Investigating the Use and Integration of Synthetic Aperture Radar Imagery in the Damage Survey Process within the NOAA/NWS Damage Assessment Toolkit (DAT)

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Damage Assessment Toolkit

Mobile and Web Application developed to support NWS personnel while performing surveys.

- Reduce prep time for site deployment
- Reduce perishable damage data collection time
- Improve damage survey data collection consistency
- Improve delivery of geospatially-accurate data to core partners and to the public.
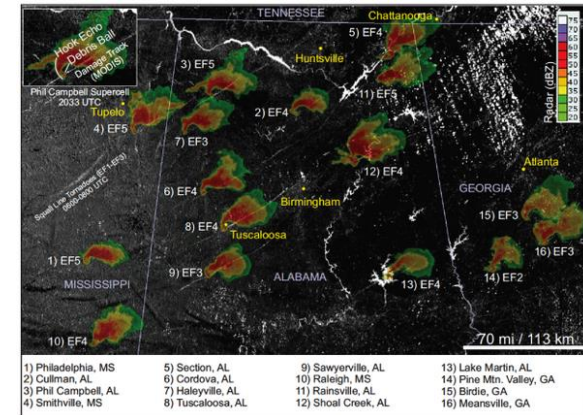
From: Molthan, A., G.Jedlovec, and B.Carcione, (2011), NASA satellite data assist in tornado damage assessments, Eos Trans. AGU, 92(40), 337.
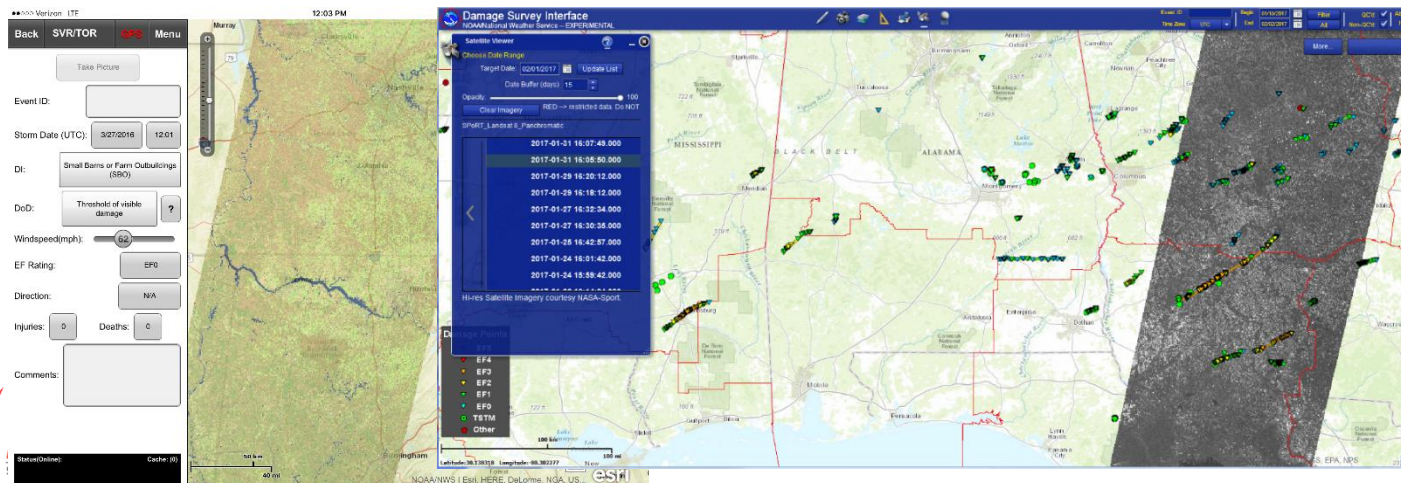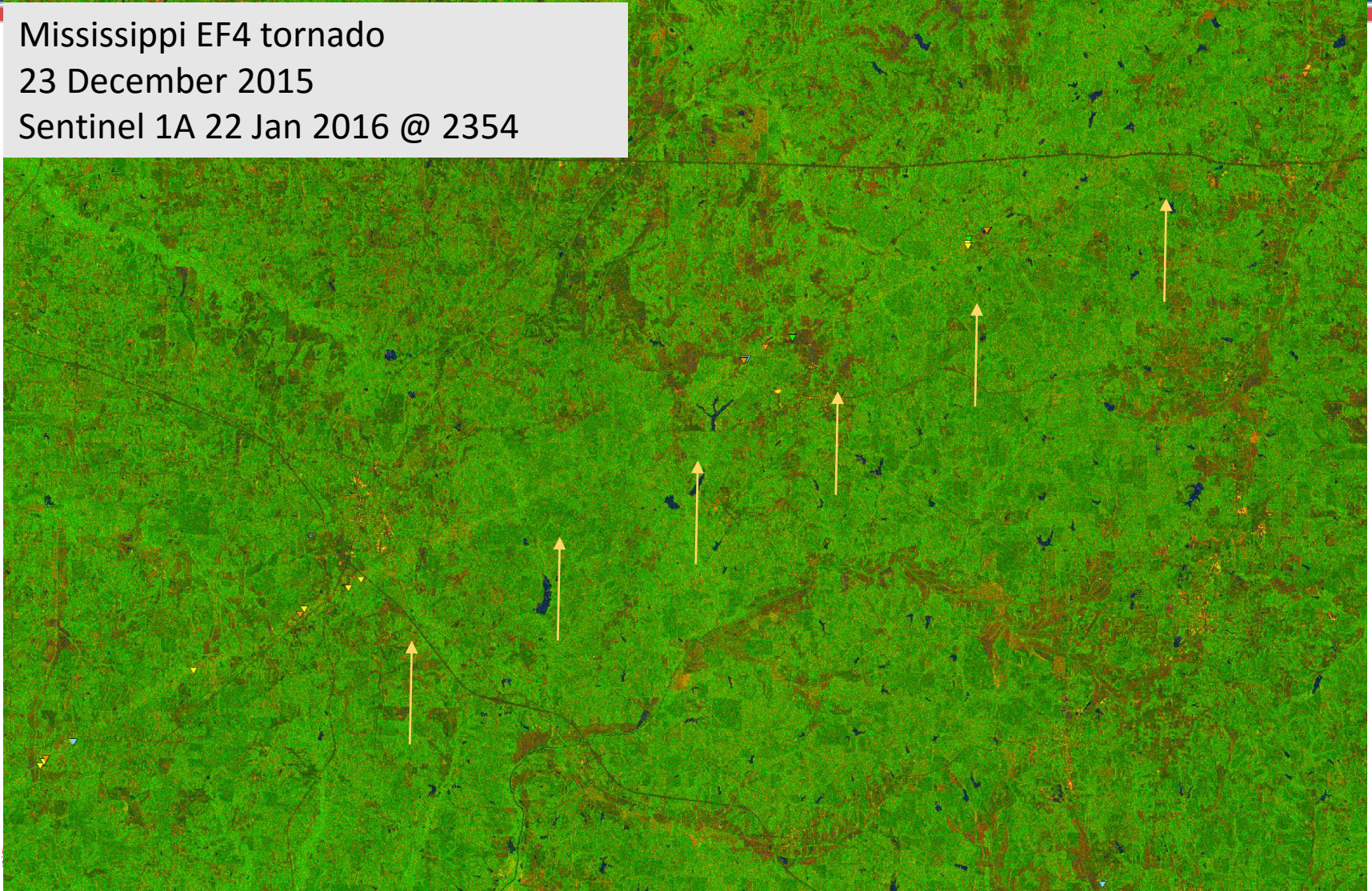
Tornado Track Detection
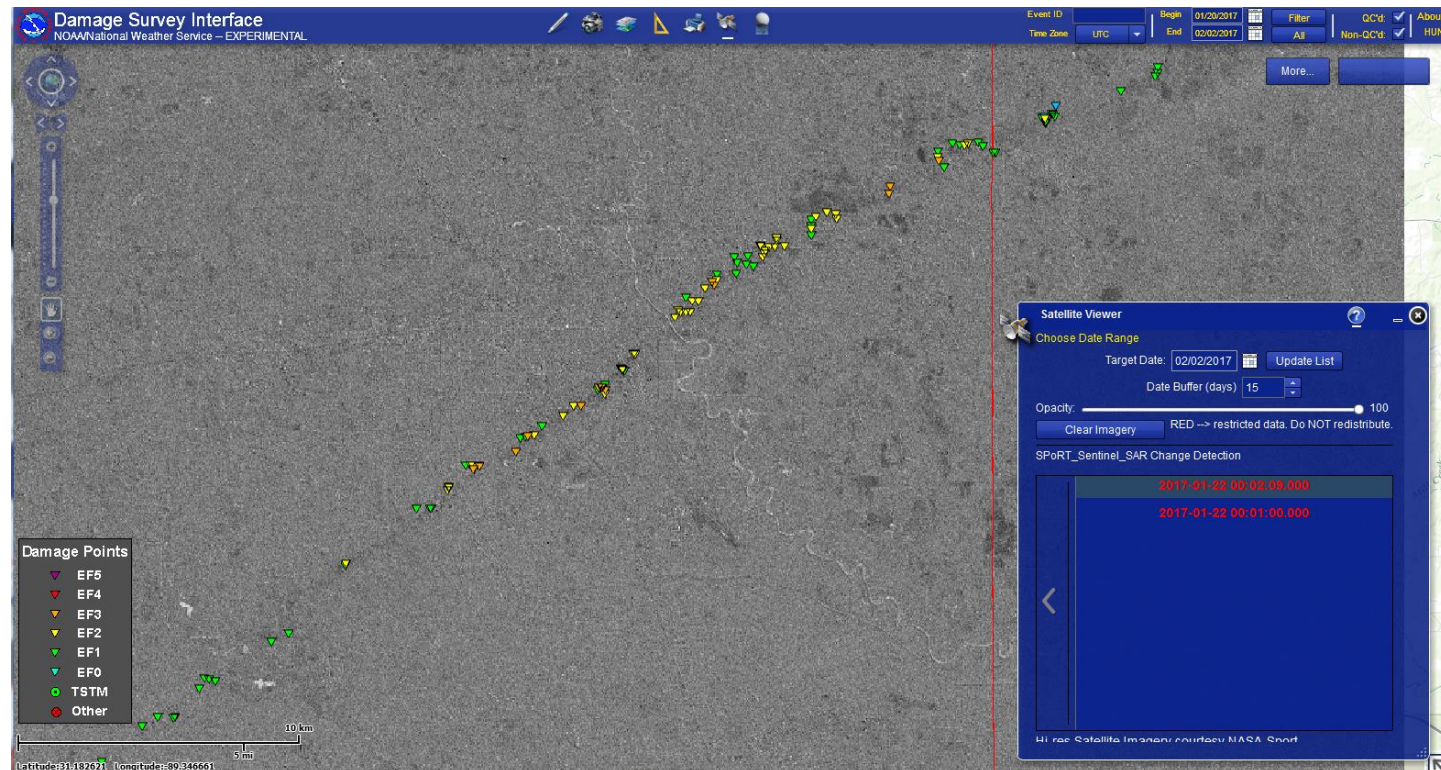
Mississippi EF4 tornado
23 December 2015
Sentinel 1A 22 Jan 2016 @ 2354

Tornado Track Detection

Change detection image produced by ASF for Hattiesburg , MS EF-3 tornado on 21 Jan 17

- Placed in the DAT for review by the NWS office
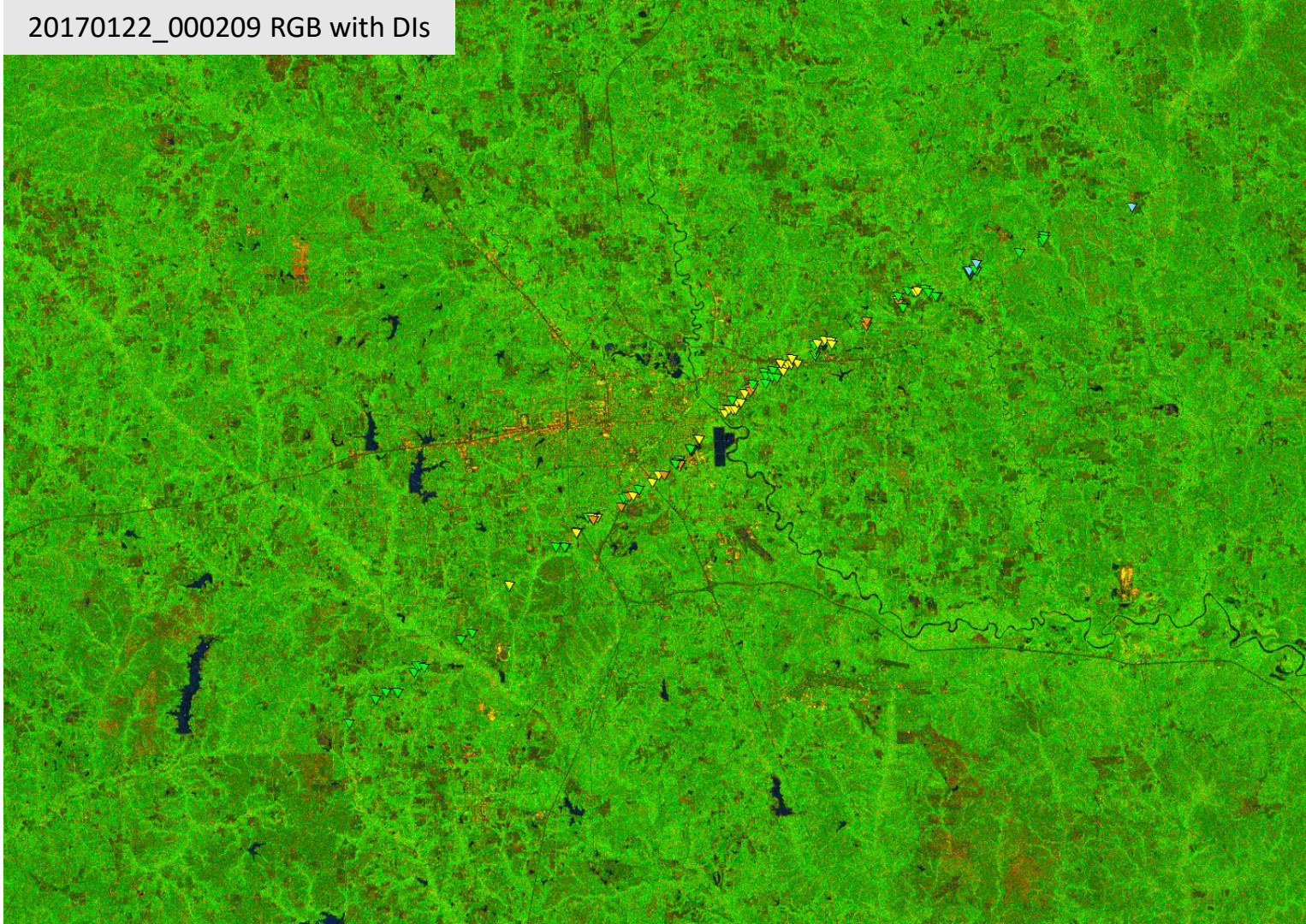- Track is visible but contrast is not great.

ASF DAAC 2017, contains modified Copernicus Sentinel data 2017.

Hattiesburg , MS EF-3

Event: January 21, 2017

20170122_000209 RGB with DIs
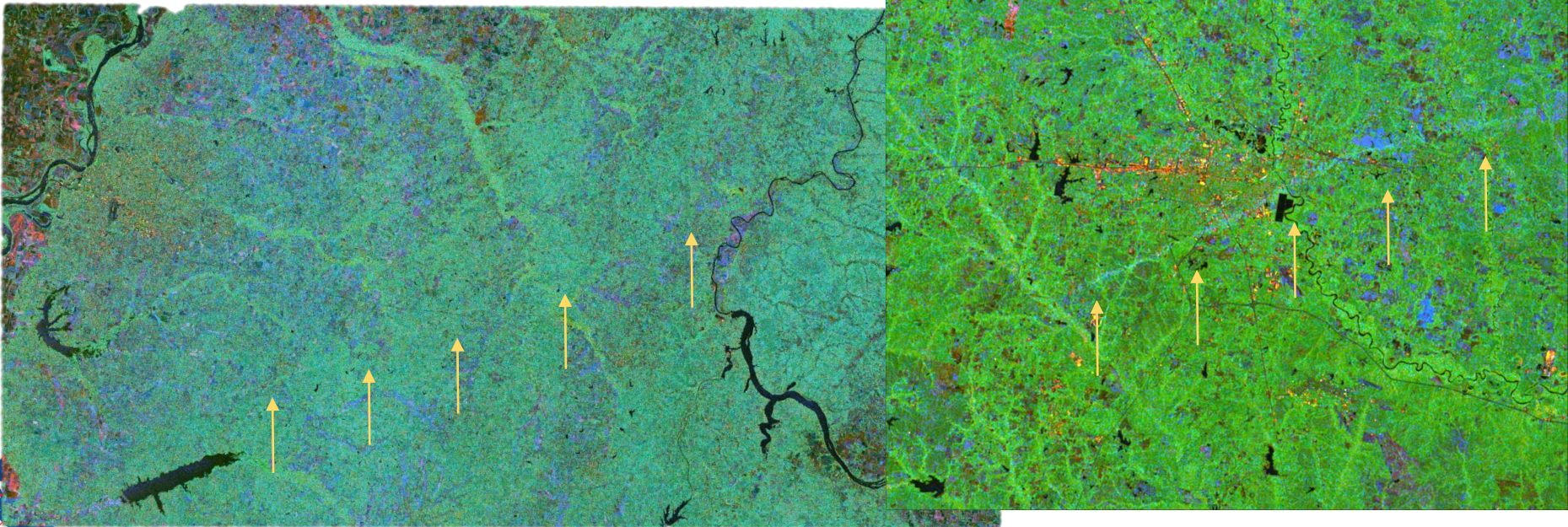
RGB Change Detection

Here, false color composites *focused on change detection*, look at differences in VH-polarization returns pre- and post-storm to visually identify tracks.
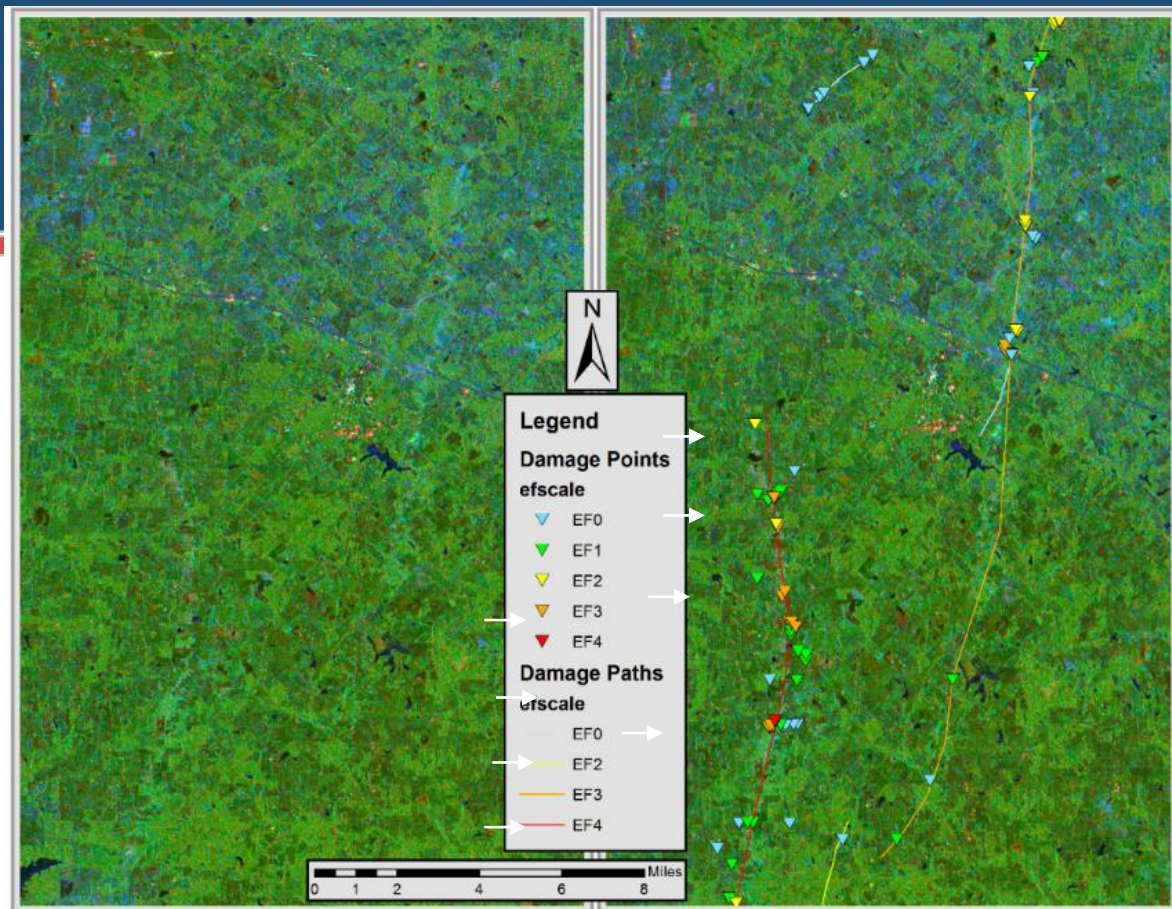
- Red channel: co-pol – post image

- Green channel: cross-pol – post image

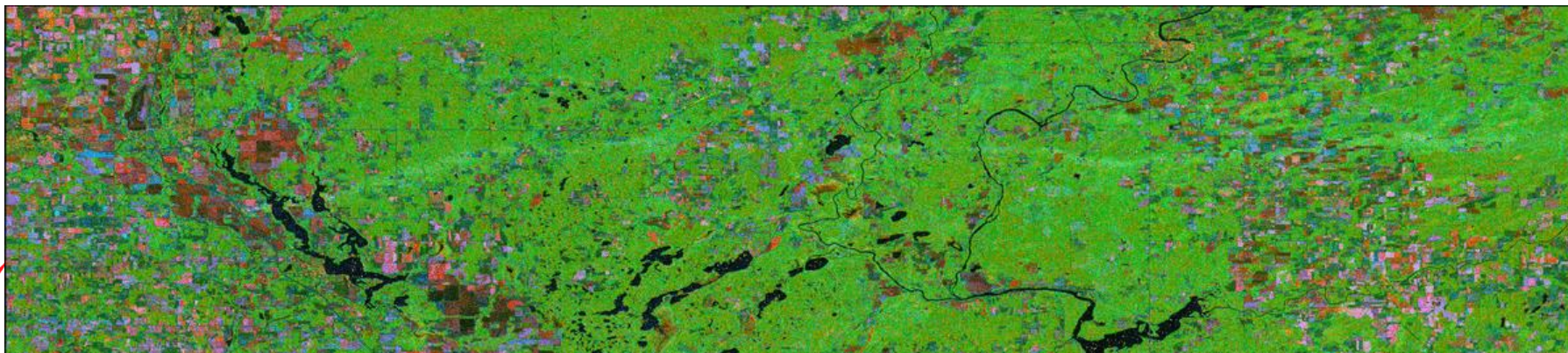- Blue channel: cross-pol -> pre - post

Examples

Sentinel 1A Change RGB
East Texas Tornado Event
(7 tornados, max: EF-4)
29 April 2017

Sentinel 1A Change RGB:
Clear Lake, Wisconsin – EF-3 tornado
16 May 2017

ASF DAAC 2017, contains
modified Copernicus Sentinel
data 2017.

Legend

Damage Points
efscale
▽ EF0
▽ EF1
▽ EF2
▽ EF3
▼ EF4

Damage Paths
efscale
— EF0
— EF2
— EF3
— EF4

Wind-driven Hail Damage to Crops

Severe thunderstorms in the Central U.S. bring combinations of large hail, damaging winds, and tornadoes during the primary growing season months of June through August.

- National Weather Service offices do not conduct storm surveys on hail events, yet are asked to confirm storm occurrence for insurance and federal aid programs

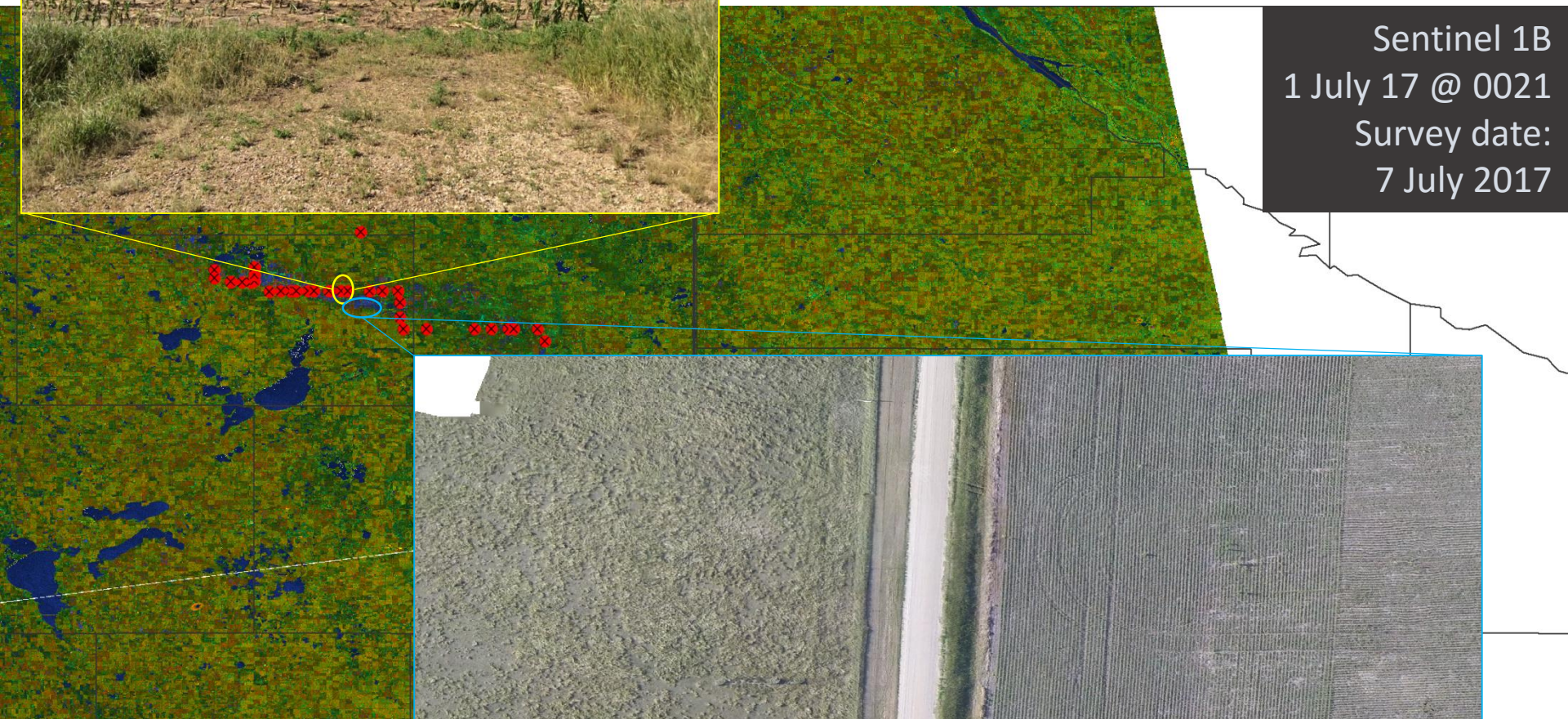South Dakota Region – 20th June 2017

Landsat 8
7 July 17 @ 1711
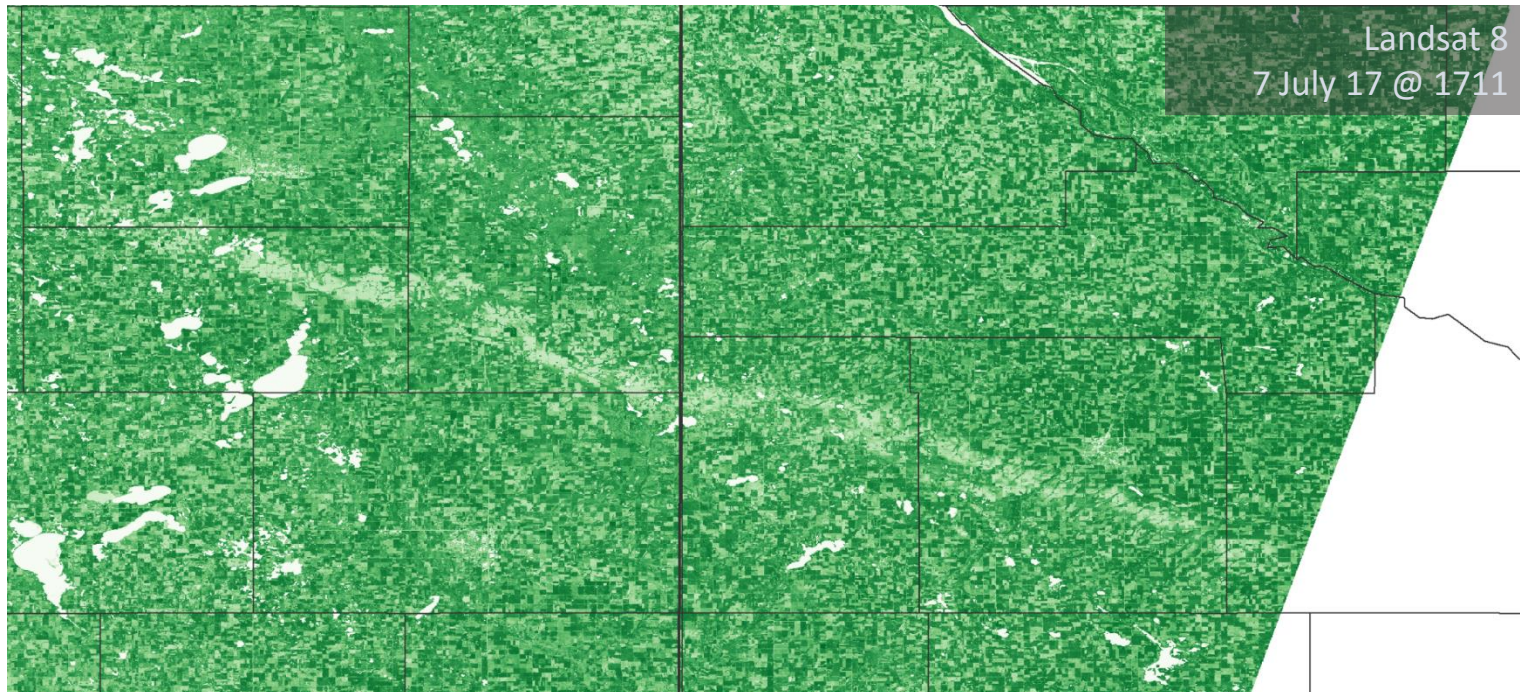
NWS Damage Survey photo: 7 July 2017

Damage to Crops

Sentinel 1B
1 July 17 @ 0021
Survey date:
7 July 2017

ASF DAAC
modified
data 2017.

University of Kansas UAV imagery
23 July 2017

Tanana River Flooding

NWS Partners at the Alaska River Forecast Center (Anchorage, AK) are responsible for flooding forecasts of all the rivers across Alaska.

Although remote sensing is an integral part of the daily operations, Synthetic Aperture Radar imagery has been missing from their forecast process for a few years.

Working with the Alaska Satellite Facility at the University of Alaska, Fairbanks, direct access to Sentinel 1A/B passes over multiple ROIs allow for greater monitoring of river flooding during the ice-melt season.

Additional products from Sentinel 2A/B provide additional analysis tools
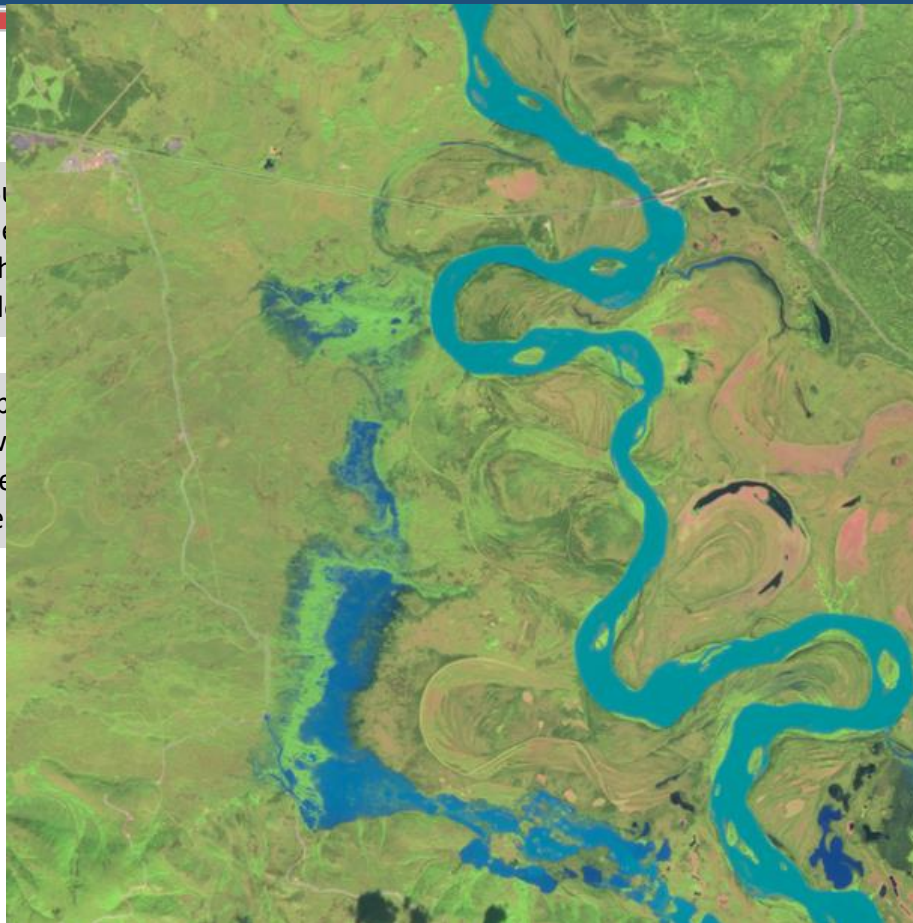
Summary / Conclusions

- Optical and synthetic aperture radar remote sensing provide numerous application opportunities to map the impacts of disasters
  - Flooding, severe weather, tropical cyclones, and other impacts have been used by U.S. partners including FEMA, the National Guard, and the National Weather Service

- Efforts will continue to evolve towards automated change detection and anomaly-based products that provide detailed mapping in addition to visual interpretation

- Collaborations with ESA on access to data and products is extremely helpful, and we look forward to working with others on new product concepts, development, and training

Many thanks to the NWS offices and personnel for their patience and feedback.