cloud and moisture analysis for use in the WRF Modeling System.

Subtasks

08.5.15.1 31 October 2007 (NCEP)
Based on parallel testing and refinement of the experimental code, deliver the 'pre- implementation' code to NCO including improved diabatic initialization (e.g. nudging to analyzed precipitation and GOES cloud-top) for the March 2008 NAM change package.

08.5.15.2 30 Jan 2008 (GSD) COMPLETE
Develop and evaluate performance of diabatic digital filter initialization (DDFI) in the RR WRF model without use of radar data

CURRENT WORK: After the progress on WRF-RR-DFI reported in the January 2008 monthly report, GSD has worked on incorporating the DFI into the 1-h RR cycle during February 2008. This has not worked consistently yet in testing and work will continue in March to incorporate DFI into the 1-h RR cycle.

08.5.15.3 30 March 2008 (GSD and CAPS)
Further refine the generalized cloud analysis for the target RR resolution, model physics scheme and use of additional data. Perform forecast test evaluations to document the impact of the cloud analysis refinements.

At CAPS, a more recent version of GSI from GSD is ported to OU's Linux supercomputer, with similar changes made as in the previous GSI version to solve system-related porting issues. This new version of GSI is linked to the newer WRF-ARW version 2.2. The new combined package passed standard tests.

During the month, a new effort is started to test the system at 4-km resolution for the 16-19 August 2007 tropical storm Erin case. Tropical storm Erin made landfall near Lamar, Texas on August 16. After landfall, Erin weakened to tropical depression status. However, early on August 19 Erin suddenly re-intensified to maximum sustained winds of 50 mph within Oklahoma and caused major flooding. The re-intensified storm showed spiral rain-band structures more characteristic of tropical storms found over ocean. There are extensive radar data coverage of this case near the coast and over land, making it a good case for testing convection and precipitation forecast.

To test the cloud analysis package for such a case, and help understand the re-intensification mechanism

over Oklahoma, a series of assimilation and forecast tests using a large 4-km grid is underway using the updated WRF-GSI. So far, several base-line WRF simulations with initial and boundary conditions from the NAM 12 km analysis and forecasts have been completed. Radar data will be added via GSI and the generalized cloud analysis to examine their impact. We also plan to add radial velocity data into the assimilation later on. Radial velocity data may have even more significant impact than reflectivity data for such events with strong organized circulations.

08.5.15.4 30 May 2008 (NCEP)
Based on development efforts, deliver 'research quality' diabatic initialization upgrades (e.g. initial use of Level II reflectivity) for consideration in the March 2009 change package for NAM.

08.5.15.5 30 Mar 2008 (GSD)
Include radar reflectivity-based latent heating within diabatic digital filter initialization (DDFI) in the RR WRF model.

CURRENT WORK: The DDFI without radar-reflectivity-based latent heating is now included in the GSD's 13-km cold start WRF-RR runs and the cycled RR runs will soon be switched to the DDFI version of the ARW (see Task 4, above). GSD tested DDFI (without radar) in the cycled-RR in February, but does not yet work consistently. These preliminary works are necessary steps in preparation to complete this subtask.

08.5.15.6 30 July 2008 (NCEP)
Based on case-study testing and refinement of the research quality code, an 'experimental' WRF code is delivered with diabatic initialization upgrades (e.g. initial use of Level II reflectivity) for the March 2008 change package for NAM.

Deliverables

08.5.15.E1 30 March 2008 (NCEP)
Subject to NCEP Director approval, the WRF-NMM code with upgraded diabatic initialization capability (e.g. nudging to analyzed precipitation and GOES cloud-top) becomes Operational at NCEP as part of the March 2008 change package to NAM.

08.5.15.E2 30 Aug 2008 (GSD)
Complete testing of GSI generalized cloud analysis for Rapid Refresh and deliver code to NCEP as part of Rapid Refresh package delivered to EMC, pending availability of NCEP testing capability.

Task 08.5.17: Infrastructure Support for operational running of WRF-based modeling system in North American Mesoscale and HiRes Window at NCEP.

NCEP
Dennis Keyser reports that since an implementation on 4 December, the GSI is not calculating virtual temperature as expected for MDCRS ACARS reports (it is analyzing sensible temperature). This will be corrected in the FY08/Q2 NAM-GSI update. 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, mesonet winds filtered by provider via NOAA/GSD's "uselist", and MODIS IR and water vapor satellite winds. QuikSCAT 0.5 deg. scatterometer wind superobs, as well as TAMDAR (via ESRL MADIS feed) and Canadian AMDAR aircraft data will be monitored in the GSI after the FY08/Q2 NAM-GSI update. Efforts to speed up the dump processing of NEXRAD Level II data are being explored.

Cooperative Agency Profiler (CAP) and RASS data are not yet available through an alternate ERSL MADIS feed.

Eric Rogers reports that NCO began distributing the real-time NAM parallel around 13 February 2008. It is a continuation of the EMC parallel with the planned NAM model/analysis changes which has been running uninterrupted since late November 2007. The changes include an 18% expansion of the NAM integration domain, changes to the WRF-NMM model (addition of gravity-wave drag/mountain blocking, unifying land-sfc physics model between NCEP & NCAR, improvements to passive advection), changes to the GSI analysis (retuned background error covariances, assimilation of new obs types: AIRS radiances, GOES 1x1 radiances, MODIS aircraft winds, Mesonet winds), new model terrain, and the use of 00z NAM forecast QPF to adjust NDAS soil moisture outside of the CONUS. The implementation of this change package is tentatively scheduled for 25 March 2008.

A parallel test of partial cycling (see Wan-Shu Wu report under Task 08.5.5) has begun with the full resolution full expanded domain. It was decided to start with the mode a partial cycling which uses GFS forecast fields for the atmosphere (temperature, wind and moisture) at the TM12 start time of the NDAS. This still leaves 12 hours for NMM to cycle with 3 hour frequency and adjust the small scales to the 12 km grid spacing of the NAM (versus ~35 km equivalent spacing of the GFS). Preliminary results confirm Wan-Shu's results with the coarser 32 km parallel she ran for a summer month on haze. Testing with mode b has not been ruled out, but with mode b there would still be a requirement to run the NDAS in order to continue the cycling of the surface land states. At the moment there is no stand-alone regional version of a surface-cycling only land-surface model.

Subtasks

08.5.17.1 (NCEP)
Maintain four-per-day North American Mesoscale runs and provide SAV and AIV guidance.

08.5.17.2 (NCEP)
Maintain four-per-day HiResWindow runs and provide SAV and AIV guidance.

08.5.17.3 (NCEP)
Provide vendors with gridded model data via Family of Services and the FAA Bulk Weather Data Telecommunications Gateway.

08.5.17.4 (NCEP)
Provide full grids from NAM, and HiResWindow on NCEP and NWS/OPS servers.

08.5.17.4 (NCEP)
Maintain access to model verification data.

08.5.17.6 Provide assistance to Inflight Icing, Turbulence, Convective Weather, Ceiling and Visibility and Oceanic Weather PDTs when their algorithms and product generation systems are ready to transition into NCEP's operational Production suite.

Deliverables

08.5.17.E1 (NCEP)
Perform ingest, quality control and preparation of both existing and new observations in support of the operational WRF runs.

08.5.17.E2 (NCEP).
As requested by other PDTs, incorporate new AIV calculations into Operational WRF Model post-processor and product generator

Task 08.5.19: Develop ability to assimilate WSR-88D radial velocity and reflectivity data through GSI and Rapid Refresh toward High-Resolution Rapid Refresh.

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Subtasks

OPTION B.

08.5.19.1 30 November 2007 (GSD, NCAR/RAL, CAPS)
Select initial case studies from summer 2007 for 3-km HRRR data assimilation case studies.

08.5.19.2 28 Feb 2008 (GSD)
Develop and test 3-km version of radar-reflectivity-based diabatic digital filter initialization (DDFI) and perform initial tests on cases. Revise during FY09 based on GSD tests and associated testing to be performed by NCAR/RAL.

08.5.19.3 30 March 2008 (NCAR/RAL)
Provide wind/temperature/moisture profiles for HRRR case studies using VDRAS for case studies. Provide these profiles to CAPS for GSI data assimilation experiments for 3-km HRRR.

08.5.19.4 30 June 2008 (NCAR/RAL)
Complete case study tests using radar-DDFI-enhanced WRF-HRRR model at 3-km. Report on effect on 0-3h forecasts using 3-km radar-DDFI assimilation.

08.5.19.5 31 August 2008 (CAPS)
Complete 3-km GSI data assimilation experiments for potential application within the HRRR assimilating radial wind and RAL-provided VDRAS profiles. Evaluate impact using 3-km HRRR-WRF model configuration as used by GSD.

08.5.19.6 January 2008 (NCEP)
Prepare for the expected doubling of Level II data volume due to the modified and additional VCP strategies.

08.5.19.7 15 July 2008 (NCEP)
Report on progress towards incorporating Level II reflectivity through the GSI analysis into the WRF model runs.

Deliverables

OPTION B.
08.5.19.E1 31 August 2008 (GSD, CAPS, NCAR, MIT/LL)
Report on radar assimilation results for HRRR from summer 2008 test under the lead of GSD with contributions from each organization.

08.5.19.E2 30 March 2008 (NCEP)

Subject to NCEP Director approval, implement upgrade package to WRF-GSI (e.g. improved use of Level II radial velocity) in the NAM and NDAS runs.

Task 08.5.20: Develop ensemble-based probabilistic products for aviation users.

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