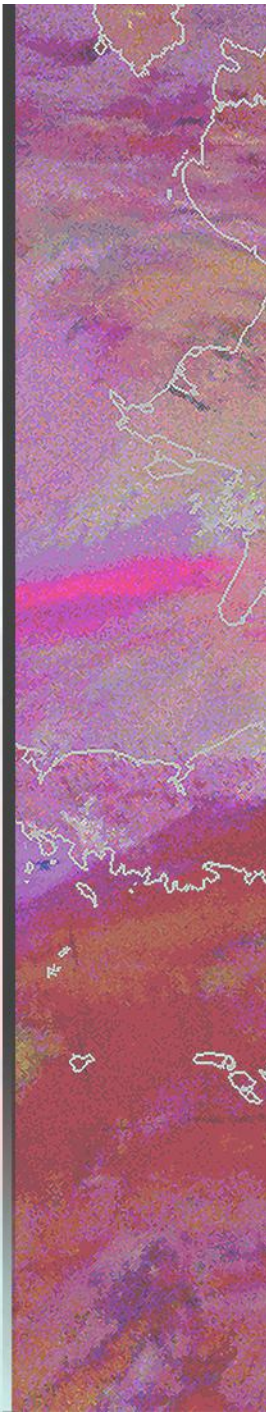# NASA's Short-term Prediction Research and Transition (SPoRT) Center: A Paradigm for Transitioning Research into Operations

Andrew Molthan, Brad Zavodsky
NASA Marshall Space Flight Center

2018 AMS Annual Meeting, Austin, Texas
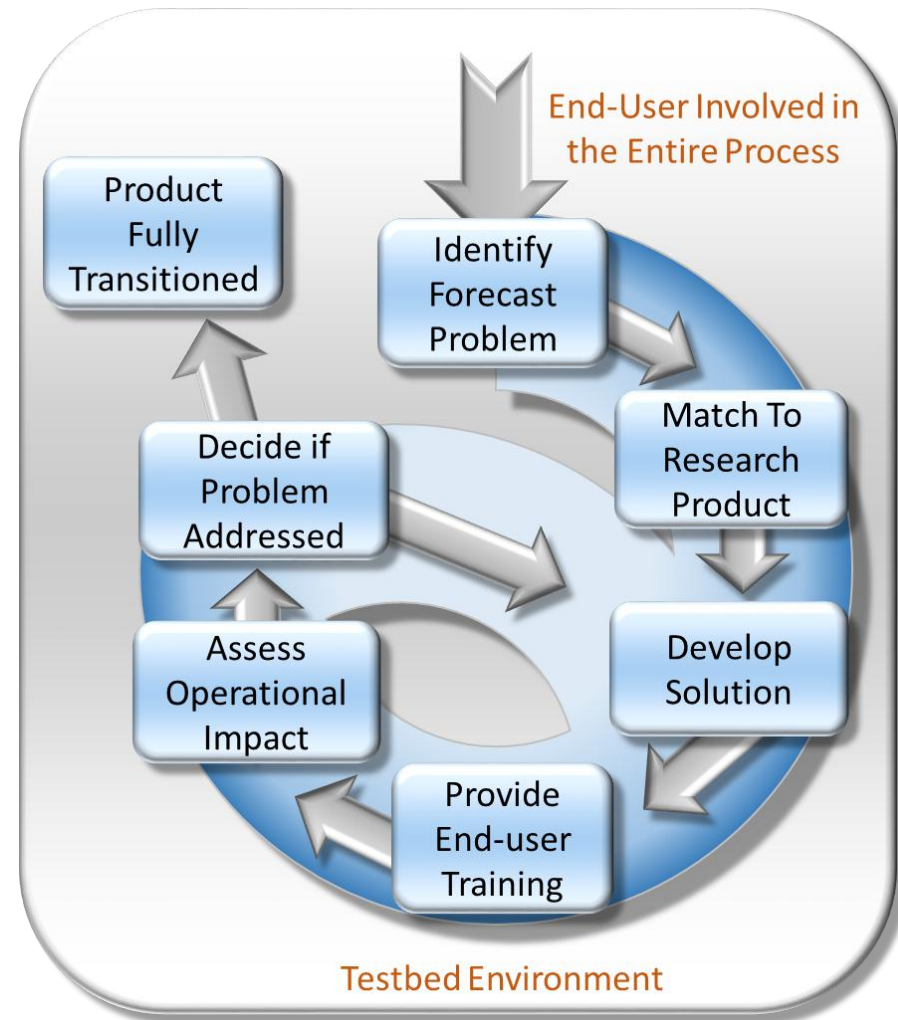
SPoRT History/Budget

Mission: Transition unique NASA and NOAA observations and research capabilities to the operational weather community to improve short-term weather forecasts on a regional and local scale.

- Established in 2002 through an unsolicited proposal from MSFC scientists (Lapenta, S. Goodman, and Jedlovec)

- Receive yearly directed funding from NASA R&A Weather Focus Area (Tsengdar Lee) based on 5 year proposal (current proposal is FY15-19)

- Write competitive proposals (NASA/NOAA) to expand core capabilities/partnerships

- SPoRT receives NOAA Reimbursable dollars from the Satellite Proving Grounds through MOU (GOES-R, since 2009), Risk Reduction proposals (JPSS, since 2011), and Modeling, Analysis, Predictions and Projections (MAPP) proposals (starting in 2017)

SPoRT R2O/O2R Paradigm

- Bridge the "Valley of Death"
- Can't just "throw data over the fence"
  - Maintain interactive partnerships with help of specific advocates
  - Integrate into user decision support tools
  - Create product training
  - Perform targeted product assessments
- Concept has been used to successfully transition more than 40 satellite datasets to operational users for nearly 15 years
- Other groups in the community have adopted this paradigm

End-User Involved in the Entire Process

Product Fully Transitioned

Identify Forecast Problem

Match To Research Product

Decide if Problem Addressed

Develop Solution

Assess Operational Impact

Provide End-user Training

Testbed Environment

Current Partnerships

National Centers for Environmental Prediction

Environmental Modeling Center
National Hurricane Center
Weather Prediction Center
Ocean Prediction Center
Aviation Weather Center
Storm Prediction Center

Over 30 NWS WFOs and All Regional Headquarters

NOAA Cooperative Institutes as Data Delivery and Product Development Partners

Legend
- 🔴 Product Development Partner
- 🟠 National Center Evaluation Partner
- 🟢 NWS Regional Headquarters
- 🔵 WFO Collaborative Partner
- 🟡 Center Weather Service Unit
- 🟣 RFC Collaborative Partner

Updated: June 3, 2016

Data Approach

- SPoRT provides experimental data to NWS users by LDM, FTP, and WMS depending on application
- Uses "backdoor" to provide data into AWIPS
- Not a 24/7 "operational" data provider but do our best to maintain data feeds because product reliability is a key to product demonstration and use by operational forecasters
- Monitor our product ingest and status for all experimental products going to a customer
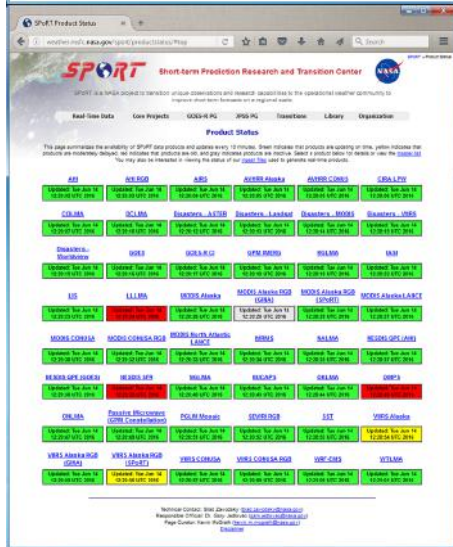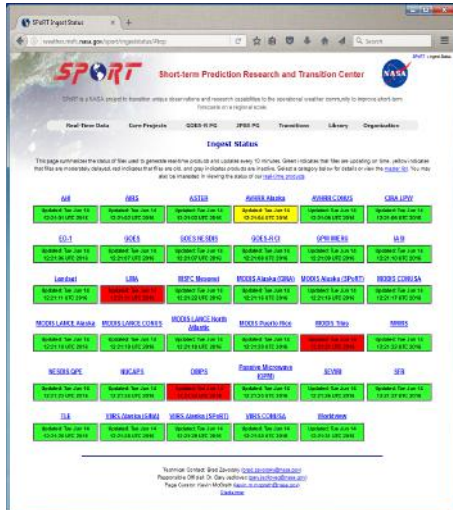
Data downlinked from satellite

Data obtained by SPoRT; value-added products generated

Product disseminated to end-user formatted for their decision support system
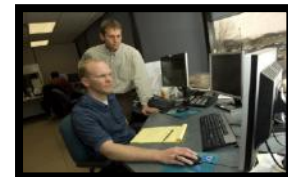
End-user makes operational decisions using SPoRT products

SPoRT Areas of Expertise

Modeling and Data Assimilation
Lightning
Remote Sensing
Disasters

Decision Support Systems

Transitions, Training, and Assessment

- Perform targeted research activities to exploit unique capabilities of NASA satellites and technologies to solve specific weather forecasting challenges

- Support for product dissemination to AWIPS, AWIPS II, N-AWIPS, WMS, etc.

- Apply unique R2O/O2R paradigm for transitioning data and obtaining valuable feedback from NWS forecasters

Modeling & Data Assimilation

1-Week Difference in Column Relative Soil Moisture (%) on 28 Aug 2017 shows impact of Hurricane Harvey

Flood risk can be inferred

Clearly defined agricultural signal
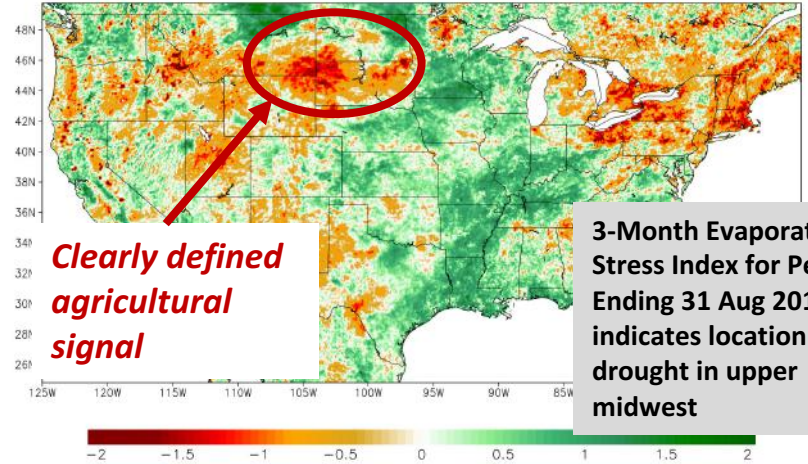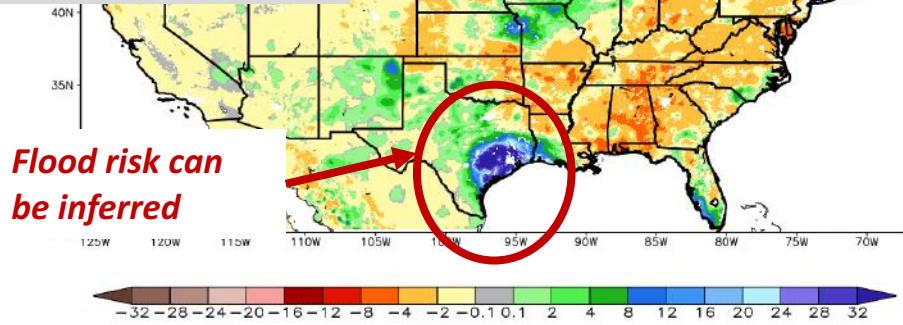
3-Month Evaporative Stress Index for Period Ending 31 Aug 2016 indicates location of drought in upper midwest

- **Land surface (LIS; SMAP) to improve short-term weather and agricultural forecasts**
- **Use satellite-derived aerosols to improve satellite data assimilation and cloud microphysics in models**

Pollution signal detected
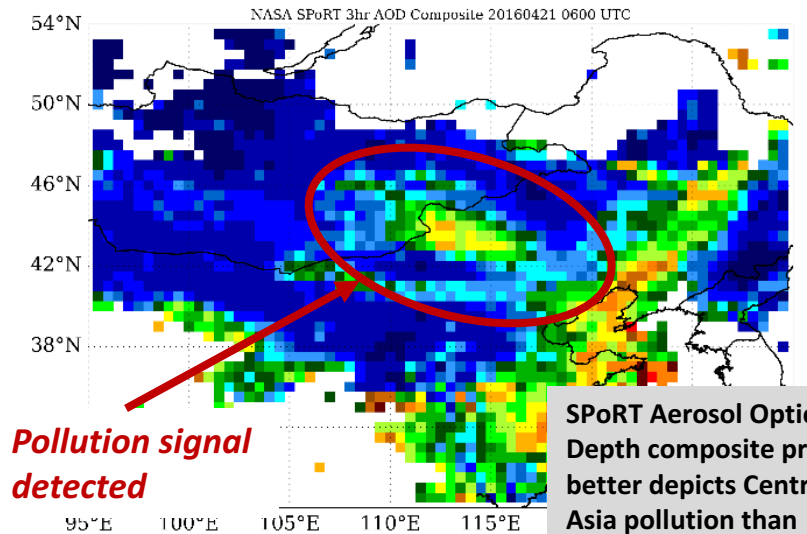
SPoRT Aerosol Optical Depth composite product better depicts Central Asia pollution than model

Lightning

GLM detects lightning along a squall line over the Gulf of Mexico on 4 May 2017

Long flashes

Offshore information on convection and strong storms

Most intense lightning may be outside of strongest updrafts

In-cloud lightning a risk to safety

Unique web viewer shows GLM-detected lightning within 10 and 20 miles of MSFC
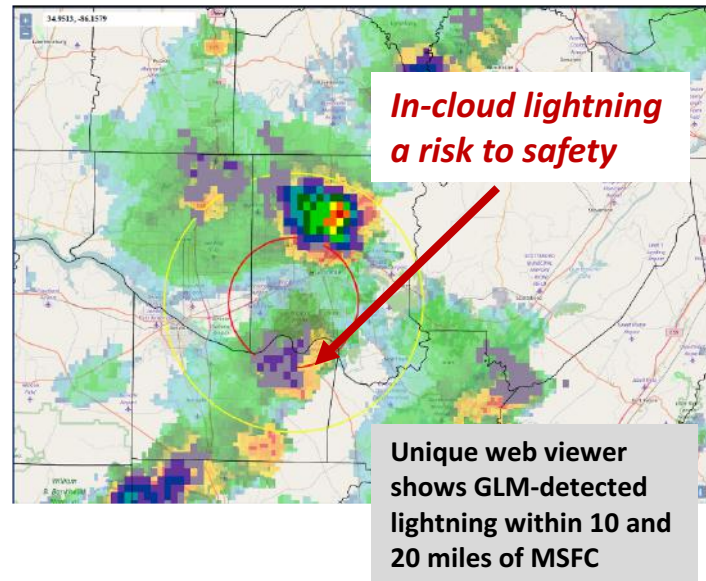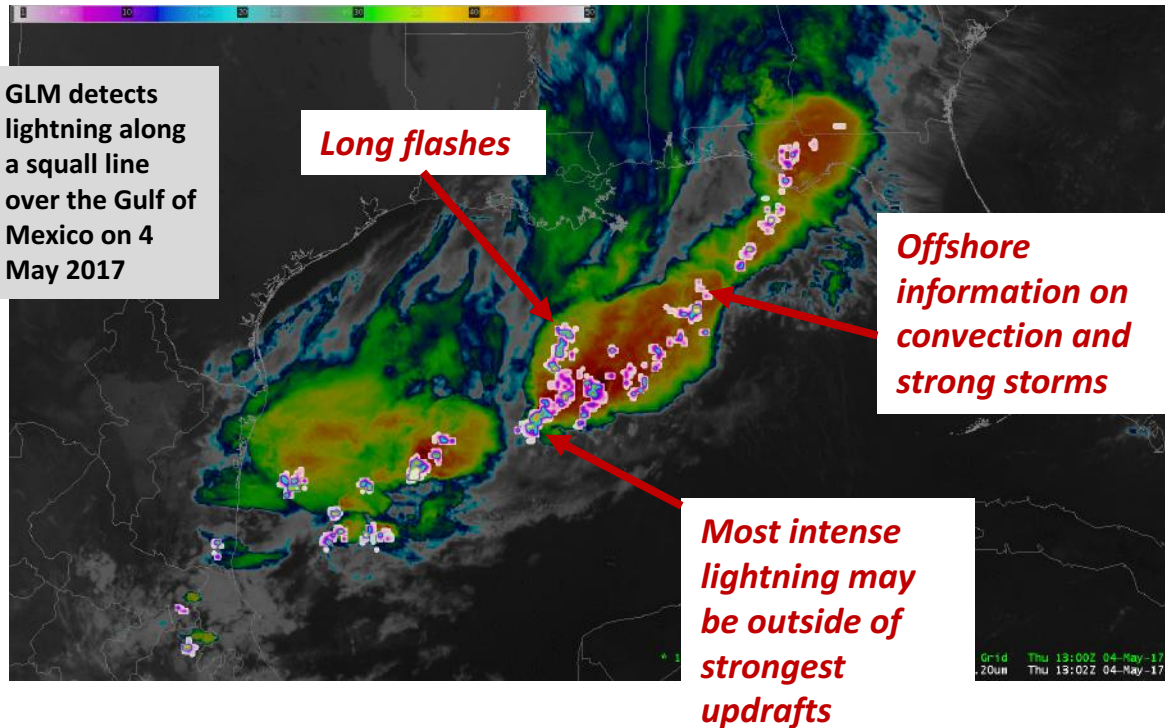
- **Transition unique total lightning data from ground-based Lightning Mapping Array for severe weather and lightning safety applications**
- **Prepared forecasters for the Geostationary Lightning Mapper (GLM) on GOES-R/S satellites and prepare for international satellites**

Remote Sensing

Better center fix
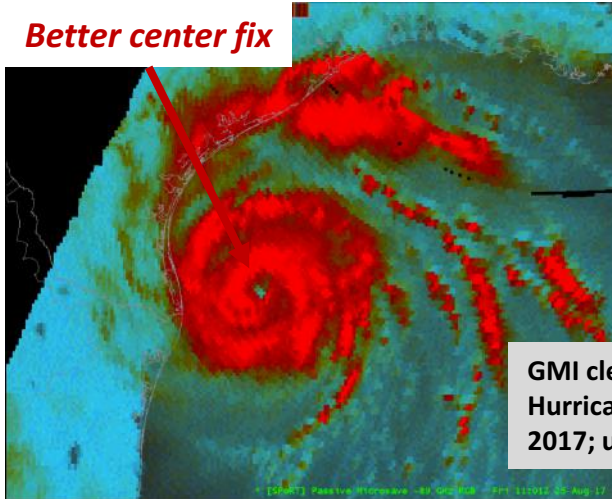
GMI clearly shows center of Hurricane Harvey on 25 Aug 2017; used by NHC

Nighttime Microphysics RGB from GOES-16 of a TN Valley fog event on 28 Mar 2017
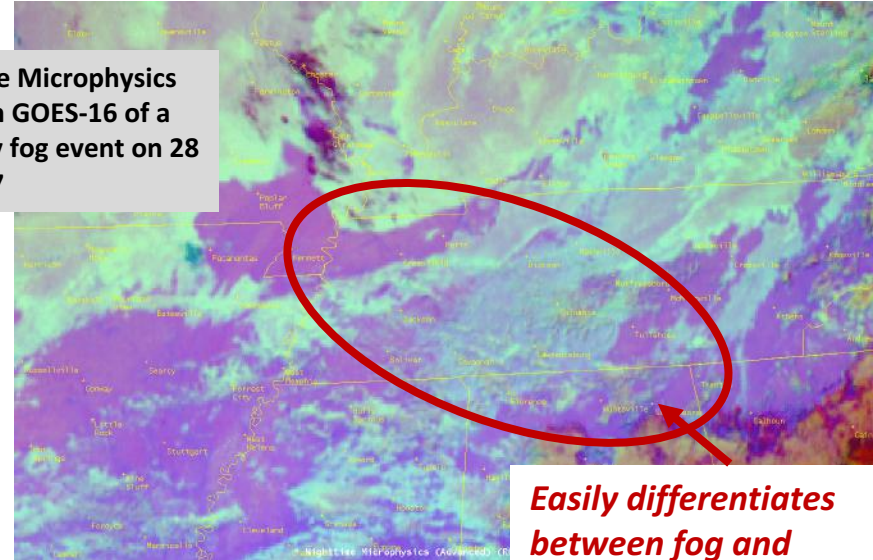
Easily differentiates between fog and low cloud

850 mb θ_e analysis from the Gridded NUCAPS identifies convective potential

Higher potential for convection
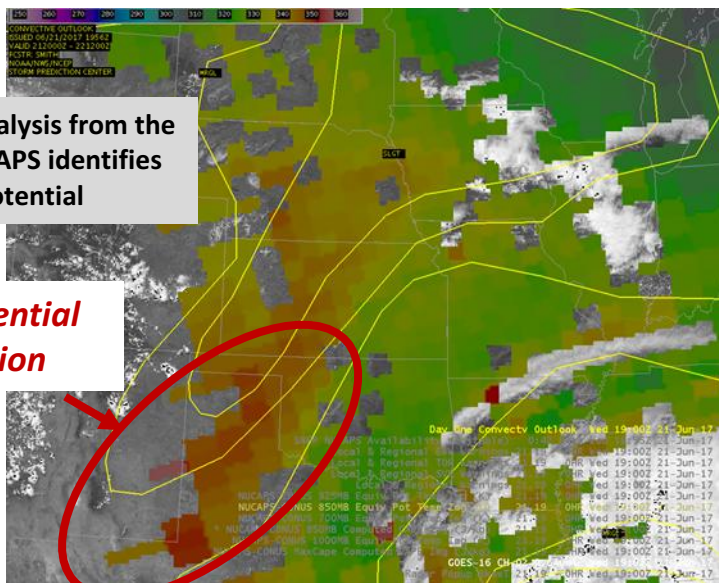
- **Transition satellite imagery from the instruments along with unique multispectral products that can be applied to GOES-16 and JPSS**
- **Transition other value-added products from NASA GPM**
- **Unique visualizations and science initiatives with NUCAPS**

Disasters

Tornado track appears in high-resolution imagery

Landsat 8
Image Acquisition: 9 April 2015
Panchromatic Band
Resolution--15 m

Rochelle, Illinois
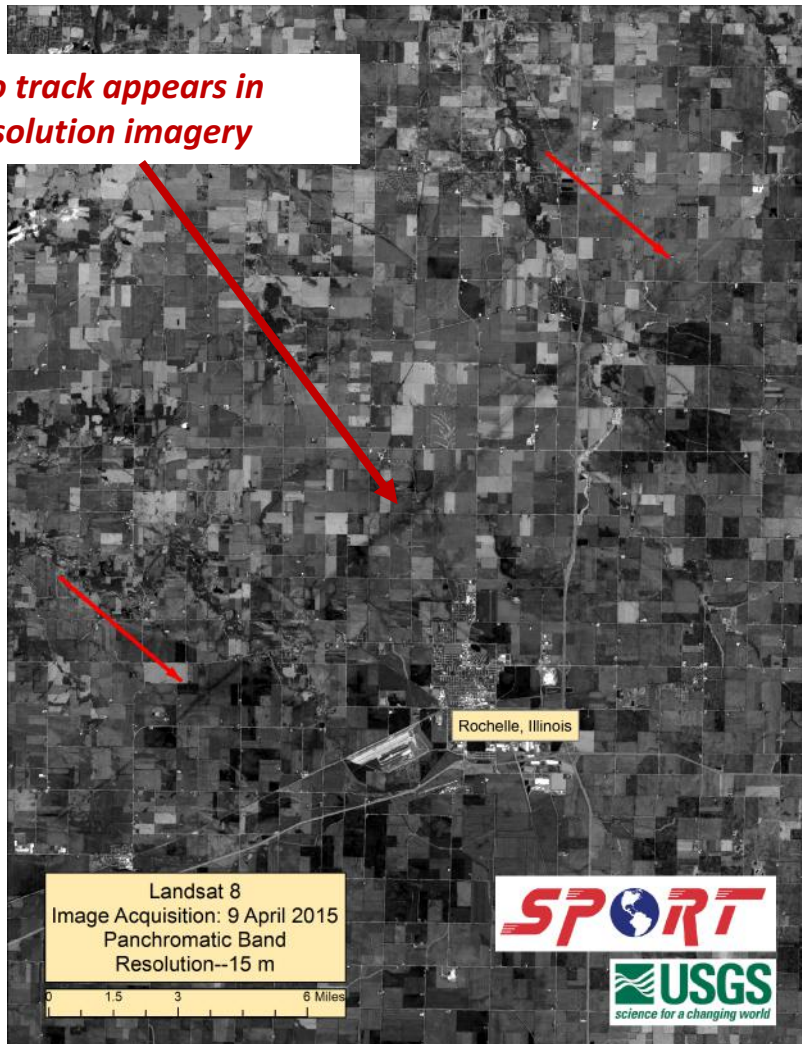
- **Transition unique high-resolution satellite imagery (Landsat, VIIRS, Sentinel, private sector) to decision makers in the aftermath of disasters**
- **Pre- and post-event imagery used to detect tornado/hail tracks and flood extent from space**
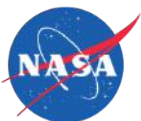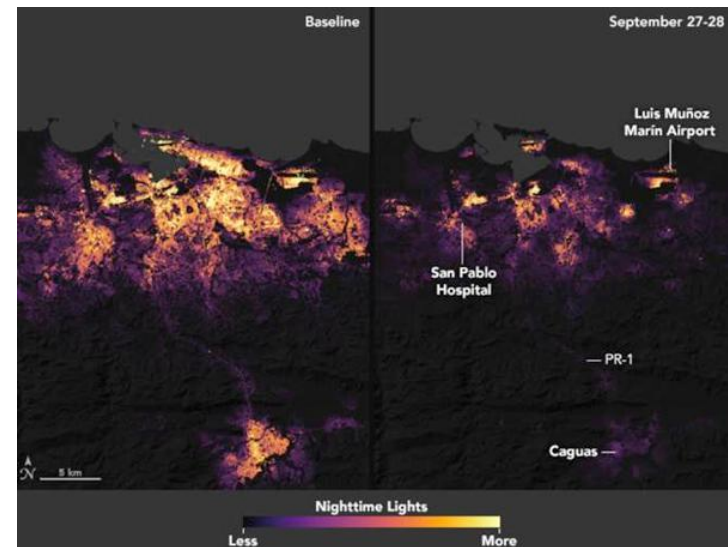
Forecaster Training

Training is developed to complement more conceptual training developed by COMET or NOAA's Training Office

Multiple flavors of training are needed to reach all forecaster learning styles

- Site visits
- Microlessons
- User-based, operational modules
- Quick Guides

SPoRT Applications Library

- 1-minute examples
- Short videos
- 21 total cases (and counting)

Collaborate with NWS forecasters for operational perspective

Viewable online or within the AIR Tool

Assessment Methodology

Assessment page

- o Quantitative questions
- o Open comments

Follow-up Emails/Phone calls

- o Submitted feedback receives a follow-up via e-mail ("Thank You", and questions).
- o Info exchange with product developers

Wide World of SPoRT Blog
(**https://nasasport.wordpress.com/**)

- o Case examples

Assessment "Wrap-up" Telecon

Results in an Assessment Report

Continued Collaboration w/ NOAA / NWS

- SPoRT has traditionally worked with NOAA / NWS using NASA weather satellite data (e.g., MODIS, AIRS, VIIRS, CrIS), but NOAA has developed a robust proving ground and these instruments will be operational within the year

- *SPoRT plans to continue engaging with its NWS partners on use of these new datasets in coordination with NWS and will continue to investigate development of additional value-added products from these weather sensors*

- SPoRT has developed experience using the NWM through collaborative discussions and visits to the NWC

- *SPoRT plans to work collaboratively with other partners within NASA to testbed NASA datasets and capabilities for the NWM*

Continued Collaboration w/ NOAA / NWS

- Upcoming NASA instruments have limited weather applicability; however, they do have some characteristics that might be relevant to NOAA / NWS

- *SPoRT plans to continue working with forecasters to collaboratively identify new NASA datasets; would like to engage with NWS HQ on these upcoming missions and aid in testbedding agreed-upon datasets for more effective use of these U.S. space-based assets*

NASA Earth Science Fleet