

SPoRT Report



Science Mission Directorate
National Aeronautics and Space Administration

Short-term Prediction and Research 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

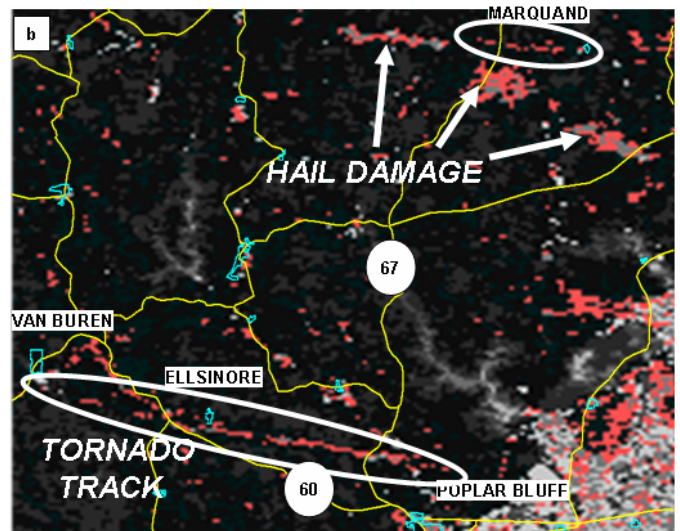
Detection of Storm Damage Tracks with MODIS and ASTER Data

The continental United States experiences hundreds of hail and tornadic storms every year. On average, tornadic storms alone are responsible for \$420 million in damage and 70 deaths annually¹. In addition to issuing severe weather watches and warnings, the National Weather Service (NWS) is also responsible for conducting surveys of damage caused by these storms. The damage surveys, which include ground and occasionally aerial observations, are used to document the location of wind and hail damage and to estimate tornado intensity and document storm damage tracks. However, damage surveys are inevitably incomplete and high resolution satellite data can be used to fill in gaps in storm damage reports.

A paper which appeared in print this quarter entitled "Detection of Storm Damage

1. Statistics based on Brooks, H. E., and C. A. Doswell III, 2001: Normalized damage from major tornadoes in United States: 1890-1999. *Wea. Forecasting*, **16**, 168-176, and Brooks H. E., and C. A. Doswell III, 2002: Deaths in the 3 May 1999 Oklahoma City tornadoes from a historical perspective. *Wea. Forecasting*, **17**, 354-361.

Tracks with EOS Data" describes analysis and display techniques used with high resolution MODIS, ASTER, and Landsat data to demonstrate the surface mapping capabilities of these instruments and their ability to provide complementary information for storm damage surveys. The case studies investigated include damage tracks from three tornadic storms; the La Plata, Maryland storm of 28 April 2002 and the Ellsinore and Marquand, Missouri storms of 24 April 2002 as well as a large hail damage region. These storms varied in intensity and occurred over regions with significantly different land cover. It was found that, depending on the nature of land cover, tornado damage tracks from intense storms (F1 or greater) and hail storms may be evident in the satellite imagery.



Unsupervised classification of May 14 2002 MODIS channel 2 and channel 6 imagery highlighting hail and tornado damage regions in southeast

In areas where the land cover is dominated by forests, the scar patterns show up very clearly, while in areas of grassland and regions with few

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trees, scar patterns are not as obvious or may not be seen at all in the satellite imagery.

Several NWS forecast offices currently have real time access to these unique NASA satellite measurements as part of the Short-term Prediction and Research Transition (SPoRT) program. Similar instrumentation on future NOAA operational satellite systems will provide this capability to all forecast offices. The article by SPoRT scientists Gary Jedlovec and Stephanie Haines and UAH collaborator Udaysankar Nair was published in *Weather and Forecasting*, Volume 21, pages 249–267.

Lightning Imaging Sensor International Workshop

The Lightning Imaging Sensor (LIS) science team and a number of National Space Science and Technology Center (NSSTC) resident scientists including Principal Investigator Dr. Hugh Christian/UAH participated in the LIS International Workshop held at the NSSTC on 9/11/06 - 9/14/06. Approximately 40 researchers attended this workshop to celebrate 11 successful years of NASA satellite lightning observations and learn more about the data, which has already been distributed to nearly 300 researchers in 27 countries.

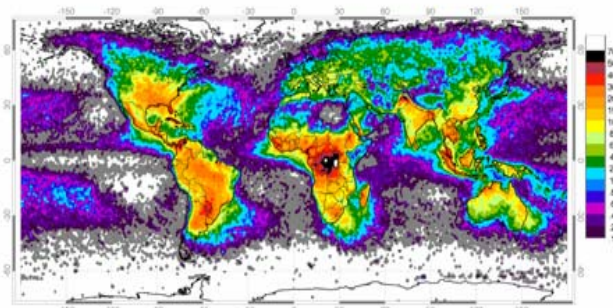
During the workshop, an announcement was sent to the international science community announcing the availability of a newly reprocessed 11-year combined LIS and Optical Transient Detector (OTD) global dataset. Attendees reviewed past research results from the LIS mission science data and discussed future scientific collaborations. Steve Goodman

reported on the Tropical Rainfall Measuring Mission (TRMM) lightning and precipitation observations that have confirmed the existence of a robust relationship between lightning flash rates and the amount of large precipitating ice hydrometeors in storms. This relationship is now being exploited, in conjunction with the capabilities of the Weather Research and Forecast (WRF) model, to forecast the threat of lightning from convective storms using the output fields from the model forecasts. A keynote address was presented by Dr. Jack Kaye, NASA HQ Associate Director for Research in the Earth Science Division.

NASA/NWS Sponsor SOO Workshop

The NASA SPoRT Center and the National Weather Service Southern Region Headquarters Scientific Services Division held a joint workshop in July that brought together NASA Earth scientists and NWS Science and Operations Officers (SOO) to share ideas related to the transition of research based products to NOAA field operations. The workshop attracted more than 80 participants including SOO's from 32 NWS Forecast Offices across 10 states and the Commonwealth of Puerto Rico. Opening remarks were provided by Mr. Bill Proenza, Director of the NWS Southern Region Headquarters and Dr. Tsengdar Lee, Program Manager for NASA High-End Computing from NASA Headquarters.

Talks, posters and breakout sessions during the two and a half day workshop fostered discussion on effective strategies to evaluate the impact of new and existing NASA observing systems and modeling capabilities on short-term prediction and the warning decision making process within the NWS Forecast Offices. A session on Collaborative Opportunities and Emerging Technologies focused on the use of current NASA research results from MODIS and AIRS with future expectations from NPP and NPOESS. A session on High Impact Weather provided presentations on the use of the North Alabama Lightning Mapping Array in the NWS Forecast Office environment to aid in the severe weather warning process and the extension of the activity to the Washington DC area. A session on Local Modeling covered the use of



Mean Annual Global Flash Density (fl/km²yr)

Eleven year global climatology of lightning data from the Lightning Imaging Sensor (LIS).

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AIRS temperature and moisture profiles in a regional assimilation system developed around the Weather Research and Forecast (WRF) model and the planned use of the NASA Land Information System designed to improve the simulation of land surface forcing within WRF.

An outcome of the workshop was a clear interest for expansion of interactions between SPoRT and Forecast Offices across the NWS Southern Region. Therefore, SPoRT management and NWS SSD have an action to develop a structured approach to project prioritization to maximize the return on investment. A modeling project between SPoRT and the Miami WFO is a candidate to test the new procedure later this fall. The workshop agenda and presentations are on the SPoRT web page at under "Meetings".

Summer Collaboration with JCSDA

Mr. Will McCarty (UAH Ph.D. student working under Dr. Gary Jedlovec) spent the summer at the Joint Center for Satellite Data Assimilation (JCSDA) to assist in the development of data assimilation techniques for AIRS radiance data. At the JCSDA, he implemented a cloud detection algorithm (developed as part of his Ph.D. research under the NASA Earth Science Fellowship Program) in the NCEP 3d-variational Gridpoint Statistical Interpolator (GSI). He also integrated a version of the CO2 slicing technique for cloud detection and height assignment in the GSI. Testing of the GSI which includes his code modifications is being conducted remotely from the SPoRT Center.

DC Lightning Mapping Demonstration supporting GOES-R GLM Risk Reduction data

In support of GOES-R Geostationary Lightning Mapper (GLM) risk reduction, Steve Goodman and Richard Blakeslee are collaborating with Paul Krehbiel of New Mexico Tech, the NWS Forecast Office in Sterling, VA, and the Office of Science and Technology, Meteorological Development Lab, to deploy a portable VHF lightning mapping array in the DC Metropolitan area to examine thunderstorms and develop techniques to improve the warning lead

time for severe and tornadic storms. The network was first installed in May and eight stations are operational as of October, with sites being provided by local universities. The system is similar to the one deployed in North Alabama to support TRMM LIS validation.

Recent Accomplishments

- **GOES aviation products to HUN/WFO** (Jedlovec / Haines) - NESDIS hourly GOES aviation products are being provided to the Huntsville WFO in AWIPS for evaluation. These products will be transferred to the other Southern Region WFOs later this year.
- **WRF/LIS development** (Lapenta / Case) - Developmental work continues with the GSFC Land Information System (LIS) to determine the appropriate spin-up time for soil moisture / temperature initialization using a 1-km resolution domain over the Florida peninsula.
- **AIRS data assimilation in WRF** (Chou / Zavodsky) - The analysis of forecasts with and without AIRS profile information for the November 20-22, 2005 case study continues. Preliminary results show significant impact on the WRF precipitation forecasts by carefully including only the highest quality profile information.
- **AIRS radiance data assimilation** (Jedlovec / McCarty) - The GSI has been run on the regional scale using provided test case with and without AIRS radiance data assimilation techniques. Analysis of the results continues.
- **WRF support to NAMMA** (Lapenta / Case) - WRF simulations for a NAMMA domain have been run with and without high resolution SST data. Results are available at: <http://namma.nsstc.nasa.gov/>
- **Broader dissemination of SPoRT products** (Jedlovec / Burks / Haines) - An implementation strategy has been developed to dissemination selected SPoRT products to other WFOs in the Southern Region. This plan has been coordinated with the Scientific Services Division (SSD) of the Southern Region.
- **WRF lightning forecasts** (Goodman / McCaul / LaCasse) - The North Alabama LMA set is providing validation ground-truth analyses for

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case studies supporting the WRF lightning threat forecast product. Development and testing of statistical software to analyze correlations between LMA fields and WRF lightning proxy fields continues with WRF runs for 9 cases (both with and without reflectivity).

Publications and Presentations

Peer-reviewed

- Jedlovec, G. J., U. Nair, and S. L. Haines, 2006: Detection of Storm Damage Tracks with EOS Data," *Weather and Forecasting*, **21**, 249–267.
- Carrier, M., X. Zou, and W. M. Lapenta, 2007: Identifying Cloud-uncontaminated AIRS Spectra from Cloudy FOV Based on Cloud Top Pressure and Weighting Functions. Accepted for publication in *Mon. Wea. Rev.*

Conferences

- Jedlovec, G., S. Goodman, M. Goodman, and B. Lapenta, 2006: Use of Earth Observing System Data in Weather Forecasting. IEEE Geosciences and Remote Sensing Society (IGARSS) 2006, Session 082 - Integrated Earth Observations for GEOSS Societal Benefit, Denver.
- McCaul, Jr., E. W., K. LaCasse, S. J. Goodman, and D. Cecil, 2006: Use of high-resolution WRF simulations to forecast lightning threat. 23rd Conference on Severe Local Storms, St Louis, AMS, CDROM.

Presentations

- Jedlovec, G. - NASA Products to Improve NWS Warnings and Forecasts. Southeast Weather Partners Workshop, October 4, Huntsville, Alabama.
- McCarty, W. - AIRS Data Assimilation at the SPoRT Center, AIRS Science Team Meeting, September 26-29, 2006, Greenbelt, MD.
- Zavodsky, B. - An update on regional profile assimilation and near-real time modeling plans. AIRS Science Team Meeting, September 26-29, 2006, Greenbelt, MD.

SPoRT Team Member Highlight

Mr. Jon Case (Senior Scientist / Meteorologist with ENSCO) has relocated and joined the SPoRT team to assist in the development of SPoRT modeling activities using the Weather Research and Forecasting (WRF) model. Jon has over 10 years of practical and professional experience in meteorology from his work with the

Applied Meteorology Unit (AMU) for NASA's Spaceflight program at KSC. He has a diverse technical background which includes technology transition, data assimilation and NWP, synoptic and meso-meteorological analysis, statistics, and coast processes. Jon is currently working on implementing a version of the NASA/GSFC Land Information System (LIS) for SPoRT/WRF applications.

Visitors

- Dr. Valentine Ananthara - Mississippi State University - to explore possible SPoRT collaborations with MSU's RPC
- Mr. John Haynes - Applied Sciences Division Program Manager, NASA Headquarters - SPoRT / SOO Workshop
- Dr. Jack Kaye - Director Research Division, NASA Headquarters - LIS Workshop and SPoRT update
- Dr. Tsengdar Lee - Science Research Division Program Manager, NASA Headquarters - SPoRT / SOO Workshop
- Mr. Tom Mango - Colsa - Huntsville, AL - explore company synergy with SPoRT activities
- Mr. Bill Proenza - Director, NWS Southern Region Office - SPoRT / SOO Workshop
- Dr. Michele Rienecker - NASA/GSFC - explore collaborative modeling activities

Calendar of Events

- **October 31, 2006** - JSC Weather USers Forum - Houston, Texas.
- **November 6-10, 2007** - St Louis, MO. -- 23rd Conference on Severe Local Storms- lightning forecast presentation
- **December 11-15, 2006** – San Francisco, CA. -- Fall Meeting of the American Geophysical Union- DC Metro Lighting Mapping Array demonstration first results
- **January 14-19, 2007** - San Antonio, Texas. -- AMS Annual Meeting and associated conferences - various SPoRT presentations

SPoRT Points of Contact

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