National Aeronautics and Space Administration

The SPoRT REPORT

SPoRT Quarterly
July – September 2010

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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

SPoRT Strategizes With NWS on Expansion

At its November 2009 meeting, the SPoRT Science Advisory Committee (SAC) recommended that SPoRT consider expanding its active collaborations to other WFOs outside of the Southern Region. The SAC felt that the project had demonstrated significant positive impact on the use of NASA data to improve short-term weather forecasts in the Southern Region and that other regions could benefit from similar focused collaborations (see October–December 2009 SPoRT Report). In response to this feedback, SPoRT convened a meeting of the Science Services Division (SSD) Chiefs of the six regional offices in March 2010 to brief them on the SPoRT program and explore their interest in collaborating with SPoRT. The SSD Chiefs welcomed SPoRT's collaborations and encouraged interactions with WFOs that are truly collaborative in nature, focused on forecast challenges, and coordinated through the regional SSD Chiefs. SPoRT knows that "one size does not fit all" and that effective collaborations need to be tailored for the various regions and forecast challenges. SPoRT staff members have begun a series of visits to the regions in order to strategize on how best to pursue this initiative. A brief synopsis of these visits is presented below.

Eastern Region

In mid-August, SPoRT members Andrew Molthan and Geoffrey Stano traveled to Bohemia, NY for 2 days of meetings with staff members of the NWS Eastern Region Headquarters (ERH). They briefed ERH staff on SPoRT activities and collaboration opportunities with their WFOs. SPoRT personnel learned about the functions and mission of Eastern Region and met with key personnel who can assist SPoRT with developing collaborative projects in line with WFO interests. Dave Radell presented an overview of Eastern Region operations, staff members, and focus areas. Primary forecast interests for the region include aviation weather and related topics of convective initiation or visibility hazards such as low cloud ceilings and fog. SPoRT personnel were given a tour of the Center Weather Service Unit (CWSU) at Long Island MacArthur Airport in Islip, NY. Collocated with the New York Air Route Traffic Control Center (ARTCC), the CWSU is staffed by a small number of NWS meteorologists who brief FAA personnel on weather information provided by other NWS forecasts, available satellite products, and other data sets. Following the visit to the CWSU, Andrew Molthan led a webinar describing the SPoRT Great Lakes temperature product that is currently available within AWIPS and the WRF Environmental Modeling System

(WRF-EMS) forecast model used in several WFOs throughout the NWS. The webinar was heavily attended by forecasters and Science and Operations Officers (SOOs) from eight offices within Eastern Region, emphasizing the Great Lakes and downwind locations. SPoRT plans to collaborate with offices in Cleveland, OH, Binghamton, NY, and Buffalo, NY, on the evaluation of the SPoRT Great Lakes product for use in AWIPS and within the region's ensemble modeling applications. Looking to the future, Andrew and Geoffrey briefed ERH staff on SPoRT's current efforts to develop unique Java plugins for the display of SPoRT and other research products in AWIPS II and discussed areas of mutual interest where SPoRT can provide new tools for product displays. Geoffrey Stano presented a second webinar on the North Alabama Lightning Mapping Array (NALMA) as a training seminar to offices interested in use of the Washington, D.C. Lightning Mapping Array (DCLMA), with eight on-duty forecasters participating. Future SPoRT efforts will seek to collaborate with offices using the DCLMA, to provide them with additional training and future AWIPS II plugins that facilitate a greater utilization of DCLMA data for both severe weather and public safety applications.

Central Region

This past September, four SPoRT personnel (Gary Jedlovec, Brian Carcione, Andrew Molthan, and Geoffrey Stano) made a 2-day trip to Kansas City, Missouri to visit the NWS Central Region Headquarters (CRH) as well as the Aviation Weather Center (AWC). The visit to Kansas City was designed to meet with both CRH and AWC personnel in order to learn how each of these organizations operate, what their forecast challenges are, and to discuss collaborations that could benefit their operations. The Central Region spans 38 Weather Forecast Offices from the Great Plains to the Great Lakes and experiences a full range of weather-related phenomena. In particular the CR needs help in diagnosing convective initiation, improving the delineation between fog and low clouds, and monitoring variations in lake ice within the Great Lakes. Interest was expressed in SPoRT's work with the Land Information System (LIS) modeling efforts as well as SPoRT's satellite activities, including the MODIS-GOES Hybrid product and developing new software plug-ins for AWIPS II where greater data fidelity will be obtained. The discussions throughout the visit were highly informative and laid the groundwork for future collaborations.

Additionally, the SPoRT personnel had the fascinating opportunity to meet with the forecasters of the AWC. The AWC provides weather support for the world's airspace for the FAA, flight service stations, and pilot subscription services. Individual AWC personnel are responsible for providing "sigmet" (Significant Meteorological Information) and "airmet" (Airmen's Meteorological Information) products over massive swaths of territory that directly impact flight operations both on the ground and while an aircraft is in transit. This was a different perspective for SPoRT personnel, as the AWC's focus is national (and beyond) in nature compared to the local and regional nature of the individual NWS forecast offices. To support their mission, the AWC forecasters are looking to improve convective initiation forecasts (particularly in the 2-4 hour timeframe), enhance the ability to detect convection (especially over the observation poor ocean routes), as well as improve the timing of the occurrence of fog. A portion of the discussion focused on lightning data, which SPoRT could provide through the available total lightning networks. There was also a good deal of discussion of what the Geostationary Lightning Mapper will be able to do for the AWC, particularly since the observations will be available both over the continental U.S. and the oceanic air routes.

Alaska Region

In late August, Gary Jedlovec and Matt Smith visited NWS facilities in Anchorage, Fairbanks, and Juneau, Alaska. In Anchorage, they went to the Alaska Regional Headquarters (ARH) for discussions with the Alaska Region Director, ESSD Chief and the staff. SPoRT learned about the region's wide ranging service areas, focusing mostly on marine, aviation, fire weather, and volcanic ash issues. The region's three WFOs (Anchorage, Fairbanks, and Juneau) cover an area about the size of one-third of the lower 48 states. The state's only River Forecast Center (RFC) and Alaska Aviation Weather Unit (AAWU) are both collocated with the Anchorage WFO. Gary and Matt met the Sea Ice Program Leader (aka the "Ice Lady" in the popular Discovery Channel show "Deadliest Catch"). She manually produces ice maps 3 times per week for the AR based on MODIS, AVHRR, and GOES data.

The Alaska Aviation Weather Unit (AAWU) deals with around 150 volcano event-days per year. Gary and Matt were given a tour of the facility and briefed on issues and data needs. The AAWU heavily relies on polar and geostationary satellite data, and the Puff and HYSPLIT models for volcanic eruption information and dispersion forecasts. The volume of commercial and private air traffic is significant throughout the state, and they could benefit from additional aviation and fog/low cloud products. The Alaska RFC has 12,000 rivers to deal with, making the monitoring of surface and atmospheric hydrologic processes an important issue. Flooding can occur from an excess in local rainfall, as well as glacier melt and the formation of ice dams. Monitoring rainfall over the region is complicated by limited radar coverage and mountain blockage. Gary and Matt also visited the Alaska CWSU, located at the Alaska FAA TRACON (at nearby Elmendorf Air Force Base) and spoke with the lead meteorologist. The CWSU is a 16-hour/7-day-a-week facility staffed by 4 meteorologists to provide support to the FAA. Their main concern is volcanic ash.

The Fairbanks WFO is collocated with the International Arctic Research Center (IARC) on the University of Alaska Fairbanks (UAF) campus. The operations floor has a spectacular view looking south towards Mt. McKinley. Gary and Matt spent time with the staff learning about office operations and forecast challenges. Their Area of Responsibility (AOR) is huge (northern two-thirds of Alaska and ocean

region) and has few surface observations. Important forecast challenges include local temperature variations, precipitation mapping, flooding issues (glacier melt and local precipitation), local variation winds, mapping sea ice breakup, and predicting freezing spray over ocean. The UAF is also the home of the Geographic Information Network of Alaska (GINA) (http://www.gina.alaska.edu). While at UAF, Gary and Matt spoke with personnel about the large amounts of satellite data downloaded at the nearby NOAA Gilmore Creek facility—from NOAA, NASA, and DMSP operational polar orbiting satellites. SPoRT plans to gain access to these data streams and focus them on new applications relevant to Alaska and Hawaii forecast issues. Gary and Matt also visited the Juneau WFO, talking with the MIC, SOO, and WCM to learn about their forecast issues and problems. The Juneau WFO could use help monitoring precipitation as they have also almost no inland radar coverage. They actively run various configurations of the WRF and look to use any enhancements that will produce improved local forecasts. They have separate short-, medium-, and long-term forecast desks that all make heavy use of smart tools to populate their forecast grids. Winds and precipitation are among their most crucial forecast issues. In summary, the Alaska Region is an enormous, sparsely observed, remote region with a myriad marine, aviation, and terrestrial forecasting issues. The AR will greatly benefit from SPoRT's infusion of NASA data and expertise—specifically in dealing with the detection and forecasting of winds, precipitation, snow, sea ice, volcanic ash, fire and smoke, and land surface temperature.

Pacific Region

As part of the initiative to explore the expansion of SPoRT activities to other NWS regions, Gary Jedlovec visited the NWS Pacific Region Headquarters in Honolulu, Hawaii on July 30, 2010 as part of the GOES-R Proving Ground OCONUS semi-annual meeting. The Pacific Region responsibilities include public, aviation, and marine forecasts for Hawaii and offshore waters. Aviation responsibilities extend into the North Central Pacific, while marine responsibilities cover the central North and South Pacific. These responsibilities are handled by just three offices, the one in Honolulu, Guam, and Pago Pago in American Samoa. The Central Pacific Hurricane Center (CPHC) is collocated with the Honolulu WFO and issues all tropical cyclone warnings, watches, advisories, discussions, and statements for tropical cyclones in the Central Pacific from 140 Degrees West Longitude to the International Dateline. The Pacific Region is not well sampled by conventional weather observations; supplemental observations from NASA satellites could play a big role in helping them with a variety of forecast issues. Timely, high-resolution imagery of surface and atmospheric features in standard visible, infrared, and microwave channels over the islands and larger regions would be beneficial to complement the GOES West satellite coverage. Derived products relevant to forecast challenges over the region include estimates of precipitation amount, surface wind and ocean parameters, and layered precipitable water. Making these basic parameters available to the Pacific Region offices is a challenge because of limited bandwidth and the lack of EOS direct broadcast capabilities in the region. However, the use of near real-time products from LANCE or other facilities could provide beneficial data sets for use in the region. The visit laid the foundation for SPoRT and Pacific Region collaborations on strategic forecast problems of interest to both NASA and the NWS.

WFO Corner

This is a new section in the SPoRT Report and highlights specific applications of research data at National Weather Service Weather Forecast Offices (WFOs) The articles are written and submitted directly by forecasters at the WFOs and document recent collaborations and use of SPoRT products in their office.

WFO Albuquerque

The CIRA Blended Total Precipitable Water (TPW) and Percent of Normal TPW products are regularly used by forecasters at WFO Albuquerque, during both warm and cool season events. During the days leading up to a recent heavy precipitation event in New Mexico, these products once again proved to be an essential tool in the forecast process. On September 20, 2010, forecasters noted that precipitable water values

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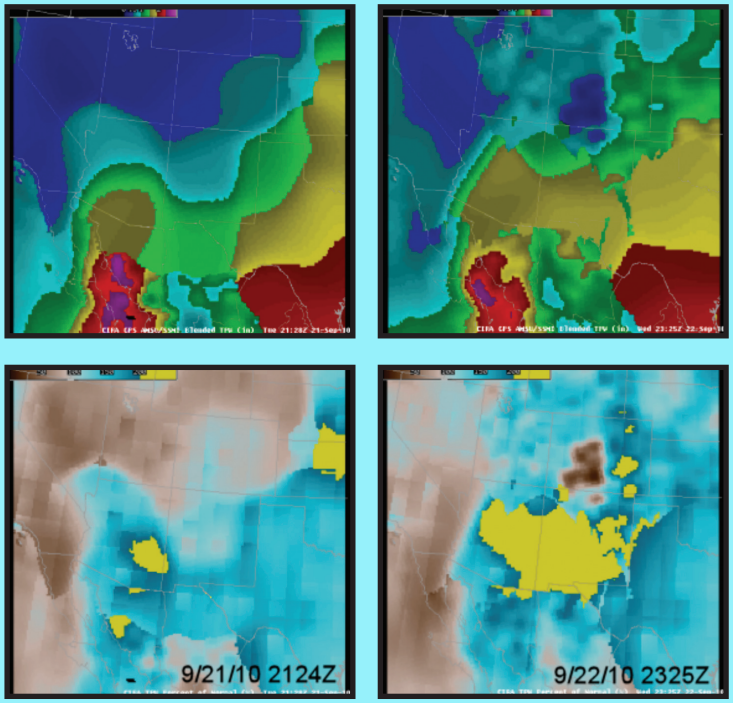


were greater than any noted during the monsoon. Although precipitable water greater than 2 inches (denoted by red in the image) over Mexico are not uncommon, larger values in excess of 2.4 inches (denoted by purple) had not been previously observed by the forecasters. Confidence was high that widespread heavy precipitation would affect much of New Mexico. In the images on the previous page the CIRA TPW and percent of normal TPW are shown for September 21–22, 2010. Note the values of large TPW over western Mexico, and the increases over New Mexico during the 24-hour period, such that much of the state had precipitable water values over 200% of normal on September 22, 2010. The 0000 UTC sounding on September 23, 2010 measured a PW value of 1.46 inches—a record value for September and the third highest PW measured by our local rawindsondes since 1948. During the event, precipitation totals in excess of 6 inches were reported in northeastern New Mexico, with numerous reports of greater than 2 inches. Official records for Albuquerque indicated that the 1.77 inches received on September 22, 2010 was the fourth highest single day amount since 1931.

WFO Birmingham

The Birmingham, Alabama (BHM) WFO teamed up with NASA SPoRT during the summer of 2010 to improve upon mesoscale boundary detection that directly lead to convective initiation. This project concluded the second summer out of four, in which the research team is attempting to solve the larger forecast problem of improving summertime probability of precipitation (PoP) forecasts across central Alabama. During the first summer campaign, the BHM WFO gathered data and statistics on every boundary and boundary interaction through the use of detailed hourly mesoanalysis. The results showed that 80% of the detectable boundaries were thunderstorm outflow generated; however, a significant number of boundaries remained unknown or undetectable, especially with regards to first-generation convection.

This past summer focused exclusively on first-generation convection, and the BHM WFO aligned with SPoRT to begin utilizing output from a real-time configuration of the Land Information System (LIS) as run by SPoRT. The LIS is a high-performance land data assimilation system that can run various land surface models (LSMs) in an uncoupled/offline mode (Kumar et al., 2006), or coupled to the Weather Research and Forecasting WRF numerical weather prediction model (Kumar et al., 2008). In the SPoRT configuration of LIS, the Noah LSM (Ek et al., 2003) was run offline with 1 km output of selected fields made available to the BHM WFO in real time. The LIS/Noah incorporated static surface fields (i.e., soil type and vegetation cover) along with atmospheric analysis and model forcing to produce unique products such as soil moisture, surface sensible and latent heat fluxes, and skin temperature. These LIS data were incorporated into the BHM WFO convective initiation forecast process in an attempt to recognize and mitigate the number of unknown boundaries as seen in the previous year. LIS/Noah output was used in combination with detailed analysis of surface observations, NEXRAD data, and Geostationary Operational Environmental Satellite imagery in an attempt to forecast first generation convective initiation.

Data analysis from summer 2010 revealed that 101 forecast polygons were issued during 2010, associated with 175 convective initiation events. Categorical skill scores revealed a probability of detection of 48% and a false alarm rate of 17%. The results have been encouraging in that some moderate skill has been shown in predicting where summer convection will first develop. It is our goal that continued efforts through summers three and four will improve upon boundary detection and that forecast skill will continue to advance for not only first generation, but subsequent convective development. The scope of this project has the potential to reach beyond central Alabama, so the BHM WFO will continue to work with SPoRT to present this project as a regional forecast issue.

WFO Corpus Christi

NASA SPoRT has made available a new satellite product called enhanced MODIS sea surface temperatures. WFO Corpus Christi found the product to be valuable early in the 2010 hurricane season with the approach of Hurricane Alex. This hurricane made landfall in northern Mexico as a Category 2 storm and there was high confidence that it would intensify to this level due to very warm sea surface temperatures as shown in the MODIS imagery. Alex was the strongest hurricane in the Atlantic Basin since 1966. Shortly after Hurricane Alex dissipated into a torrential rainfall across the mountains of Mexico another tropical cyclone developed near the origins of Alex. The concern with the second system, Tropical Depression number 2, was a track further north and possible greater impact to deep South Texas. Based largely on the cooler waters turned up with Hurricane Alex, and depicted in SPoRT MODIS enhanced sea surface temperatures, forecasters were able to accurately anticipate a slow strengthening of the cyclone and relay this information to decision makers prior to landfall across Brownsville Texas on July 8th. The new SST product uses multi-sensors that blend with microwave SST data from AMSR-E and GOES/POES information. This product is expected to improve latency issues typically associated with MODIS imagery.

WFO Houston/Galveston

WFO Houston/Galveston continued to run their local WRF model with and without the SPoRT MODIS SST data. The primary qualitative observation/benefit of having the MODIS SST data was a more accurate depiction of the sea breeze front. On several occasions the forecasters noted that the timing and inland penetration of the sea breeze was better resolved with the inclusion of the MODIS SST data. The WFO has begun experimenting with a larger WRF model domain and is planning to begin using the SPoRT Land Information System in that version of the model. Images on the following page are of sea breeze differences from June, comparing our no MODIS SST

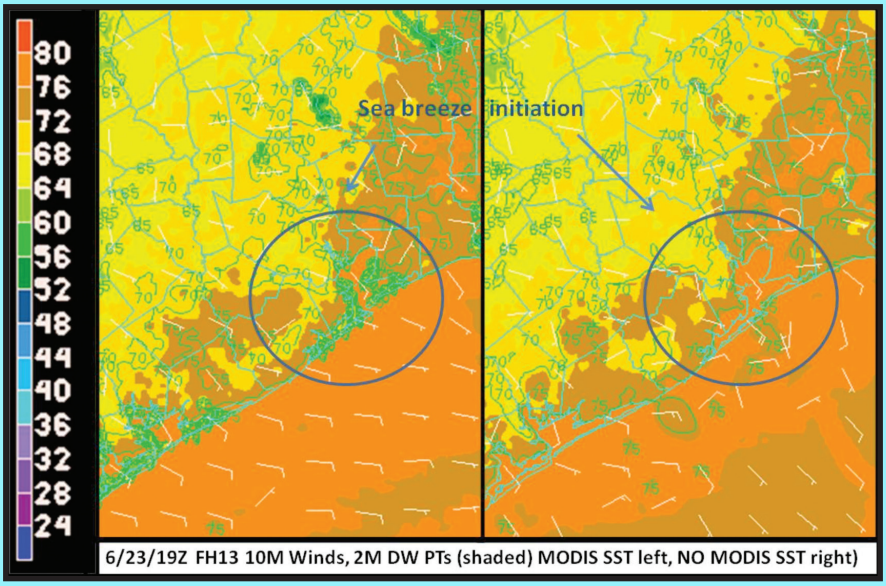
and MODIS SST WRF 4km runs. In both cases the MODIS SST run was a better representation of reality in the highlighted areas. Convection near the boundary also makes assessing model fields difficult.

WFO Mobile

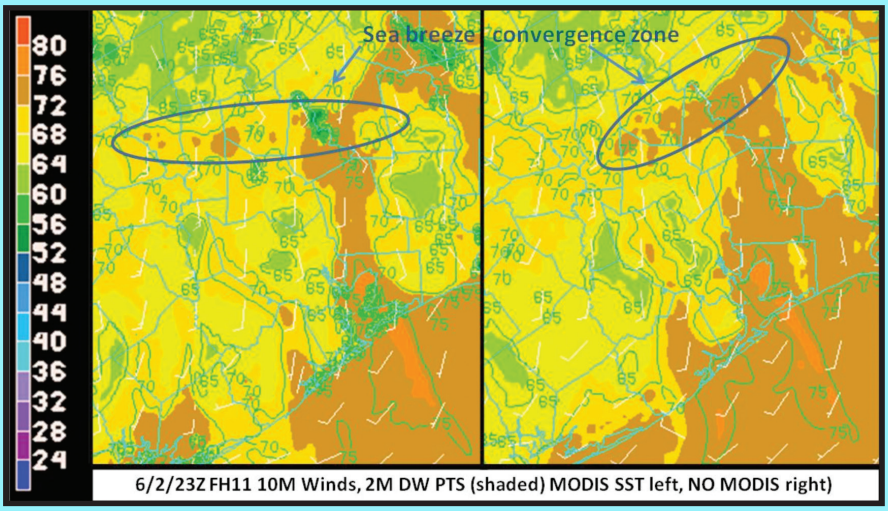
WFO Mobile forecasters were using the MODIS true color imagery within a few days after the Deepwater Horizon Oil Rig exploded, and the oil sheen became visible. The imagery was used extensively by the WFO forecasters to determine the rate of spread of the oil sheen. The thickest oil and heaviest sheen began washing ashore by late June. One vivid recollection from the summer of 2010 was that there were numerous times when the WFO Mobile forecasters were observed to be huddled around an AWIPS workstation discussing various aspects of the event while examining the latest MODIS imagery provided by SPoRT.

WFO Nashville

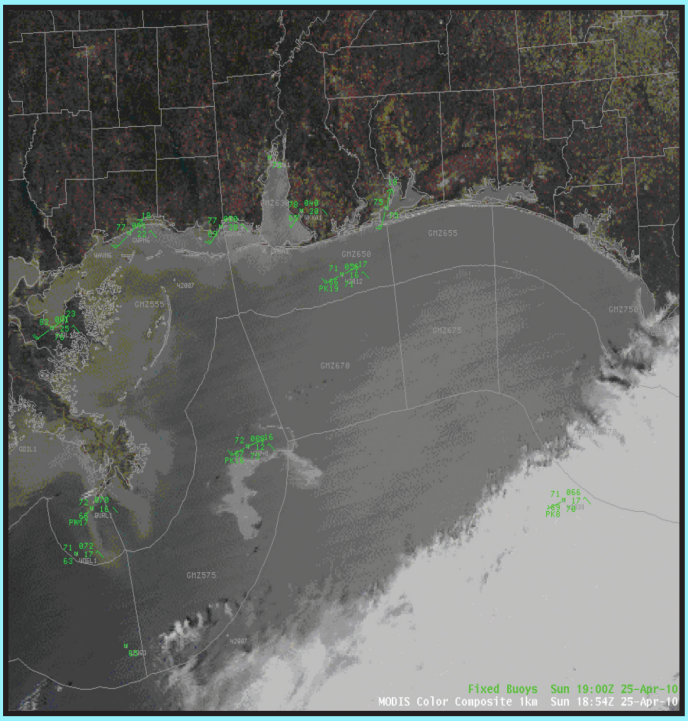
Analysis of surface data is critical to providing situational awareness for local WFOs. Several offices have found the SPoRT ADAS analysis to provide more flexibility in flagging bad data than the RTMA in AWIPS. Due to poor station siting, during days when sunshine is abundant and winds are light, the T is too high (and T_d would then also suspect). WFO Nashville forecaster worked with Brad Zavodsky to blacklist the T and T_d observations between 1300 and 0100 UTC for Smyrna (MQY) site in middle Tennessee in order to produce a more accurate ADAS analysis.



6/23/19Z FH13 10M Winds, 2M DW PTs (shaded) MODIS SST left, NO MODIS SST right)



6/2/23Z FH11 10M Winds, 2M DW PTS (shaded) MODIS SST left, NO MODIS right)



Recent Publications and Presentations

Conference/Workshop Presentations

Chou, S-H, B.T. Zavodsky, and G.J. Jedlovec, 2010: Impact of Atmospheric Infrared Sounder (AIRS) Thermodynamic Profiles on Regional Weather Forecasting. 17th Conference on Satellite Meteorology and Oceanography, Annapolis, MD.

Jedlovec, G.J., F. LaFontaine, J. Shafer, J. Vazquez, and C. Mattocks, 2010: Impact of high resolution SST data on regional weather forecasts. IEEE Geosciences and Remote Sensing Society (IGARSS), 2010, Honolulu, HI.

Jedlovec, G.J., 2010: SPoRT–Transitioning NASA Satellite Data into Weather Forecast Operations. 17th Conference on Satellite Meteorology and Oceanography, Annapolis, MD.

Visitors

- Brad Doorn, NASA HQs Applied Science, received a SPoRT update, September 22.
- Sujay Kumar, NASA/GSFC, gave a seminar and learned about SPoRT, September 15.

External Workshops/ Meetings Attended

- 17th Conference on Satellite Meteorology and Oceanography, September 27–30 (Annapolis, MD), Conference presentations by Jedlovec and Chou.
- NWS Central Region Headquarters/ Aviation Weather Center (AWC)– September 20–21 (Kansas City), discuss SPoRT expansion ideas.
- NWS Alaska Region Headquarters (and associated WFOs, CWSU, AAWU) August 23–27, discuss SPoRT expansion ideas.
- ROSES09 Interdisciplinary Science Panel Review, August 3–5, Washington, DC.
- IGARSS, July 26–30, Honolulu, SPoRT presentation by Jedlovec.
- GOES-R Proving Ground Meeting, July 28–30, Honolulu, participate in PG activities, visit Honolulu WFO to discuss expansion ideas.
- NWS Eastern Region Headquarters, July 22–23, NY, discuss expansion strategies.

Proposals Submitted

Call: ROSES10 A.24 Enhancing the capability of computational Earth system models and NASA data for operation and assessment

- Assimilation of Soil Moisture Estimates from the Soil Moisture and Ocean Salinity Satellite into the Land Information System, Dr. Clay Blankenship, PI.
- Improved Impact of Atmospheric Infrared Sounder Radiance Assimilation in Numerical Weather Prediction, Bradley Zavodsky, PI.

Call: GOES-R Risk Reduction Program

- Incorporating RGB Imagery Capabilities within AWIPS I and II, Kevin Fuell, PI.
- The WRF Lightning Forecast Algorithm for GLM: Refinement and Incorporation into Convection–Allowing Ensemble Forecasts, Dr. Eugene W. McCaul, PI.
- The GOES-R GLM Lightning Jump Algorithm: Research to Operational Algorithm, Dr. Walter A. Petersen, PI.
- Rate of Change Products for Geostationary Lightning Mapper Demonstration Data, Dr. Geoffrey T. Stano, PI.

Calendar of Upcoming Events

- SPoRT October Coordination Call, October 21
- NASA Science Community Workshop on Polar Orbiting Infrared and Microwave Sounders, Nov. 1–2, Greenbelt, MD
- NOAA Technology Summit, November 2–4, SPoRT presentation on NASA technologies helping weather forecast activities
- NASA Sounder Science Team Meeting, November 3–5, Greenbelt, MD Zavodsky presentation and discussions of utility of hyperspectral sounders
- NWS Eastern Region Headquarters Virtual Satellite Workshop, November 9, SPoRT participation
- LANCE Working Group Meeting, November 16–17, GSFC, Jedlovec member of Working Group
- SPoRT November Coordination Call, November 18
- Visit by Deputy Director JCSDA–November 19, Sid Boukabara–give presentation and learn about SPoRT
- GOES-R Proving Ground All Hands Conference Call, November 23
- SPoRT December Coordination Call, December 16
- AMS Annual Meeting, January 2011, Seattle, numerous presentations

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

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