



SPoRT Quarterly
April – June 2008

The SPoRT REPORT

Short-term Prediction Research and Transition (SPoRT) Center
NASA Marshall Space Flight Center (MSFC), Huntsville, AL
<http://weather.msfc.nasa.gov/sport/>

The SPoRT Center is a NASA-funded project to transition unique observations and research capabilities to the operational community to improve short-term weather forecasts on a regional scale. While the direct beneficiaries of these activities are selected Weather Forecast Offices (WFOs) in the Southern Region, the research leading to the transitional activities benefits the broader scientific community.

Quarterly Highlights

Convective Weather Product Evaluation and Use for FAA Air Traffic Management in the New York Area

SPoRT has partnered with ENSCO and the Federal Aviation Administration (FAA) in the creation of an Enhanced Convective Forecast (ECF) product to demonstrate improved convective weather forecast capabilities for air traffic route planning over the New York region. The ECF product provides 2–12 hr convective forecast information to complement the Collaborative Convective Forecast Product (CCFP) now in use by the FAA. The CCFP is produced by the Aviation Weather Center (AWC) and provides 2–6 hr probabilistic forecast guidance for larger convective regions <<http://aviation-weather.gov/products/ccfp/>>. The ECF on the other hand is designed to provide guidance for scattered storms (below CCFP criteria), include more details on structure and orientation of convection,

and provide forecast guidance out to 12 hr. The product is currently being used in a test-bed mode by air traffic managers at the FAA Command Center, the New York Air Route Traffic Control Center (ARTCC), and the New York Terminal Radar Control Center (TRACON) as well as airlines with significant air traffic into and out of the New York area <<http://dist2.extremeforecasting.com/weather/tracon/main.jsp>>. SPoRT scientists are providing overall project management, guidance on the product development, and contributions to the product assessment and impact report. ENSCO forecasters in Florida are generating and distributing the ECF product during the summer experiment period.

The ECF product is generated using a variety of forecast and observational

data. A local application of the Weather Research and Forecasting (WRF) model specially tuned for forecasting convection is run in a nested grid configuration every 3 hr by ENSCO from 09 to 00Z. The inner 3-km grid is initialized with an ADAS “warm start” that includes level II radar data, a 2-km MODIS composite SST product produced by SPoRT (Haines et al. 2007), and a full suite of local observations. These convective forecasts are used as a starting point in the ECF product generation. Several other forecast models are examined including a version of the WRF run by the National Severe Storms Laboratory (NSSL). The NSSL WRF has performed especially well with convective events as demonstrated during the NSSL spring program. In the ECF product generation, ENSCO forecasters

anticipate the strength and coverage of convection by continuously monitoring convective guidance from these forecast models and a host of atmospheric parameters from observational data such as radiosondes, satellite imagery, and radar reflectivity. The figure below shows an example of the 6-hr ECF product and the verifying composite reflectivity data for July 13, 2008. Note the ECF identifies areas of convection that will significantly affect air traffic and does not try to forecast all precipitation identified in the radar image.

Haines, S. L., G. J. Jedlovec, and S. M. Lazarus, 2007: A MODIS Sea Surface Temperature Composite for Regional Applications. *Trans. Geosci. Rem. Sens.*, 45, No. 9, IEEE, 2919–2927.



ECF data



Composite data

Recent Accomplishments

Current activities continue to be focused on both research and transitional activities with WFOs. The items below present a snapshot of some of the active tasks.

AIRS Profile Assimilation and Forecast

The configuration of the WRF-Var assimilation system to replace the previous ADAS approach for AIRS data assimilation case study evaluation has been completed. A background error covariance required for the assimilation process was created using the WRF-Var “gen_be” program, which uses differences between multiple 12- and 24-hr forecasts to determine model forecast error. In our application, a 2-week period of WRF forecasts was used to generate the background error covariances. Since the AIRS over-land and over-water soundings have different error characteristics due to surface emissivity issues, the WRF-Var source code was modified to add different AIRS-Water and AIRS-Land datasets with observation errors based on estimates cited by AIRS Science Team. The assimilated AIRS profiles produced an analysis closer to in situ observations than the background field, which provided improved initial conditions and better forecasts when used to initialize a model forecast. Unlike the previous work with ADAS, the WRF-Var approach provides for a better balance between the mass and momentum fields in the initial state. A month-long series of 48-hr forecasts using the AIRS-enhanced initial conditions is currently being evaluated. The basic thermodynamic parameters from these forecasts will be verified against in situ observations. Additional sensible weather products will also be viewed for impact and assessment.

CloudSat Project Status

Recent work with CloudSat data has focused on in-depth analyses for case studies of cold-season midlatitude cyclones and frontal boundaries responsible for the production of snow in the central United

States. These phenomena are ideal candidates for CloudSat applications, as attenuation is less severe and there are opportunities for additional modeling comparisons to the observations of the NWS radar network. Preliminary results for a January 2008 case suggest that changes to the snow distribution parameters within a single-moment bulk water microphysics scheme may improve the match between modeled radar reflectivity and observations from either the CloudSat radar or terrestrial systems.

Collaboration With NSSL

Two SPoRT staff members, Brad Zavodsky and Andrew Molthan, assisted NSSL staff by providing forecast guidance and product evaluation at the National Weather Center during the Spring Program. Most of their time was spent evaluating the reliability and performance of high-resolution models for severe convective weather. Modeled cloud microphysical processes have a strong impact on the evolution of convective forecasts, and it is likely that changes evaluated from a CloudSat perspective (Molthan’s Ph.D. thesis) will also impact thunderstorm forecasts. Additionally, work by Jon Case using this operational configuration of the WRF for a severe weather case from March 2007 is being used to illustrate improvements in convective weather forecasts resulting from the new Goddard shortwave radiation scheme and the Land Information System (LIS). This collaboration and the dissemination of the NSSL forecasts to several WFOs for use as supplemental forecast guidance shows a clear pathway for research capabilities to operations.

Product Transition and Assessment

SPoRT has successfully transitioned the NESDIS GOES Aviation products that include icing, icing and cloud top height, low cloud base, and fog depth products to numerous WFOs in the Southern Region to address visibility restrictions resulting from fog and low clouds. A formal assessment period is plan for late summer when the

overnight occurrence of fog peaks at inland locations. SPoRT also has collaborated with the Cooperative Institute for Research in the Atmosphere (CIRA) to transition the total precipitable water (TPW) anomaly products to selected WFOs. To support these transitions, SPoRT has provided a new online survey and assessment page on the SPoRT Web site and has developed several additional training modules to be used with these products.

Enhanced Collaborations With Partner WFOs

To enhance collaborative interactions, SPoRT staff members have made several visits to partner WFOs. These visits allowed forecasters to learn more about SPoRT and to allow the forecasters to directly ask questions about NASA products. The trips were very successful, and forecasters had numerous recommendations for new products and training needs. Recent visits included NWS Southern Region Headquarters in Ft. Worth, Texas; Spaceflight Meteorology Group in Houston, Texas; and two WFOs in Texas: Corpus Christi and Houston. Visits to other offices are planned for the near future.

SPoRT Training Modules

SPoRT staff members continue to provide expertise on the use of unique NASA products through science sharing sessions at the Huntsville WFO. This activity allows SPoRT personnel to more closely interact with Huntsville forecasters and provide brief 10–15 min training on a specific SPoRT product. The program is designed to present several sessions in order to reach all of the forecasters during their shift work. Three new training modules have been developed and made available to end users. The GOES aviation product and CIRA TPW modules are directly applicable to SR WFOs. An enhanced convective forecast module developed for the SPoRT FAA collaboration provides a detailed explanation of the forecast product and impact on FAA air traffic management and planning.

North Alabama Lightning Mapping Array (NALMA)

The Nashville WFO is one of four partner WFOs using total lightning data from the NALMA in their AWIPS to monitor severe weather. Nashville is also using the 2-min data provided on the Internet in the office's situational awareness station. This is a multiscreen display where the office can show multiple products for all of the forecasters. In addition to providing situational awareness, this setup increases the forecaster's awareness of the NALMA data. SPoRT will follow-up on this with additional NALMA training. In May, the need arose for maintenance with several NALMA sensors. This maintenance work replaced several older hardware components and replaced hardware damaged by a recent lightning strike. These tasks were completed at the start of June and ensured the reception of high-quality data for dissemination to the WFOs. Since the upgrade, several early June events have been identified as potential training cases.

Peer-Reviewed Papers

Just Published

- Carrier, M.J., X. Zou, and W.M. Lapenta, 2008: Comparing the Vertical Structures of Weighting Functions and Adjoint Sensitivity of Radiance and Verifying Mesoscale Forecasts Using AIRS Radiance Observations. *Mon Wea. Rev.*, 136, 4, 1327–1348, April 2008.
- Jedlovec, G.J., and S.L. Haines, 2008: Spatial and Temporal Varying Thresholds for Cloud Detection in GOES Imagery. *IEEE Trans. Geo. Rem. Sens.*, 46, 6, 1705–1717, June 2008.
- LaCasse, K.M., M.E. Splitt, S.M. Lazarus, and W.M. Lapenta, 2007: The Impact of High Resolution Sea Surface Temperatures on the Simulated Nocturnal Florida Marine Boundary Layer, *Mon Wea. Rev.*, 136, 4, 1349–1372, April 2008.

Accepted

- Case, J.L., W.L. Crosson, S.V. Kumar, W.M. Lapenta, and C.D. Peters-Lidard, 2008: Impacts of high-resolution land surface initialization on regional sensible weather forecasts from the WRF model. Accepted for publication in *J. Hydrometeorology*.
- McCaul, E.W., Jr., S.J. Goodman, K.M. LaCasse, and D.J. Cecil, 2008: Forecasting Lightning Threat Using Cloud-resolving Model Simulations. Conditionally accepted by the *Monthly Weather Review*. The manuscript describes several approaches that can be used to provide quantitative forecast maps of the lightning threat within high-resolution model forecasts.

Conferences Papers/ Presentations

- Chou, Shih-Hung, Bradley Zavodsky, Gary Jedlovec and William Lapenta: Assimilation of Atmospheric InfraRed Sounder (AIRS) profiles using WRF-Var. 9th Annual WRF Users' Workshop, Boulder Colorado, June 23–27, 2008.
- Cisneros, G., Dembek, S.R., Dudhia, J., and Kain, J.S., 2008: Effect of non-IEEE-compliant optimization on WRF numerical results. 9th Annual WRF Users' Workshop. June 23–27, Boulder, CO.
- Molthan, A.L., J.L. Case, S.R. Dembek, G.J. Jedlovec and W.M. Lapenta, 2008: The Super Tuesday Outbreak: Forecast Sensitivities to Single-Moment Microphysics Schemes. Severe Local Storms Conference in Savannah, GA, October 27–31, 2008.

Proposals Submitted/Funded

(continued on page 4)

Proposals Submitted/Funded

- Integrated Modeling of Aerosol, Cloud, Precipitation and Land Processes at Satellite-Resolved Scales. A Proposal Submitted to NASA Solicitation NNH08ZDA001N-MAP, Modeling, Analysis, and Prediction. Co-PIs: Christa Peters-Lidard, Wei-Kuo Tao, and Mian Chin (Miller and Case Cols).
- Validating and Improving a Single-Moment Bulk Water Microphysics Scheme Using Observations from the CloudSat Cloud Profiling Radar. Student proposal (Andrew Molthan) submitted to the NASA Earth and Space Science Fellowship program, February, 2008—selected for funding (Dr. Walt Petersen, Advisor).

Visitors

- Dave Jones, StormCenter Communications, Inc.—demonstrate new TouchTable technology.
- Steven Lazarus from Florida Institute of Technology in Melbourne, FL briefing on his work and discuss opportunities for future collaborations with SPoRT.
- Junjie Liu, UC-Berkeley—presented seminar on data assimilation.
- Mr. Todd McNamara from the 45th Weather Squadron at Cape Canaveral Air Station, Florida visited the SPoRT Center.
- Leslie Miller—generate news clip on tornado damage tracks.
- Bill Proenza, NWS SR, SPoRT visit.
- Lars Peter Riishojgaard, JCSDA,—collaborative research discussions with SPoRT.
- Dr. Nick White—Director Science and Exploration Directorate—GSFC, learn about SPoRT.

External Meetings Attended

- Collaboration workshop, Atlantic Oceanographic and Meteorological Laboratories (AOML), April 8, Miami, FL.
- AIRS Science Team Meeting, April 15–17, Pasadena, CA.
- Enhanced SST Composite Program planning meeting, April 18, JPL, Pasadena, CA.
- 20th International Lightning Detection Conference, April 21–23; and the 2nd International Lightning Meteorology Conference, April 24–25, Tucson, AZ.
- NPOESS and GOES-R Training Development Workshop, May 13–16, Boulder, CO.
- WRF Users Workshop, June 23–27, Boulder, CO.

Calendar of Upcoming Events

- WFO visit to Melbourne: July 14–17 and NASA/KSC/Advanced Meteorology Unit (AMU).
- FAA TRACON Demonstration: June – August 2008.
- WFO visit to Birmingham, Nashville, and Knoxville: late August.
- Southern Region WFO Coordination Calls: July 10, August 7, September 4.
- AIRS Science Team Meeting, Greenbelt, MD: October 14–17, 2008.

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