Use of Remote Sensing Data to Enhance the National Weather Service (NWS) Storm Damage Toolkit

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Background

• Following a severe weather outbreak, NOAA/NWS meteorologists are tasked with providing storm reports of damage associated with tornadoes, damaging winds, and hail.
• For tornadoes, this often involves dispatching meteorologists to the field, where they take detailed notes of damage locations, intensity, and gather corroborating evidence such as photos of damaged areas.
• Wide availability of smartphones, tablets, and GIS-capable devices allow for geotagging of data and aggregation within a GIS for further analysis.
Project Goals

• Satellite remote sensing can support damage assessment activities, especially for significant outbreaks.

• Our goal is to incorporate NASA, NOAA, and commercially available satellite data sets into the NOAA/NWS Damage Assessment Toolkit to assist in storm damage survey efforts.
  – The Damage Assessment Toolkit allows storm survey teams to snap photos, take notes, and obtain other information in a GIS framework that collocates the information with radar and other data.
  – Funded as a feasibility study and possible follow-on activity under the NASA Applied Sciences Program.
Case Study: April 27, 2011

- Severe weather on April 27, 2011 led to numerous devastating and deadly tornadoes across the southeast.
- NASA’s SPoRT Center collaborated with the NWS to provide MODIS and ASTER data in support of the damage assessment.

In Huntsville CWA:
- 38 tornado paths
  - 2 EF-5s
  - 4 EF-4s
  - 7 EF-2s
  - 21 EF-1s
  - 4 EF-0s
- 484.2 total path miles

In Alabama:
- 62 tornadoes
- 238 fatalities
- 1,201.8 total path miles
- 2 tornadoes 120+ miles
Satellite Data

• In response, SPoRT provided applications of NASA satellite data:
  – MODIS true color imagery
  – MODIS before and after changes in 250-m red channel surface reflectance.
  – ASTER false color composites at 15-m resolution.
Satellite Data

15-m ASTER False Color Composites provide detailed tornado damage tracks that correspond to storm-scale characteristics.
Going Forward

• Goals of the proposed feasibility:
  – Incorporate these data sets within the DAT.
  – Demonstrate application for a case study (Apr. 27)
  – Develop improved MODIS capabilities.
  – Explore inclusion of VIIRS (MODIS-like) data.
  – Explore inclusion of commercial data sets.

Above: ASTER false color composite shown (zoomed out) within the NWS Damage Assessment Toolkit
Recent Application

• Ongoing development of products for the DAT application was leveraged in response to Hurricane Sandy.
  – ASTER collections tiled, staged, and used to identify damage areas.
  – New applications explored with VIIRS data, emphasizing the day-night band.

• Although not specific to the feasibility study’s emphasis on tornadoes, demonstrates additional applications possible within NOAA’s DAT.
Mantoloking Bridge / Barrier Island

Coastal New Jersey
ASTER False Color
July 1, 2012

transitioning unique NASA data and research technologies to operations
Barrier island breach inferred from change in ASTER characteristics

Coastal New Jersey
ASTER False Color
November 4, 2012
Barrier island breach inferred from change in ASTER characteristics

Coastal New Jersey
ASTER False Color
November 4, 2012

Associated Press before and after photo comparison of Mantoloking Bridge

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New Applications of the VIIRS Day-Night Band
Detects moonlit clouds, city lights, and fires.

Pre-Sandy: August 31, 2012

Massachusetts
Long Island
New Jersey
Delaware
Changes (loss) in city lights correspond to outages

Post-Sandy: November 1, 2012

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False color combinations identify outages for assessment

Post-Sandy Cloud Cover

Yellow: Lights missing after damage from Sandy
These data were provided to USGS and FEMA to assist with their response efforts

Post-Sandy: November 1, 2012

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Summary

• SPoRT is improving the use of near real-time satellite data in response to severe weather events and other disasters.
  – Supported through NASA’s Applied Sciences Program
• Planned interagency collaboration to support NOAA’s Damage Assessment Toolkit, with spinoff opportunities to support other entities such as USGS and FEMA.
• Interested in hearing more?
  – Check out our NASA Hyperwall Presentation on Thursday morning, 10:20-10:40 am.