



SPoRT Quarterly
July–September 2014

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 Attends EUMETSAT Satellite Conference

The 2014 EUMETSAT Meteorological Satellite Conference took place on September 22–26 in the beautiful lakeside city of Geneva, Switzerland. Situated where the Rhone exits Lake Geneva, the city is a global financial center and worldwide center for diplomacy thanks to the presence of numerous international organizations. EUMETSAT was joined in the organization and hosting of the event by MeteoSuisse, the national provider for weather and climate services in Switzerland. The focus of this year's conference was on the use of satellite data for forecasting and in studying atmospheric processes. Several SPoRT team members attended the conference and presented research results on SPoRT's use of red-green-blue (RGB) composite satellite imagery from NASA's EOS satellites. The presentations were well received and provoked some post presentation discussion with their European colleagues. Afterwards, SPoRT team members were invited to visit a MeteoSuisse weather office



(the equivalent to a National Weather Service's weather forecast office) located in the World Meteorological Organization (WMO) facility in Geneva to learn about how the Swiss have been using RGB composite imagery from their satellites to address critical forecast problems for the last 10 years. The Europeans have pioneered the use of RGB image composites from the Meteosat Second Generation (MSG) sensors to address critical weather issues in Europe and Africa.

Shown in the photo is a typical workstation configuration in the MeteoSuisse weather office, not unlike NWS WFO offices. The displays show typical satellite and in situ data products used to evaluate the current weather situation and to make short-term weather forecasts. Of note is the nighttime microphysics product (top middle display), which is extensively used to monitor low clouds and fog over the region. The discussion with Swiss forecasters confirmed the validity of the approach SPoRT is taking with its use of RGB imagery with NASA satellite data.



Recent Accomplishments

SPoRT program review by Science Advisory Committee

The SPoRT Science Advisory Committee (SAC) met on August 28–30 at the National Space Science and Technology Center (NSSTC) in Huntsville, Alabama to review team activities over the last two years. The SPoRT SAC is made up of stakeholders from NASA and NOAA and provides programmatic and scientific guidance to help shape future SPoRT activities. The meeting included presentations by SPoRT team members on recent modeling and data assimilation activities, product assessments and training, advances in data dissemination and decision support systems (such as AWIPS II and web mapping services), and an overview of new products from the suite of Suomi NPP instruments. Additionally, the team reported on recent accomplishments in the GOES-R and JPSS Proving Ground projects and highlighted its disaster assessment and response activities (for which it received a NASA Group Achievement Award). Initial feedback on SPoRT's current activities and direction was largely positive and encouraging. A final written report of formal SAC recommendations will be delivered by the end of the calendar year.

Damage Assessment Toolkit workshop

During the last week of July, SPoRT Disasters Team hosted a technical exchange and discussion regarding future collaborations related to the NOAA/NWS Damage Assessment Toolkit (DAT). The three-day workshop focused on work related to the team's recently funded disasters award from NASA Applied Sciences that SPoRT received as a follow on to a successful feasibility study. The meeting brought together stakeholders from NOAA/NWS management and forecast offices and data dissemination partners at USGS to develop a comprehensive plan for the first of three years of collaborations. This effort will bring near-real-time Earth remote sensing products to the DAT to assist with severe weather

damage assessments. Upon completion of the workshop, a well-organized plan and timeline was in place for getting the near-real-time data to the DAT as well as plans for training and assessments of the products during the fall 2014 and spring 2015 severe weather seasons.

Experimental Product Development Team

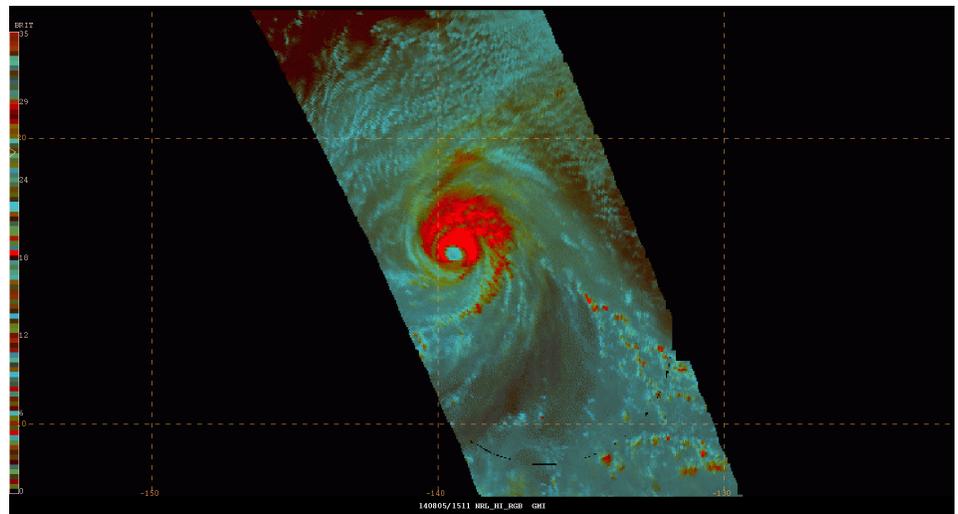
SPoRT is guiding the AWIPS II external developer community in the creation of new tools and capabilities through the Experimental Product Development Team (EPDT). EPDT's focus has been to help promote research-to-operations transition of data and techniques to the AWIPS II platform. SPoRT hosted a three-day EPDT code sprint in Huntsville on September 23–25. During the code sprint, sub-teams within EPDT worked on various projects such as the tracking meteogram tool, phased array radar display, and ingest and display for GOES-R derived products. They also extended the AWIPS II RGB displays to support EUMETSAT recipes using source single-band data. The sub-team projects made significant progress during the code sprint and continued the participants' learning through real-world, hands-on application of concepts. The projects initiated during this workshop will be refined over time and will help to extend the AWIPS II platform to address the needs of the GOES-R Proving Ground and the meteorological community.

AWIPS II Update

SPoRT continues working with our partner offices as they transition to AWIPS II, helping them to utilize SPoRT-provided products. There are now 6 of our partners with the new DSS: Huntsville, AL; Houston/Galveston, TX; Anchorage and Fairbanks, AK; Morriston, TN; and Miami, FL. Each office chose the specific SPoRT-provided products they want to receive. Boulder, CO and Raleigh, NC are pending regional approval. Plans call for up to 7 new partner offices to be transitioned in the final quarter of 2014.

Initial collaborations with Global Precipitation Measurement mission

Global Precipitation Measurement (GPM) is an exciting new NASA mission, whose core observatory was launched on February 27, 2014. SPoRT has been coordinating with its partners on establishing the best practices to take advantage of GPM and other microwave data in operations. One of the first partners to receive GPM data was the National Hurricane Center (NHC), adding to the existing suite of passive microwave products SPoRT is already transitioning. GPM provides a new platform to help NHC investigate tropical cyclone structure. The image below comes from NHC and displays the GPM 89 GHz RGB composite product over Hurricane Iselle a few days before it made landfall on the Big Island



GPM 89 GHz RGB composite product over Hurricane Iselle on August 5, 2014 at 11:15 am UTC.

of Hawaii. The product combines the horizontal and vertical polarizations into a single product. The resulting combination emphasizes strong convection and deep clouds in bright red. This is only the first effort in what may be a wider set of collaborations using GPM data.

OCONUS Research to Operations Interchange Meeting

Geoffrey Stano attended the OCONUS Research to Operations Interchange Meeting in Honolulu, HI on July 29–Aug 1. This meeting brought together developers and operational personnel to focus on GOES-R and Suomi NPP applications outside of the lower forty-eight states. NASA SPoRT presented on its research to operations activities with Alaska and Pacific Region as well as with the National Centers and the forecast office in San Juan, Puerto Rico. The participants also discussed the operational needs from these specific end users and provided a forum for the mission managers to update the status of the GOES-R and Suomi NPP programs.

Research/Transition Updates

Summer/Fall LIS assessment

An assessment of the real-time Land Information System (LIS) run at SPoRT is ongoing from August to October with three NOAA/NWS weather forecast offices: Huntsville, AL; Houston/Galveston, TX; and Raleigh, NC. The focus of the assessment is to determine the potential utility of LIS soil moisture products for decisions involving weekly drought monitoring and evaluating areal flooding potential based on antecedent soil moisture conditions on a case-by-case basis. Forecasters at each office were asked to complete online surveys consisting of short questions that help quantify the use and utility of the LIS data for drought monitoring and areal flooding events. Through the end of September, 18 online surveys have been completed, 16 in the area of drought monitoring and 2 in areal/river flooding. Preliminary survey feedback has indicated high confidence in the LIS data, and that the data were being incorporated to some extent into decisions regarding the U.S. Drought Monitor classifications, particularly on sub-county scales. The most relevant output fields applied to drought monitoring have consistently been the column-integrated relative soil moisture and the weekly change of this variable. Forecasters have also provided SPoRT with valuable feedback regarding the display of the data in AWIPS II, which has already led to improved fidelity of the weekly change soil moisture field and ideas for a dynamic soil moisture change field based on varied time intervals.

Other LIS activities

SPoRT personnel are working on developing a 30-year LIS soil moisture climatology over the Continental U.S., spanning 1981–2010. Such a climatology at relative high resolution (~3 km) would help to place real-time LIS soil moisture into proper historical context for better assessing drought and areal flooding potential. SPoRT is pursuing applications of LIS soil moisture in the Applied Sciences and Public Health arenas using this soil moisture climatology. Additionally, SPoRT seeks to upgrade to the latest version of LIS currently supported by NASA GSFC. The upgrade is important so that SPoRT modifications to LIS can be more easily incorporated and officially supported by the LIS development team. The soil moisture climatology is being made with the latest public version of LIS.

Aerosol Optical Depth product

In 2014, SPoRT began developing an aerosol optical depth (AOD) composite product in an effort to monitor the SPoRT staff transport of Asian aerosols to the western United States. The AOD composite product will support the NOAA CalWater 2 field campaign that is set to take place from January to March 2015 with the objective of developing a better understanding of the interaction of aerosols with atmospheric rivers (ARs) and the subsequent impact on precipitation. Aircraft missions that will gather essential in situ measurements of aerosols over the eastern Pacific Ocean

are a critical component of the CalWater 2 field campaign. The SPoRT AOD composite product will provide the science investigators leading the field campaign with critical information on the concentration and spatial variability of Asian aerosols across the Pacific Ocean that will help with their aircraft mission activities, such as planning appropriate departure times and flight tracks. Additionally, investigators involved in a SPoRT-led NASA proposal submitted in July intend to assimilate the AOD product into the Weather Research and Forecasting with Chemistry (WRF-Chem) model in a project that aims to quantitatively diagnose the impact of Asian aerosols on precipitation events associated with ARs.

The SPoRT AOD composite product combines information from the NASA Moderate Resolution Imaging Spectroradiometer (MODIS), NOAA Geostationary Operational Environmental Satellite (GOES), and Japan Meteorological Agency (JMA) Multi-functional Transport Satellite (MTSAT) in order to generate detailed near-real time maps of the concentration and spatial variability of aerosols across the entire Pacific Ocean basin. Developing an AOD product capable of effectively mapping the trans-Pacific transport of Asian aerosols is not a trivial task due to frequent cloud cover over the Pacific, which prevents valid AOD retrievals. Through combining all the available information from polar-orbiting and geostationary satellites, the cloud cover issues are mitigated in the SPoRT

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Satellite Proving Ground Activities

Total lightning at the Aviation Weather Center

(Excerpted from the final report for the summer experiment by Amanda Terborg, Satellite Liaison, AWC.)

SPoRT's pseudo-geostationary lightning mapper (PGLM) product was again available for assessment at the Aviation Weather Center's Summer Demonstration. The use of the PGLM was limited due to several of the ground-based lightning mapping arrays that were used to create the PGLM being down for maintenance. However, the PGLM still received input from the participants during the FAA operations in the latter half of the summer experiment. One response was a request for a change in the format of the PGLM mosaic for use in N-AWIPS, the Aviation Weather Center's display system. The current format does not allow for easy overlays with other observations. As such, the Aviation Weather Center has requested that the format be changed to GRIB2 to better utilize these data in operations. This is being addressed now by SPoRT. As for the operational impact, one of the largest concerns by FAA managers is determining when aircraft need to be diverted around a storm, as this requires extra fuel. The fuel amount also can be significant depending on the areal coverage of storms. Further complicating the issue is that for longer flights, it is necessary to make a diversion decision well ahead of any impending weather. Generally, traffic flow managers attempt to prevent diversions until absolutely necessary. Typically, it is only when lightning is observed in the radar echoes that consideration will be given to changing traffic patterns en route. As a result of the PGLM demonstration, it is believed that total lightning will be of great use. With both intra-cloud and cloud-to-ground observations, managers will be able to identify lightning activity much more accurately, particularly in the vicinity of the Gulf of Mexico and Atlantic flight routes where there may only be satellite and lightning data available. With Geostationary Lightning Mapper observations coming

from GOES-R, the PGLM has helped set the stage for how these data can aid the aviation community, particularly in data sparse regions.

New Total Lightning Collaborations

SPoRT continues to work with the lightning community to establish collaborative partnerships with owners of numerous ground-based lightning mapping arrays (LMA). The effort relies on SPoRT's eleven years of expertise of transitioning these data to operations. By extending these efforts, SPoRT can work with additional forecast partners to assess the utility of total lightning, as well as help prepare forecasters for the Geostationary Lightning Mapper that will launch aboard GOES-R. This quarter has seen several successes. The first has been the initial reception of LMA data from Kennedy Space Center. To date, the data feed has only been available briefly, but the groundwork is set to provide these data once the network is fully operational. Additionally, SPoRT is working closely with three additional networks that will likely be online for the 2015 convective season. These include the LMAs at Wallops Island, Virginia (NASA), the North Georgia LMA in Atlanta, Georgia (Georgia Tech), and the Ontario LMA in Toronto, Canada (Environment Canada). The latter network is awaiting a final memorandum of understanding between Environment Canada and NOAA and will support the Buffalo, New York Weather Forecast Office.

Continued collaborations with Pacific Region

In May, SPoRT participated in the first of two Proving Ground visiting scientist trips to the National Weather Service's Pacific Region in Honolulu, Hawaii. The first trip set the stage for the initial collaborations with Pacific Region and the Honolulu Weather Forecast Office. One of the outcomes was the focus on the NESDIS Quantitative Precipitation Estimate (QPE)

product developed by Dr. Bob Kuligowski at NESDIS. SPoRT coordinates with Dr. Kuligowski to transition the QPE product to end users for assessment and evaluation. During the summer, the Honolulu forecast office was informally observing the QPE product to look for potential training cases, gain an understanding of the product, and to see how it may integrate best into operations. During this informal review, the Honolulu office provided a number of suggestions to improve the use of the product. One is to adjust the color curve from its default setting to one that matches the rain rate products available in AWIPS now. Forecasters will now have the option to use the default curve or the modified one. Additionally, the office requested to expand the region covered by the QPE product. Since QPE is derived from GOES-West, SPoRT is working on updates to use the wider region so that the QPE product can be viewed over other locations of interest to Pacific Region, such as Wake Island and American Samoa, neither of which have their own radar.

National Centers for Weather and Climate Prediction Visit

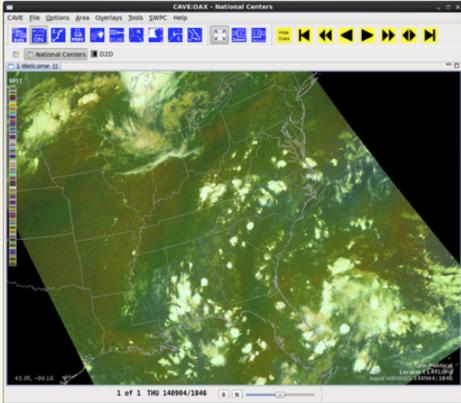
On August 5–6, SPoRT team members traveled to the NCWCP (National Centers for Weather and Climate Prediction) in College Park, MD for a visit to the Weather Prediction Center (WPC), Satellite Analysis Branch (SAB), and Ocean Prediction Center (OPC). The visit was hosted by Michael Folmer, satellite liaison for WPC/SAB/OPC and a champion for SPoRT at the NCWCP. The goals of the visit were (1) to discover how SPoRT-provided products are used by forecasters there, (2) to discuss how SPoRT-provided data would be used during the AWIPS II transition, and (3) to meet with NCEP's AWIPS II Development Team in preparation for the Visiting Scientist Program trip in September. SPoRT staff were shown several instances of SPoRT-provided data in operational use, and gained an understanding of potential data flow issues.

GOES-R Visiting Scientist Program: RGB products in the AWIPS II National Centers Perspective

September was the culmination of a joint visiting scientist project as SPoRT's Kevin McGrath joined team members from CIRA and CIMSS visiting the National Center for Weather and Climate Prediction to discuss and test methodologies to ingest

and display RGB products in the National Centers Perspective (NCP) of AWIPS II. This 'perspective' is one of two GUI options in AWIPS II. WFOs transitioning to AWIPS II will use the WFO perspective, while National Centers (traditional users of NAWIPS) will use the NCP. SPoRT has developed plug-ins for the WFO perspective and plans to develop software for the NCP.

The trip included discussions with NCEP AWIPS II developers as well as testbed work within the NCP, where SPoRT has successfully displayed pre-generated Air Mass RGB imagery. SPoRT, CIRA, and CIMSS plan to continue discussing options to ingest and display RGB imagery in NCP by leveraging existing capabilities demonstrated within the Weather Forecast Office perspective. An ultimate goal is to develop the capability to generate 24-bit RGB products within NCP based upon single-channel source data. The figure shows an example display within NCP.



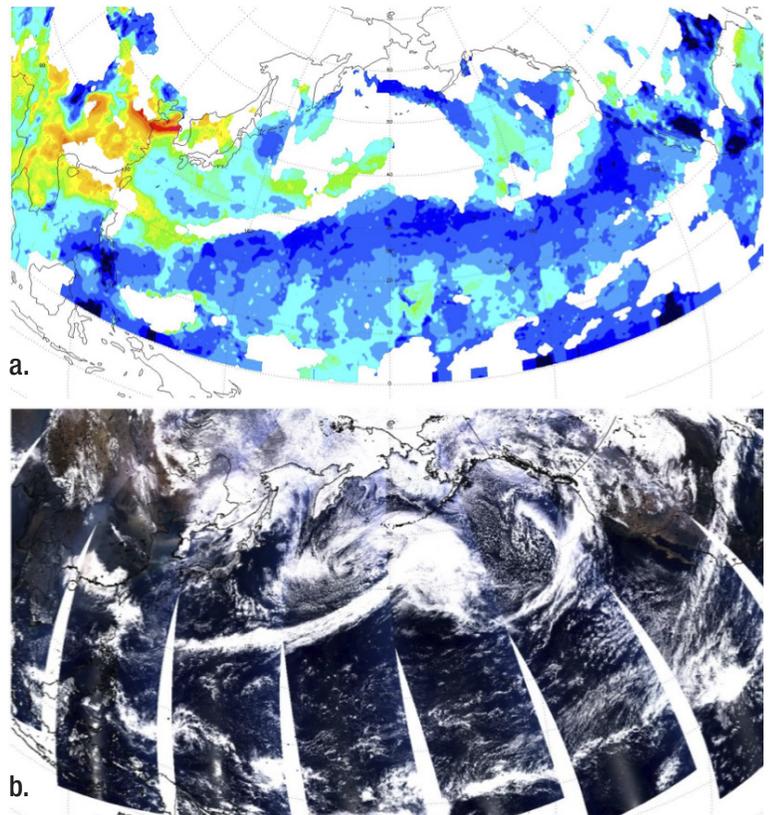
Pre-generated MODIS Air Mass imagery in the AWIPS II NCP using the NCEP McIDAS ingest plug-in and the NCEP Satellite display plug-in.

AIRS Total Ozone products

SPoRT has worked closely with Michael Folmer, the GOES-R and JPSS Proving Ground Satellite Liaison, to develop and transition its total column ozone and ozone anomaly products to the Ocean Prediction Center (OPC). These products have been evaluated and used in operations at the OPC to forecast cyclogenesis, stratospheric intrusions, and hurricane-force wind events. The AIRS ozone products can be used to enhance interpretation and increase forecaster confidence in the Air Mass RGB imagery before GOES-R launch. Future goals include expanding the ozone products to include Metop-A IASI and next-generation S-NPP/JPSS NUCAPS retrievals in order to increase temporal and spatial coverage of the products. Emily Berndt gave an invited presentation summarizing these activities at the July virtual GOES-R Science Seminar.

Aerosol Optical Depth product *continued*

AOD product, and trans-Pacific transport of aerosols can be realized. The product is generated at six-hourly and daily temporal resolutions on a 0.5° grid domain extending from East Asia to the central United States. The six-hourly product will be very useful for the WRF-Chem model assimilation activities while the daily product will support the NOAA CalWater 2 field campaign activities. Panel a shows an example of the SPoRT AOD daily composite product valid on 12 March 2010 at 00 UTC while panel b shows the MODIS true-color composite image on that same day. The product clearly shows a dust storm (which would transit across the Pacific) beginning to propagate eastward from Asia. Areas of broad overcast cloud cover, such as the extratropical cyclone in the central Pacific, prevent any valid AOD retrievals and cause gaps in the spatial coverage. However, in the regions of scattered and broken cloud cover, the product shows the spatial coverage of AOD very well.



(a) SPoRT AOD composite map valid on 12 March 2010 at 00 UTC and (b) MODIS true color RGB composite image on that same day.

moisture did not lead to any changes in the U.S. Drought Monitor for the following week. However, the SPoRT LIS soil moisture variables have certainly helped forecasters in Raleigh and other locations (Houston and Huntsville) with drought designation decisions during the assessment period. Six posts during the quarter have involved the LIS and its application during the assessment period.

Other posts during the quarter largely involved the use of total lightning data and satellite RGB composite imagery in forecast operations. The Great Falls, MT office made a great contribution to the blog in mid-September. Their post, titled “A richly-structured Nighttime Microphysics RGB image”, contained very detailed analysis of an array of cloud types across their area in the early morning hours of September 9th. This post highlighted the ability of RGBs to more effectively assess cloud types and their potential sensible weather impacts (primarily that of fog and low stratus). This is a great instructional post for forecasters who will be gradually incorporating these data and imagery into operations in the GOES-R era. A post about the use of total lightning data detailed its use regarding a flash flood warning situation at the Huntsville office in early August. Two more recent posts showed microwave images of Hurricane Odile from the GPM satellite, and ASCAT wind data and MODIS Airmass RGB imagery from the first hurricane-force extra-tropical low in the East Pacific this cold season.

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).

Thanks, and we hope you'll keep reading!

Presentations

- Berndt, E. B., B. T. Zavodsky, M. J. Folmer, and G. J. Jedlovec. Impact of the Assimilation of Hyperspectral Infrared Retrieved Profiles on Advanced Weather and Research Model Simulations of a Non-Convective Wind Event, EUMETSAT Meteorological Conference, Geneva, Switzerland, September 26, 2014. (presented by Kevin Fuell)
- Berndt, E. B., B. T. Zavodsky, M. J. Folmer, A. L. Molthan, and G. J. Jedlovec. The Use of Red Green Blue Air Mass Imagery to Investigate the Role of Stratospheric Air in a Non-Convective Wind Event EUMETSAT Meteorological Conference, Geneva, Switzerland, September 26, 2014 (poster presented by Kevin Fuell)
- Berndt, E. B., B. T. Zavodsky, and G. J. Jedlovec, 2014: Demonstration of AIRS Total Ozone Products to Operations to Enhance User Readiness. GOES-R Science Seminar, 25 July 2014. [Available at http://www.goes-r.gov/users/sci-sem/2014_07_25.html].
- Blankenship, C. B., J. L. Case, B. T. Zavodsky and G. J. Jedlovec: Assimilation of SMOS retrieved soil moisture into the Land Information System, EUMETSAT Meteorological Conference, Geneva, Switzerland, September 26, 2014. (presented by G. J. Jedlovec)
- Burks, Jason: Advanced Weather Interactive Processing System–Next Generation (AWIPS 2): A Short-Term Prediction and Transition (SPoRT) Perspective, NASA/UAH Brown Bag Seminar, Sep. 24, 2014.
- Jedlovec, G. J.: Impact of the Short-term Prediction Research and Transition (SPoRT) Project on the Operational Weather Community, NASA/UAH Brown Bag Seminar, Sep. 17, 2014.
- Stano, G. T.: NASA SPoRT OCONUS Collaborations, OCONUS R2O Interchange Meeting, Honolulu, Hawaii, 30 July 2014

Publications

- COMET Program lesson–GOES-R GLM: Introduction to the Geostationary Lightning Mapper (Dr. Geoffrey Stano served as an additional science contributor for the module.)
- Stano, G. T., C. J. Schultz, L. D. Carey, D. R. MacGorman, and K. M. Calhoun, 2014: Total lightning observations and tools for the 20 May 2013 Moore, Oklahoma, tornadic supercell. *J. Operational Meteor.*, 2 (7), 71–88.
- Chronis, T., R. Said, K. Cummins, W. Koshak, E. McCaul, E. Williams, G. Stano, and M. Grant (accepted with revisions): Climatological Diurnal Variation of CG Lightning Peak Current over the Continental United States. *J. Geophys. Res.*
- Gravel, C. M., J. R. Mecikalski, K. M. Bedka, W. E. Line, R. A. Petersen, J. M. Sieglaff, G. T. Stano, and S. J. Goodman (submitted): Using GOES-R demonstration products to “Bridge the Gap” between severe weather watches and warnings: An example from the 20 May 2013 Moore, OK Tornado Outbreak. *Bull. Amer. Meteor. Soc.*

Seminars

NESDIS snowfall rate products and new development.
Huan Meng, NOAA/NESDIS/STAR, July 2.

Visitors

Dr. Huan Meng (NOAA/NESDIS/STAR) visited the NSSTC on July 2–3. Dr. Meng works on snowfall rate detection algorithms from NASA, NOAA, and EUMETSAT microwave observations and has been working with SPoRT for the last year to transition and evaluate the operational utility of these products with operational NWS partners. Dr. Meng visited to discuss her NASA-funded project to apply techniques for snowfall rate detection to the NASA/NOAA Advanced Technology Microwave Sounder (ATMS) aboard the Suomi-NPP satellite.

Michael Smith, Senior Vice President and Chief Innovation Executive for AccuWeather Enterprise Solutions (AES) visited with SPoRT on July 10 and gave a presentation on his current activities. AccuWeather Enterprise Solutions is a world leader in business-to-business mitigation of extreme weather which is taking an ever-enlarging toll on the American economy. Mike presented the current state of the business during his visit to Huntsville, and discussed new technologies used by SPoRT to save lives and property that could benefit AES's clientele across the nation and the world.

Science and Operations Officer **John Schmidt** and hydrologist **Tom Wallace** from the Southeast River Forecast Center visited SPoRT on July 23. Discussions were conducted on how SPoRT's coupled LIS-Noah runs might be potentially utilized by RFCs.

Dr. Ralph Ferraro (NOAA/NESDIS/STAR) visited with SPoRT on September 24. Dr. Ferraro is Chief of the Satellite Climate Studies Branch at NESDIS and specializes in passive microwave satellite observations. He is involved with the PMM Science Team and is working within NOAA to identify NWS forecaster applications for data from the Global Precipitation Measurement (GPM) Mission. Dr. Ferraro was visiting SPoRT to discuss ways that SPoRT can work with NESDIS to expedite the use of GPM data in NWS operations through SPoRT's expertise in formatting data for AWIPS, developing training, and obtaining forecaster feedback.

Calendar of Events

2014		
November 18–20	Suomi NPP Applications Workshop	Huntsville, AL
December 15–19	AGU Fall Meeting	San Francisco, CA
2015		
January 5–9	AMS Annual Meeting	Phoenix, AZ
February 23–26	NOAA Satellite Science Week	Boulder, CO
April 27–May 1	NOAA Satellite Conference	Greenbelt, MD
May 25–29	SMOS Science Conference	Madrid, Spain
June 15–19	Satellite Proving Ground/User Readiness Meeting	Kansas City, MO
September 21–25	EUMETSAT Meteorological Satellite Conference	Toulouse, France

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