National Aeronautics and Space Administration

SPoRT Quarterly
October–December 2010

The SPoRT REPORT

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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

WindSat Ocean Surface Wind Vectors to AWIPS for NWS

While the direct measurement of ocean surface winds from buoys are relatively scarce, ocean surface wind vectors inferred from scatterometers (ASCAT and SeaWinds) onboard European (METOP) and NASA QuikSCAT polar orbiting satellite platforms provide global, twice daily, measurements of ocean surface wind vectors under nonprecipitating conditions to address various tropical and marine weather forecast issues. Surface wind observations over the oceans are an important parameter to NOAA for diagnostic analysis and short-term marine weather forecast at various NWS WFOs and for assimilation into weather forecast models at various forecast centers (Bi, et al., 2010). The failure of the SeaWinds instrument on the QuikSCAT satellite in November of 2009 significantly reduced the coverage of wind measurements over the ocean. At the recent Satellite Meteorology and Oceanography conference in Annapolis, MD (September 27–30, 2010), scientists at the Naval Research Lab (NRL) in Monterey demonstrated improved retrieval accuracy of ocean surface wind vectors from multifrequency – dual polarized passive radiometer measurements from the Department of Defense (DoD) WindSat instrument on the Coriolis satellite (Gaiser, 2004) over previous algorithms (Bettenhausen et al., 2010; Bettenhausen, et al., 2006). These studies applied new and refined retrieval techniques to the WindSat data, producing ocean surface wind vectors with an accuracy of ±2 m/s and ±20 degrees. At the meeting, NOAA approached SPoRT for help transitioning these experimental WindSat ocean surface wind vectors to the National Weather Service for testing and use in their Advanced Weather Information Processing System (AWIPS) – the main visualization and decision support system at all weather service offices. SPoRT scientist Matt Smith and NWS Applications Integration Meteorologist (AIM) Brian Carcione (of the Huntsville WFO) explored potential ways to ingest this data. Since AWIPS had previously been used to display QuikSCAT data, WindSat data files were obtained from NRL and reformatted into the QuikSCAT data format for dissemination and display in AWIPS. SPoRT has recently demonstrated this ingest and display capability for WindSat data in the Alaska Region WFOs, who are now in the process of evaluating its quality before the real-time data is more broadly disseminated.

Bettenhausen, M.H., I.S. Adams, and P. W. Gaiser, 2010: A parameterized forward model for WindSat ocean vector

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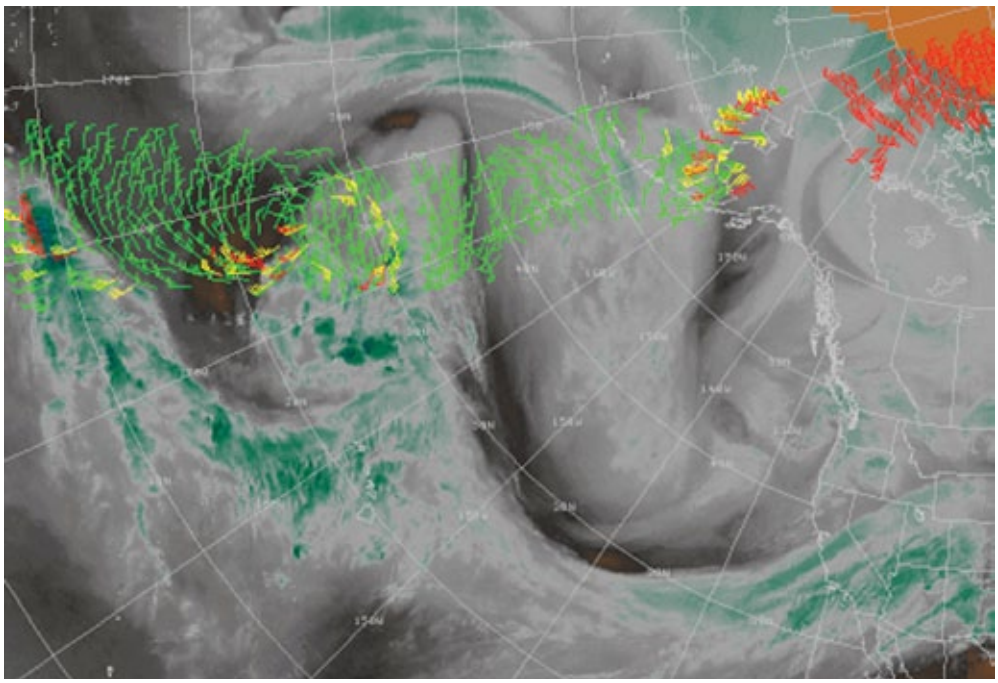
wind retrievals. Presentation 6.4, 17th Conference on Satellite Meteorology and Oceanography, AMS, Annapolis, MD.

Bettenhausen, M.H., C.K. Smith, R. M. Bevilacqua, N.-Y. Wang, P.W. Gaiser, and S. Cox, 2006: A nonlinear optimization algorithm for WindSat wind vector retrievals. IEEE Trans. Geosci. Remote Sens.,44, 597–608.

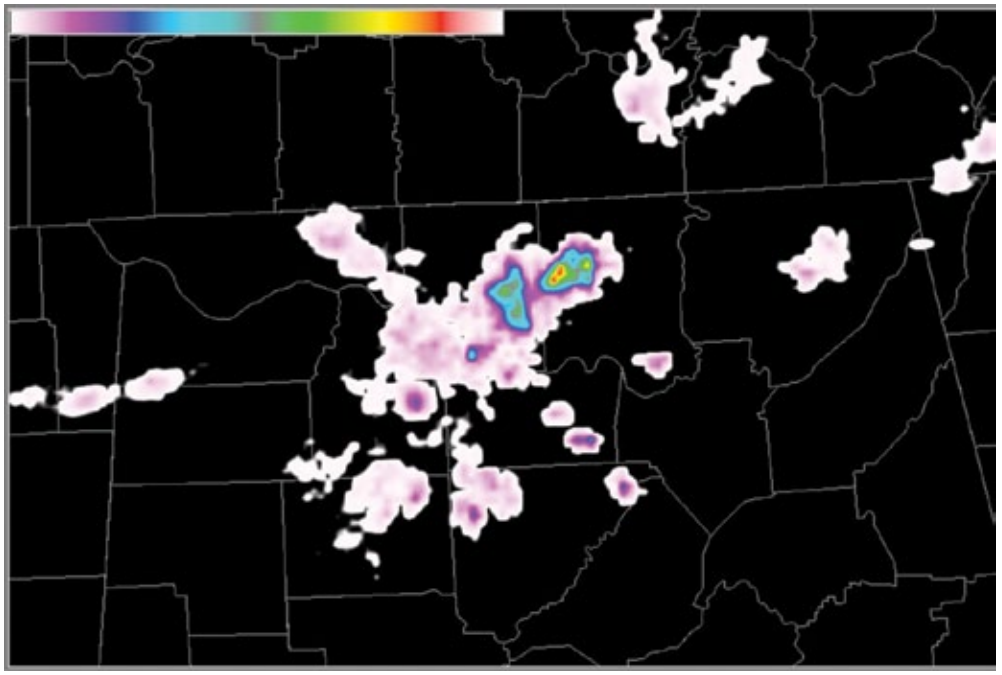
Bi, Li, J.A. Jung, M.C. Morgan, J.F. Le Marshall, 2010: A Two-Season Impact Study of the WindSat Surface Wind Retrievals in the NCEP Global Data Assimilation System. Wea. Forecasting, 25, 931–949 .

Gaiser, P.W. , 2004: WindSat: Remote sensing of ocean surface winds. NRL Review Article. Available at <http://www.nrl.navy.mil/research/nrl-review/2004/featured-research/gaiser/>.



Total Lightning Jumps to AWIPS II

Jason Burks (NWS), Matt Smith (UAH), and Kevin McGrath (Jacobs) have been actively working to transition existing SPoRT products into the NWS's new decision support tool, AWIPS II. One of the first completed transitions is the total lightning source density product. This product is used by a number of WFOs to provide additional insight into the intensity of convective storms and aids in severe weather warnings. The product emulates capabilities from the future GOES-R Geostationary Lightning Mapper (GLM). In the legacy system, the source densities are ingested as grids (via a netCDF formatted file) and displayed with D-2D (display 2-dimensional). However, the display process smoothed the source densities reducing its maximum and often eliminates spatially small features that had a low number of source densities. Both ingest and display plug-ins have been written for the total lightning source densities in AWIPS II that maintain data fidelity both during ingest and display. The ingest plug-in reads the data from a slightly modified netCDF file and formats it for the postgres database. This approach preserves the use of the input data file for both AWIPS II and the legacy system for easy operational transition. The display plug-in allows for the display of the source densities in CAVE, preserving an accurate representation of source density features. SPoRT will be demonstrating these capabilities with selected WFOs in the coming months.



Source density image from the North Alabama Lightning Mapping Array generated by the total lightning AWIPS II plug-in.

MODIS-GOES Hybrid Imagery for the GOES-R Proving Ground

SPoRT is creating a hybrid product using MODIS imagery inserted

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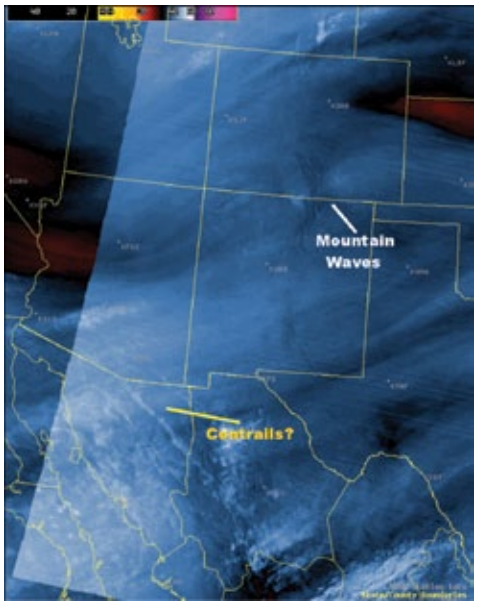
into GOES-based imagery and then remapped to the resolution of the ABI. This provides a near real-time, ABI-like product as a demonstration to forecasters of the new era of satellite meteorology that will accompany the launch of GOES-R. SPoRT is collaborating with eight WFOs who have agreed to formally evaluate these GOES-R Proving Ground (PG) products in addition to their normal SPoRT interactions. The WFOs included in SPoRT's GOES-R PG work are ABQ, CRP, HGX, HUN, OHX, MRX, MLB, and JAN. Ingest of the hybrid imagery (11μ, 3.9μ, visible, water vapor) has begun at these WFOs with evaluations to follow in Spring 2011. Additional PG products to be examined by these WFOs will include SST, convective initiation, RGB imagery, and Pseudo GLM total lightning products. Other SPoRT partners have a "NASA" version of the hybrid imagery available at the highest MODIS resolution, which includes the spectral difference product (i.e., fog/low cloud detection). The GOES-R Aviation Algorithm Working Group is creating the official "fog" product; hence, SPoRT is not providing such a product within its GOES-R PG work. The Albuquerque WFO began ingesting the hybrid product and immediately noticed the small-scale features evident in the product. Forecaster Brian Guyer (ABQ) indicated that forecasters could identify mountain waves in the water vapor imagery as well as features assumed to be contrails based on the location and known air traffic routes.



MODIS-GOES Hybrid of Water Vapor remapped to ABI resolution of 2 km as part of SPoRT's GOES-R Proving Ground work. Image submitted by Brian Guyer (ABQ) after install of SPoRT hybrid imagery and identification of small-scale features (mountain waves, contrails). MODIS image fills most of image, while GOES fills in on the left and at off times when MODIS is unavailable.

WFO Corner

Collaborations with National Weather Service Eastern Region

SPoRT continues to collaborate with NWS forecast offices in the Eastern Region, focusing efforts on the development and assessment of a Great Lakes surface water temperature (GLST) product for use in nowcasting and modeling applications. SPoRT developed the GLST to support WRF simulations of lake-effect precipitation that often result in hazardous weather and travel conditions over relatively small areas downwind of ice-free areas of the Great Lakes when cold air masses travel over the relatively warmer, open water surfaces. Currently, the GLST product is derived from MODIS observations using a compositing technique similar to Haines, et al., (2007) and incorporates an ice analysis obtained from the NOAA Great Lakes Environmental Research Laboratory (GLERL, Assel, et al., 2002; Norton, et al., 2000). By combining the GLST with the GLERL ice mask, the resulting product provides a consistent depiction of water temperature and ice cover for use in analysis and modeling applications. In order to investigate the role of ice cover and water temperature on lake-effect snowfall, SPoRT is performing experimental simulations of "Lake Effect Storm Bluegill," which impacted the NWS Buffalo area on December 1–3, 2010 with highly localized snowfall amounts in excess of 12 inches. SPoRT is working with forecasters to identify the impacts of the GLST on short-term forecasts and present results at the upcoming Great Lakes Environmental Modeling Workshop on March 21–23, 2011.

Assel, R.A., Norton, D.C., and Cronk, K.C., 2002. A Great Lakes Ice Cover digital data set for winters 1973–2000. NOAA TM GLERL-121. Great Lakes Environmental Research Laboratory, Ann Arbor, MI. (available on the Internet at: ftp://ftp.glerl.noaa.gov/publications/tech_reports/glerl-121/tm-121.pdf

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

Norton, D.C, R.A. Assel, D. Meyers, B.A. Hibner, N. Morse, P.J. Trimble, K. Cronk, and M. Rubens, 2000: Great Lakes Ice Cover Data Rescue Project. NOAA TM ERL-GLERL-117, NOAA, Great Lakes Environmental Research Laboratory, Ann Arbor, MI. ftp://ftp.glerl.noaa.gov/publications/tech_reports/glerl-117/

Coordination Calls

In October, SPoRT partner WFOs presented their NWA conference papers/posters during the monthly coordination call. Scott Overpeck of the Houston/Galveston WFO presented a coastal gravity wave event where high winds caused damage and the short-term, local models had not predicted a gravity wave scenario. The discussion included how the SPoRT ADAS could help forecasters more quickly analyze surface conditions and pressure patterns that characterize such events. Deirdre Kann of the Albuquerque WFO presented several operational applications of SPoRT-provided data, including the use of MODIS False-Color Snow RGB to when forecasting the impact of snow cover on the high temperature, and the use of high-resolution MODIS visible imagery to detect blowing sand from the White Sands area.

In addition, one of the product developers for the CIRA Blended TPW attended the October SPoRT/NWS coordination

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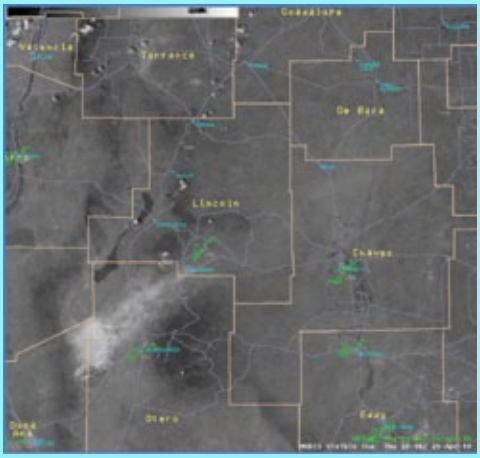
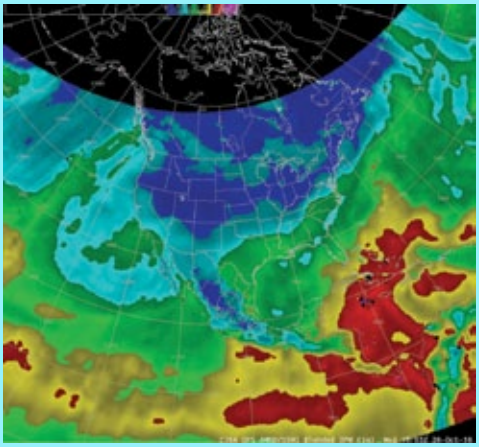
call and participated in teletraining for the newest version of the product being offered through SPoRT. The new experimental product uses an "overlay" method versus averaging multiple values over the same area and has a binomial smoother applied to it to lessen the discontinuities at the edge of the satellite passes. This smoother seems to cause areas of maximum TPW to be slightly less than the operational product from NESDIS; however, other factors are involved. Both use data from NOAA 15, 16, 17, 18, and 19 as well as Metop-A (AMSU), but the new product includes DMSP F16 and F17 (SSMIS). The most significant addition is the data from the Microwave Integrated Retrieval System (MIRS). MiRS provides microwave-derived TPW over land—something previously not possible with standard algorithms. Lastly, the two products are not processed simultaneously; therefore, one may have more or less data than the other.

The November NWS/SPoRT Coordination call included a short overview of SPoRT's involvement in the GOES-R Proving Ground (PG). SPoRT has been participating in the Hazardous Weather Testbed Spring Experiment at SPC as part of the GOES-R PG and has provided products, data, and training in areas such as total lightning and convective initiation. SPoRT has also been developing MODIS-GOES Hybrid imagery products as a near real-time ABI proxy. During the call, SPoRT articulated its vision of the requirements for one of its WFO partners to participate in SPoRT's PG work. SPoRT also discussed the hybrid imagery install and display instructions that it would send to prospective WFOs given their agreement to these requirements. Evaluations will take place in phases with the basic ABI-like imagery first during the late winter, early spring, and other products such as SST or CI in the spring and summer.



MODIS visible imagery shows a plume of sand (lower left) from the White Sands area moving toward Ruidoso, NM in south, central New Mexico.



CIRA Blended TPW with MiRS data fills in the land areas of Canada and Central/South America where previously only GPS-MET sensors were available. This image is a subset of the product obtained by SPoRT.

Publications

Kain, J.S., S.R. Dembek, S.J. Weiss, J. L. Case, J.J. Levit, and R.A. Sobash, 2010: Extracting unique information from high resolution forecast models: Monitoring selected fields and phenomena every time step. Wea. Forecasting, 25, 1536–1542.

Molthan, A.L., W.A. Petersen, S.W. Nesbitt, and D. Hudak, 2010: Evaluating the Snow Crystal Size Distribution and Density Assumptions within a Single-Moment Microphysics Scheme. Monthly Weather Review, Volume 138, 4254–4267

Molthan, A.L, W.A. Petersen, 2011: Incorporating Ice Crystal Scattering Databases in the Simulation of Millimeter Wavelength Radar Reflectivity. Journal of Atmospheric and Oceanic Technology, In press, available as an Early Online Release.

Contributions

Articles used in this report were contributed by Gary Jedlovec (NASA), Andrew Molthan (NASA), Matt Smith (UAH), Kevin Fuell (UAH), and Geoffrey Stano (ENSCO) of SPoRT and from forecasters Scott Overpeck in the Houston/Galveston office and Deidre Kahn and Brian Guyer in the Albuquerque WFO.

Visitors

- Todd Foisy, NWS Alaska Region Headquarters—to learn about SPoRT and enhance collaborations between Alaska and SPoRT.
- Sid Boukabara, Deputy Director JCSDA—provided seminar on current research and learn about SPoRT.
- Rick Knabb/Daniel Dix—The Weather Channel, gave seminar presentation.

External Workshops/ Meetings Attended

- AGU Fall Meeting, December 13–17, San Francisco, Andrew Molthan attended and gave several conference presentations.
- NOAA Technology Summit, Gary Jedlovec attended and gave a presentation on SPoRT.

Calendar of Upcoming Events

- NWS Southern Region SOO Workshop, February 23–25, Norman, OK
- High Impact Weather Workshop, February 24, Norman, OK
- Direct Broadcast Workshop, April 4–8, Miami, FL
- NOAA Testbed Workshop, May 3-5, Boulder, CO
- GOES-R Proving Ground Annual Meeting, May 17–19, Boulder, CO
- GOES-R Proving Ground OCONUS Meeting, July 26–28, Juneau, AK

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