

**Monthly Report
of the WRF Program Coordinator
to
Executive Oversight Board**

September-October 2005

1. WRF Model Implementation:

- **Next WRF operational implementations:**
 - (a) **NCEP** – Testing of an expanded multi-model Short Range Ensemble Forecast (**SREF**) with **6 WRF members** is well advanced. The new WRF runs (three based on the WRF-ARW and three on the WRF-NMM) bring the total ensemble members to 21 and have added significant skill to the SREF forecast products. Operational implementation of the expanded SREF with WRF members is now expected in 1st quarter 2006.
 - (b) **AFWA** – **First operational implementation of WRF-ARW** in AFWA's classified domains remains scheduled for 2nd quarter FY06. AFWA has begun its Extended Operational Tests, which represents the final stage of real-time testing prior to operational implementation. Additional retrospective tests and evaluations are also ongoing.
- NCEP's implementation of the **North American Mesoscale (NAM) WRF-NMM** in March 2006 remains **on track**. Recent testing has focused on improving the balance among physical processes to reduce biases in low-level temperature predictions.

2. Community Support and Outreach:

- **Release of WRF Reference Code:** By the end of October, NCAR will release new **WRF version 2.1.1 code**, containing both WRF-ARW and WRF-NMM, for community use.
- **WRF tutorials:** **Three tutorials** have been held in the past four months to train new users of the WRF system. Two have focused on WRF-ARW and one on WRF-NMM (also see section 5 below). All have been very well attended, indicating growing community acceptance of the WRF modeling system. Feedback from attendees on the clarity and utility of the tutorials has been very positive.

3. WRF Software Development

- **NCEP Hurricane-WRF:** The development version of **WRF-NMM with vortex-following one-way nesting** and GFS physics has run flawlessly on a 9-km grid throughout the 2005 hurricane season. Runs include all stages of storm evolution from initial formation to dissipation or extratropical transition. Solutions have been consistent with those from GFS and other hurricane models. Meanwhile, a **two-way interface** for moveable nested grids has been developed and is undergoing preliminary testing. Hurricane-WRF remains on track for operational implementation in 2007.
- **NCAR ARW for Hurricanes:** NCAR has been performing **real-time, convection-resolving hurricane simulations** this season using a moving nested-grid configuration of WRF-ARW with a 4-km inner mesh. Track and intensity predictions to +3-5 days for Hurricanes Katrina and Rita have been impressive. Forecasts can be viewed at http://wrf-model.org/plots/realtime_hurricane.php
- **Rapid Refresh WRF:** **Plans and schedule for development, testing and implementation** of Rapid Refresh (RR) WRF are being coordinated among Earth System Research Laboratory/Global Systems Division (ESRL/GSD)¹, NCEP/EMC, FAA/AWRP and DTC. Scheduling of work has conflicted with development and implementation of NAM WRF-NMM and RUC-13 (13-km Rapid Update Cycle), leading to possible delay of RR-WRF. Additional time is needed to develop capabilities to test and evaluate potential components for RR-WRF: dynamical cores, physics, etc. NCEP and DTC will assist GSD in development and testing of component software. RR-WRF will replace RUC for aviation interests and other customers interested in short-term NWP guidance.
- **GRIB2 for WRF:** A **GRIB2 implementation of WRF I/O API** for both input and output has been delivered by Todd Hutchison (WSI) and is being tested for inclusion in next release of WRF code. Adding GRIB2 capability to the I/O API will allow higher compression of WRF datasets in WMO-standard gridded-binary format that is favored by operational centers.
- **4th ESMF Community Meeting:** NCAR/MMM's Tom Henderson attended the ESMF community meeting at MIT on 20-21 July 2005. The meeting provided an opportunity to discuss WRF-ESMF integration activities, usability of ESMF, design of future ESMF modules, and WRF prototype coupling code.

4. WRF Management

- The next **meeting of the WRF Executive Oversight Board** is scheduled for January 5, 2005, at NCAR.

¹ ESRL/GSD was formerly known as FSL.

- **WRF - ESMF convergence:** Potential invitees to a technical workshop on merger (convergence) of the WRF and ESMF infrastructures are being collected. A charge has been written and supplemental documents collected to guide the workshop participants.
- **WRF Research Applications Board (WRAB):** The WRAB is preparing a **planning document** that identifies priority areas for future **WRF-related research and model enhancements** needed to accomplish that research. WRAB members have been tasked to summarize priority research needs in designated areas based on their expertise and have solicited input from appropriate working groups. The final report from the WRAB will become part of the **WRF Five-Year Plan** and will be posted on the WRF website to help guide development activities in the research community. The WRAB is also helping with planning for the next WRF Users Workshop, scheduled for June 2006.

5. DTC – OTC

- **Advisory Board:** The **first meeting** of the DTC Advisory Board was held on September 15, 2005, by telecon. The entire board was present on at least part of the call. Afterwards, the board provided the DTC with an **evaluation of proposed DTC activities** for FY06. This information has been compiled and is being used to craft the Boulder DTC operating plan for the coming year. All the data and conclusions will be shared with the Advisory Board.
- **Community Support:** The **first DTC WRF-NMM tutorial** was held 27-29 September in Boulder, with assistance of NCEP, NCAR/MMM and FSL. The class was full with 36 participants. Of these, 16 were from the university community, 14 from various government agencies, 4 from the private sector and 2 from foreign countries. Many more applications were received than could be accommodated and a second tutorial is being planned for January-February 2006, with a third expected sometime next summer.
- **COAMPS integration with WRF:** The **NRL-Monterey DTC** is continuing work to integrate **COAMPS physics into WRF, and WRF physics into COAMPS**, within a single physics driver that works in WRF and COAMPS dynamic cores. NRL-MRY DTC is also integrating **WRF I/O** into COAMPS to allow input/output to be compatible with WRF. Code to initialize WRF from COAMPS fields and to initialize COAMPS with WRF fields is nearly completed and will be provided to the Boulder DTC as WRF contributed code. Initial development is expected to be completed by end of CY05, with extensive testing beginning in CY06. User training on the WRF-COAMPS capabilities will be offered following testing of the I/O and interoperable physics software.

- **Terrain-Induced Rotor Experiment (TREX):** NRL-MRY DTC will participate in the spring 2006 TREX, running **near-real-time forecasts of COAMPS**.

6. WRF and COPC

- All sections of the **WRF Joint Implementation Plan** have been **completed**. The full document is being reviewed by the Joint Action Groups for Operational Community Modeling and for Central Communications Management, after which it will be delivered to COPC's Committee for Support and Backup (CSAB) for formal review and approval.

7. WRF and Air Quality Forecasting

- **CMAQ-WRF-NMM:** The meteorological driver for the operational air-quality forecast system developed by NOAA and EPA will **transition from Eta to WRF-NMM** in March 2006. A version of CMAQ-WRF has been developed and is now undergoing realtime and retrospective tests on the domain of the current CMAQ-Eta operational system, which covers the eastern two-thirds of the CONUS. A full-CONUS version of CMAQ-WRF is expected to become operational by June 2006.

8. WRF and Short-Range Ensemble Forecasting

- **Joint Ensemble Forecast System (JEFS):** FNMOC and AFWA are currently finalizing plans for the experimental JEFS. The plan will include a roadmap for exchanging datasets, testing global and regional perturbation techniques and running JEFS with WRF and COAMPS members. The ensemble would be merged into WRF over the next few years. A proposal is being prepared to the DoD High Performance Computing Modernization Office to expand computer resources at the joint OTC to support JEFS experimentation.
- **WRF in NCEP SREF:** NCEP has been testing an experimental 21-member SREF that includes six WRF members (three based on WRF-ARW and three based on WRF-NMM). The WRF members will supplement the existing 15 members of SREF based on Eta and the Regional Spectral Model (RSM). In development testing the six WRF members have made a substantial improvement in SREF RMSEs and ensemble mean scores. They have also improved the SREF system's "spread", i.e., ability to represent natural diversity.

Glossary of WRF Acronyms
6 June 2005

AFWA	Air Force Weather Agency
AIP	Agreement In Principle
AO	Announcement of Opportunity
ARL	Army Research Laboratory
AWRP	FAA's Aviation Weather Research Program
BAMEX	Bow Echo And MCV Experiment
COAMPS	Coupled Ocean-Atmosphere Mesoscale Prediction System™
COMET	Cooperative Program for Operational Meteorology, Education and Training
CONUS	CONTinental United States
COPC	Committee for Operational Processing Centers
DTC	Development Testbed Center
DWFE	DTC Winter Forecast Experiment
ESMF	Earth System Modeling Framework
ESRL	Earth System Research Laboratory
ExOB	Executive Oversight Board
FSL	Forecast Systems Laboratory
FTE	Full-Time Equivalent
FNMOCC	Fleet Numerical Meteorology and Oceanography Center
GFS	NCEP Global Forecast System
GSD	Global Systems Division of ESRL, formerly FSL
GSI	Gridpoint Statistical Interpolation
JCSDA	Joint Center for Satellite Data Assimilation
MCV	Mesoscale Convective Vortex
MMM	NCAR Mesoscale and Microscale Meteorology division
NAM	NCEP North American Mesoscale domain
NCAR	National Center for Atmospheric Research
NCEP	National Center for Environmental Predictions
NCOM	Navy Coupled Ocean Model
NOGAPS	Navy Operational Global Atmospheric Prediction System
NOAA	National Oceanic and Atmospheric Administration
NRL	Naval Research Laboratory
NSSL	National Severe Storms Laboratory
NWS	National Weather Service
OAR	NOAA/Office of Oceanic and Atmospheric Research
OST	NWS/Office of Science and Technology
OTC	Operational Testbed Center
POP	Princeton Ocean Prediction model
QPF	Quantitative Precipitation Forecast
RAMS	Colorado State University Regional Atmospheric Modeling System
RR	Rapid Refresh version of WRF
RUC	Rapid Update Cycle
RTVS	Real Time Verification System

SPC NCEP Storm Prediction Center
SREF Short Range Ensemble Forecast
TOR Terms of Reference
USWRP US Weather Research Program
WRF Weather Research and Forecast modeling system and program
WRF-ARW WRF Advanced Research WRF dynamical core
WJIP WRF Joint Implementation Plan of COPC
WRF-NMM WRF Nonhydrostatic Mesoscale Model dynamical core
WRF-SI WRF Standard Initialization