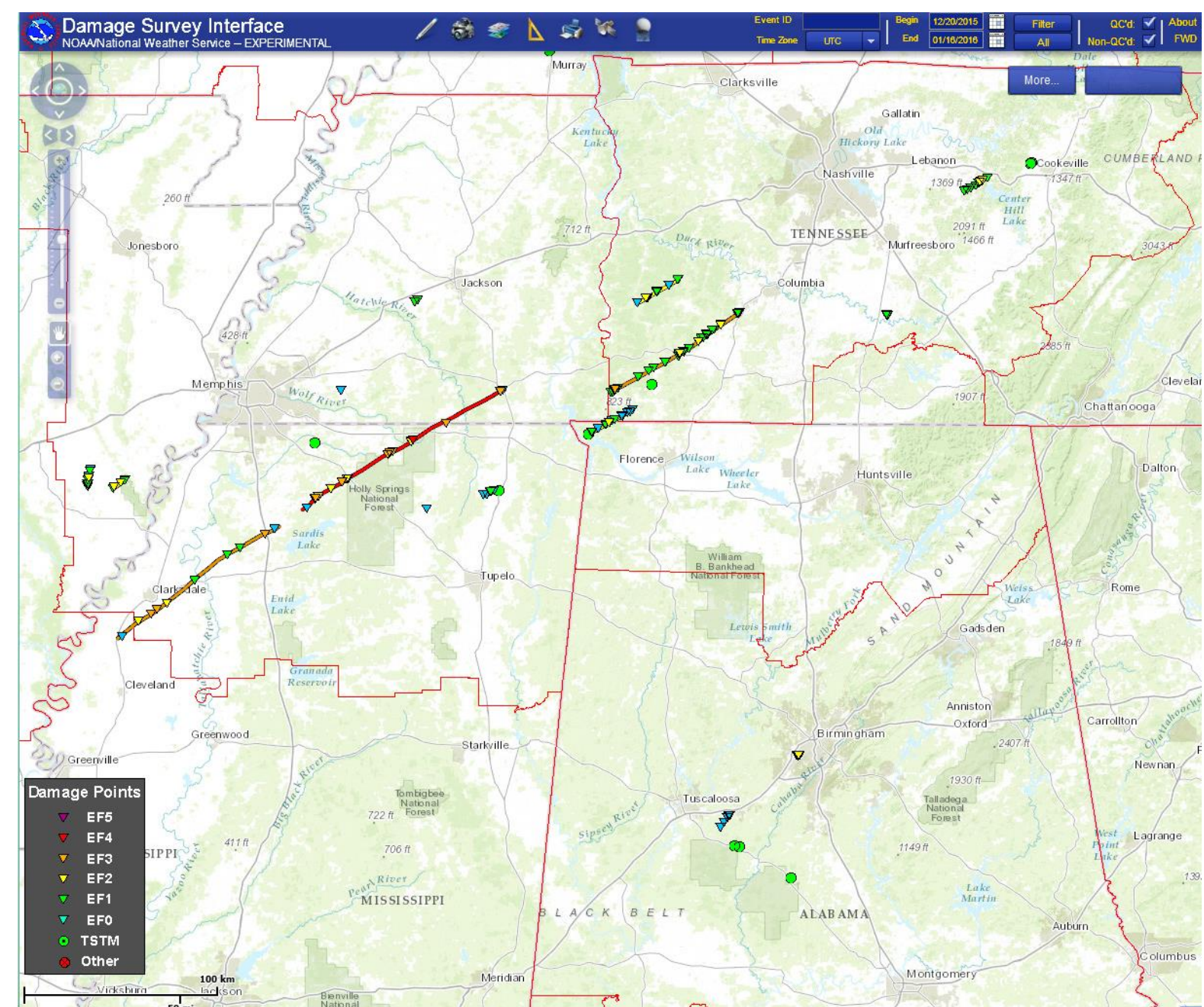


# Applications of Earth Remote Sensing for Identifying Tornado and Severe Weather Damage



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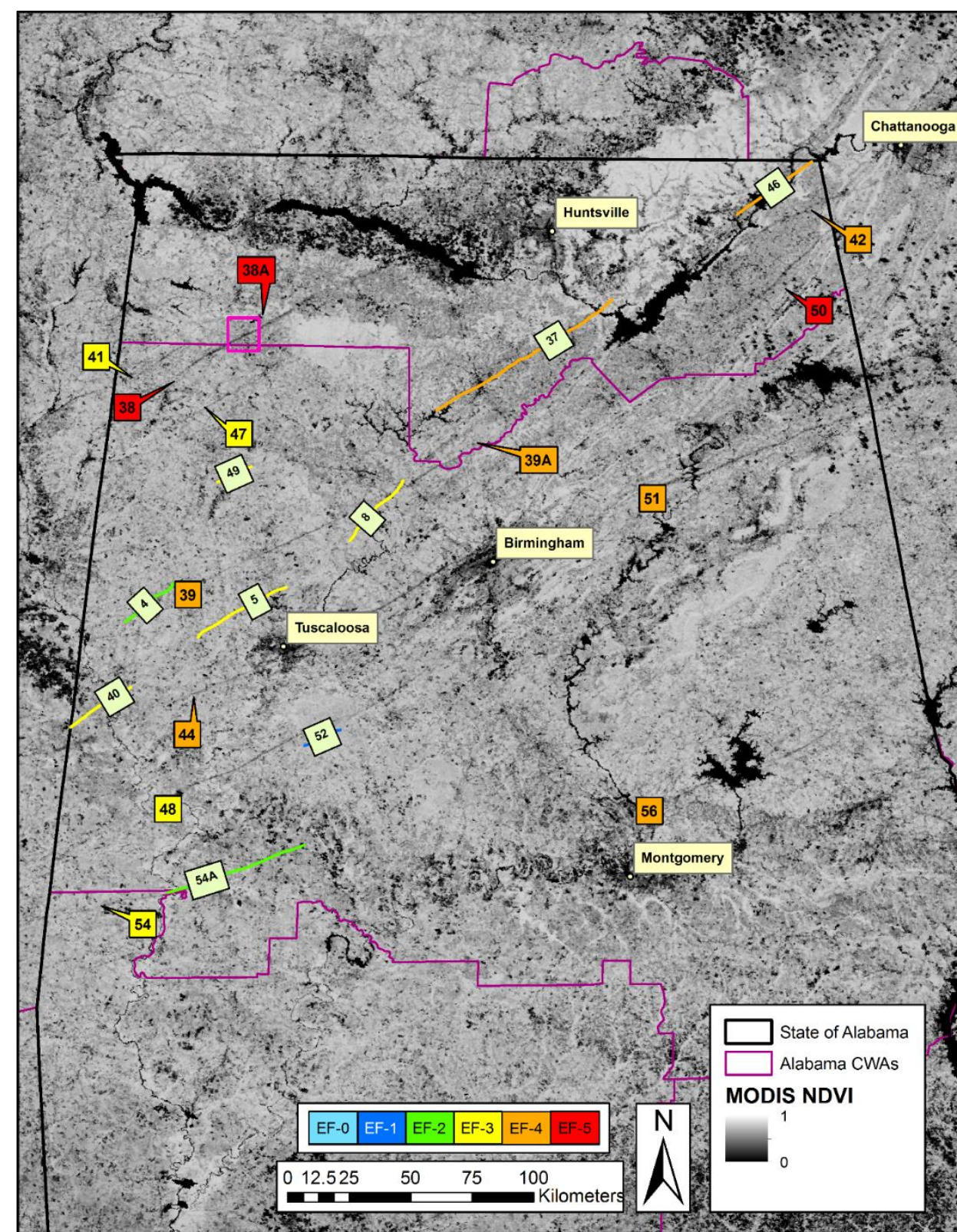
## Project Background



In the United States, the National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) is charged with performing damage assessments when storm or tornado damage is suspected after a severe weather event. This has led to the development of the Damage Assessment Toolkit (DAT), an application for smartphones, tablets and web browsers that allows for the collection, geolocation, and aggregation of various damage indicators collected during storm surveys.

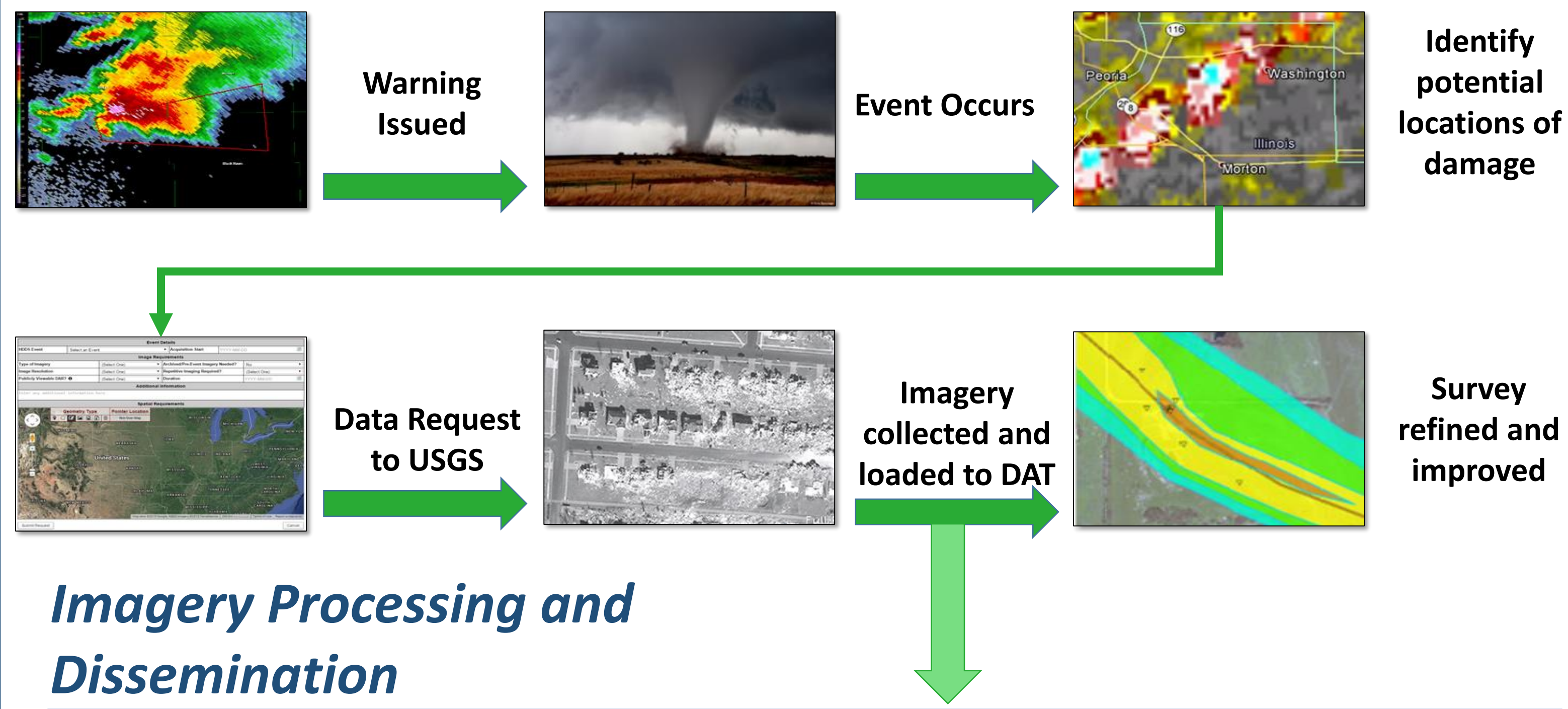
## Project Motivation

- NASA SPoRT provided MODIS and ASTER imagery to WFOs in Alabama to support April 27<sup>th</sup>, 2011 damage assessments across the state
- SPoRT was awarded a NASA Applied Science: Disasters Feasibility award to investigate the applicability of including remote sensing imagery and derived products into the NOAA/NWS Damage Assessment Toolkit (DAT)
- Proposal team was awarded the 3 year proposal to implement a web mapping service and associate data feeds from the USGS to provide satellite imagery and derived products directly to the NWS thru the DAT.

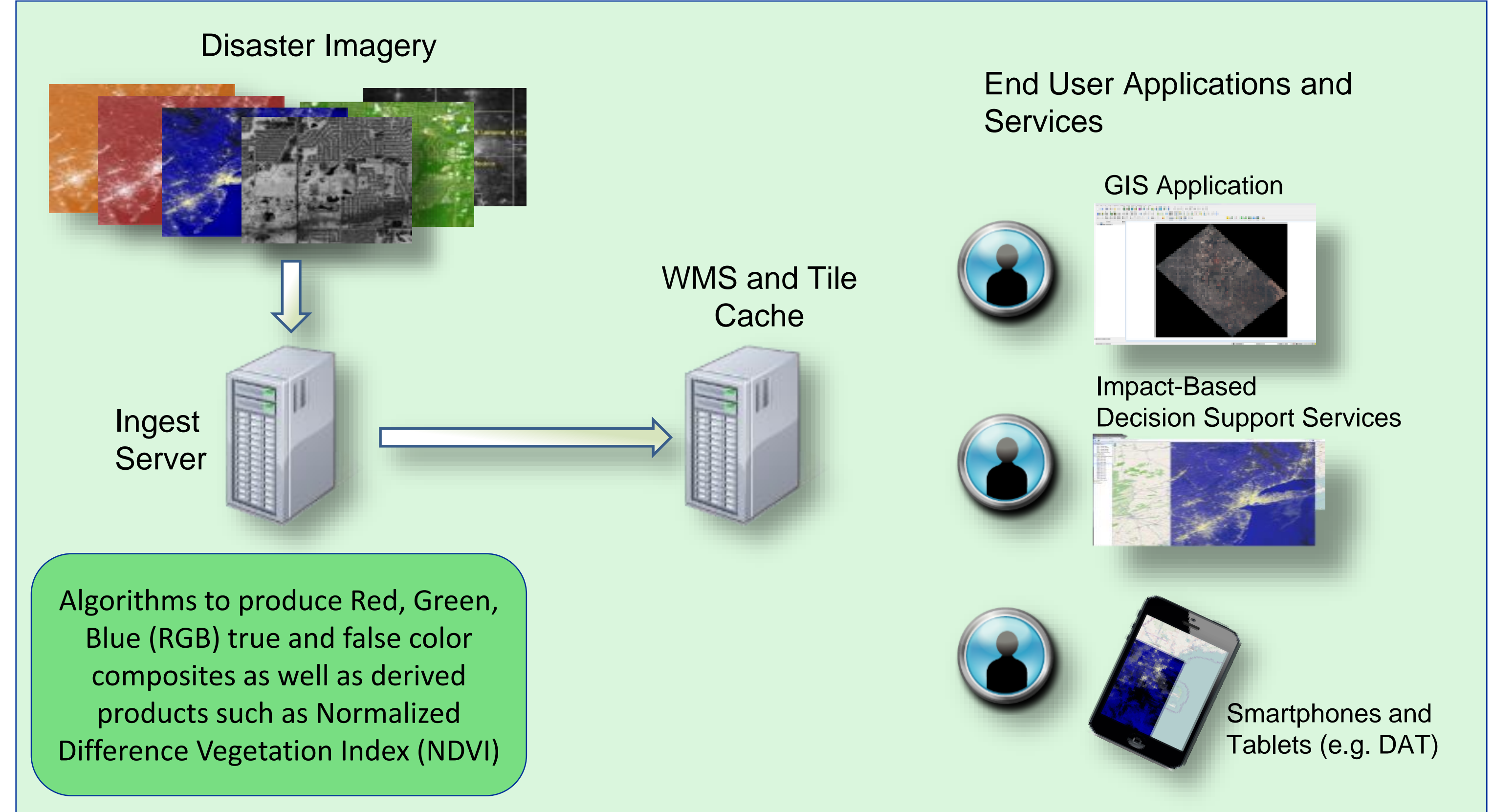


## Timeline and Usage

If severe weather is forecasted for an area, the workflow that is most often followed is as follows:

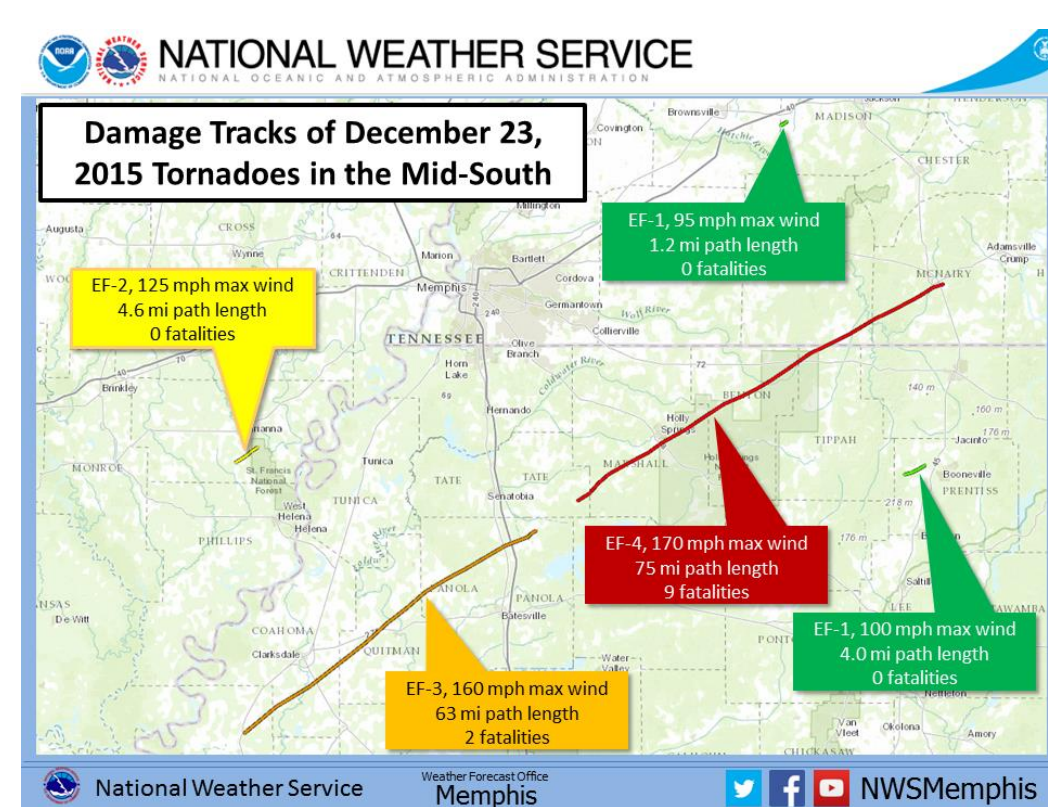


## Imagery Processing and Dissemination



## Severe Weather Event on 23 December 2015

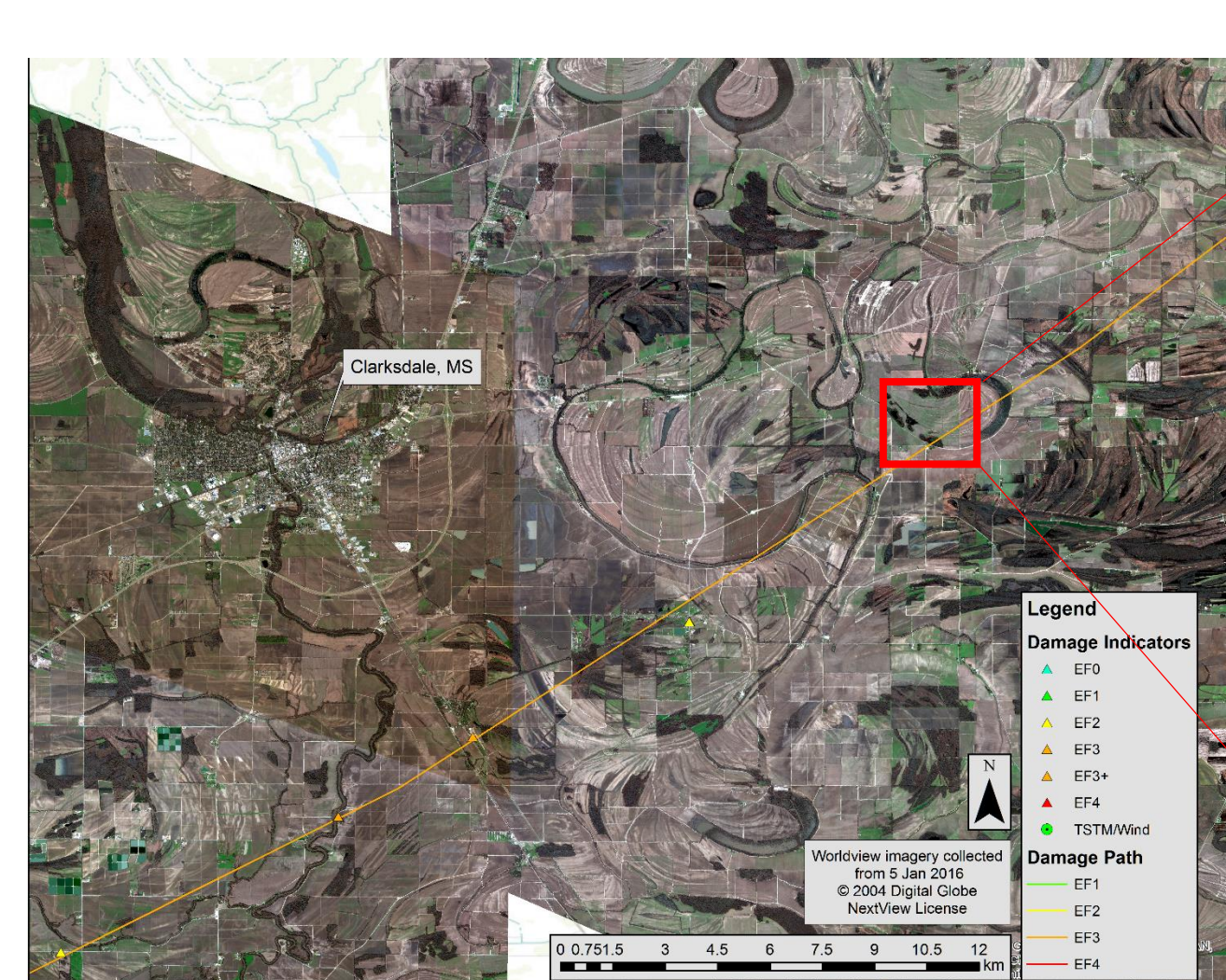
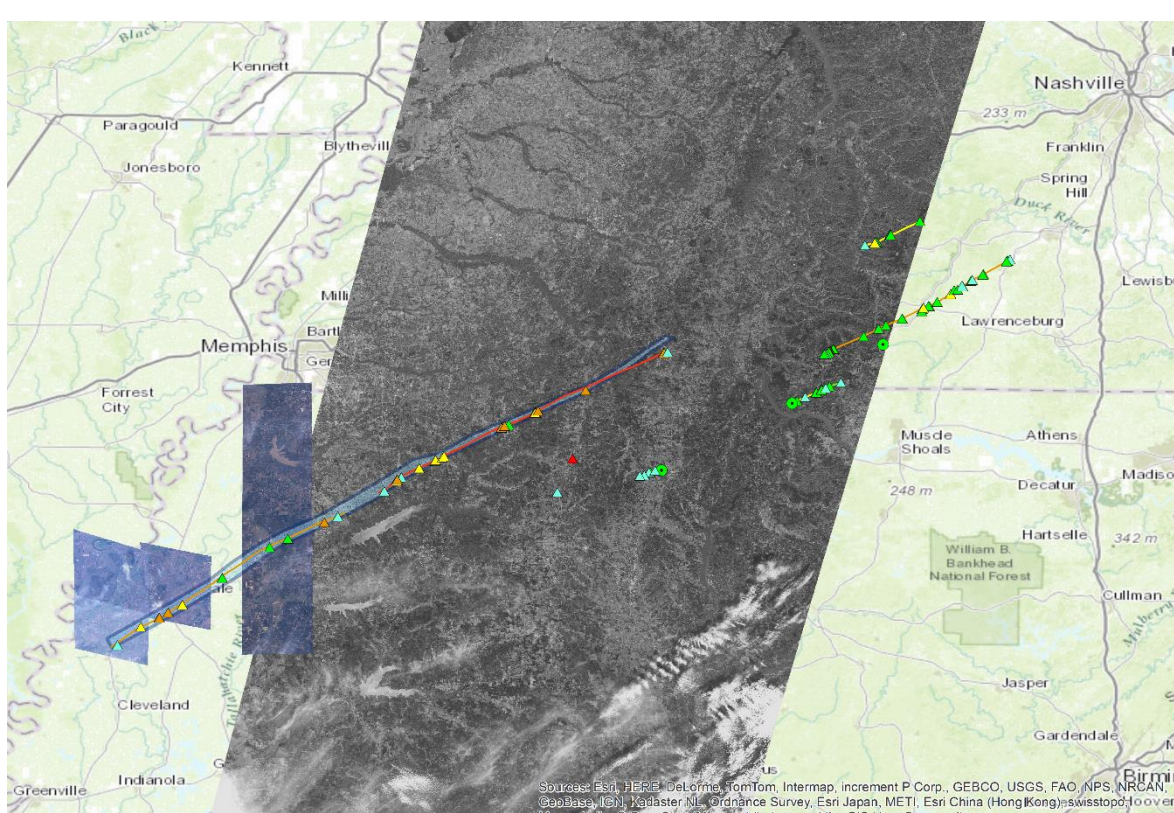
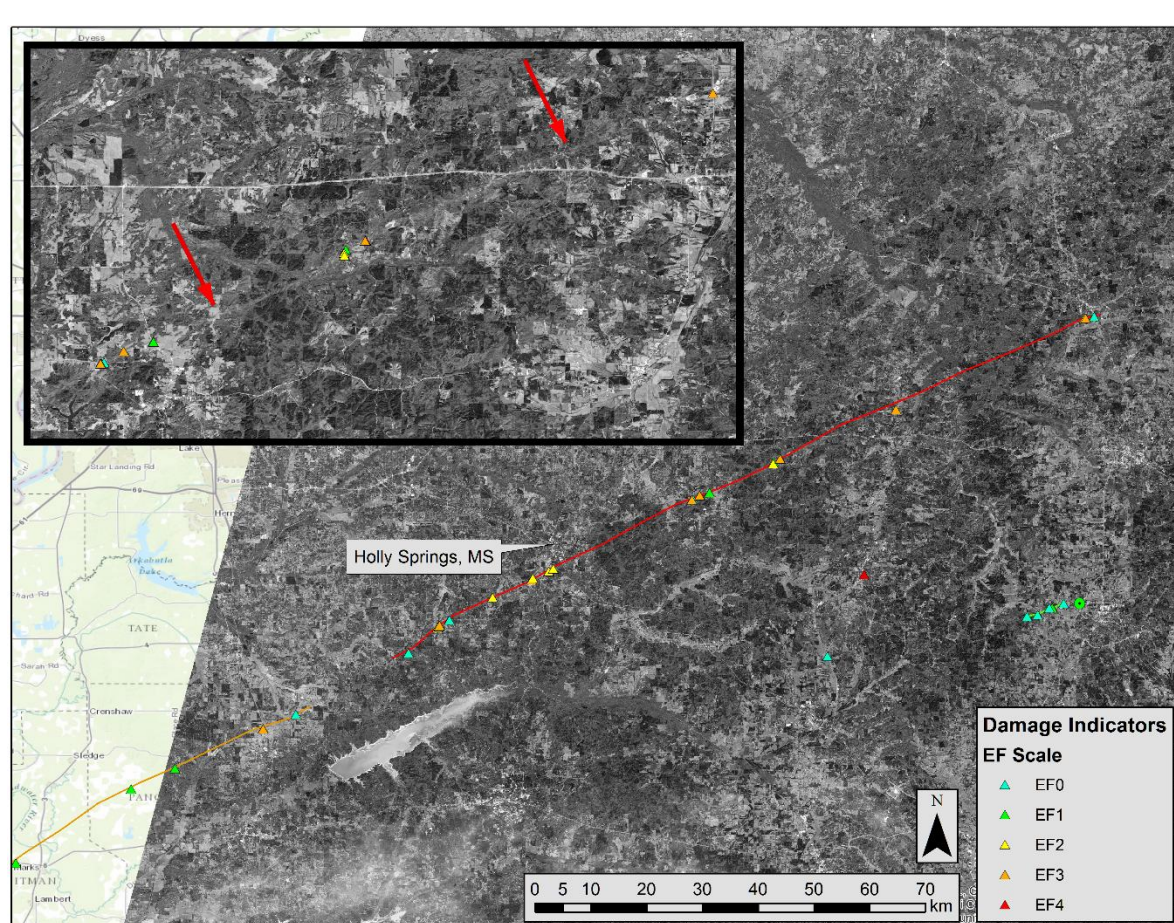
A strong system with record warm temperatures along with impressive upper level wind fields provided the ingredients to produce five tornadoes across the Mid-South on December 23, 2015, including two long tracked violent tornadoes, killing eleven people. Fourteen deaths in and over 100 injuries nationwide were attributed to the storm system and an estimated property loss of over \$16 million dollars were reported.



National Weather Service forecasters from the Memphis office were deployed to conduct surveys early on the 24<sup>th</sup> using the Damage Assessment Toolkit (DAT) application installed on mobile devices.

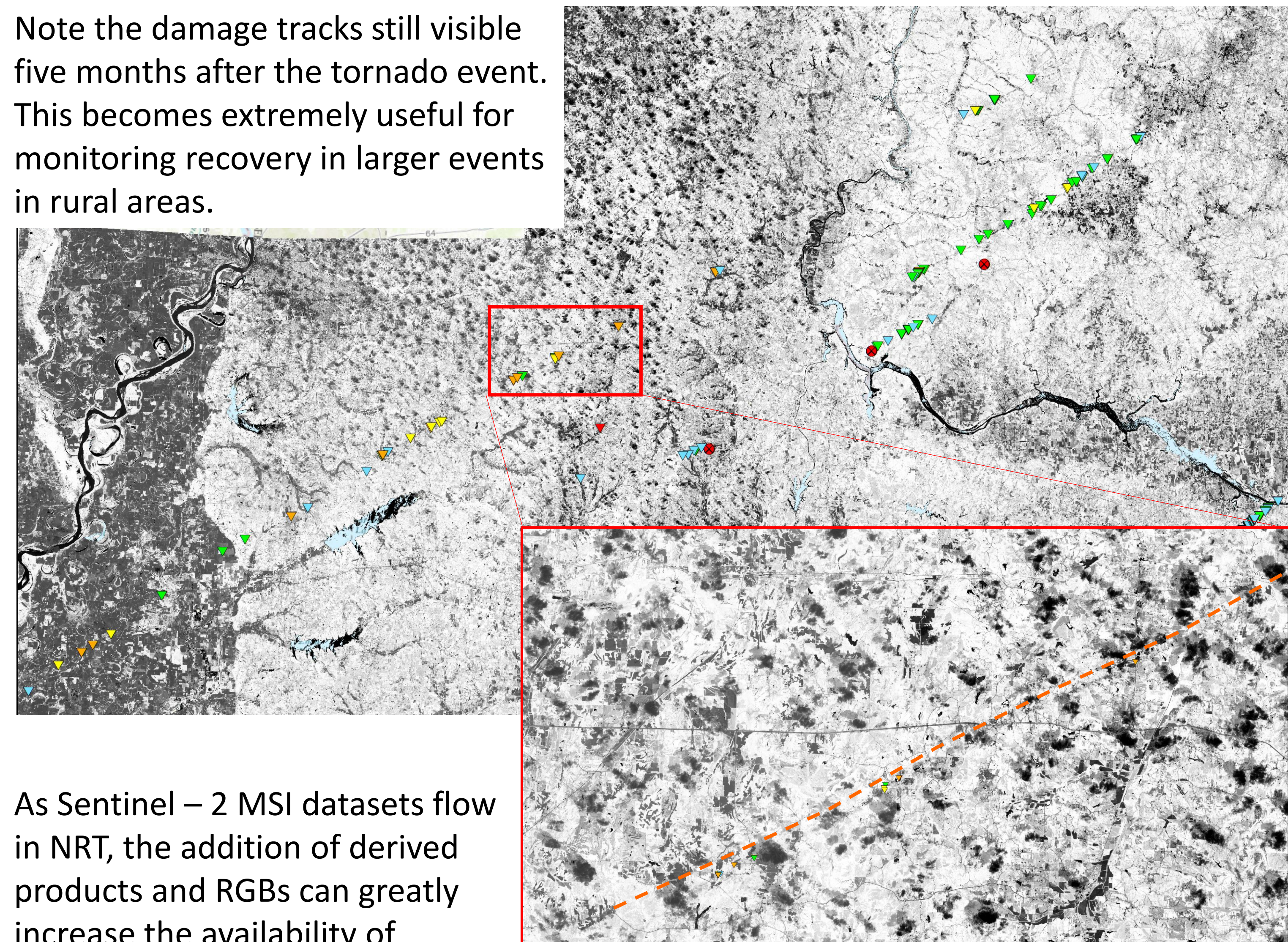
The Landsat 8 instrument passed overhead on the afternoon of the 24<sup>th</sup>, providing the forecasters a first look of the damage from satellite. Additional data from DigitalGlobe's WorldView-3 satellite became available through a partnership with the U.S. Geological Survey (USGS) Hazard Data Distribution System (HDDS: <http://hddsexplorer.usgs.gov/>) in early to mid-January.

As shown to the left, the provided WorldView imagery was located to the far western portion of the first EF-3 track. Scarring was visible in the open fields. Similar high-resolution imagery was not available over the EF-4 track to the east.



Sentinel-2 MSI imagery was not available in near realtime (NRT). Using data acquired from the USGS Earth Explorer portal, all available imagery was acquired from December to June. (December through March was too cloudy to be used for analysis.) Shown here is the NDVI product for the May 5<sup>th</sup> and 13<sup>th</sup> passes over North Mississippi, North Alabama and southern Tennessee.

Note the damage tracks still visible five months after the tornado event. This becomes extremely useful for monitoring recovery in larger events in rural areas.



As Sentinel – 2 MSI datasets flow in NRT, the addition of derived products and RGBs can greatly increase the availability of satellite data to the NWS personnel in support of damage surveys. Data such as these has been used to confirm/change track start and end points, determine width, as well as identify tracks missed by the ground survey team due to limited access or terrain considerations.

The increased temporal resolution provided by the use of Landsat and Sentinel derived products together greatly impacts track detection and analysis, especially when commercial imagery is unavailable.

### Image Credits and Copyrights

**Landsat:**  
 USGS/NASA Landsat Program  
 Data available from the U.S. Geological Survey. Questions concerning the use or redistribution of USGS data should be directed to: [ask@usgs.gov](mailto:ask@usgs.gov) or 1-888-ASK-USGS

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