National Aeronautics and Space Administration

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

The SPoRT Roadshow

On August 22nd through the 26th, SPoRT members Kevin Fuell, Geoffrey Stano and Kris White traveled to the Jackson (Mississippi), Slidell, and Mobile National Weather Service offices to meet with staff and discuss how SPoRT capabilities can help local operational needs. These offices had recently requested (through Southern Region SSD) to acquire NASA/NOAA research data and participate in SPoRT product evaluations. In addition to sampling some of the great food for which the region is known, the SPoRT team presented an overview of the NASA SPoRT program, as well as specific products and imagery that match known forecast challenges. The first visit was to the Jackson, Mississippi NWS office (JAN) where there was a large turnout by the office staff and management. There was high interest in the NASA 3-km Land Information System (LIS) fields for local modeling efforts as well as high-resolution hybrid imagery for analysis of convective clouds and fog. The 250-meter resolution MODIS visible difference imagery was also of interest for aiding the post-event analysis and survey of tornado tracks. Greg Garrett, Science and Operations Officer, indicated that they have many rural areas in the forecast area that are difficult to get to, and this type of imagery could be very helpful with the storm survey process. In addition, they receive requests from the local and state emergency management offices for this type of tornado track map.

Next, the team made a two-day visit to the NWS New Orleans/Baton Rouge (LIX) office and Lower Mississippi River Forecast Center (LMRFC) in Slidell, Louisiana, speaking with forecasters, hydrologists, and modelers. At LIX, the SPoRT team learned about the difficulty with the early detection of advection fog off the northern

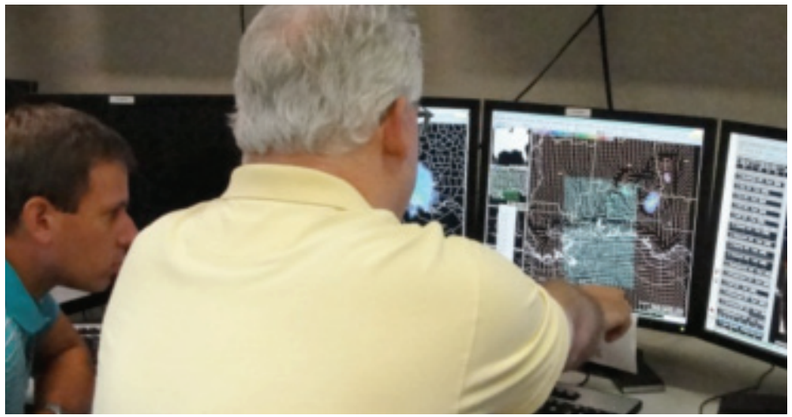
LMRFC senior hydrologist speaks with Kevin Fuell (left) and Geoffrey Stano (right).

Gulf of Mexico, particularly during the winter season. LIX has already found value in the single swath MODIS low cloud and fog (11-3.9 µm) product, therefore, the MODIS-GOES hybrid version of this product was suggested. MODIS RGB imagery to address fog and low clouds was also presented as a future GOES-R capability. Additionally, SPoRT highlighted that the Mobile and Houston/Galveston WFOs have applied the MODIS SST composite as a valuable tool in determining the potential likelihood for fog development in the region. Mike Koziara (SOO) at LIX discussed a forecast challenge where the marine boundary layer (MBL) influences the stability over land near the coast and inhibits convection. This MBL influence is often not captured well by models or national watch areas. A potential collaboration with LIX and SPoRT could involve the use of SPoRT SST and LIS as initialization to the surface boundary of a local model in order to examine their influence on convection. More important may be the sensitivity of the planetary boundary layer (PBL) scheme used within the model with these SPoRT data sets. Tim Erickson at LIX has interest in looking at this issue for the upcoming winter/spring period. Although the occurrence of tornadoes are not as common as in the Jackson area, SOO Mike Koziara likewise expressed great interest in the MODIS difference plots for the detection of tornado paths and for help with post-storm surveys. This was a common theme with forecasters at all of the offices that were visited.

Co-located with LIX is the Lower Mississippi RFC. Kai Roth is a geologist at the RFC who provided the description of their operations and responsibilities. The team met with staff and presented a SPoRT program overview as well as examples of NASA LIS output fields. Future collaborations between the RFC and SPoRT may include providing some near-realtime datasets such as Greenness Vegetation Fraction or soil moisture from future SMAP (Soil Moisture Active Passive). Also, there may be opportunities to use LIS output to help force hydrologic modeling.

On the last day of the road tour we made a visit to the Mobile, AL NWS office and had a great time interacting with a relatively large group of staff there. Jeff Medlin (SOO) is actively involved with running local models and has been incorporating NASA LIS and MODIS SST datasets into the WRF EMS model since 2007. Running a verification of the model is difficult because of the large file sizes involved, but efforts are underway to work with the SPoRT modeling team to test local model runs initialized with NASA datasets against control runs. Jeff and the Mobile office were perhaps most interested in heavy precipitation and flash flood cases in which to run model comparisons.

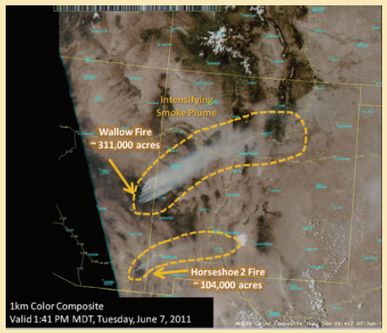
The SPoRT team would like to thank personnel at these offices who took time out of their very busy schedules to meet and interact with us. Through this process, much was learned, both from the operational forecaster perspective and from the SPoRT perspective. We are looking forward to more such opportunities in the near future.



Science and Operations Officer Jeff Medlin at NWS Mobile shows model output from the local WRF EMS, initialized with NASA LIS data.

SPoRT hosts the 2011 Partners Virtual Workshop

On August 31, 2011 SPoRT hosted the Second Collaborative Partners Workshop. Unlike the first one in 2010, SPoRT adopted a web seminar format creating a virtual workshop forum. The virtual format allowed for far more attendance from forecasters who otherwise would not have been able to make the trip to Huntsville. The workshop brought together SPoRT's collaborative National Weather Service partners as well as hosting attendees from other offices and regions to learn more about SPoRT and its collaborations with the National Weather Service. The format was a success with a dozen presentations and over 30 separate groups dialing in to participate during the day.



Example image from Deirdre Kann (SOO – Albuquerque, New Mexico) illustrating the use of the MODIS true color composite to identify smoke plumes and plot their impact in a Graphicast.

Starting with a welcome from SPoRT and introductions by the National Weather Service's Eastern and Southern Region Headquarters, the workshop covered a wide range of topics. These were split across three main headings: Modeling, Application and Development of SPoRT Products, and Convection and Severe Weather. The format included a combination of presentations by SPoRT personnel describing new capabilities, such the Land Information System for model initialization, to presentations by our partners on integrating products to identify hazardous weather (Albuquerque) and improving summer probability of precipitation forecasts (Birmingham). A listing and links of the day's presentations can be found in the Library section of SPoRT's web page (http://weather.msfc.nasa.gov/sport/workshops/).

The day-long workshop concluded by identifying four key actions. First, our partner offices have expressed interest in receiving more of our GOES-R Proving Ground products for evaluation. Secondly, our partners involved in modeling activities are interested in SPoRT providing support for implementing the MET Tools verification package. Unlike normal grid-based verifications schemes, MET Tools verifies against model objects. Also, the aforementioned Land Information System resulted in a great deal of interest, both in its utility to be imported into AWIPS and the GFE to observe surface features but also as a tool to improve model initialization. Lastly, SPoRT's Red-Green-Blue product suite was indicated as another data set our partners are interested in evaluating in their operations.

GOES-R Proving Ground Activities

SPoRT has been a funded participant in in the GOES-R Proving Ground (PG) since 2009. During that time, SPoRT has made contributions related to new or enhanced applications of GOES-R proxy data. One activity included attending the 2009 Hazardous Weather Testbed (HWT) Spring Program where SPoRT staff interacted with end users and participated in operations to better understand what improvements were needed for the simulated Geostationary Lightning Mapper (GLM) product, as well as potential new Advanced Baseline Imager (ABI) proxy data. SPoRT created a Pseudo-GLM product for use in the 2010 and 2011 Spring Experiments that provided a training tool demonstrating GLM-resolution data. The Pseudo-GLM is a precursor to the official Algorithm Working Group (AWG) GLM proxy. SPoRT works closely with users attending the Spring Experiment, as well as several National Weather Service Weather Forecast Offices to continually evaluate new total lightning products. As a result, several new applications related to the Pseudo-GLM are in development.

More recently, SPoRT developed a new application referred to as the MODIS-GOES Hybrid to provide near real-time ABI proxy imagery for use in operations. The Hybrid differs from the case-based ABI proxy data created for GOES-R demonstration in that it utilizes current instrument capabilities from MODIS, which are similar to those of ABI. The benefit to the real-time product is that it provides exposure to the imagery over a range of scenarios and allows users to supplement other current data sets. In order to simulate the temporal frequency of GOES-R, the current GOES imagery is used at 15-minute intervals and the high-resolution MODIS imagery is remapped into the ABI resolution as available. Therefore, a series of images from the Hybrid is animated like many other GOES satellite products, but ABI proxy data are included to expose forecasters to new GOES-R capabilities. A derivative of this work is to create Hybrid products such as the spectral difference imagery from both GOES and MODIS used to identify fog and low clouds.

SPoRT has also begun to develop a standard suite of Red-Green-Blue (RGB) composite products, which use MODIS as a proxy for future GOES-R capabilities. This suite is based on best practices documented by the EUMETSAT User Services Group and their operational experiences using the SEVIRI instrument on MeteoSat Second Generation (MSG). The RGB proxy products will initially focus on creating RGB imagery to depict air mass, dust, cloud microphysics, fog/stratus, snow, and true color. These products have been transitioned to NAWIPS for use at the Hydrometeorologic Prediction Center (HPC), the Ocean Prediction Center (OPC), the NESDIS Satellite Analysis Branch (SAB), and the National Hurricane Center (NHC). Additional information on these and other products can be found in the new GOES-R PG section on the SPoRT web page (http://weather.msfc.nasa.gov/sport/goesrpg/).

WFO Corner

Albuquerque (ABQ)

In late August and through September, WFO Albuquerque used the MODIS-GOES Hybrid 3.9-µm imagery to monitor a hotspot from the Guacamalla Fire southwest of Los Alamos. In previous examples of small fires, the baseline GOES 3.9-µm imagery tended to overexagerate the spatial coverage of the fire due to its relatively coarse resolution. However, in this case the 2-km SPoRT MODIS-GOES Hybrid 3.9-µm imagery (at GOES-R ABI resolution) showed the hot spot with much greater detail, delineating the size and location of the fire compared to the GOES 3.9-micron imagery. MODIS 1-km imagery showed even more detail of the hotspot location.

Melbourne (MLB)

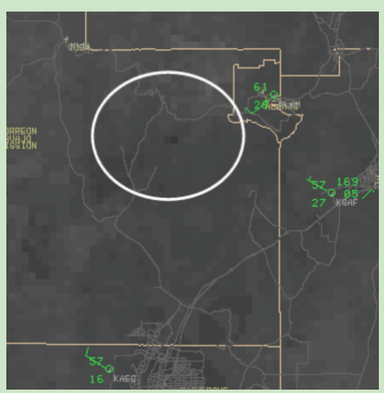
A nocturnal thunderstorm event on September 07, provided MLB the opportunity to evaluate the UAH Convective Initiation (CI) product's night-time utility. In particular, this event occurred during GOES rapid scan operations, which will be the standard temporal frequency of GOES-R. The forecast concern was the timing of thunderstorms near airports as well as in the short-term forecast. Initial evaluation of the event by the SOO and others had several conclusions. The night-time algorithm seemed both stable and consistent. Confidence for convective initiation would not have been specific to any one feature (necessarily), but would have increased with the persistent signature between 0845 UTC and 0915 UTC. This confidence was accentuated with rapid scan, but lessened with other features (i.e., CI indicators) that did not remain as persistent through the event.

Miami (MFL)

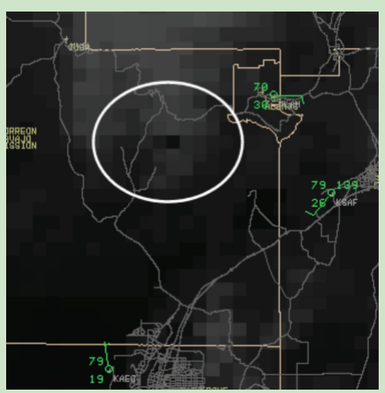
The Miami WFO is participating in the evaluation of the UAH Convective Initiation product in conjunction with MLB and HUN. Convective activity in Florida has a somewhat longer season than more northerly WFOs in Southern Region. Like MLB, the staff at MFL have submitted examples of where the CI product correctly provided advance warning of convection and resulting thunderstorms, up to 30 minutes. The number of missed convective events is qualitatively estimated to be about 40 percent. In many cases, high clouds from thunderstorm outflow or upper level cirrus identified as the culprit preventing the detection of cumulus clouds growing underneath.

Huntsville (HUN)

In addition to the Miami and Melbourne FL WFOs, WFO Huntsville is also testing the UAH Convective Initiation product (part of the GOES-R AWG proxy products). On September 22 a relatively unstable air mass was in the Tennessee Valley area. The HUN short-term forecaster was able to use the UAH CI product to monitor the potential for convective storms which may also lead to the threat of lightning for aviation impacts and for a couple of outdoor activities. In Jackson County, the CI algorithm allowed for about a 40 minute lead time on the occurrence of deep convection and lightning (as validated by subsequent radar). However, it was noted that the other areas in Jackson County were not detected by the CI algorithm. Evaluation of the product will continue and ramp up in Spring of 2012. Efforts also continue with the use of the 1-km NASA Land Information System (LIS) soil moisture fields to assess rainfall deficit impacts for input to the U.S. Drought Monitor. Also of particular interest, was the "dryness" noted in the 1-km LIS soil moisture fields during the passage of the remnants of tropical storm Lee in early September. Very dry antecedent soil moisture conditions (relative integrated soil moisture values around 20–40 percent), as depicted in the LIS, apparently played a large role in the lack of flooding experienced by the area, despite very abundant and widespread 4–12-inch rainfall amounts. This, and other cases, will be examined in future studies to determine the applicability of the LIS data in assessing flooding potential.



MODIS-GOES Hybrid Image at 0531 UTC, 24 September 2011



GOES Image at 1915 UTC, 24 September 2011

Recent Accomplishments

Data Assimilation

After completing development of a cycling script to mimic NCEP operations, the SPoRT data assimilation group has shifted focus to examining diagnostic output from the Gridpoint Statistical Interpolation (GSI) system for the handling of hyperspectral radiances assimilated within the system. An examination of these diagnostic variables will clarify the processing used in the assimilation of individual observations and the implications for tracking which observations are rejected by data thinning, detection of cloud-contamined radiances, and impact of surface emissivity on the use of AIRS radiances within GSI. Additionally, SPoRT is developing a three-dimensional moisture analysis product enhanced with the assimilation of AIRS profiles to monitor atmospheric rivers of moisture over the Pacific ocean. This product is being developed as a way to aid in the forecasting of these moisture features in Western and Alaska Region NWS WFOs. Additionally, SPoRT continues its collaboration with Don Morton and his staff of the Arctic Region Supercomputing Center at the University of Alaska Fairbanks in their efforts to assimilate AIRS profile data into an operational version of the High-Resolution Rapid Refresh configured for an Alaska domain (HRRRAK). These efforts have a path to being transitioned to SPoRT's partnering offices in the Alaska region.

Updating and Transitioning Model Verification Scripts

SPoRT updated internal scripts that generate model verification statistics using the Model Evaluation Tools (MET) software developed by NCAR. The goal is to produce a streamlined scripts that can be transitioned to SPoRT partners interested in conducting evaluations of their local numerical weather prediction models. Forthcoming plans involve installing and testing the first version of these streamlined scripts at select WFOs as part of establishing a NWS Southern Region modeling collaboration with SPoRT.

SPoRT-SERVIR Modeling Collaboration

SPoRT and NASA/SERVIR initiated a collaboration to aid SERVIR in upgrading their Mesoamerica modeling system from the Mesoscale Model version 5 (MM5) to the WRF model. The current MM5 configuration over Mesoamerica consists of two separate daily nested MM5 runs at 27-km and 9-km horizontal grid spacing over the Caribbean and Gulf of Mexico regions. SPoRT developed an experimental nested grid configuration of the WRF model to run once per day that could potentially replace the two separate MM5 runs. The resolution of the grids was increased with a 12-km grid covering the entire Gulf of Mexico and Caribbean region and two inner 4-km nests covering all of Central America and the Dominican Republic/Puerto Rico region, respectively. Run on SPoRT's "Weather-in-a-Box" clusters, the SPoRT-SERVIR WRF setup is initialized at 0600 UTC each day and incorporates the SPoRT SSTs into the initial conditions.

SPoRT also began developing a model verification capability for the Mesoamerica region. Using the SPoRT/MET verification scripts as a basis, SPoRT acquired observational datasets from the GFS Data Assimilation System (GDAS) and the Climate Prediction Center Morphing (CMORPH) satellite precipitation estimate to generate verification statistics for a sample WRF model run over Mesoamerica. Future efforts shall include the production of surface and upper-air point verification statistics for a series of WRF forecasts, as well as quantitative comparison to the CMORPH precipitation product and possibly other satellite estimates of precipitation. In addition, SPoRT is pursuing the steps needed to generate verification statistics for the current SERVIR MM5 forecasts to compare against the experimental WRF simulations.

Technical Interchange Meeting

In August, three SPoRT personnel attended a Technical Interchange Meeting in Omaha, Nebraska, home of the Raytheon group responsible for writing the core software for AWIPS II. The TIM was a two-day discussion between the architects of AWIPS II and groups from NASA/SPoRT, CIMMS/UW, CIRA/CSU, and NOAA/OST. Raytheon explained much of the software design from a high level, and answered many of the questions of the attendees. The group was given explanations of upcoming changes and historic perspectives of why the code was written as it is. Some of the most significant answers involved the future of 64-bit hardware requirements and expected operating system changes. Some exciting future AWIPS II capabilities were discussed (such as 3D display) that are awaiting full NWS/WFO installation before becoming accessible. Since the TIM, SPoRT has used the Raytheon McIDAS plug-in to ingest and display satellite data and has modified it to better suit SPoRT satellite data needs. There will likely be another TIM after Operational Test and Evaluation during the first half of 2012.

Proposal Accepted

NOAA/NESDIS has agreed to fund a proposal submitted by SPoRT to conduct a demonstration activity for the Visible Infrared Imager Radiometer Suite (VIIRS) data on NPP. On October 28, NASA launched a new member of its Earth-observing fleet called the NPOESS Preparatory Project (NPP) as a demonstration satellite for NOAA's reformulated Joint Polar Satellite System (JPSS, http://www.nesdis.noaa.gov/jpss/) program. In addition to extending the suite of long-term NASA measurements to measure variables critical to the understanding the Earth's climate, the NPP observations extend NOAA's operational weather forecasting support first begun with the polar observing program (http://www.nasa.gov/mission_pages/NPP/news/new-era.html). SPoRT) will demonstrate the utility of multispectral observations from the VIIRS, one of several instruments on the NPP satellite, to improve short-term weather forecasting at various weather offices in the continental U.S. and Alaska. SPoRT scientists will work collaboratively with staff from the University of Alaska Fairbanks (UAF) and the Naval Research Lab (NRL) in Monterey, California over the next two years demonstrating new capabilities of VIIRS including a new low light sensor which can detect moonlight reflected from the Earths surface and clouds for night time weather monitoring.

Calendar of Events

- Missions Applications Workshop, Arlington, VA, Sept. 28–29
- NWA Annual Meeting, Birmingham, Oct. 17–20, numerous SPoRT presentations
- GOES Users Conference, Birmingham, Oct. 20–21, numerous SPoRT presentations
- NPP Launch, Oct. 27
- NOAA GPM User Workshop, Nov. 29–Dec. 1
- SPoRT Science Advisory Committee (SAC) Meeting, Huntsville, Nov. 29–Dec. 1
- AGU Fall Meeting, San Francisco, Dec. 5–9, several SPoRT presentations
- NWS Corporate Board AWIPS II Demonstration, Dec. 7–8, Silver Spring, MD.
- AMS Annual Meeting, Jan. 22–26, numerous SPoRT presentations
- NPP Science Team Meeting, Jan. 31–Feb. 2, GSFC, Greenbelt, MD.
- NPP Applied Science Workshop, Mar. 7–8, Ames Research Center
- LANCE Users Meeting, Feb. 6–8

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