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

SPoRT's Weather in a Box Systems Arrive!

Over the last few months, SPoRT has acquired two high-speed CRAY supercomputers to help demonstrate the utility of NASA modeling capabilities and satellite data sets to improve short-term weather forecasts. These systems are advertised as "Desktop Supercomputers" in that they have only a slightly larger footprint than a desktop PC and do not require significant additional power or cooling requirements beyond that available in a standard office environment. Both systems have 64 high-speed processors on 8 compute nodes that are connected by Infiniband cables. The combination of the fast processor speed and communication between compute nodes through the Infiniband has provided the capability to process model and data assimilation runs approximately 5–10 times faster than SPoRT's current 24-node cluster. The

two systems were configured by SPoRT with help from the Software Integration & Visualization Office group at Goddard Space Flight Center (GSFC). The first of these systems, WiB1, was delivered to MSFC in December and became operational in late January. WiB2 was configured and tested at GSFC and shipped to MSFC the last week of March. WiB2 will be ready for model runs within days of its delivery. SPoRT plans to use WiB1 to support SPoRT's operational data assimilation and modeling system, and WiB2 will serve as the research and development system. WiB2 will also act as an operational spare if WiB1 is down.

SPoRT's use of WiB1 is to demonstrate the utility of NASA modeling capabilities and data sets to improve short-term weather forecasts. The WiBs give SPoRT the capability to mimic operational forecast models used in real-time by NOAA. The National Centers for Environmental Prediction (NCEP) regularly runs an operational version of the Nonhydrostatic Mesoscale Model Weather Research and Forecasting (WRF-NMM) model called the North American Mesoscale (NAM) model over a domain that covers much of North America to produce long-range forecasts that support National Weather Service (NWS) operations. In addition, the National Severe Storms Laboratory (NSSL) in Norman, OK runs an operational version of the Advanced Research WRF (WRF-ARW) model over a CONUS domain to produce forecasts that are used by the Storm Prediction Center (SPC) for guidance in their daily convective outlooks.

Initially, SPoRT is configuring WiB1 to mimic the NSSL/WRF to produce a 36-hour forecast in real-time. The NSSL/WRF model configuration currently runs on a 1,200 × 800 × 35 domain with 4-km horizontal grid spacing with physics options that are conducive for accurately simulating convection. The NCEP North American Mesoscale Model (NAM) output is used as initial and boundary conditions. SPoRT has set up the same NSSL/WRF domain and physics schemes as in the NSSL/WRF runs; however, SPoRT is incorporating several unique NASA capabilities into the daily model runs to compare the results to the NSSL/WRF forecasts. The SPoRT high-resolution sea surface temperature (SST) data replace the SST initialization provided by the NAM model. For the land surface, a NASA Land Information System (LIS) spin-up run provides consistent, 4-km resolution land surface fields to initialize the WRF soil variables each day. Also, SPoRT produces a 1-km, daily-updated Moderate Resolution Imaging Spectroradiometer (MODIS) Greenness Vegetation Fraction (GVF) dataset over CONUS that replaces the coarse-resolution climatological GVF data in WRF, as well as in the LIS spin-up run. Finally, swaths of Atmospheric Infrared Sounder (AIRS) retrieved thermodynamic profiles are assimilated into the atmospheric initial conditions for the SPoRT/WRF runs each day using the WRF 3D variational assimilation system. This SPoRT model run will be used in a model intercomparison activity at NSSL/SPC later this Spring.
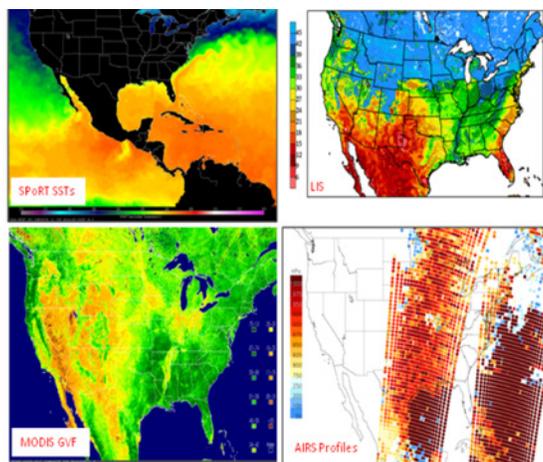
Later this year, SPoRT's use of WiB1 will include daily forecasts in the NSSL/WRF configuration using the NASA Unified WRF (NU-WRF) and Gridpoint Statistical Interpolation (GSI). GSI will run every three hours and use a cycling methodology whereby a 3-hour forecast from a previous SPoRT/NU-WRF forecast will be used as the background field for the analysis. At each assimilation time, all available conventional, radiance, and radar observations that are assimilated operationally in NCEP's NAM Data Assimilation System (NDAS) will be used. The only exception to the above is that instead of assimilating AIRS and Infrared Atmospheric Sounding Interferometer (IASI) radiance data, the SPoRT/NU-WRF system will assimilate AIRS and IASI thermodynamic profiles. Using IASI profile data allows SPoRT to anticipate the methodology and potential analysis impact that might be seen by NASA/NOAA's Cross-track Infrared Sounder (CrIS). Updated initial conditions from GSI and updated lower boundary conditions from the LIS and SPoRT SSTs—all containing unique NASA observations/capabilities—are hypothesized to improve overall forecast performance of this modeling configuration.

Various research projects are also slated for WiB2. On the modeling side, SPoRT plans to run various experiments of LIS over CONUS and Alaska domains including use of new precipitation data sets and assimilation of satellite retrievals of land-surface characteristics using NU-WRF. For data assimilation, SPoRT plans to configure a version of the WRF-NMM/GSI that mimics NCEP's NAM/NDAS system in an effort to test the impact of unique NASA data sets in that regional model. Plans with this system include comparing the impact of hyperspectral radiances and retrieved profiles and finding new strategies for assimilating hyperspectral radiances on regional domains. This parallel modeling configuration that mimics the NAM/NDAS means that any other unique NASA data sets can easily be assimilated to show their impact within an operational regional forecasting system developed to visualize each of these products.

Recent Accomplishments

SPoRT Real-time Product Status Page

SPoRT strives to provide the most timely and reliable experimental data products to its partners and end users via several different delivery mechanisms. A system has been developed to monitor the availability of LDM and FTP products and summarize the latency of each product based on its age. Summaries are posted to <http://weather.msfc.nasa.gov/sport/productstatus/> every 10 minutes. A green-yellow-red legend is used to display the latency information. Green boxes indicate that products are updating on time, yellow indicates that products are moderately delayed, and red indicates that products are old. Email notifications are sent for any red products to alert responsible parties.

SATCAST

The UAH Convective Initiation forecast algorithm ("SATCAST": SATellite Convection AnalysiS and Tracking) has been upgraded to include the detection of convective initiation features for nighttime operations, to complement its operations during the day. Also, among other enhancements, the processing runtime has been decreased in order to reduce product latency. The next major step will be to advance the algorithm to the stage where it can be applied with GOES CONUS Rapid Scan data.

Lightning Forecasting

A proposal submitted to the NOAA R3 call by Bill McCaul to refine the WRF Lightning Forecast Algorithm (LFA) has been accepted. Work has already begun to prepare the WRF software (that had been previously implemented on the NSSL WRF daily simulations) for transfer to personnel at the Center for Analysis and Prediction of Storms (CAPS) at the University of Oklahoma. By the end of March, the code had been transferred, installed and tested on the CAPS WRF platform.

The LFA will be run in 2011 with forecasts from the NSSL WRF and all ARW members of the WRF run by CAPS. This will allow for provision of probabilistic ensemble-based output from the LFA

to participants in the 2011 Hazardous Weather Testbed (HWT) Experimental Forecast Program (EFP), a prerequisite for getting wide exposure of the product to the community, and necessary for further refinement of the algorithm. Summary statistics for each simulation will help identify cases featuring predicted flash rate densities higher than the upper limits used in the original LFA study, so that such cases can be studied in more detail using any appropriate Lightning Mapping Array (LMA) data. Such new studies will assist in refining the LFA calibrations for very high flash rate cases. Work also commenced on construction of a training module designed to introduce novice NWS users to the concepts and utility of the LFA.

Transition of Hybrid Imagery

SPoRT has transitioned the MODIS-GOES Hybrid imagery to its WFO partners. The Hybrid is a combination of MODIS and GOES imagery and is provided every 15-minutes for 11 µm, 3.9 µm, water vapor, and visible channel imagery. A subset of its partners has volunteered to evaluate a version of the Hybrid that serves as a near real-time proxy to imagery from the future ABI on GOES-R. The value of the hybrid is its ability to provide high-resolution MODIS imagery within the framework of the more frequent GOES imagery. Hence, forecasters have an integrated product in which to loop the imagery that includes data from polar-orbiting satellites, something not previously available with pure single-swath imagery. A training module for the hybrid has also been developed and provided in order to prepare forecasters for the evaluation period in April for this product as part of SPoRT's collaboration within the GOES-R Proving Ground.

Real-Time GSI Assimilation

SPoRT is currently working to configure the DTC GSI to mimic NCEPs operational NDAS configuration. This configuration has 12-km grid spacing and assimilates various satellite radiance datasets. These radiance datasets,include AMSU-A, AMSU-B, HIRS-4, and MHS data and test cases were run using single-data type datasets to ensure that each dataset was properly assimilated. With the assimilation of each data type, analysis increments

were examined to ensure reasonable matches with ingested data. Successful assimilation of these data brings SPoRT one step closer to providing a regional data assimilation testbed to evaluate the impact of unique NASA datasets on near real-time operational weather forecasts. Over the coming months, SPoRT will work to improve the timeliness of assimilation analyses and assimilate NEXRAD and GOES data.

WRF LIS Studies

SPoRT presented a talk at the American Meteorological Society annual meeting in Seattle, WA that highlighted the development of a 1-km resolution MODIS Normalized Difference Vegetation Index (NDVI) daily composite used to produce a daily updated Greenness Vegetation Fraction (GVF) dataset for numerical weather prediction applications. The NDVI/GVF data are being produced in real time over a Continental U.S. domain using MODIS NDVI swaths from the previous 16 days to form a composite, similar to the SPoRT SST compositing algorithm. The NDVI data are converted to GVFs for use in weather models by querying the previous several months of NDVI composites and blending the data with the current operational monthly GVF climatology where snow/ice cover exists. The GVF daily composites have been incorporated into the NASA Land Information System (LIS) framework in preparation for sensitivity experiments and real-time modeling applications.

The new SPoRT/MODIS GVF dataset was also incorporated into the generic Weather Research and Forecasting (WRF) modeling framework. To accomplish this, the GVFs in the LIS data format were reformatted to the binary format required by the WRF preprocessor, and duplicated 12 times to emulate the current monthly climatology used by the WRF model. The data reformatting methodology required no source code modification to the WRF modeling system. This capability enables the initialization of SPoRT GVFs into the SPoRT-WRF model runs for the upcoming Spring Experiment campaign, and eventually the use of these GVFs in local modeling initiatives at SPoRT partner WFOs.

SPoRT also successfully displayed real-time LIS output into the Advanced Weather Interactive Processing System (AWIPS) at the NWS Huntsville WFO. Since last summer, SPoRT has posted selected LIS graphics over a 1-km Alabama domain to a real-time web page <http://weather.msfc.nasa.gov/sport/case_studies/lis1km_alabama.html>, which were used in a diagnostic capacity by the NWS Birmingham, AL WFO for their convective initiation study. However, having the display capability available in AWIPS will greatly facilitate the regular incorporation of LIS products into daily operations. The next step will be to add the real-time LIS products into the SPoRT data feed transmitted via the local data manager.

Collaborations With NWS Eastern Region

SPoRT continues to develop collaborative opportunities with NWS forecast offices in the Great Lakes areas of the Eastern Region. Select offices continue to evaluate a Great Lakes Surface Temperature (GLST) Composite that is produced by SPoRT in a manner comparable to the MODIS/AMSR-E Sea Surface Temperature composite currently provided to coastal forecast offices in the Southern Region. Forecasters in the Eastern Region have incorporated the SPoRT GLST product within their AWIPS display system for analysis capabilities, and SPoRT has worked with developers of the Weather Research and Forecasting model — Environmental Modeling System (WRF-EMS) to incorporate the data set for availability within local model runs performed at individual offices. To advance the collaborative activity, Andrew Molthan attended the 19th Great Lakes Operational Meteorology Workshop in Ithaca, NY. Andrew gave a presentation updating forecasters on SPoRT's efforts to validate and improve the GLST product, and also received some feedback from attendees on ways the product and usefulness may be improved. SPoRT plans to continue developing the GLST product over the next several months in preparation for the next lake-effect snow season, and to develop collaborative modeling activities with select offices to evaluate the impact of the product on events that occurred in 2010.

SPoRT Brown Bag Monthly Lecture Series

SPoRT recently began sponsoring a seminar series whereby scientists from within the NSSTC or external visitors could share their research and discuss future collaborations with SPoRT and other scientists within the building. The series is an opportunity for SPoRT scientists to stay in touch with various activities that could lead to future collaborations with SPoRT. The first of the monthly seminar series was presented by Xuanli Li and John Mecikalski from the Department of Atmospheric Sciences at the University of Alabama Huntsville on February 3, 2011. Their seminar was titled "ARMOR Dual-Polarimetric Radar Data Assimilation with WRF 3DVAR" and focused on their efforts to implement forward operators for horizontal reflectivity, differential reflectivity, specific differential phase, and radial velocity (the variables obtained from dual-polarimetric radars.) They showed that these variables can be successfully assimilated into WRF 3DVAR and that these observations brought benefits to storm initialization compared to the information obtained only from NEXRAD. The next SPoRT seminar is scheduled for Monday, April 25 and will feature a talk by Udaysankar Nair from the University of Alabama Huntsville entitled "Use of satellite derived smoke emissions and aerosol optical thickness for air and water quality decision support applications." Refreshments will be served.

SPoRT Involvement in the Hazardous Weather Testbed 2011 Spring Experiment

The annual Hazardous Weather Testbed (HWT) Spring Experiment has been ongoing for several years running, and will take place again this year in Norman, OK from May 9 to June 10. Currently, the Spring Experiment campaign consists of three main components: The Experimental Forecast Program (EFP), Experimental Warning Program (EWP), and GOES-R Proving Ground (PG) activities. The HWT invites scientists and forecasters to participate for a week at a time within the EFP or EWP to analyze cutting-edge data and products that have the capability to improve forecast operations and skill. Within the EFP, scientists and forecasters examine and analyze convection-allowing and storm-scale ensemble numerical weather prediction (NWP) models, and GOES-R Proving Ground simulated satellite products to produce experimental severe convection and quantitative precipitation forecast outlooks. In the EWP, forecasters from across the country are immersed in an operational environment focused on convective warnings, in which they incorporate and evaluate experimental products and provide valuable feedback to the product developers. The GOES-R PG component overlaps activities in both the EFP and EWP so that participants and forecasters are exposed to the next generation geostationary satellite capabilities.

The SPoRT program will have a significant presence in each component of the 2011 Spring Experiment. SPoRT will field several scientists involved in the EFP, EWP, and GOES-R PG throughout the campaign to help promote various SPoRT products that will be assessed during the Spring Experiment. A summary of the SPoRT personnel participating in the campaign is given in table 1.

SPoRT is providing numerous experimental products ranging from NWP model output to GOES-R PG data for evaluation by Spring Experiment participants, as summarized in table 2. SPoRT recently acquired new high-end computing platforms from the Software Integration and Visualization Office at the Goddard Space Flight Center. The first "Weather-in-a-Box" cluster was received by SPoRT in December 2010 (refer to companion article titled "SPoRT's Weather in a Box Systems Arrive!") and is now running an experimental version of the National Severe Storms Laboratory's (NSSL) convection-allowing Weather Research and Forecasting (WRF) model run, but initialized with unique NASA datasets (hereafter referred to as SPoRT-WRF). During the EFP, the SPoRT-WRF forecasts will be evaluated against the NSSL and other model forecasts to determine the impact of NASA data sets on the model predictions. In addition, SPoRT is providing the Lightning Forecast Algorithm (LFA), which computes total lightning flash rate densities based on WRF model microphysics output. The LFA will be available during the Spring Experiment in the deterministic NSSL-WRF and SPoRT-WRF runs, as well as in the storm-scale ensemble forecast system of 40+ high-resolution modeling members run by the Center for Analysis and Prediction of Storms. The LFA product will be evaluated at the EFP for its potential to forecast lighting from convective storms in the 0–36-hour time frame.

Table 1. List of SPoRT participants in the Spring Experiment, the weeks attending, program involvement, and product focal points/association

Participant	Week Attending	Program(s)	Product Focal Point
Geoffrey Stano	May 9–13	EWP/GOES PG	Pseudo GLM
Jonathan Case	May 23–27	EFP/GOES PG	SPoRT-WRF; WRF LFA
Bill McCaul	May 31–June 3	EFP/GOES PG	WRF LFA
Brad Zavodsky	June 6–10	EFP	SPoRT-WRF; AIRS DA

SPoRT is also providing two datasets for evaluation within the EWP/GOES-R PG components of the Spring Experiment. SPoRT will generate and disseminate its Pseudo Geostationary Lightning Mapper (PGLM) product, which maps the total lightning data from four separate ground-based networks into a GOES-R-like flash density product at 8-km resolution. The purpose of this product is to demonstrate the concepts of total lightning in general, and the basic resolution of the Geostationary Lightning Mapper (GLM). This will be accomplished with the PGLM product as well as onsite and an online training module. With the PGLM in the EWP, forecasters have the opportunity to provide insight as to how the future GLM products can be visualized and implemented into real-time operations. Additionally, SPoRT is collaborating with scientists from the University of Alabama–Huntsville (UAH) to reformat and disseminate a convective initiation product from its SATellite Convection AnalysiS and Tracking (SATCAST) algorithm: a GOES-R Algorithm Working Group product which will be evaluated within the EFP. The SATCAST algorithm tracks geostationary cloud features to determine the most likely clouds that will initiate deep, moist convection. Through the infusion of personnel and unique data products, SPoRT hopes to contribute to the overarching science goals of improved convection forecasts and warnings.

Table 2. Summary of the SPoRT products being assessed at the Spring Experiment along with a brief description of each product.

Product	Description
SPoRT-WRF	NASA initialization datasets applied to the NSSL WRF model: • SPoRT MODIS + AMSR-E Sea Surface Temperatures, • SPoRT MODIS daily greenness vegetation fractions, • Land Information System land surface initialization • AIRS temperature and moisture profile assimilation
WRF LFA	Proxies for total lightning based on WRF model microphysics: • Graupel flux at −15 °C and vertically integrated ice • Blends these two proxies into a total lightning threat • To appear in both deterministic model and ensembles • Aids in future GOES-R lightning data assimilation

PGLM	Simulated GOES-R lightning product based on LMA networks:
	• Convert raw VHF observations into flashes
	• PGLM is a flash extent density product
	• Uses the 8-km Geostationary Lightning Mapper resolution
	• Plots spatial extent of lightning well
	• Data from four total lightning networks will be used
	  – North Alabama Lightning Mapping Array
	  – Oklahoma Lightning Mapping Array
	  – Washington D.C. Lightning Mapping Array
	  – Kennedy Space Center Lightning Detection and Ranging
	• Training module provided

UAH CI Product (SATCAST)	Depicts clouds likely to initiate convection within 2 hours: • Identifies potential convective-form clouds as "objects" • Tracks select cloud objects between consecutive images • Applies six spectral/time differencing tests on cloud objects • Provides extended lead-time on convective initiation

WFO Corner

SPoRT has provided initial instructions and held an introductory telecon with the Jackson, MS (JAN) and New Orleans, LA (LIX) NWS Forecast Offices to incorporate them as new SPoRT collaborators. The LIX has expressed interest in using SPoRT products to improve forecasts in the areas of marine fog/low clouds, convective initiation, as well as heavy precipitation. In addition, LIX has a strong interest in using high-resolution satellite imagery to help determine the structure, intensity, and future movement of tropical convective systems such as waves, depressions, storms, and hurricanes. The JAN office has interest in improving boundary layer analysis and model initialization through the use of tools such as LIS that provides surface properties such as soil moisture and temperature. Local modeling is a point of emphasis at JAN, and Greg Garret (SOO) would like to use SPoRT data (i.e., LIS output, SST composite) to initialize their model runs in order to improve convective initiation forecasts.

Monthly coordination calls focused on products to be evaluated this coming year. Emphasis is being put on ABI proxy products, modeling case studies or events with SPoRT data impacts, new total lightning products, and the use of SPoRT analysis products (i.e. LIS output of surface fields, SST composite, and MODIS NDVI composite). We also discussed SPoRT's desire to coordinate efforts with NWS partners to have a strong contingent at the NWA meeting this coming Fall in Birmingham. The call focused on potential topics and what SPoRT can do to support collaborations. Lastly, one of the calls focused on how SPoRT can best collaborate in the area of local modeling with the NWS Southern Region WFOs. Limitations were discussed and work is ongoing to find a mutually beneficial method for assessing the impact of SPoRT's model initialization and data assimilation work on NWS local modeling efforts.

Recent Publications and Presentations

Publications

Molthan, A.L., and W.A. Petersen, 2011: Incorporating Ice Crystal Scattering Databases in the Simulation of Millimeter Wavelength Radar Reflectivity, *Journal of Atmospheric and Oceanic Technology*, in press.

Conference

- Case, J.L., F.J. LaFontaine, S.V. Kumar, and G.J. Jedlovec: *A real-time MODIS vegetation composites for land surface models and short-term forecasting.* Proceedings from the 24th Conference on Weather Analysis and Forecasting/20th Conference on Numerical Weather Prediction, AMS, Seattle, WA, 2011.
- Cipullo, M.L., A. Molthan, J. Shafer, J. Case, and G. Jedlovec: *Forecasting Lake-Effect Precipitation in the Great Lakes Region using NASA Enhanced Satellite Data.* Proceedings from the 24th Conference on Weather Analysis and Forecasting/20th Conference on Numerical Weather Prediction, AMS, Seattle, WA, 2011.
- Darden, C.B., B. Carcione, A. Woodward, and G.T. Stano, 2011: *The Utility of Total Lightning for Diagnosing the Severity of Summer Pulse Convection.* Proceedings from the Fifth Conference on Meteorological Applications of Lightning, AMS, Seattle.
- James, R.S., J.L. Case, A.L. Molthan, and G.J. Jedlovec: *Analysis of Summertime Convective Initiation in Central Alabama Using the Land Information System.* Proceedings from the 24th Conference on Weather Analysis and Forecasting/20th Conference on Numerical Weather Prediction, AMS, Seattle, WA, 2011.

- Jedlovec, G.J., M.R. Smith, and K. McGrath: *Challenges in Transitioning Research Data to Operations: The SPoRT Paradigm.* Proceedings from the First Conference on Transitions of Research to Operations: Successes, plans, and challenges, AMS, Seattle, WA, 2011.
- Kozlowski, D., and B. Zavodsky: *Demonstrating the Operational Value of Atmospheric Infrared Sounder (AIRS) Profiles in the Pre-Convective Environment.* Proceedings from the 24th Conference on Weather Analysis and Forecasting/20th Conference on Numerical Weather Prediction, AMS, Seattle, WA, 2011.
- Molthan, A.: *Evaluating the Performance of Single–and Double Moment Microphysics Schemes During a Synoptic-Scale Snowfall Event.* Proceedings from the 24th Conference on Weather Analysis and Forecasting/20th Conference on Numerical Weather Prediction, AMS, Seattle, WA, 2011.
- Stano, G.T., K.K. Fuell, and G. Jedlovec: *NASA SPoRT prepares for the Geostationary Lightning Mapper.* Proceedings from the Seventh Symposium on Future NPOESS-JPSS and GOES-R, AMS, Seattle, WA, 2011.
- Stano, G.T., B. Carcione, and C.B. Darden: *Improved real-time lightning trend products.* Proceedings from the Fifth Conference on Meteorological Applications of Lightning, AMS, Seattle, WA, 2011.
- Molthan, A.L., M. Rigney, J. Shafer, F. LaFontaine, and J.L. Case: Development and Evaluation of a Great Lakes Surface Temperature Product

for use in Modeling and Analysis, 2011 Great Lakes Operational Meteorology Workshop, Ithaca, NY, 2011.
- McCaul, E.W., WRF lightning forecasting research, High Impact Weather Workshop, Norman, OK, February 2011.

External Workshops/ Meetings Attend

- AMS Annual Meeting and Conferences — Jon Case, Andrew Molthan, Gary Jedlovec, Geoffrey Stano, and Brian Carcione made presentations on various SPoRT activities
- NWS Southern Region SOO Workshop, February 23–25, Norman — Brian Carcione and Jon Case attended for SPoRT
- SPoRT visit to Miami WFO — April 4, Andrew Molthan, to enhance collaborations
- SPoRT visit to NHC — April 6, Andrew Molthan, to enhance collaborations and facilitate ingest of SPoRT products into NAWIPS for use during hurricane season
- High-Impact Weather Workshop, Norman, OK. — February 24 — Bill McCaul made a presentation on Lightning Forecast Algorithm (R3)

Visitors

- Chris LandSea (SOO NHC), March 30 — made a seminar presentation and explored future collaborations with SPoRT
- Bill Emery (University of Colorado), February 9 — made a seminar presentation on current research and explored future collaborations with SPoRT

Calendar of Events

- NOAA 2011 Direct Readout Conference, April 4–8, Miami
- SPoRT "Brown Bag" Seminar Series–April–Speaker: Udaysankar Nair from the University of Alabama Huntsville will give a presentation entitled "Use of satellite derived smoke emissions and aerosol optical thickness for air and water quality decision support applications"
- Hazardous Weather Testbed Spring Experiment, Norman, OK, May 9–June 10
- GOES-R Proving Ground Annual Meeting, May 17–19, Boulder
- JCSDA Science Meeting, May 24–25
- SPoRT "Brown Bag" Seminar Series–May–Speaker: TBD
- SPoRT "Brown Bag" Seminar Series–June - Speaker: TBD
- 12th WRF User's Workshop, June 20–23, Boulder
- GOES-R Proving Ground OCONUS Meeting, July 26–28, Juneau