Applications of Satellite Remote Sensing for Response to and Recovery from Meteorological Disasters

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18th Conference on IOAS-AOLS / Satellite Data and Technology for Forecasting and Responding to Natural Disasters
2014 AMS Annual Meeting in Atlanta, GA, February 2-6

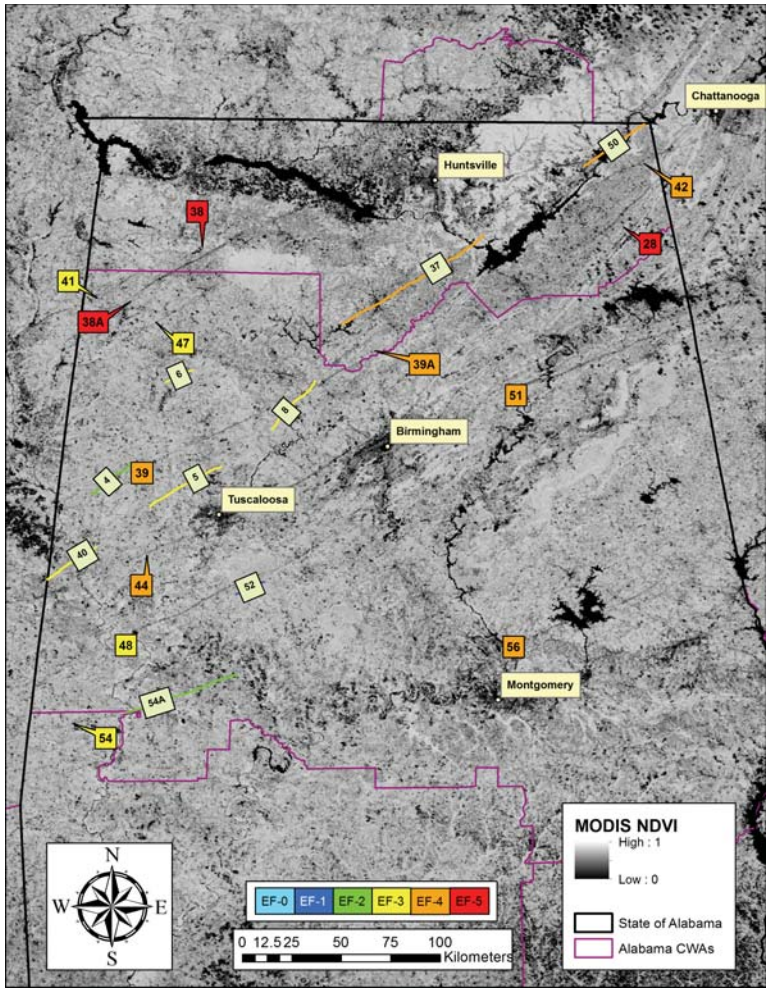
Background

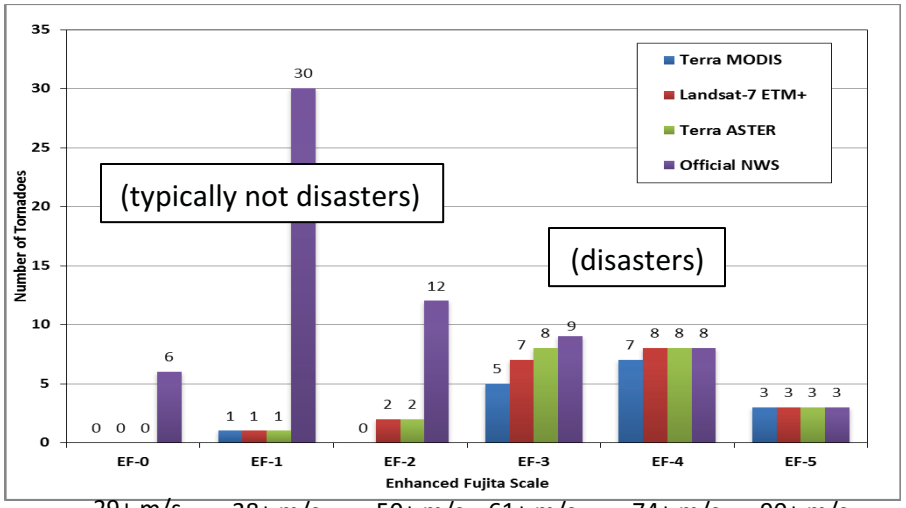
- Natural hazards become disasters when they affect life or property.
- Many natural disasters are meteorological in nature, or influenced by ongoing weather:
  - Tornadoes, hurricanes, typhoons, wildfires (lightning-initiated), drought, floods, blizzards, extreme temperature, and impacts on other human-caused disasters.
- Near real-time remote sensing offers several capabilities to support disaster assessment and response.
  - In addition, the broader availability of near real time Earth remote sensing provides continuity of weather observations to support response activities.

The SPoRT Disasters Team

- SPoRT has a 10+ year relationship supporting NOAA's National Weather Service, providing new satellite products, analysis techniques, appropriate training, and collaborative partnerships.
- SPoRT provided imagery to NWS offices following the April 27, 2011 "Super Outbreak" of tornadoes across the southeastern U.S.
  - ROSES 2011: Applied Sciences: Disasters "feasibility study" award
- Primary goals of the feasibility study:
  - Include near real-time Earth remote sensing within the NWS "Damage Assessment Toolkit", the smartphone app used in the tornado damage survey process.
  - Demonstrate that satellite data adds value to the survey process.
  - Explore additional techniques for supporting disaster response and assessment via use of near real-time NASA, NOAA, and other data.
- SPoRT has provided imagery in support of Superstorm Sandy assessments, Super Typhoon Haiyan, and other events.

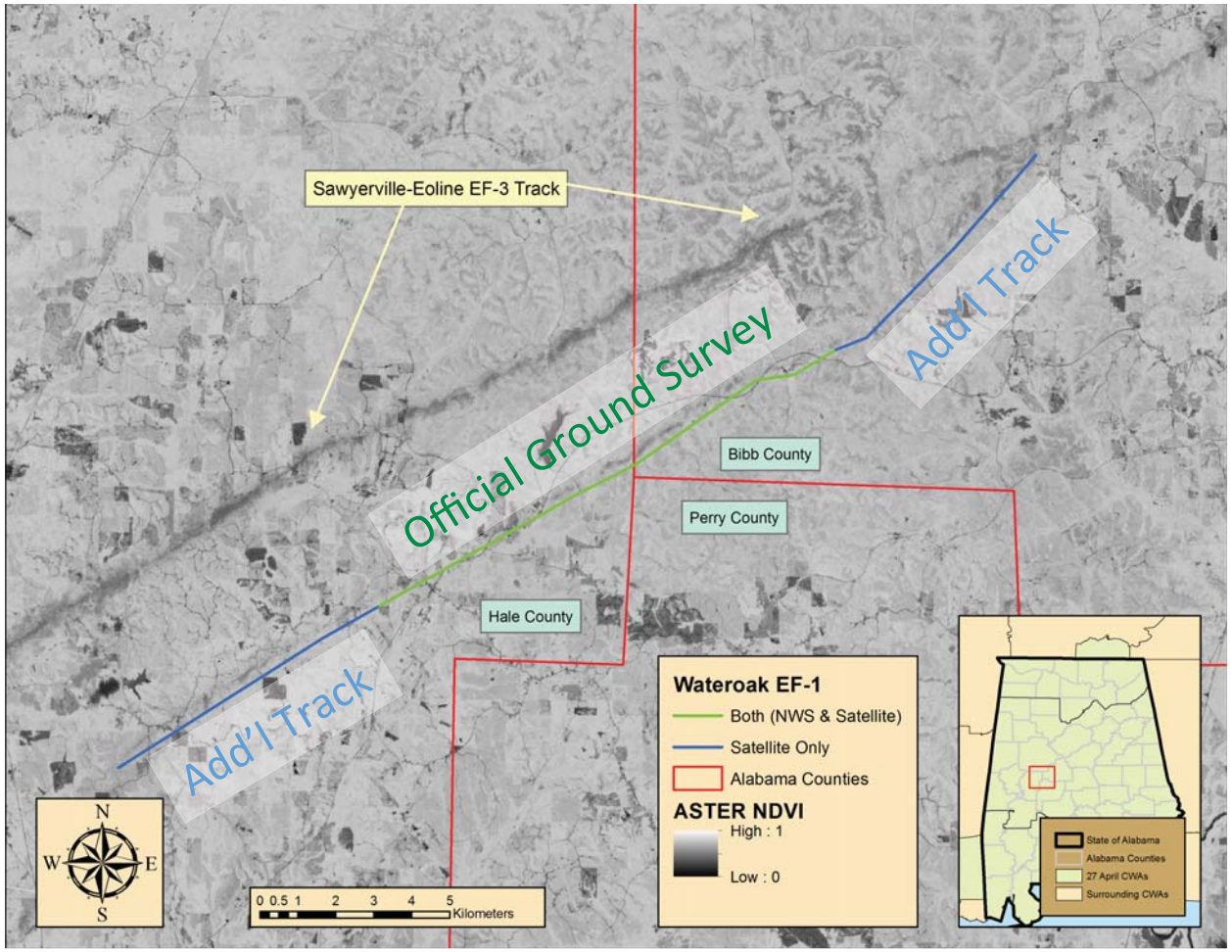
Case Study: April 27, 2011





- We examined all Alabama tornadoes from April 27, 2011 and track detection from MODIS, Landsat-7, or ASTER.
  - Bell et al. (in review)
- Most tornadoes typically causing disasters (EF-2+) produce tracks visible in NDVI imagery during the primary severe weather season (March-August).

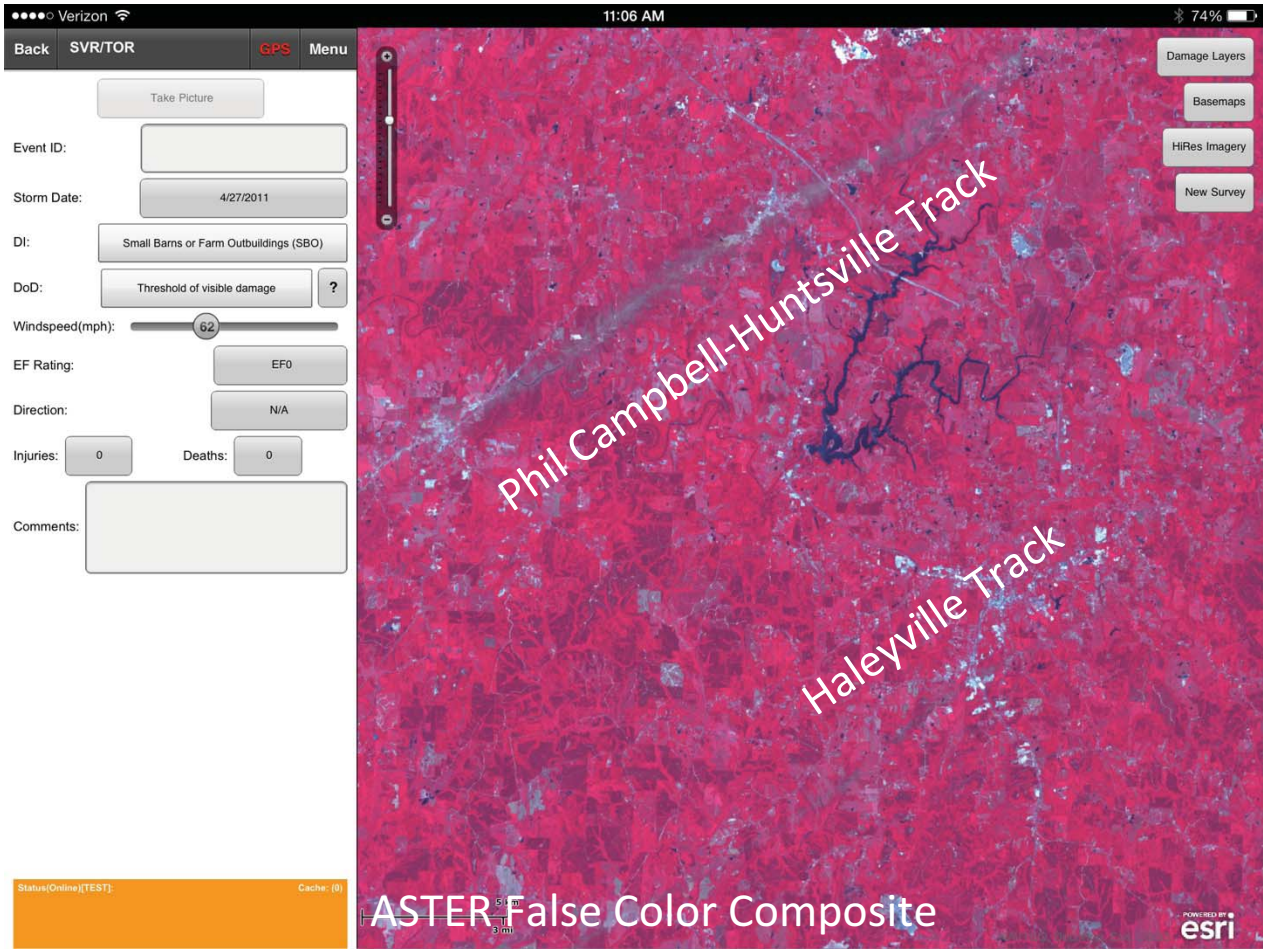
Case Study: April 27, 2011



In this example, the EF-3 tornado damage track is readily apparent.

An EF-1 track was also surveyed and is apparent from visual inspection, however, the ground survey limited the track extent. It may have been extended if satellite imagery were available.

Enabling Data Access
Integration into the Damage Assessment Toolkit



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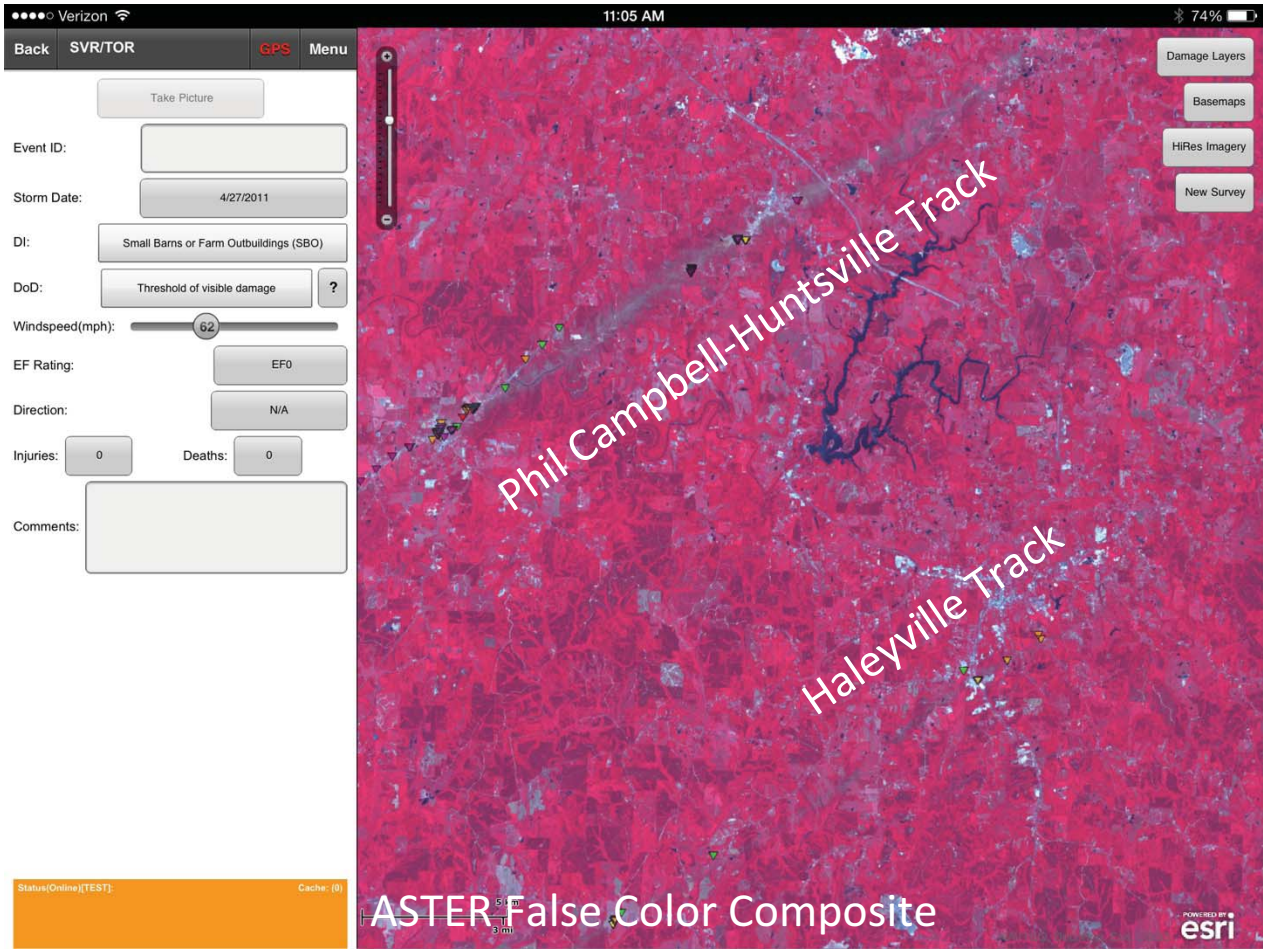

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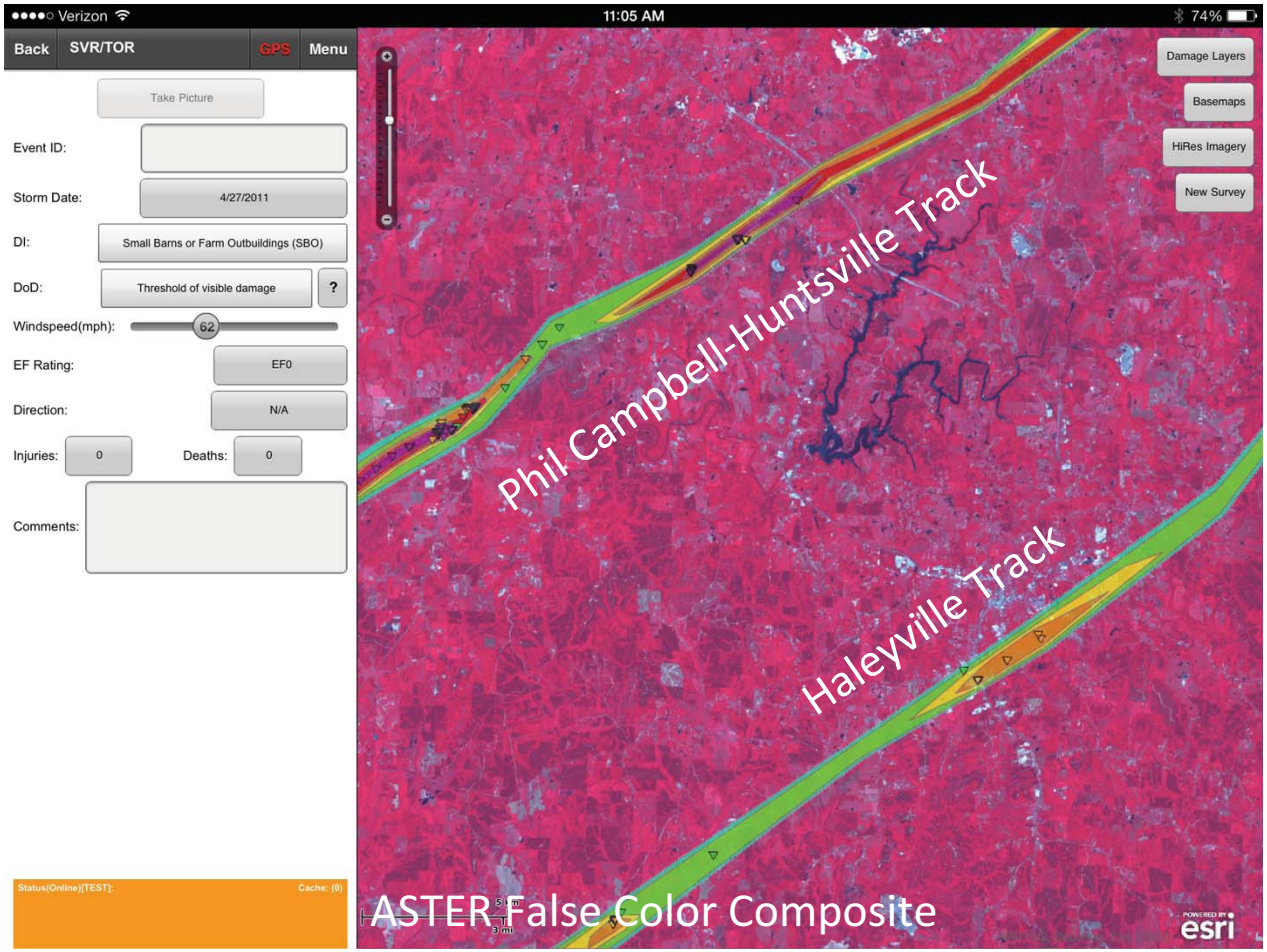
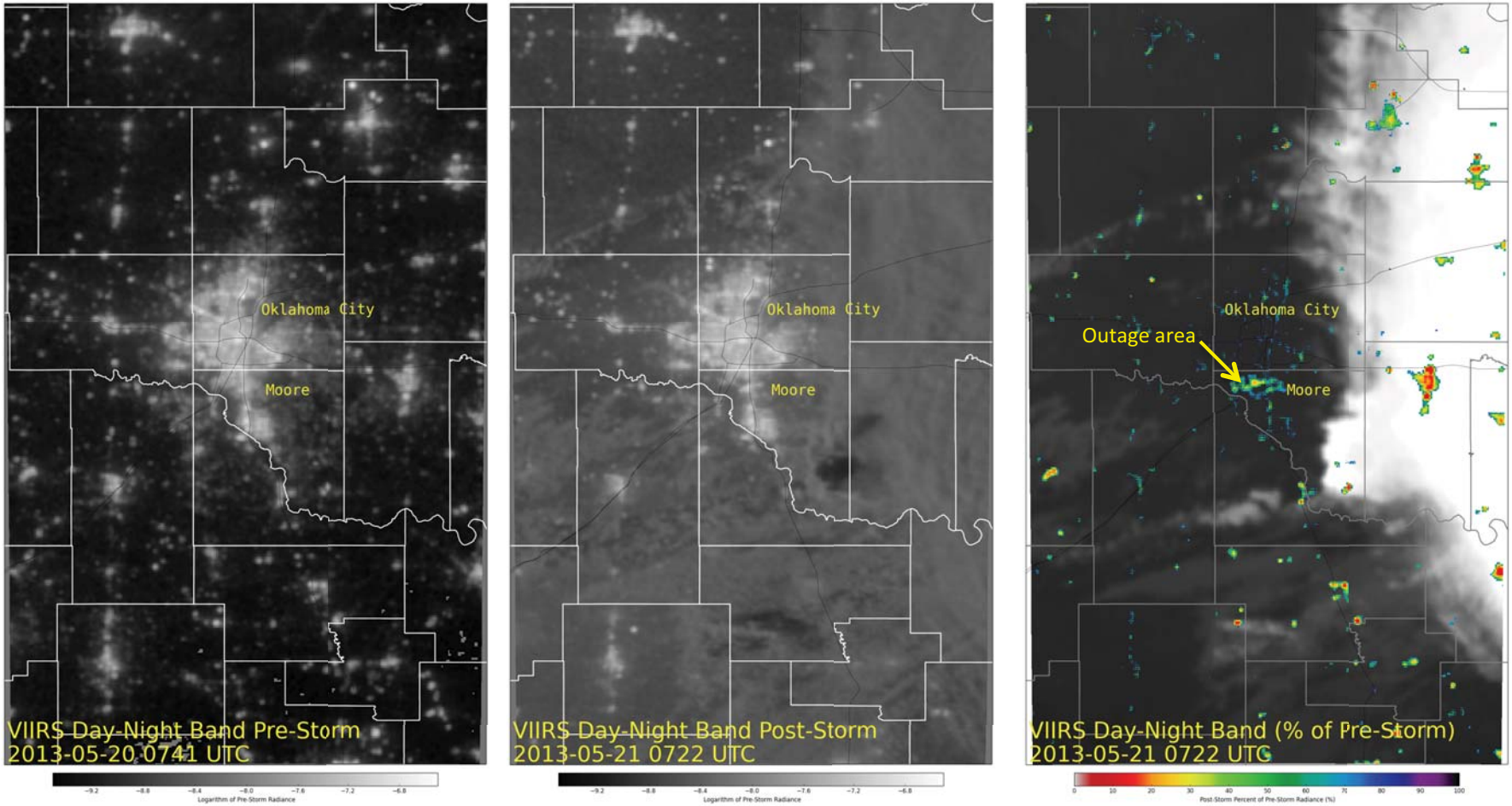


Significant Events in 2013

- The feasibility study resulted in an evaluation version of the DAT application, suitable for testing the integration of satellite data sets.
- The SPoRT Disasters Team has examined use of NRT data within the DAT for:
  - The May 20, 2013 EF-5 tornado in Moore, OK
  - The November 17, 2013 EF-4 tornado in Washington, IL

Moore, Oklahoma Tornado

May 20, 2013



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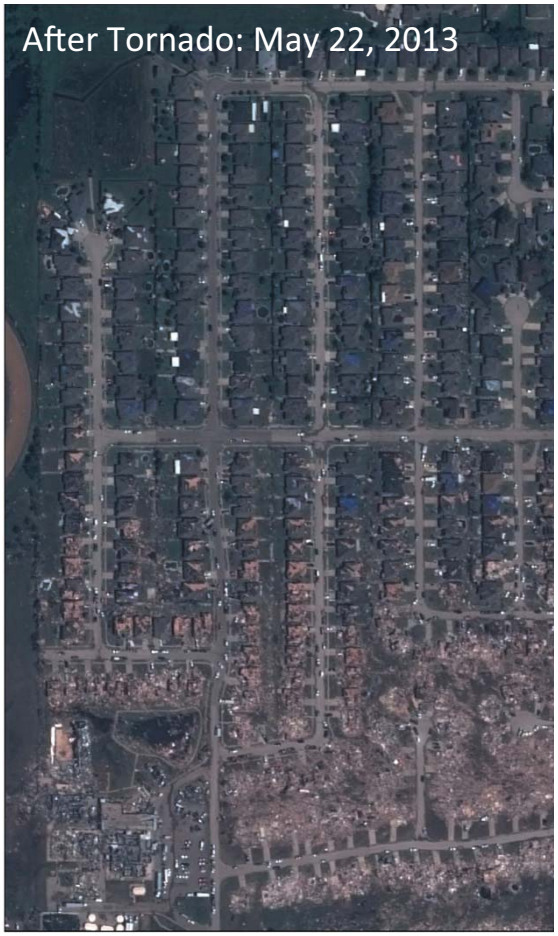

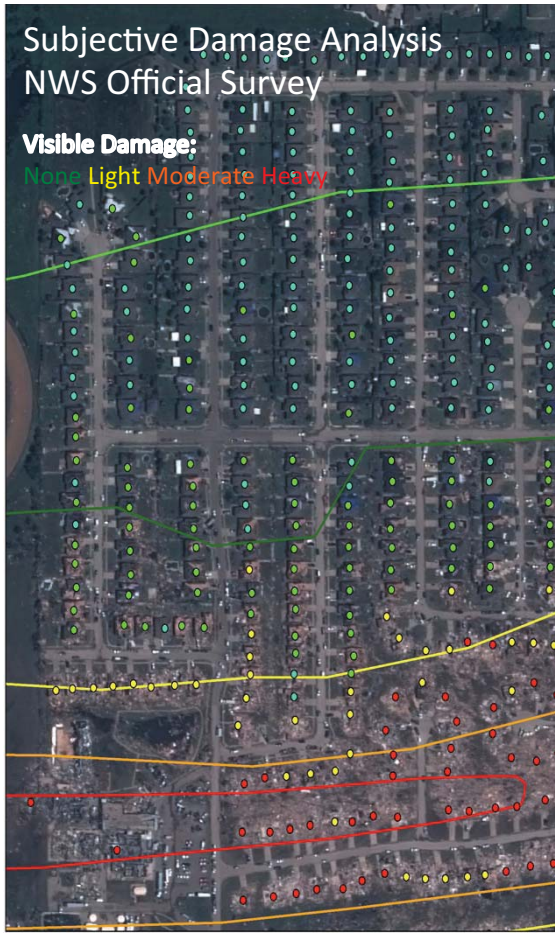

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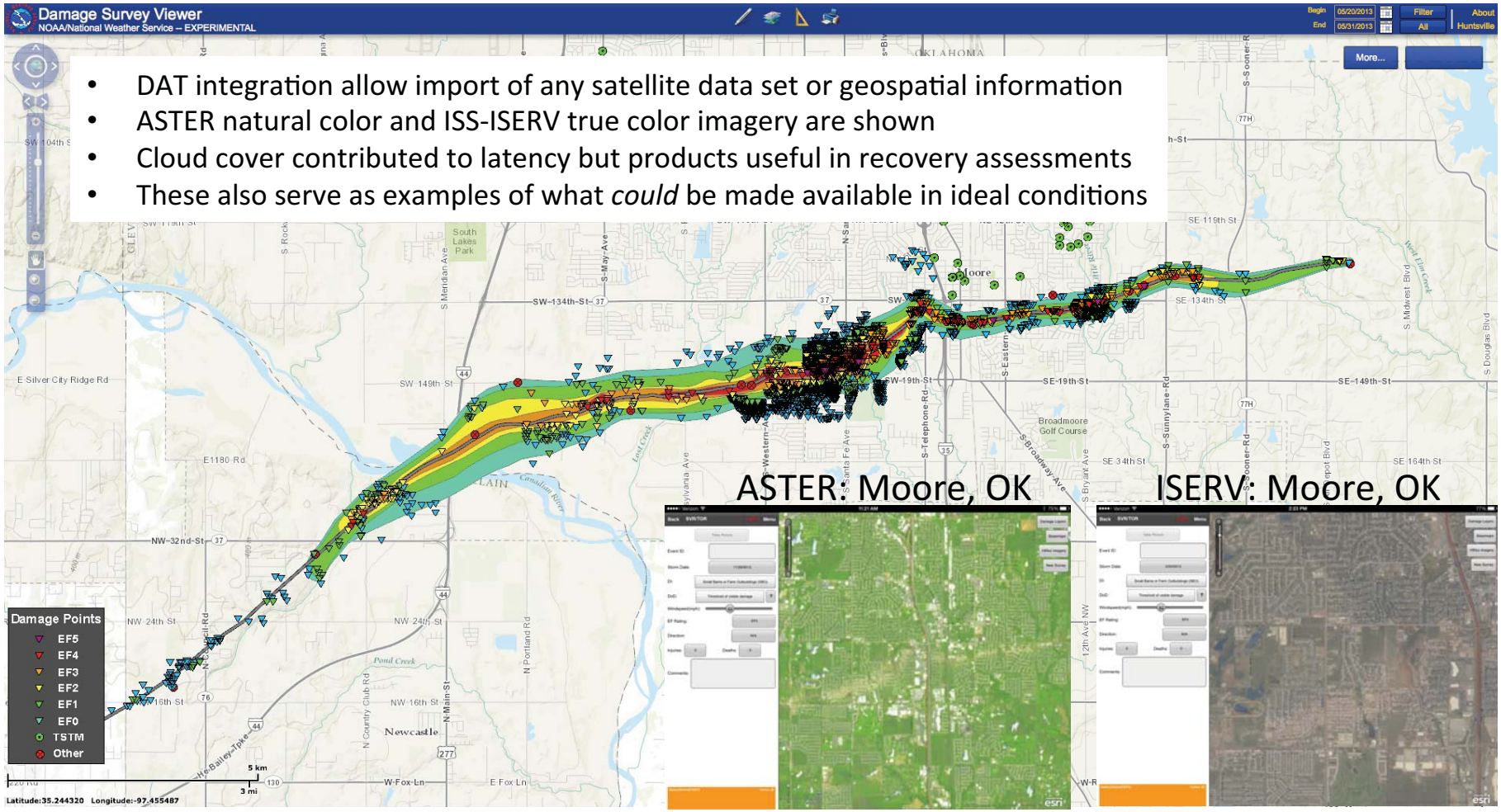
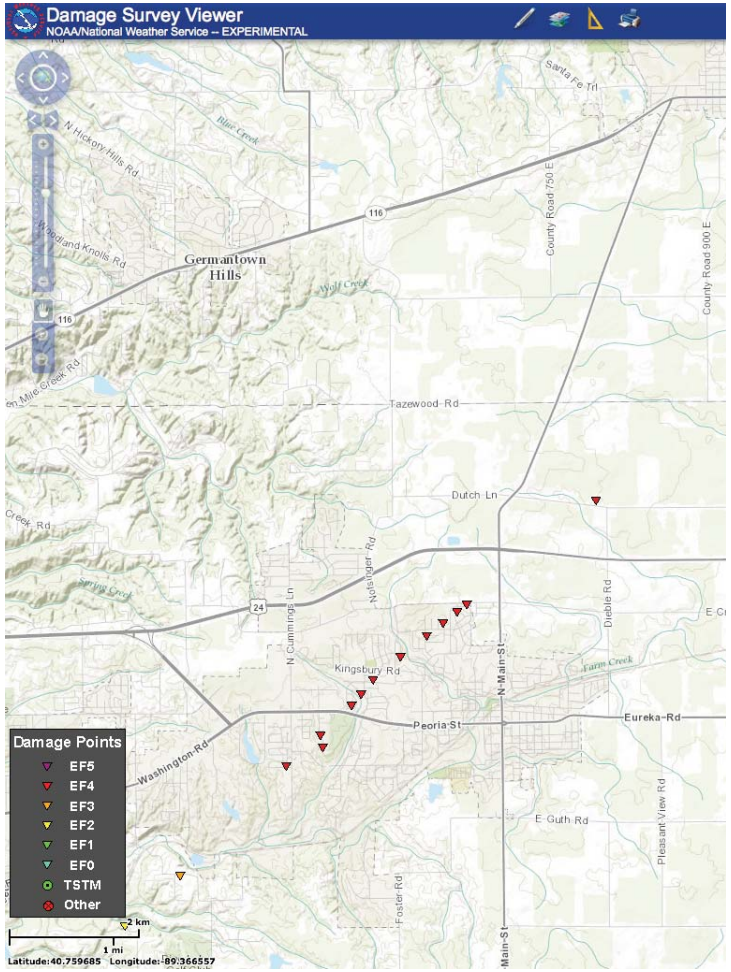
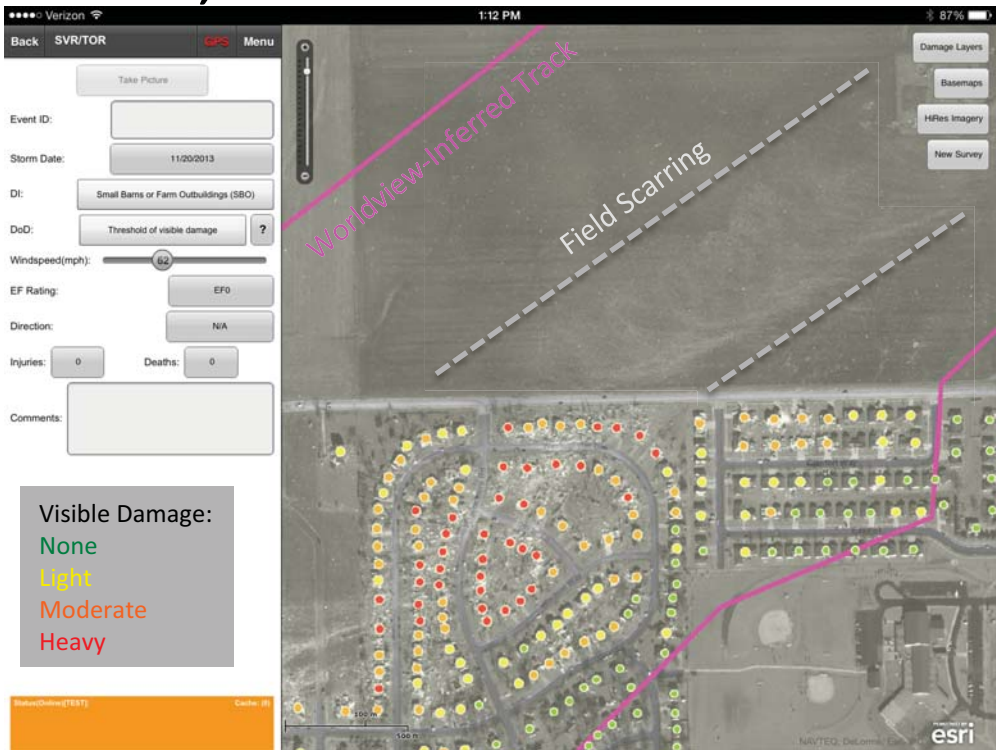


Peoria/Washington, Illinois Tornado

November 17, 2013





Worldview image of tornado damage in Washington, IL. Damage categories assessed by J. Bell of SPoRT Disasters Team. Underlying Worldview panchromatic image (~0.5m) copyright DigitalGlobe, provided via USGS for disaster response efforts.

Early Praise for NASA/NOAA Collaborations

"***Using this (high resolution) imagery, we can revolutionize the way we conduct surveys*** … If we had this imagery much sooner (***even within a month***), there's no telling how dead-on we could be with our surveys...and there would be little to no mistaking what actually happened (tornado vs. straight line winds)."

-- NWS Collaborator, Nashville, TN

"[The proposal team] got us images for the Moore, OK Tornado and the [Norman NWS] … working with Parks Camp (proposal collaborator, NWS Tallahassee) and NASA … re-defined the polygon as we were able to make the images available in Damage Assessment Toolkit. The imagery is very useful and has come in very handy for these types of events. Fortunately these also worked for the River Flooding in NWS Central Region's area. ***I think we should support this and the images have already been used in operations***."

-- NWS Collaborator, NWS Southern Region HQ

Summary and Future Work

- The SPoRT Disasters Team has successfully performed a feasibility study demonstrating integration of NRT Earth remote sensing within the NWS Damage Assessment Toolkit
  - Demonstrated benefits from April 27, 2011 case study in addition to high impact events of 2013.
  - Significant, early praise and excitement already received from NOAA/NWS partners.
- The team plans to continue supporting NOAA/ NWS partners as part of a three-year Applied Sciences: Decisions award, if received in FY2014.

Questions?

- Contact: andrew.molthan@nasa.gov

- Interested in learning more?
  - See our Hyperwall presentation at the NASA Exhibit Booth on Thursday at 10:30 am
  - Several related posters in the poster session
  - Additional information about tornado applications, plus extension to wildfires and tropical cyclones.