Dissemination of Earth Remote Sensing Data for Use in the NOAA/NWS Damage Assessment Toolkit

Andrew Molthan\textsuperscript{1}, Jason Burks\textsuperscript{1}, Parks Camp\textsuperscript{2}, Kevin McGrath\textsuperscript{3}, and Jordan Bell\textsuperscript{4}

\textsuperscript{1}NASA Short-term Prediction Research and Transition (SPoRT) Center, Huntsville, Alabama

\textsuperscript{2}NOAA/NWS Weather Forecast Office, Tallahassee, Florida

\textsuperscript{3}Jacobs, Inc./SPoRT, Huntsville, Alabama

\textsuperscript{4}University of Alabama in Huntsville, Huntsville, Alabama

andrew.molthan@nasa.gov

Presentation 3.1, 31\textsuperscript{st} Conference on Environmental Information Processing Technologies (EIPT)

2015 (95\textsuperscript{th}) AMS Annual Meeting, Phoenix, AZ
Background

- Following the April 27, 2011 severe weather outbreak across the southeastern U.S., the SPoRT team provided MODIS and ASTER imagery to NWS forecast offices in Alabama.
  - Imagery was used to refine and adjust some tornado tracks, particularly those that crossed CWA boundaries or were in areas with limited road access.
- SPoRT was awarded a NASA Applied Science: Disasters “Feasibility” award to pursue inclusion of Earth remote sensing imagery and derived products within the NOAA/NWS Damage Assessment Toolkit.
Damage Assessment Toolkit

• NOAA/NWS Damage Assessment Toolkit (DAT)
  • The DAT is a smartphone, tablet, and web-based framework for acquiring, editing, and publishing storm survey information.
  • Users can acquire geotagged photos and other information, assess storm damage and intensity, and log for further review at their office. Information collected provides additional spatial data regarding tornado damage, extent, and intensity.

• Through the NASA Applied Science award, SPoRT and NOAA/NWS collaborate to establish a Web Mapping Service and data feeds that provide satellite imagery and products as viewable data layers.
As part of the Feasibility Study, the team worked with Parks Camp (NWS WFO Tallahassee, FL) to integrate full resolution imagery within the mobile and web versions of the DAT.

Shown here, the mobile DAT interface now includes additional buttons and other features to search and display imagery that SPoRT provides via WMS.
Damage Assessment Toolkit

An additional toggle button creates a menu to search for available imagery based upon the viewing location and time of year.

Caching of imagery allows users to download data before they go out to the field, ensuring availability despite a loss of cellular data.
In this example, the WMS has two types of imagery available for Washington, IL in the period of interest:

MODIS true color imagery provided via SPoRT, and higher resolution Worldview (commercial) imagery provided via the USGS.
By drilling down through the data menus, an image can be loaded for this specific event and then displayed within the DAT application.
Date and time for the Worldview image is shown, and here, a red text view is a reminder that this imagery is restricted for NOAA/NWS use only, and not available for public release.

Certain data sets are restricted to use by governmental agencies (not released to the public) due to their licensing requirements.
Damage Assessment Toolkit

When loaded, this Worldview example provides the original grayscale image along with value added damage analysis provided by UAH graduate student and SPoRT team member Jordan Bell.

Colored points identify areas of varying degree of damage, and the pink outline is an estimate of the path based upon imagery analysis.
The DAT application allows for pinching and zooming, just like Google Maps.

The WMS continues to provide higher resolution tiles, up to full resolution of the data (higher than shown here, ~0.5 m), so that DAT users can compare their survey to available imagery.

Imagery can help to identify damage in adjacent areas, clarify previous structures via pre-event imagery, and provide other analysis capabilities.
Damage Assessment Toolkit

Coming Soon:
- Satellite imagery integrated into the web client.
- Similar menu structure accessible through the ‘Satellite Imagery’ menu.
## Satellite Products

<table>
<thead>
<tr>
<th>Platform</th>
<th>Sensor</th>
<th>Product</th>
<th>Resolution</th>
<th>Repeat Cycle</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terra / Aqua</td>
<td>MODIS</td>
<td>NDVI True Color</td>
<td>250 m 500 m</td>
<td>Daily</td>
<td>Direct Broadcast (CIMSS) NASA LANCE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>True Color Day-Night Band</td>
<td>375 m 375 m 750 m</td>
<td>Daily</td>
<td>Direct Broadcast (CIMSS)</td>
</tr>
<tr>
<td>Suomi NPP</td>
<td>VIIRS</td>
<td>NDVI True Color</td>
<td>30 m</td>
<td>16 Days</td>
<td>USGS Earth Explorer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Natural Color</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landsat 7, Landsat 8</td>
<td>ETM+</td>
<td>Natural Color NDVI</td>
<td>30 m</td>
<td>16 Days</td>
<td>USGS Earth Explorer</td>
</tr>
<tr>
<td></td>
<td>OLI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>False Color NDVI</td>
<td>15 m</td>
<td>On Demand</td>
<td>ASTER Expedited USGS Earth Explorer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Natural Color NDVI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>International Space Station</td>
<td>ISERV</td>
<td>True Color</td>
<td>5 m</td>
<td>On Demand</td>
<td>SERVIR Project at MSFC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>True Color</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>Varies</td>
<td>Panchromatic True Color</td>
<td>&lt; 1 m 1 m</td>
<td>On Demand</td>
<td>USGS Hazards Data Distribution System</td>
</tr>
</tbody>
</table>

Latency of products vary by type of imagery and source. Through partners, we provide a broad range of sensors for post-storm analysis. Data can be used by surveyors up to 60 days after the event.
Data Dissemination and Use Case

Warning

Issued

Event

Occurs

Provide Imagery

in DAT

Refine Survey

Improved Survey

Ingest Server

WMS and Tile Cache

Smartphones and Tablets (e.g. DAT)

Custom or Future DSS

Web Clients

GIS Application

GIS Application

Disaster Imagery

Smartphones and Tablets (e.g. DAT)
Imagery Support and Training

- SPoRT provides training and support for delivered products.
- The team provided teletraining to partnering WFOs in NWS Southern Region
- A series of “Quick Guides” has been established for “just in time” training and use of data during operations.
NWS and SPoRT Partnership

• NASA’s Applied Science projects require a full “research to applications” transition

• SPoRT and the NWS will partner over three years to ensure a successful transition

• Upcoming for 2015: Expanding partnerships to NWS Central Region
Future Work / Transition Plan

• January 2015-July 2015
  • Continue partnerships with selected Southern Region and upcoming Central Region WFOs.
  • SPoRT disseminates data, aids regions with acquiring commercial products provided through USGS

• Late Summer 2015
  • Project team meeting and discussion to begin transition of product dissemination to NOAA/NWS partners
  • Establish POCs for handling data and broader strategy for disseminating WMS products from NOAA/NWS

• Second Year (2015-2016)
  • SPoRT aids NOAA/NWS in setting up dissemination of selected products as a testbed activity
Questions?

• Check out some related talks!
  • Development of a Near Real-Time Hail Damage Swath Identification Algorithm for Vegetation
    • J. Bell, University of Alabama in Huntsville, J8.5
      • Tuesday, 2:30 pm, 231ABC (20th Satellite)
    • L. Schultz, University of Alabama in Huntsville, 1A.2A
      • Thursday, 2:00 pm, 230 (20th Satellite)

• If you’re interested in learning more about the project, contact me at andrew.molthan@nasa.gov