

**SPoRT Quarterly**  
January – March 2015

# 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- and NOAA-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) and National Centers, the research leading to the transitional activities benefits the broader scientific community.

## Quarterly Highlights

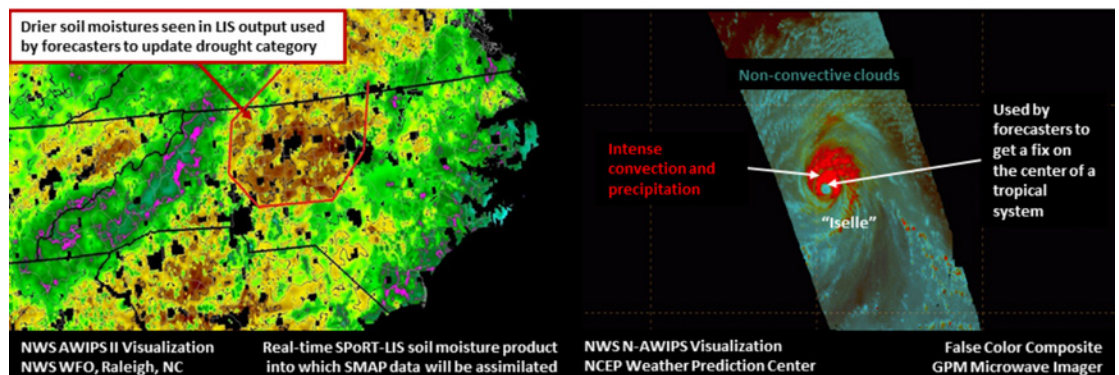
### SPoRT Participation in NASA Early Adopter Activities

Recently, NASA Earth science satellite missions have established Early Adopter programs to provide groups with an opportunity to demonstrate applications of NASA satellite data in their real-time, operational systems prior to availability of science-quality data. Early Adopters are granted early access to proxy datasets and beta versions of algorithm products in an effort to accelerate operational use of data products early in mission lifecycles. SPoRT is recognized as Early Adopters for both the Global Precipitation Measurement (GPM) and Soil Moisture Active Passive (SMAP) missions and have taken part in a number of applications workshops to discuss ways in which the operational weather community might benefit from NASA datasets.

For GPM, SPoRT has obtained L1 imagery products and L2 rain rate products from

the Goddard Space Flight Center near-real-time processing system. L1 imagery has already been transitioned to the National Weather Service (NWS) National Centers (the National Hurricane Center [NHC] and Weather Prediction Center [WPC]). Forecasters at NHC and WPC have been excited to see the GPM products because both of these organizations have a long history of using data from passive microwave imagers. The image on the right shows an example of a derived multi-channel GMI imagery product visualized in the

N-AWIPS decision support system used by the NWS National Centers. In this image, cold cloud tops associated with strong convection and precipitation near the storm center appear in red; non-convective clouds appear in cyan. Forecasters use these observations to pinpoint the center of tropical systems. Traditional visible and infrared imagery sometimes are problematic for finding the storm center if the eye of the storm is cloud-covered. Additionally, SPoRT is transitioning L2 rain rate products from GPM to forecast offices to fill in



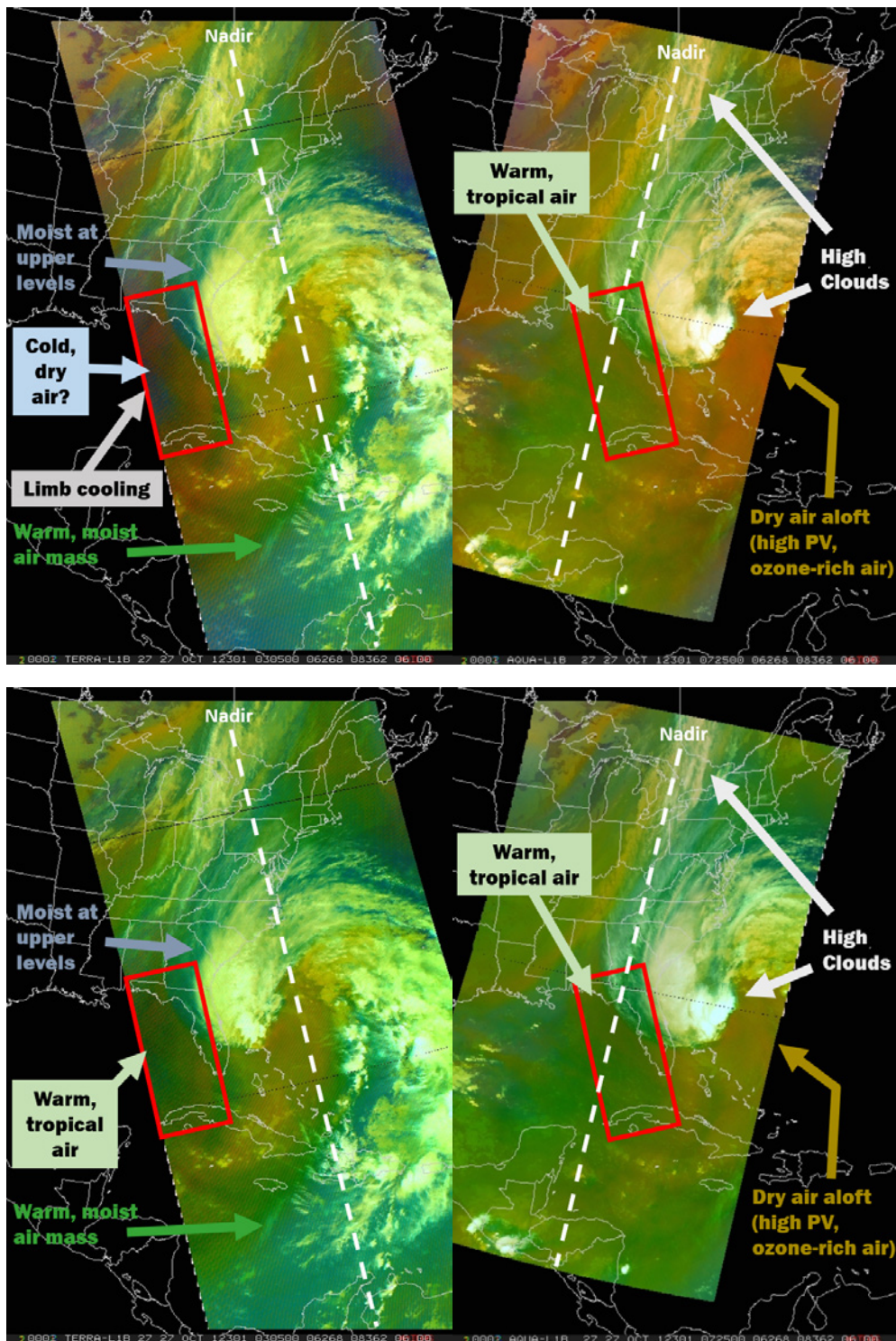


# Recent Accomplishments

## Improved Limb Correction for RGB Imagery

An improved methodology was developed to correct for limb effects in Moderate resolution Imaging Spectroradiometer (MODIS) Air Mass, Dust, and Night Microphysics multispectral imagery (i.e., RGBs). The limb effect, which is a result of an increasing optical path length of the absorbing atmosphere as scan angle increases, interferes with the qualitative interpretation of RGB composites at the edge of the MODIS swath. The limb correction corrects for limb effects as a function of latitude and season to account for variability in air mass characteristics, such as temperature and water vapor content. In the corrected imagery, anomalous cooling due to limb effects is removed, enabling the RGB product to more accurately depict atmospheric conditions on the limb. The correction also normalizes the MODIS channels to match channels from the European Spinning Enhanced Visible and Infrared Imager (SEVIRI), which are similar to the channels that will be available on the GOES-R Advanced Baseline Imager. This normalization accounts for channel differences between sensors, ensuring that the colors in the RGB products are consistent from sensor to sensor. This correction has been applied to real-time RGB imagery being provided to SPoRT end users.

The figure to the right demonstrates the improved utility of the corrected Air Mass RGB. The feature bounded by the red box in the uncorrected Terra MODIS Air Mass RGB appears to be cold, dry air as a result of the limb effect. However, the same feature, when observed at nadir in the Aqua MODIS Air Mass RGB approximately 4 hours later, is correctly depicted as warm, tropical air. After correction, both the Terra and Aqua MODIS Air Mass RGBs correctly depict the feature as warm, tropical air. Note also that the RGB coloring between the corrected Terra and Aqua MODIS Air Mass RGBs are very similar, allowing for these products to be used jointly for analysis.



27 October 2012 uncorrected 0305 UTC Terra MODIS Air Mass RGB (top left), uncorrected 0725 UTC Aqua MODIS Air Mass RGB (top right), corrected Terra MODIS Air Mass RGB (bottom left), and corrected Aqua MODIS Air Mass RGB (bottom right) of a developing Hurricane Sandy.

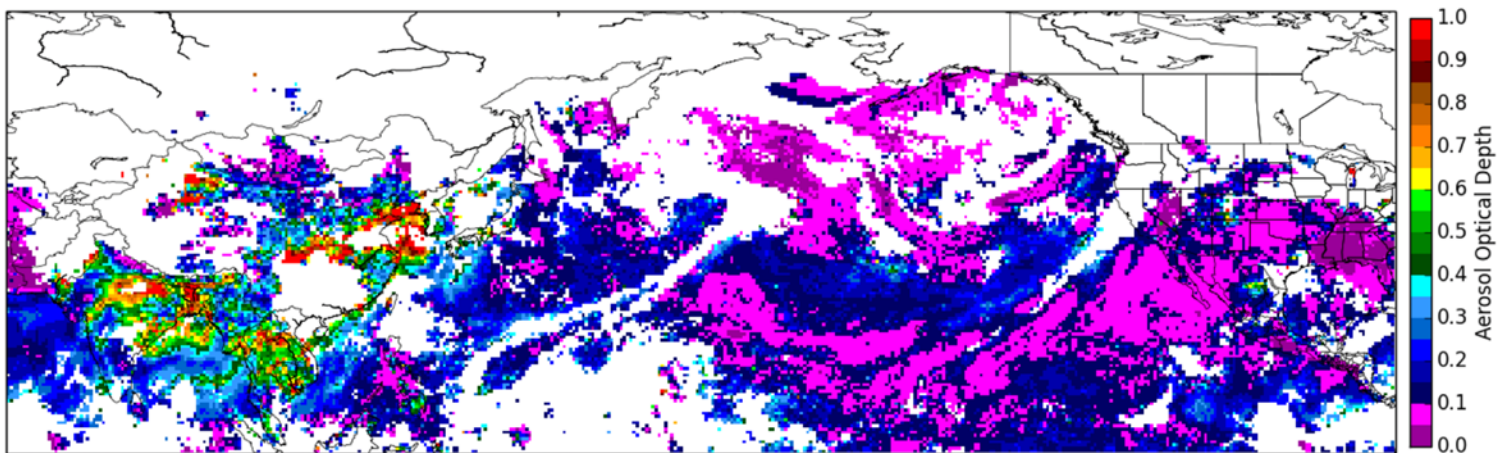
## Aerosol Product Used during NOAA Field Campaign

In 2014, SPoRT began development of an aerosol optical depth (AOD) product that blends data from GOES, MODIS, and Visible Infrared Imager Radiometer Suite (VIIRS) to track Asian dust and pollution that originates in mainland Asia and propagates across the Pacific Ocean. The main forecast challenge addressed with this dataset is understanding and predicting the impact of these aerosols on weather processes, such as development of clouds and

precipitation of the West Coast of the United States, air quality, and visibility.

This product was used by researchers participating in the NOAA-led CalWater2 field campaign to designate the location of aerosols in the vicinity of atmospheric rivers. One of the objectives of CalWater2 was to better understand the impacts of aerosols on atmospheric river development. The figure below is the SPoRT AOD

composite product from 7 February 2015 showing high concentrations of aerosols over Asia and the Western Pacific. The product also shows elevated concentrations of aerosols in the vicinity of a landfalling atmospheric river in northern California. Additional data and results from the field campaign are still being analyzed.



NASA SPoRT Daily AOD Composite 20150207 0000 UTC  
SPoRT AOD Composite product from 0000 UTC on 7 February 2015 showing aerosol patterns across the Pacific Ocean.

## Satellite Proving Ground Activities

NOAA Satellite Proving Ground activities for OCONUS continue as SPoRT began to acquire near-realtime VIIRS and MODIS data from both the JPSS direct broadcast station in Hawaii (central Pacific) as well as NASA LANCE (in support of W. Pacific). Channels were acquired to create the RGB suite of products assessed previously in CONUS and Alaska. As part of funded Satellite Proving Ground work, SPoRT has been directed to transition RGB products to demonstrate the future Himawari and GOES-R imagers in order to prepare forecasters prior to the availability of these data and

products. Test data from the imager aboard Himawari, which was launched in October 2014, was acquired and processed in preparation for transition to WFO and National Center forecasters later this year, once these data are more operationally available. SPoRT's passive microwave product suite includes ATMS, and efforts were made to ready this data for the Central Pacific Hurricane Center in Hawaii, analogous to its application at the National Hurricane Center. Total lightning continues to be a focus of SPoRT's PG effort via annual participation in HWT

as well as continued support of WFOs/CWSUs with lightning networks in their areas. Total Lightning product developments have included a 2-minute, running summation of total flashes (for networks with 1-minute update cycles) as well as a 6-minute, running summation product (from both 1- and 2-minute networks). These new products are a direct result of transition activities and feedback from operational users who desired a less "noisy", high-frequency product. Training updates to the web module were made and provided to HWT.



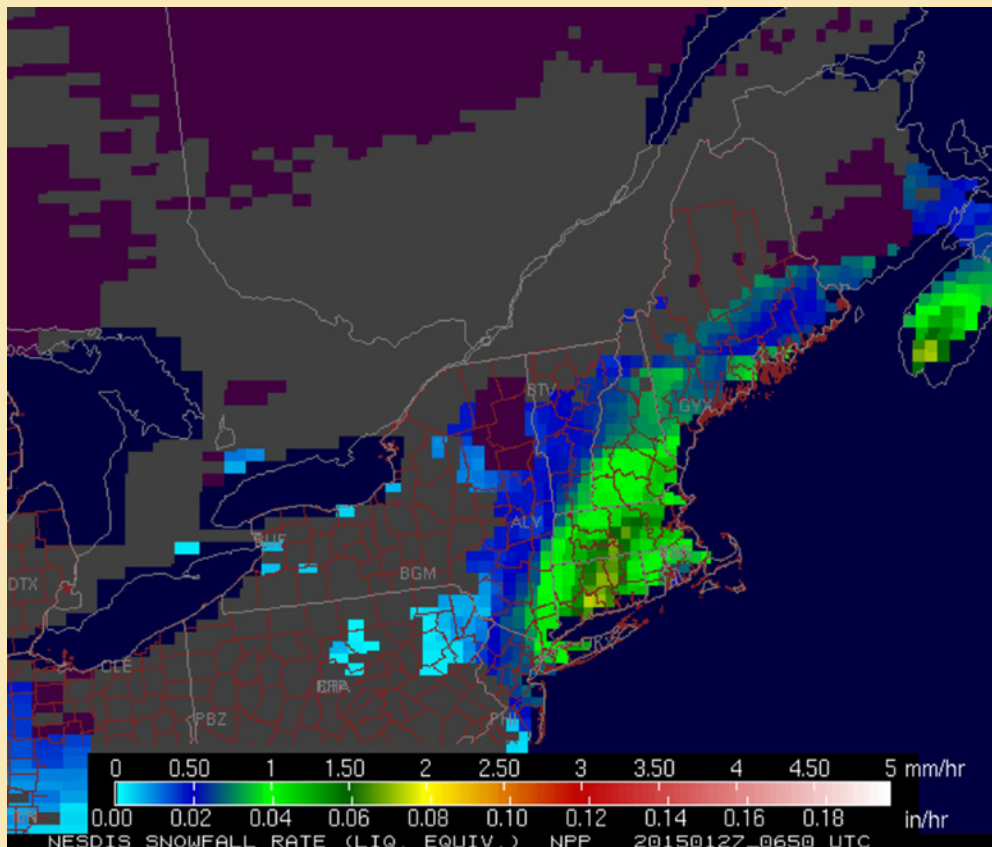
# Transitions and Assessments

## 2014/2015 NESDIS Snowfall Rate Assessment

SPoRT collaborated with NOAA/NESDIS/STAR on transition of an experimental snowfall rate (SFR) product derived from passive microwave instruments aboard multiple polar-orbiting satellites, including the NASA/NOAA Advanced Technology Microwave Sounder (ATMS) aboard the Suomi National Polar-Orbiting Partnership (NPP) satellite. The primary objective of this season's evaluation was to understand the impact of the second iteration of the SFR product on NWS operations. The winter 2014 assessment received lots of positive feedback regarding the location of where snowfall was occurring, but also revealed some product limitations (see assessment report on SPoRT Transition webpage: <http://weather.msfc.nasa.gov/sport/evaluations/>) that were addressed by the NESDIS/STAR developers to increase the operational applicability of the product. Two evaluation periods were performed. The first was during fall (October-December 2014) and involved the three WFOs in Alaska (Anchorage, Juneau, and Fairbanks); the second was during the winter (January-March 2015) and included 5 forecast offices (Burlington, Charleston [WV], Albuquerque, Boulder, and Cheyenne) and the Satellite Analysis Branch. Case

examples from the assessment were presented during the JPSS Science Seminar series, and a report of user

assessment results will be available on SPoRT's Transition webpage following evaluation of forecaster feedback.



NESDIS Snowfall Rate Product from ATMS capturing the historic blizzard in the Northeast U.S. at 0650 UTC (around 2:00 A.M. local time) on 27 January 2015.

## SPoRT LIS Soil Temperature Trial Evaluation

While SPoRT conducted an official assessment of several select LIS soil moisture output during the late summer and early fall of 2014, a more informal trial evaluation of SPoRT LIS 0-10 cm soil and surface skin temperature outputs was conducted during winter 2014/15. These LIS variables provide forecasters with an awareness of near-surface temperatures during winter weather events, which can be especially important when surface temperatures are close to freezing and frozen

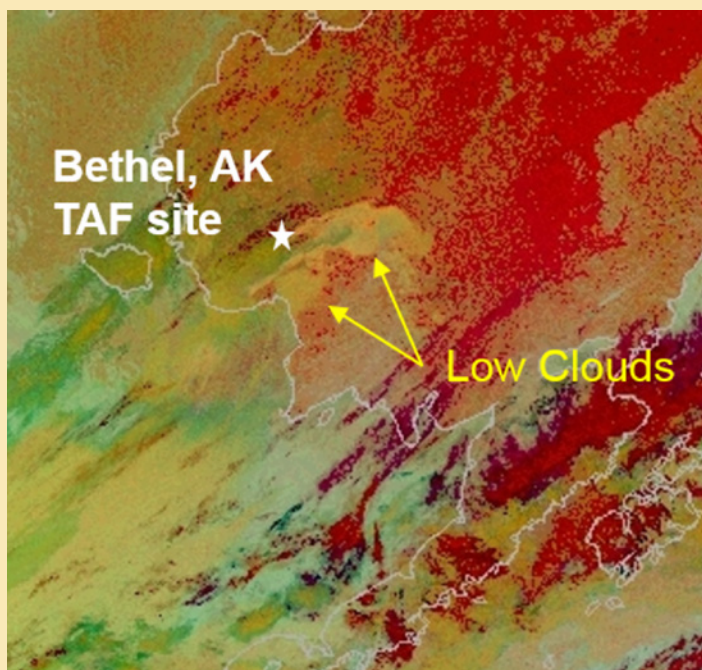
precipitation is expected. This type of information can be beneficial to operations as soil/surface temperature can help determine whether frozen precipitation will accumulate (particularly for lighter precipitation rates). Participating NWS WFOs included Houston, Huntsville and Raleigh. Overall, feedback was mixed, indicating the need for more investigation into how the gridded LIS skin/ground temperatures can be used to determine the likelihood for winter weather impacts during frozen

precipitation episodes. Based on some of the events that occurred this winter, it was observed that snow and/or sleet accumulations can still occur despite relatively warm soil temperatures as long as precipitation rates are sufficiently high. For example, northern Alabama experienced a high-impact event on 5 March 2015 when one inch of sleet accumulated on the ground and road surfaces despite LIS 0-10 cm soil temperatures being well above freezing at the onset of the event.

## 24-Hour Microphysics RGB Assessment

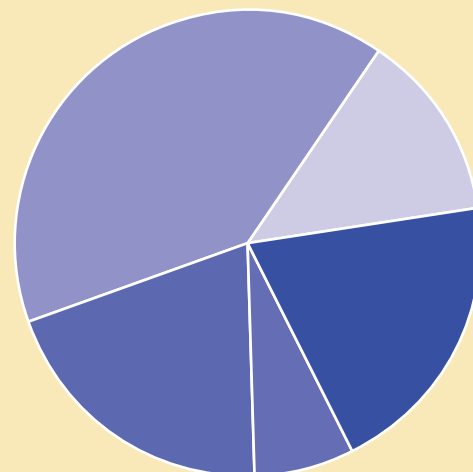
The Anchorage, Fairbanks, and Juneau WFOs assessed the application of a new RGB imagery developed from MODIS and VIIRS data as a follow-on to initial evaluations performed in winter 2013/14. The VIIRS and MODIS 24-hr Microphysics RGB allows forecasters to monitor potential ceiling and visibility hazards to their aviation forecasts for both day and night scenes. The prior evaluation used only the Nighttime Microphysics RGB (NtMicro),

but that version of the product is not available during the daytime and can sometimes have a grainy appearance in extreme cold scenes. Both of these situations occur with regularity in Alaska during the summer and winter, respectively. Three case examples from the assessment were presented during the JPSS Science Seminar series, and a report of user assessment results will be available on SPoRT's Transition webpage.



VIIRS 24hr Microphysics RGB used by Anchorage WFO forecaster to adjust TAF ceiling values for Bethel, AK. Low clouds near site were analyzed using this multi-spectral product and accounted for in the short-term forecast according to user feedback gathered during SPoRT's assessment.

Rank the Impact of the 24-Hour Microphysics RGB on Aviation Forecasts in general.



Very Small	3	20%
Small	1	7%
Some	3	20%
Large	6	40%
Very Large	2	13%

## Visitors

### RedOrbit

Editors and writers from the redOrbit website ([www.redorbit.com](http://www.redorbit.com)) visited SPoRT as a part of a larger visit to MSFC to communicate the center's role in space exploration and science to their general public readership. The website offers science, space, technology, and health news along with videos, images, and reference information. SPoRT gave a presentation and had Q&A with the redOrbit staff to promote SPoRT initiatives to transition unique satellite datasets and capabilities to operational weather forecasters.

### Center for the Advancement of Science in Space (CASIS)

SPoRT gave a presentation to Dan Blaettler, the Program Manager for the Center for the Advancement of Science in Space (CASIS), as part of his visit to MSFC. CASIS is mandated by congress to better facilitate the use of the International Space Station (ISS) for science for humanitarian and commercial applications. They are working with various private sector partners on developing instruments for the ISS, and MSFC is working to collaborate in this venture. SPoRT's presentation to

Mr. Blaettler communicated experiences with real-time product development and transition of research to operations.

### Prospective University of Alabama in Huntsville Students

SPoRT met with two sets of prospective Master's students for the University of Alabama in Huntsville (UAH). A briefing was given highlighting the SPoRT project and the connection between SPoRT and UAH facility and students. SPoRT currently supports four UAH graduate students and continues to look for opportunities to mentor students.

# Blog Summary

The Wide World of SPoRT blog received about 1,950 views during the first quarter of 2015. As usual, the great majority of views were from the U.S., however a relatively large number of visits came from S. Korea (83) during the month of March, while Puerto Rico comprised a fairly sizable number of visits (56) during the month of February. The international presence continues to be fairly active on the Wide World of SPoRT blog, representing about one-fourth of the total number of views. As always, we welcome research and operational weather enthusiasts alike from all across the globe.

The blog received 12 posts during the quarter; three during January, five in February and four in March. Posts detailing the use of the NESDIS Snowfall

Rate Product (SFR) were prevalent in January. In fact, those comprised each of the three posts during the month. Blog posts during the month of February were more varied in content, and detailed the use of RGB products, the CIRA total layered precipitable water product (which is SPoRT is transitioning to select collaborating offices), the Aerosol Optical Depth (AOD) product, and a couple of soil temperature products via the SPoRT LIS. An additional blog post by the Raleigh NWS office in March detailed their experiences with the SPoRT LIS soil temperature data during the winter, while another post detailed the use of the LIS antecedent soil moisture to help evaluate flooding potential during a heavy rain event in December in the Carolina Piedmont. These types of posts offer

valuable feedback for product developers at SPoRT, outlining how products are used in the operational environment, and can also serve as valuable training aids for other forecasters.

As usual, while we can't mention all posts made during the quarter, the SPoRT group is very appreciative of the efforts of all of our collaborative authors. Please visit the Wide World of SPoRT blog to see these and other posts when you can, at <http://nasasport.wordpress.com>. Also, you can follow us through Facebook (NASA SPoRT Center) and Twitter (@NASA\_SPoRT). If you would like privileges to post on the SPoRT blog, please send an email to Kris White ([kris.white@noaa.gov](mailto:kris.white@noaa.gov)). Thanks and we hope you'll keep reading!

## SPoRT Participation in NASA Early Adopter Activities...continued

radar gaps over the western U.S., over the ocean or near geopolitical borders (e.g., U.S./Mexico). The increased temporal frequency of these observations constructed from the constellation of inter-calibrated satellites makes the GPM data more attractive than previous passive microwave rain rate products for operational application. Additionally, the L2 data will be available with a latency of between 30 and 90 minutes, which will allow for some operational implementation of the products where ground-based observations are not available. SPoRT is also working with the L3 Integrated Multi-satellite Retrievals for GPM (IMERG) products, which provide a global, estimate of precipitation rates every 30 minutes. These products are likely to be more applicable to hydrological users such as NWS River Forecast Centers due to their latency (> 4 hours); and SPoRT has engaged with these forecasting entities to understand the specific forecast challenges that need to be addressed.

SPoRT will be providing SMAP observations to NWS forecasters by assimilating the L2, 9-km active/passive soil moisture retrievals into SPoRT's real-time,

high-resolution Land Information System (LIS) soil moisture products. The SPoRT-LIS is run 4-times per day at approximately 3-km resolution over the continental U.S., and soil moisture output from this model is regularly transitioned to a handful of collaborating NWS Weather Forecast Offices. A formal assessment performed in the summer/fall of 2014 indicated that NWS forecasters find substantial benefit from high-resolution soil moisture analyses for evaluating drought and areal flooding potential. The image on page 1 is an example of the SPoRT-LIS 0-200 cm relative soil moisture product as seen by forecasters in their AWIPS II decision support system. This example from late September 2014 was provided by the Raleigh, NC NWS WFO as part of the feedback obtained during the assessment period. In this example, the SPoRT-LIS product is indicating a larger area of dry soil moisture conditions compared to the abnormally dry D0 category areal extent in the prior week's U.S. Drought Monitor (USDM) product (not shown). Through use of the SPoRT-LIS product, the surface hydrologist at the Raleigh NWS WFO made a recommendation that the USDM D0 outline should

be expanded for the area outlined in red. The USDM weekly author took this recommendation, and the following week's product matched a region very similar to the extent of the dry soils in the SPoRT-LIS product. The capability of having a combined active/passive product that has comparable accuracy to the radiometer observations at a higher spatial resolution is extremely attractive for regional land surface modeling applications. SPoRT has been developing techniques to assimilate SMAP soil moisture observations into SPoRT-LIS through use of soil moisture the European SMOS mission and these data will begin to appear in the real-time system this summer. This assimilation technique will ensure that SMAP data are able to be assimilated into the real-time SPoRT-LIS shortly after the SMAP science team finalizes their algorithms and releases the data for operational use. Through the previous demonstrations at NWS Forecast Offices and plans for an expanded distribution of these SPoRT-LIS fields to other collaborating partners, SMAP data will be part of the decision-making process for forecasters as they attempt to diagnose drought and areal flooding.



## WFO Corner

### Atlanta

Collaborations are beginning to occur with Atlanta-area forecasters at both the WFO and CWSU, in preparation for the summer convective season. WFO-FFC and CWSU-KZTL expressed an interest in evaluating a GOES-R proxy product, GOES-R CI, to support aviation hazard forecasting. In part, this activity will help establish relationships and dataflow prior to the operational use of the new North Georgia LMA, paving the path for smooth transition of lightning products in the future.

### Pocatello

SPoRT products were included in Tweets by the Pocatello WFO. Specifically, the MODIS 11-3.9 $\mu$ m showing low clouds in the valleys. Some e-mail exchanges indicated their interests are spread from low clouds and fog in winter to summer issues related to convection, dust, and vegetation/soil conditions. Fire weather is a priority in summer and the WFO hopes to use the NASA/LIS output to analyze vegetation health and soil moisture to anticipate regions becoming prone to fires well before the event, and then the use of GOES-R CI to assist detection of cells in radar void regions that may produce initial lightning strikes.

### Tucson

SPoRT staff visited the WFO as part of during travel to the AMS Annual Meeting. Previously, the WFO participated in SPoRT's Users Virtual Workshop demonstrating their use of NASA data. A SPoRT overview was presented to WFO management and discussions with forecast staff revealed many of their needs were related to the summer monsoon of the U.S. Southwest. While many of the RGB imagery products and other satellite data were already in the WFO's operational system, SPoRT helped them add the CIRA Layered Precipitable Water product to assist with analysis of potential precipitation.

## Publications and Presentations

### Presentations

Several members of the SPoRT team attended the AMS Annual Meeting in Phoenix, Arizona from January 4-8, 2015, participating in collaborative discussions and providing updates on SPoRT activities through numerous presentations. Combined, the team provided 25 oral and poster presentations, including a NASA Hyperwall presentation on SPoRT's Applied Sciences and related activities that was given at the NASA booth in the AMS Exhibit Hall. Within the general sessions, presentations focused on research and development activities related to NOAA's GOES-R and JPSS Proving Grounds and Risk Reduction programs, formal training, feedback, and assessments of products provided to end users, and continued development of SPoRT products for dissemination to the NOAA/NWS Damage Assessment Toolkit.

A full list of all of SPoRT's AMS presentation can be found on the SPoRT website (<http://weather.msfc.nasa.gov/sport/conference/>).

### Publications

- Berndt, E. B., B. T. Zavodsky, and M. J. Folmer, 2015: Development and Application of Atmospheric Infrared Sounder Ozone Retrieval Products for Operational Meteorology, accepted, IEEE Transaction on Geoscience and Remote Sensing
- Naeger, A. R., P. Gupta, B. Zavodsky, K. McGrath, 2015: Monitoring and Tracking the Trans-Pacific Transport of Asian Aerosols Using Multi-Satellite Aerosol Optical Depth Retrievals, submitted, Advances in Meteorology.
- Folmer, M. J., M. DeMaria, R. Ferraro, J. Beven, M. Brennan, J. Daniels, R. Kuligowski, H. Meng, S. Rudlosky, L. Zhao, J. Knaff, S. Kusselson, S. D Miller, T. Schmit, C. Velden and B. Zavodsky, 2015: Satellite Tools to Monitor and Predict Hurricane Sandy (2012): Current and Emerging Products, submitted, Atmospheric Research

### Seminars

- Cory Morin, NASA Postdoctoral Program Fellow, "Climate Models Go Viral: Simulating Climate and Environmentally Driven Infectious Diseases", 5 February 2015, SPoRT Seminar
- Nicholas Elmer, "Limb Correction of Individual Infrared Channels for the Improved Interpretation of RGB Composites", University of Alabama in Huntsville, 10 March 2015, UAH Thesis Defense

# Calendar of Events

- April 7–8, 2015: NASA Weather Focus Area Workshop, Washington, DC
- April 7–10, 2015: NWS Western Region Headquarters, WFO, and RFC Site Visits, Salt Lake City, UT
- April 13–17, 2015: UCAR Software Engineering Assembly, Boulder, CO
- April 14–17, 2015: NOAA/NWS DSS Boot Camp, NWS Central Region Headquarters Site Visit, Aviation Weather Center Site Visit, and Operations Proving Ground Site Visit, Kansas City, MO
- April 14–16, 2015: U.S. Drought Monitor Forum, Reno, NV
- April 14–16, 2015: NOAA Testbed Workshop, Boulder, CO
- April 17–18, 2015: Southwest Aviation Weather Safety Workshop, Las Vegas, NV
- April 27–May 1, 2015: 2015 NOAA Satellite Conference, Greenbelt, MD
- May 4–8, 2015: Hazardous Weather Testbed Experimental Warning Program, Norman, OK
- May 4–8, 2015: WRF-Hydro Tutorial, Boulder, CO
- May 11–15, 2015: GOES-R OCONUS Meeting, Anchorage, AK
- May 11, 2015: Visit from Alaska RFC, Huntsville, AL
- May 11–15, 2015: National Hydrologic Program Managers Meeting, Tuscaloosa, AL
- May 13–15, 2015: 13th JCSDA Technical Review & Science Workshop on Satellite Data Assimilation, College Park, MD
- May 27–28, 2015: TEMPO Science Team Meeting, Huntsville, AL
- May 27–28, 2015: CYGNSS Applications Workshop, Silver Spring, MD
- June 3–4, 2015: SMAP Early Adopters Applications Benchmark Meeting, College Park, MD
- June 8–10, 2015: 2nd GPM Applications Workshop, College Park, MD
- June 15–19, 2015: NOAA Satellite Proving Ground User Readiness Meeting, Kansas City, MO
- June 15–19, 2015: 16th Annual WRF User's Workshop, Boulder, CO
- June 29–July 3, 2015: 27th Weather Analysis and Forecasting/23rd Numerical Weather Prediction Conference, Chicago, IL

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