



SPoRT Quarterly
July – September 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

SPoRT Strategic Plan

The SPoRT Science Advisory Committee (SAC) recently recommended that a strategic plan be developed to guide the project and to articulate its vision and mission to the external community. The SPoRT 2009–2014 Strategic Plan has been developed and is under review by the SAC. After approval, the plan will be released to the public. SPoRT strives to be an Agency focal point and facilitator for the transfer of NASA Earth science data and technologies to the operational weather community on a regional and local scale. To achieve this vision, the SPoRT program focuses on access to new data and technologies and developing and testing solutions to critical forecast problems. The solutions are then integrated into end user decision support tools. SPoRT will extend and enhance its current capabilities with MODIS, AMSR-E, AIRS, and total lightning measurements from ground-based networks at existing WFOs, and look to partner with other organizations and end users that have significant forecast needs that can be met by SPoRT objectives.

New areas of focus will include use of National Polar-orbiting Operational Environmental Satellite (NPOESS) data and the transition of products and capabilities to AWIPS II. Over the next few years, SPoRT will enhance partnerships with NOAA/NESDIS for new product development and data access to exploit the remote sensing capabilities of instruments on the NPOESS satellites to address short-term weather forecasting problems. The Visible/Infrared Imager/Radiometer Suite (VIIRS) and the Cross-track Infrared Sounder (CrIS) instruments on the NPOESS Preparatory Project (NPP) and follow-on NPOESS satellites provide similar observational capabilities to the MODIS and AIRS instruments on Terra and Aqua. The NWS is embarking on a new generation of information systems to aid forecasters in the development and dissemination of forecast products to the public. The next generation system, called AWIPS II, will be deployed beginning in the fall of 2009. The architecture will allow for more flexibility in the use of new datasets

and the enhanced visualization of data streams where the old system was too constraining. SPoRT will transition NASA and NPOESS observation capabilities to the AWIPS II environment to continue the continuity and growth of the transitional activities. Additionally, new display capabilities that better portray the four-dimensional variability of total lightning data will be developed and transition for use in AWIPS II. The SPoRT program will evolve to stay relevant to the changing needs of NASA's research objectives and forecast issues in the Earth and atmospheric science community. Most of the current end users reside at the NWS WFOs, but expansion to include other government and private sector end users is seen as a bridge between the Research and Analysis (R&A) program and Applied Sciences programs. SPoRT will also strengthen ties with NOAA NESDIS to transition new observational datasets into advanced decision-support tools.

SPoRT Biennial Report

Established in 2002 to demonstrate the weather and forecasting application of real-time Earth Observing System (EOS) measurements, the SPoRT project has grown to become an end-to-end research-to-operations activity focused on the use of advanced modeling and data assimilation techniques, nowcasting, and unique high-resolution multispectral observational data to improve short-term weather forecasts. SPoRT currently partners with several universities and other government agencies for access to real-time data and products and works collaboratively with them to develop new products and infuse these capabilities into the operational weather environment. While the majority of the SPoRT end users are forecasters at various National Weather Service (NWS) Weather Forecast Offices (WFOs) in the Southern Region (12 of the 13 offices), the inclusion of private sector users in SPoRT shows the relevance of NASA data and research capabilities to a broader segment of the weather community. In this way, SPoRT strives to be an Agency focal point and facilitator for the transfer of NASA Earth science data and technologies to the operational weather community on a regional and local scale. SPoRT has produced its first biennial report which describes current research and transition activities being conducted by the SPoRT project.

The report, published in even-numbered years opposite the SPoRT Science Advisory Committee (SAC) workshop, provides an update on ongoing activities in the area of short-term weather forecasting, data assimilation, and nowcasting, and highlights new products and capabilities transitioned to operational weather forecasting environment. The report also discusses other ongoing and new activities with collaborative partners started as a result of winning work through the NASA Research Opportunities in Space and Earth Sciences (ROSES) solicitation and other funding sources. The report also presents a listing of the SPoRT partners and the role they play in executing the SPoRT mission.

Contributions to the report come from the following staff members: Rich Blakeslee, Dennis Buechler, Jonathan Case, Shih-Hung Chou, Kevin Fuell, Stephanie Haines, Melody Herrmann, Gary Jedlovec, Frank LaFontaine, Wayne MacKenzie, Will McCarty, Bill McCaul, John Mecikalski, Andrew Molthan, Geoffrey Stano, and Brad Zavodsky. The report provides an update

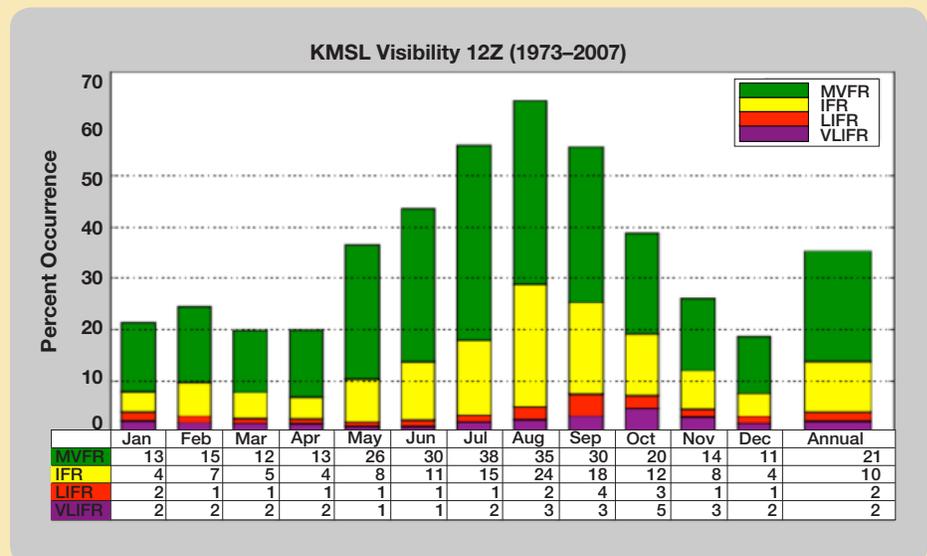
on activities since the last meeting of its Science Advisory Committee (SAC) in June 2007. While not all-inclusive of the SPoRT activities, it does provide an overview of the project. The report can be accessed from the SPoRT Web site. Printed copies can be obtained from the SPoRT project manager, Melody Herrmann (melody.herrmann@nasa.gov).

Assessments of GOES Aviation Products

Fog Depth Enhancement & Low Cloud Base

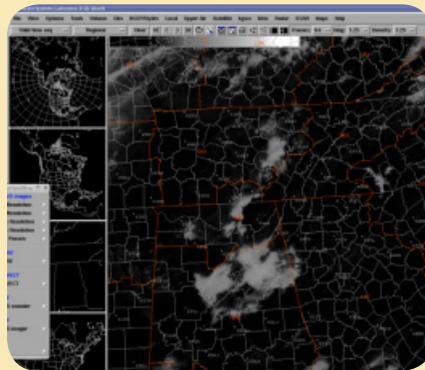
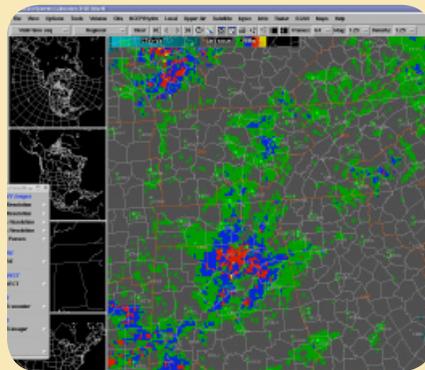
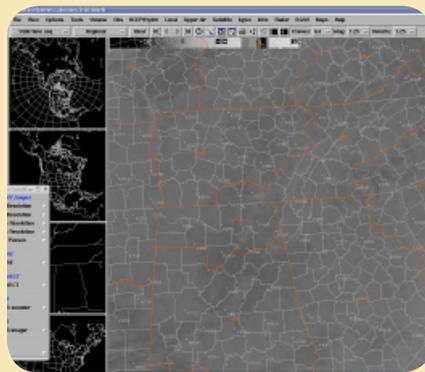
In spring of 2008, SPoRT began transitioning a set of GOES Aviation products to its partners in the NWS Southern Region. These NESDIS-created products were being tested with a few select offices prior to this wider implementation. In May of 2008, SPoRT developed a self-paced, web-based training module on the application of two of the products in the suite: the Fog Depth Enhancement and Low Cloud Base (LCB). With the data flowing and users primed with initial training, the time was right for an assessment of these products. SPoRT collaborated with each WFO to obtain climatological data showing the time of year when visibility restrictions are most prevalent at terminal aerodrome forecast TAF sites. For inland sites, the August and September months tended to have peaks in the occurrence of Instrument Flight Rules (IFR) and Low IFR (LIFR) conditions where visibility is less than three and one mile(s), respectively. For coastal WFOs in the southern U.S., the period of maximum occurrence of IFR and

Monthly climatology of the occurrence of aviation flight rule conditions based on a 25 year period for the Muscle Shoals (KMSL) location. Notice the peak in IFR conditions is in August, but the peak in LIFR conditions lags by a month. Fog is likely associated with all LIFR conditions and some IFR events.

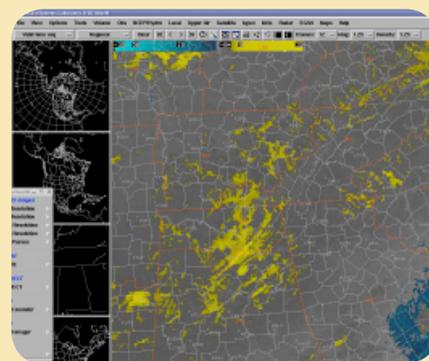


LIFR conditions tended to occur in the months of January, February, and March. We assumed that many of the IFR and nearly all of the LIFR events were due to fog and used these criteria to determine a common study period. The Huntsville, Birmingham, Nashville, and Knoxville WFOs were part of the initial intensive assessment period from August 25 to September 14, while the remaining coastal WFOs and the Albuquerque, New Mexico WFO are scheduled for a similar assessment from January 5–25, 2009. For the first assessment period, there were a number of fog events for forecasters to examine the utility of the Fog Depth and Low Cloud Base products. During the three week period, approximately 34 user surveys were submitted, and site visits by Geoffrey Stano and Kevin Fuell were made to Birmingham and Nashville. Knoxville was visited on September 15, just after the assessment period, as they tend to have more events of low and very low IFR conditions in September and October. Approximately one-third of the survey responses were positive, indicating that the areas of fog were easier to identify in terms of spatial coverage and depth using the GOES Fog Depth enhancement and the Low Cloud Base products. In certain cases, users indicated that TAF and/or short-term forecast statements were influenced by the use of these products. In addition, a case obtained from the Nashville site visit demonstrated that the maximum fog depth, and hence longest area of fog to “burn off,” was correctly identified by the product enhancement. Several WFOs experienced the limitation of using the infrared-based products when areas were obscured by mid- and upper-level cloud decks. Further limitations were seen at times in areas of either very narrow or very thin fog, and because of this limitation, the fog was sometimes reported by ASOS sites ahead of the products being identifying in the imagery. One potential resource,

already available to a few SPoRT partner WFOs, is the 1km resolution MODIS Fog product (i.e. 11-3.9 micron channel difference). While the MODIS product only provides a snapshot a few times at night, the higher resolution data provide more detail to the fog structure, identifies smaller regions of fog, and is used in a complementary nature to the GOES



September 7, 2008 case where fog developed in Tennessee Valley, middle Alabama, and up the Appellation chain. The upper image from AWIPS shows the 11-3.9 micron IR image, traditionally used for fog detection at night, while the middle image shows the same data with the NESDIS Fog Depth enhancement; both occurring at 1100 UTC. The lower visible image shows fog and clouds at 1445 UTC after sunrise. The areas shown by the middle image to have thicker fog (blue and red areas) correlate well with areas of fog in the visible image that have yet to “burn off.”



September 7, 2008 0717 UTC (2:17 AM Central Time). MODIS 1km imagery of the 11-3.9 micron channel difference (i.e. Fog Product) as seen in AWIPS. Yellow areas indicate fog and low stratus. Blue areas are higher cirrus-type cloud cover that blocks the view of low-level cloud features. Narrow areas of fog in valleys and low lying river areas are better defined than in the GOES Aviation Fog Depth product.

products. Several user surveys during the study period indicated an interest in applying the NESDIS Fog Depth enhancement to higher resolution MODIS data from NASA’s Aqua and Terra satellites. This MODIS product will soon be transitioned to all SPoRT WFO partners as part of a wider evaluation of its value in conjunction with the higher temporal GOES Aviation products. Users at Birmingham commented that they would like to see the Low Cloud Base product have further delineation of cloud bases at 250, 500, and 750 ft as opposed to simply a single category of <1000 ft. This would better serve their needs in terms of the various flight rule categories (i.e. IFR, LIFR, & VLIFR). Forecasters at Knoxville provided consistent and quality feedback that included requests to make both products 15-minutes in frequency (the LCB is hourly vs. the 15-minute Fog Depth) and then combine them into a single product in some form. A more formal report of this fall 2008 assessment period with example imagery will be available for NWS users and NESDIS product developers on the SPoRT website. Preparations for the January 2009 assessment period are ongoing with lessons learned from the first study period, and another report will follow.

Project Updates:

Recent Accomplishments:

Microphysics Adjustments in WRF using CloudSat: Based on some initial case study results and discussions with Dr. Toshi Matsui of NASA GSFC, work continues on the implementation of a temperature-based parameterization for the snow crystal size distribution within the NASA Goddard microphysics scheme. This parameterization is based on the combined results of several field campaigns, as described by Ryan (2000). Code adjustments have been implemented within the NASA GSFC scheme and are being tested for stability through a variety of simple, idealized simulations, and some sensitivity calculations to determine how this change affects simulated microphysical processes. Initial work towards real data simulations on a large domain began in late September. In addition, data from the Canadian CloudSat/CALIPSO Verification Project (C3VP) are being investigated to acquire higher quality data for possible verification of model improvements, as detailed cloud and surface observations are otherwise uncommon.

Evaluation of the MODIS False Color product with WFO Great Falls, Montana

An AMS preprint and poster presentation was developed with the Great Falls, Montana WFO, in collaboration with Service Hydrologist Gina Loss. Over the last several winter and spring seasons, Great Falls WFO has evaluated the utility of the MODIS False Color Composite developed by NASA/SPoRT, which emphasizes the difference between clouds, clear ground, and snow/ice-covered ground. Feedback from the WFO indicates that the MODIS data provided a more complete overview of the extent of snow cover and retreat than by relying on visible imagery and/or sparse, point observations of snow depth. This has been particularly useful in monitoring snow cover changes for the low-population-density regions that lack regular human reporting. Combined with observed snow depths, this product helped forecasters focus on areas of concern where a quick snow melt may result in flooding. Loss indicated that she has been able to give county emergency managers greater lead time (i.e. several days) in preparation for flooding events by

monitoring the trends in snow/ice cover seen in the MODIS False Color imagery. Additionally, ice jams in rivers have been more easily anticipated and monitored. The value of this product in operations has been presented at the Western Region's Great Divide Workshop and will be presented again at the upcoming 89th American Meteorological Society meeting in Phoenix.

LIS/WRF Studies and NSSL Collaboration

Jonathan Case revised the page proofs for the American Meteorological Society (AMS) *Journal of Hydrometeorology* manuscript on the Land Information System (LIS)/Weather Research and Forecasting (WRF) model study over Florida during May 2004. The manuscript is available online as an early online release at <http://ams.allenpress.com/perlserv/?request=get-abstract&doi=10.1175%2F2008JHM990.1&ct=1> and will be published in one of the upcoming monthly issues of the *Journal of Hydrometeorology*. Case and Scott Dembek also co-authored an invited paper for the AMS 24th Conference on Severe Local Storms to be held in Savannah, GA October 27–31, entitled “Severe-weather Forecast Guidance from the First Generation of Large Domain Convection-allowing Models: Challenges and Opportunities.” Finally, Case and Gary Jedlovec submitted an abstract that was accepted for oral presentation at the upcoming 2009 AMS annual meeting, entitled “Examining the Impacts of High-Resolution Land Surface Initialization on Model Predictions of Convection in the Southeastern U.S.”

Lightning Forecasting

During the third quarter of 2008, SPoRT Lightning Forecasting researchers, led by Eugene McCaul, received reviews of their full-length article entitled “Forecasting Lightning Threat Using Cloud-resolving Model Simulations.” The manuscript was categorized by *Weather and Forecasting* as acceptable, pending revisions. The authors have completed the revisions and replies to reviewers. The team also resumed simulation work with WRF, with several new cases being considered for study.

SPoRT Visits WFO Partners

The SPoRT Center has continued its work from the previous quarter in visiting several partner National Weather Service Forecast Offices. The importance of these visits

cannot be overstated as the visits help foster collaboration by developing advocates within each office, letting forecasters meet SPoRT personnel and learn about the SPoRT program, and providing science-sharing to the forecasters. SPoRT was able to visit the Melbourne Weather Forecast Office (WFO), as well as the Applied Meteorology Unit at the Kennedy Space Center. Additionally, with their proximity, the 45th Weather Squadron was visited; reciprocating a visit by Mr. Todd McNamara in June. The primary discussion was a science-sharing session with all parties, discussing the uses of total lightning data in operational forecasting. While the Kennedy Space Center is far outside the range of the North Alabama Lightning Mapping Array, these groups do have access to the Lightning Detection and Ranging (LDAR II) network that provides similar data to the Space Coast. Other discussions focused on other SPoRT products, such as the Sea Surface Temperature Composite and potential model initialization fields. The face-to-face conversations were educational to SPoRT, as well, with the Melbourne Internet Technologies Officer providing valuable information to provide improved instructions for ingesting MODIS data by other SPoRT partners.

In early September, the SPoRT liaisons had the opportunity to see a great deal of the countryside with visits to the offices in Birmingham, Nashville, and Morristown, Tennessee. Each trip provided a day for continuous interaction between SPoRT and the National Weather Service's forecasters. Several collaborative items were accomplished. First, SPoRT provided an overview of the program, as well as science-sharing sessions in the use of the North Alabama Lightning Mapping Array and the GOES Aviation Fog products. The timing was particularly useful for the later, as an intensive evaluation period had begun. Secondly, the subsequent discussions provided a great deal of feedback. This ranged from explaining scenarios where the Fog Depth product was difficult to use, such as with low stratus clouds, to suggested improvements, such as combining the Fog Depth and Low Cloud Base products into one. The talks also included how to best incorporate polar orbiting MODIS data into operational forecasting. The MODIS high-resolution, spectral-differencing product was recommended as a way to get a snapshot of fog activity,

particularly in valley regions. A unique use was proposed by the Morristown WFO that uses the Land Surface Temperature product to contrast the temperature of several bodies of water in their county warning area versus the surrounding land. Several terminal aerodrome forecast sites for Morristown are closely located to bodies of water, which heavily influence fog locally. Finally, the visits were an excellent opportunity to see, in person, the SPoRT products on our partner's AWIPS workstations. This allowed SPoRT the chance to identify a few problems and provide corrections, including fixed color curves and troubleshooting data-ingest problems.

SPoRT Website Update

The SPoRT website is undergoing major changes to its content and format. For the last three months, significant work has been done to rework the scripts that collect the various operational and research products for display on the website. In addition, SPoRT team members have contributed detailed write-ups of the projects that they are responsible for producing. The new Web site format organizes each SPoRT product based on instrument and provides easy access to real-time data and descriptions of each product. The new SPoRT Web site is scheduled to be launched in mid-November.

WRF/SST collaborative work with NWS Miami, FL

Jonathan Case and Kevin Fuell continued collaborating with the Florida Institute of Technology on results from the WRF modeling sensitivity study over NWS Miami's south Florida domain from February to August 2007. Case prepared a draft instruction document on how to obtain and use the SPoRT MODIS SSTs for initializing the WRF model in the Environmental Modeling System (EMS) software. They also submitted an abstract that was accepted for oral presentation at the upcoming 2009 AMS annual meeting, titled "Impact of Lake Okeechobee Sea Surface Temperatures on Numerical Predictions of Summertime Convective Systems over South Florida." This paper topic came about based upon preliminary results seen in May 2007 of large diurnal variations (up to 8°C) in SST over Lake Okeechobee.

Upcoming Activities

WRF model and LIS land surface study

Jonathan Case will configure and run LIS sensitivity studies using the WRF model and LIS land surface initialization datasets for examining convective cases from summer 2008 over the Mobile, AL and Miami, FL forecast domains. The SPoRT team will transition the MODIS SST composites into operations on a trial basis at the NWS Miami, FL and Mobile, AL weather forecast offices, for use in initializing their local WRF Environmental Modeling System (EMS) predictions. Finally, conference papers and presentations will be prepared for the upcoming annual meeting in Phoenix, AZ in early January 2009.

Related Activities

Convective weather products for TRACON advanced weather forecasting (FAA task)

During this past summer SPoRT partnered with the Earth Systems Research Lab (ESRL), ENSCO, and AvMet in the generation and validation of an enhanced convective forecast product for use by the FAA in the New York air traffic control region. Included were products generated at NSSL using their daily 4 km resolution convection-allowing WRF forecast. The summer experiment phase is over, and SPoRT continues to work collaboratively with ESRL in Boulder, CO on validation of the results. A final report and recommendations to the FAA will be produced later this year.

Daily chlorophyll composites for coastal applications

This work, funded under a Rapid Prototype Capability (RPC) activity by NASA's Applied Science program, is adapting the SPoRT composite SST product methodology for chlorophyll. WorldWinds, Inc. has the algorithm running and will be serving the data to the community in the near future.

Enhanced composite SST product

We have adapted the SPoRT SST compositing methodology to the JPL Physical Oceanography DAAC data stream. This will allow for a direct comparison to our in-house product production and access to a more comprehensive near-real-time data base, containing better cloud masking

and error information. Near-future work will combine the AMSR-E SST values in the compositing product including bias correction and error weight (by latency) information.

NASA products to enhance energy utility load forecasting

Gary Jedlovec attended the project kickoff meeting at Ventyx in Atlanta in September. This project funded under ROSES07 is lead by Battelle and Ventyx with collaboration from SPoRT. Ventyx provides software to utilities to predict energy load requirements based on surface weather observations. SPoRT is providing additional surface weather information from the SPoRT/NSSL WRF daily model runs produced at the NSSL for four utility coverage regions. This unique weather information will drive the energy load model run by various utility companies.

Recent Publications and Presentations

Conferences papers/presentations

Case, J.L., S.R. Dembek, J.S. Kain, S.V. Kumar, T. Matsui, J.J. Shi, W.M. Lapenta, and W-K. Tao, 2008: "A Sensitivity Study of the Operational NSSL WRF Using Unique NASA assets." Preprints, 9th Annual WRF Users' Workshop, Boulder, CO, National Center for Atmospheric Research, P9.4. Available online at <<http://www.mmm.ucar.edu/wrf/users/workshops/WS2008/abstracts/P9-04.pdf>>.

Gina Loss (NWS), David Bernhardt (NWS), Kevin Fuell, Geoffrey Stano: "Monitoring Snowfall and River Ice with the MODIS False Color Composite. NOAA/NWS 12th Annual Great Divide Workshop in Billings, MT, October 7-9, 2008.

Presentations

The WRF lightning forecasting work was presented at a meeting of the Global Lightning Mapper research assessment team in Huntsville, AL on September 29, 2008. At the meeting, there was interest in applying WRF lightning threat forecast methods to a large full-disk WRF simulation conducted by CIMSS researchers. Efforts are underway to determine if it is feasible to provide assistance to the CIMSS team, although the amount of work required and the level of available funding make the collaboration uncertain.

Proposals submitted

SPoRT is a Co-Investigator on a proposal submitted by Storm Center, Inc. (Dave Jones) entitled: "Extending AWIPS II Visualization and Collaboration Capabilities for Enhanced Decision Making Using NASA Data within NOAA NWS and FEMA," submitted to ROSES08. SPoRT's role is to facilitate the transition of products to end users in the Touch Table Decision Tool.

Members of the SPoRT Lightning Group submitted a proposal entitled "Transition Total Lightning Measurements to AWIPS II" to ROSES08. The proposal seeks to transition total lightning products into AWIPS II.

Recent Events

Dr. Bill Lapenta leaves SPoRT for position at NCEP—Dr. William (Bill) Lapenta, SPoRT Co-Investigator and modeling and data assimilation lead for SPoRT, has left NASA to take a position at NOAA/Environmental Modeling Center (EMC). Lapenta was very instrumental in integrating short-term weather forecasting capabilities in the initial SPoRT concept and has led the modeling and data assimilation activities in SPoRT for the last six years. Lapenta's work with SPoRT focused on assimilating satellite observations in regional weather forecast models which has led to several important papers on the subject. In his new role as deputy director of the Environmental Modeling Center (EMC), Lapenta will continue to influence the direction of operational weather forecasting at the regional and global scales.

UAH graduate student becomes NASA co-op student

—Andrew Molthan, SPoRT Ph.D. student and NASA Earth and Space Science Fellowship (NESSF) recipient, has accepted a position in the NASA/MSFC Earth Science Office as a NASA co-operative education student. The position will allow Molthan to continue his Ph.D. studies while working more closely with NASA scientists on a number of weather related problems. Molthan brings significant remote sensing and modeling expertise to NASA including the use of the CloudSat simulator to evaluate cloud parameterizations in the WRF model. Molthan expects to finish his Ph.D. in December of 2009.

UAH graduate student receives his degree

—Will McCarty, UAH graduate student and NASA Earth and Space Science Fellowship (NESSF) recipient, successfully defended his dissertation and completed all of his degree requirements leading to the awarding of his Ph.D. in atmospheric science from UAH. His dissertation work on "The Impact of the Assimilation of AIRS Radiance Measurements on Short-term Weather Forecasts" was presented in an open forum at a recent NSSTC seminar. McCarty is preparing the results of two components of his research for publication in various scientific journals. Will is currently continuing his data assimilation work for SPoRT as a UAH research scientist.

Visitors

- **Celeste Jarvis, Michael Walker**—GST—explore possible collaboration opportunities with SPoRT
- **Steve Goodman**—discuss GOES-R proving Ground activities with SPoRT
- **Toshi Matsui**—participate in the NSSTC seminar series and install the satellite simulator software
- **Jacklyn Shafer**—Florida Institute of Technology—to learn more about SPoRT and share work done in tropical product evaluation

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Huntsville, AL 35812
www.nasa.gov/marshall

www.nasa.gov

Calendar of Upcoming Events

- 33rd NWA Annual Meeting, Louisville, KY: October 14–17, 2008
- AIRS Science Team Meeting, Greenbelt, MD: October 14–17, 2008
- Southern Region WFO Coordination Calls: October 23, December 18
- AMS 24th Conference on Severe Local Storms, Savannah, GA: October 27–31, 2008
- AGU Fall Meeting, San Francisco, CA: December 8–12, 2008
- AMS 89th Annual Meeting, Phoenix, AZ: January 11–15, 2009