INFORMATION SYSTEMS

The Role of RADARSAT-2 for Disaster Management

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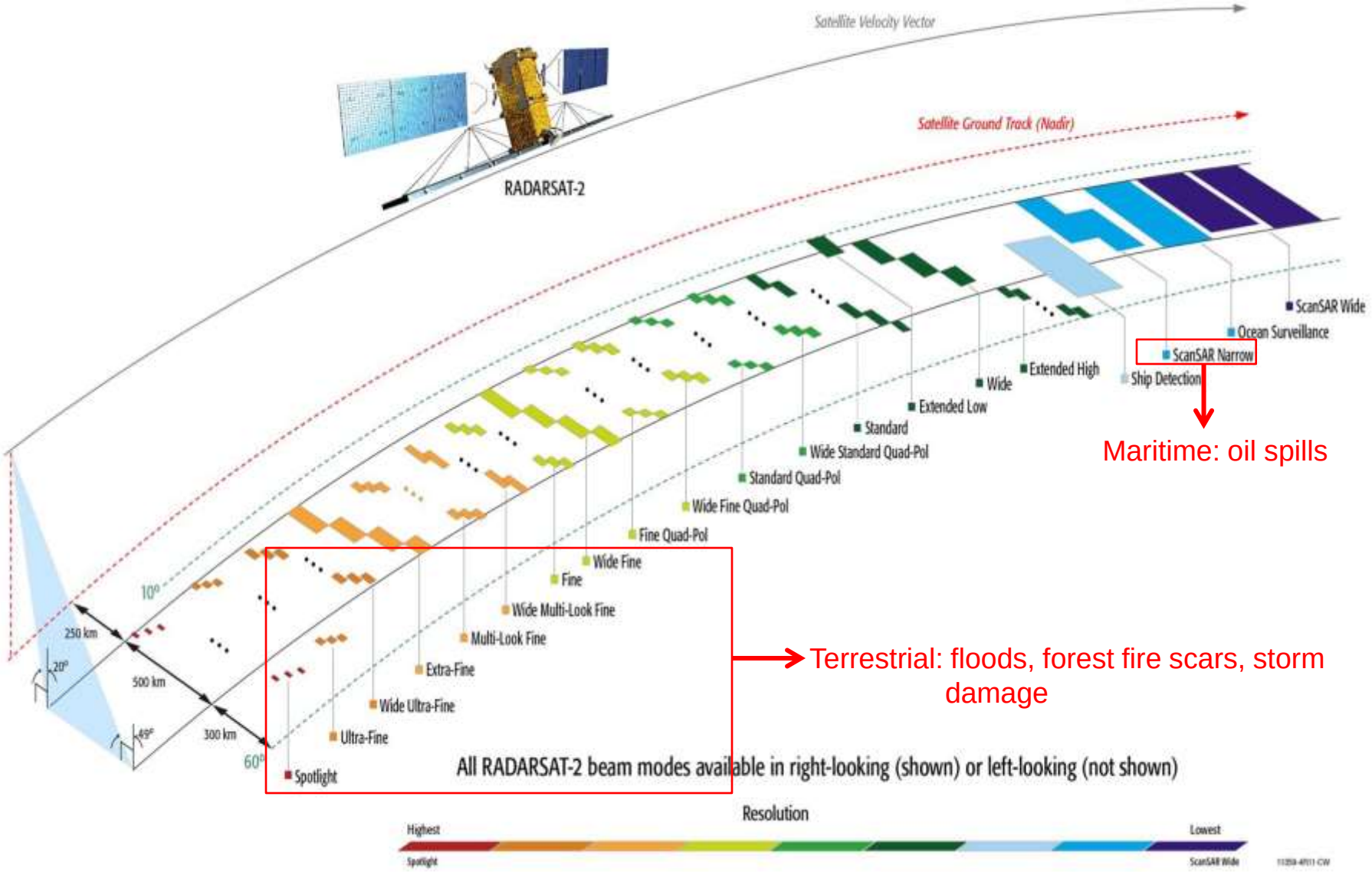
Introduction

- During a disaster, there is a critical need to acquire information to support mitigation efforts. Information is derived from a variety of sources, of which RADARSAT-2 is a key source.

- To meet operational needs, new RADARSAT-2 modes that provide high-resolution, wide-area coverage have been developed, which coupled with a responsive ground system, are ideally suited for disaster management.

- The objectives of this presentation are to:
  - Provide an brief overview of RADARSAT-2 modes
  - Discuss the application of RADARSAT-2 for terrestrial and maritime disasters

Disaster Response: Space Segment



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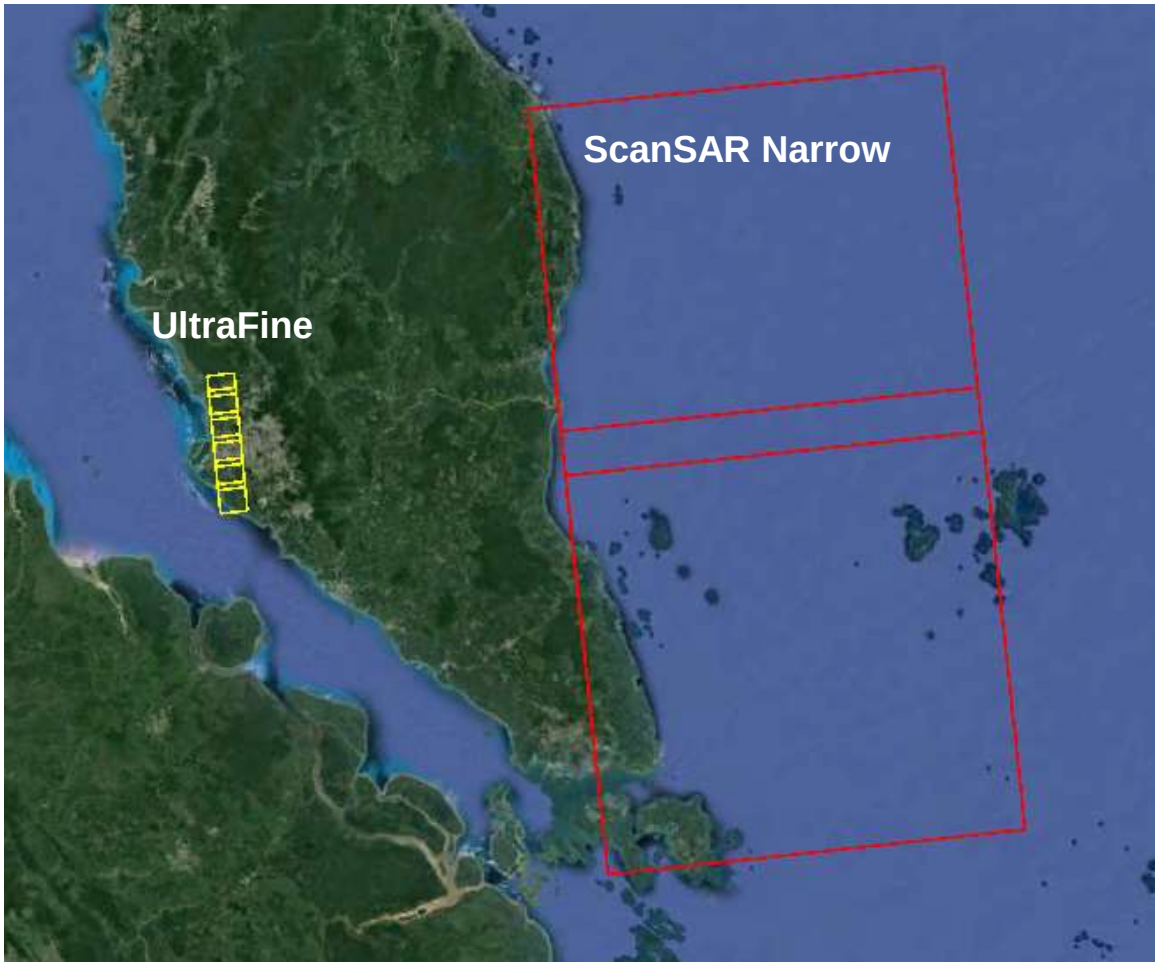
UltraFine and ScanSAR Narrow Coverage



UltraFine (3 m resolution, 20 km x 20 km scene size) provides high resolution imagery for flood mapping versus ScanSAR Narrow (50 m resolution, 300 km x 300 km scene size) for wide-area oil spill detection.

Disaster Response: Ground Segment

- Programing
  - The satellite can be programmed in as little as twelve hours, with four-hour programming possible for emergencies as defined by RADARSAT-2 Mission Management
- Data Downlink
  - Within a ground station mask: data acquisition/downlink are simultaneous
  - Record and downlink: depends on ground station location with-respect-to acquisition AOI, but typically no more than ~ 4-6 hours
- Data Processing, Information Extraction, and Delivery
  - Processing: < 10 minutes
  - Information extraction: depends on scene complexity, but usually < 2 hours
  - Electronic delivery: depends on communication bandwidth and information-product volume

Rapid Beam Mode-Switching to Track Hurricane Matthew

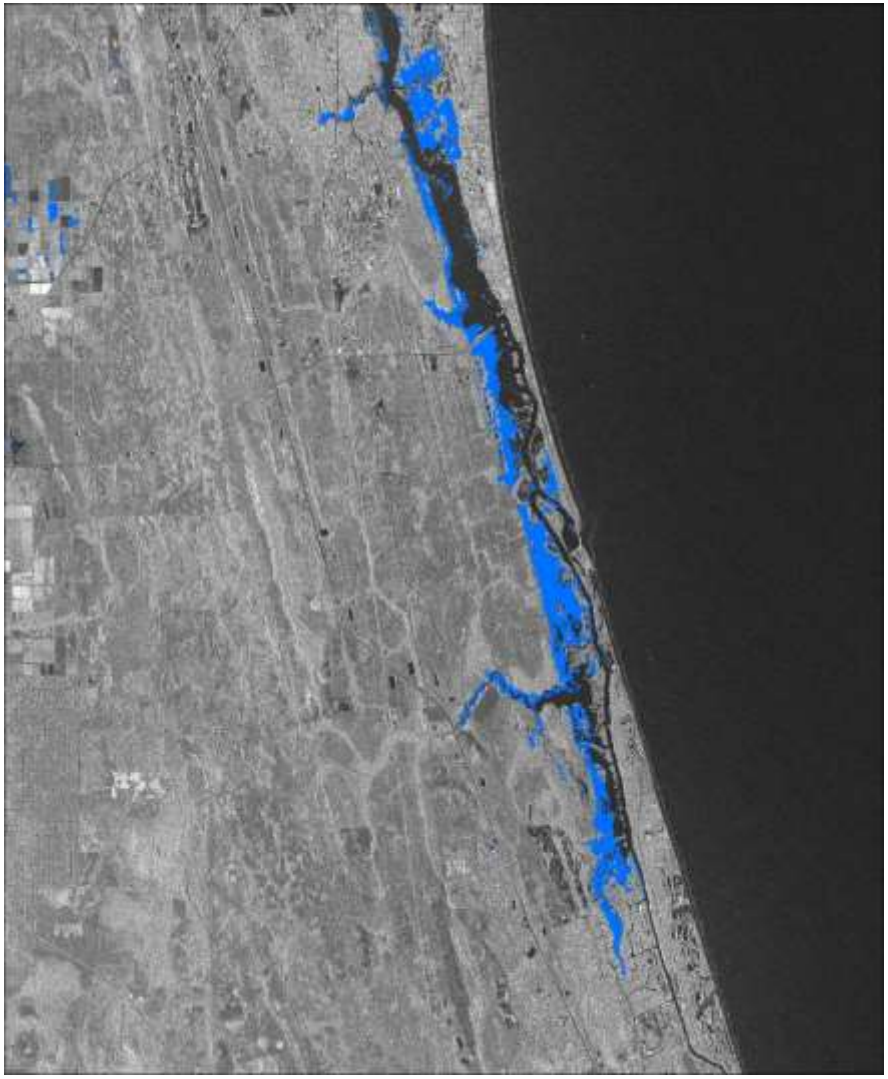
Oct 7/16 ~ 7 AM local time

Oct 7/16 ~ 7 PM local time

Disaster Management Examples

- Flooding
- Forest fire burn scars
- Oil spills

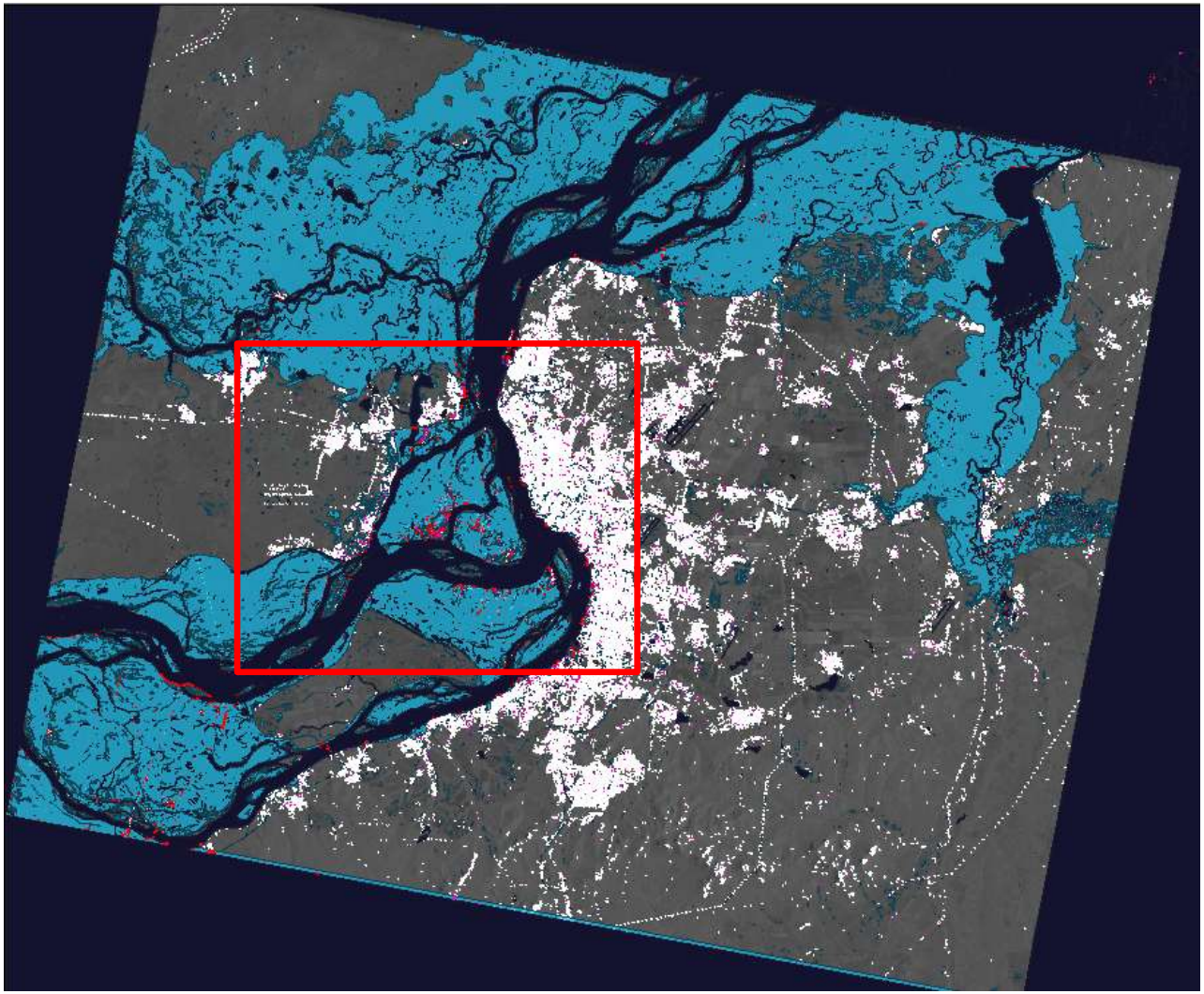
Flood Extent, Georgia
Hurricane Matthew

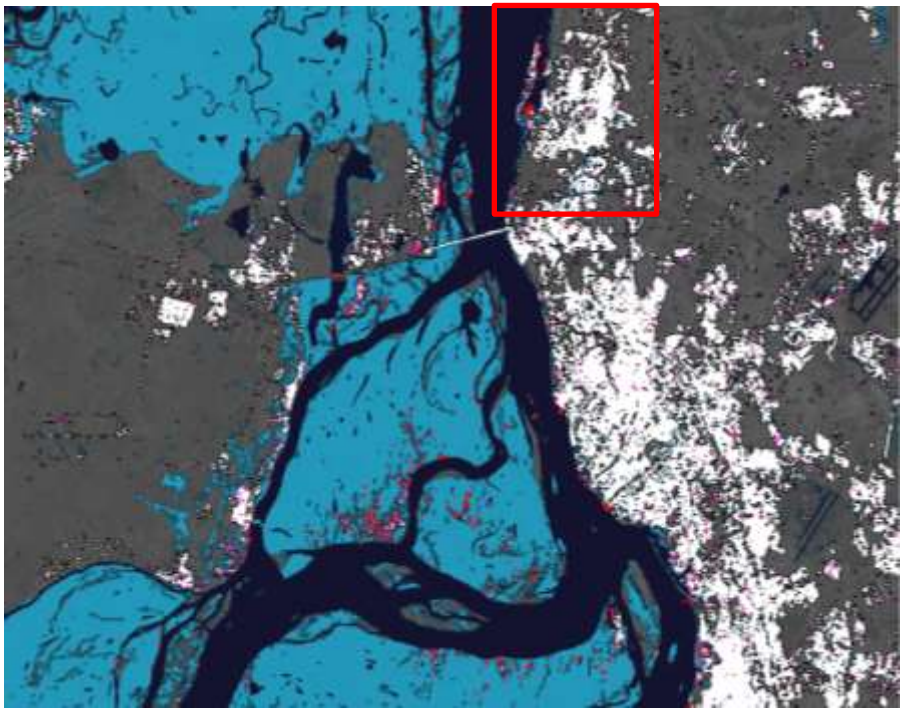


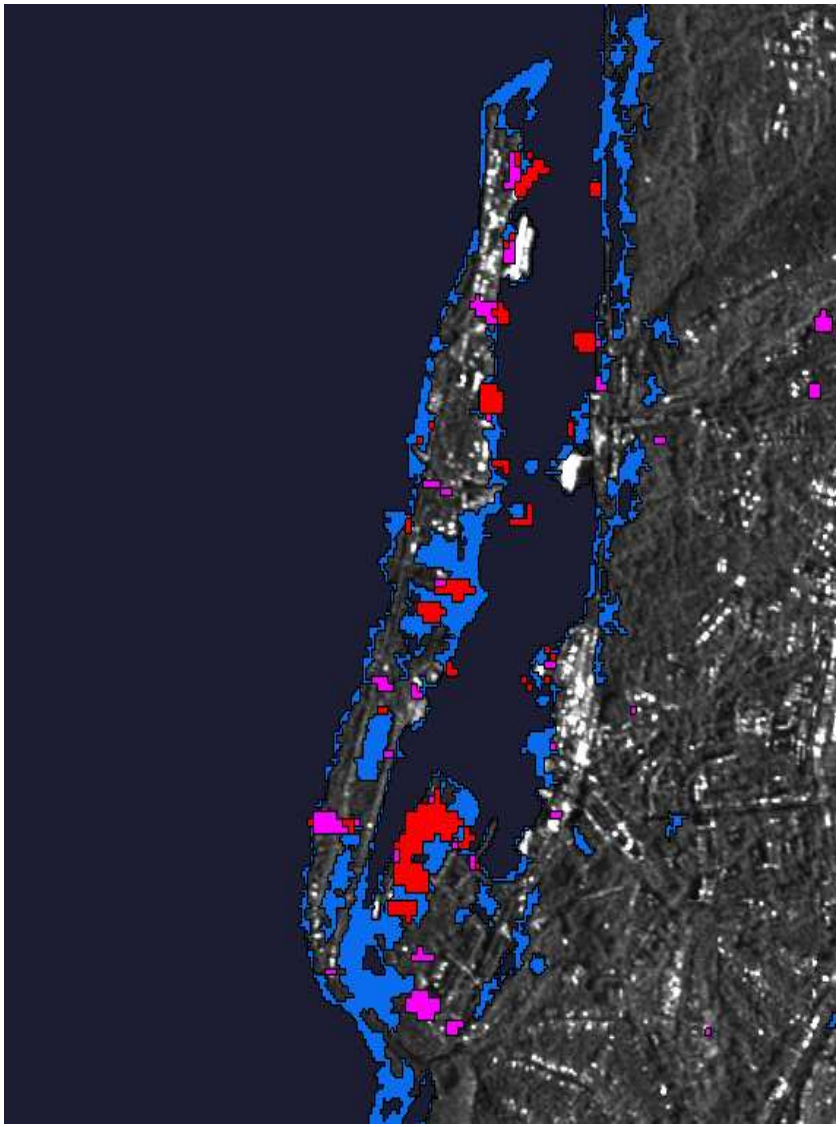
- RADARSAT-2 image acquired on Oct 7/16 at ~ 7 PM.
- Flood extent outlined in blue. Based on comparison to RADARSAT-2 image acquired Sept 10/16
- Time from image request to image acquisition: 3 hr 56 min

Flood Mapping

Khabarovsk, Russia







- Unchanged bldngs infrastructure
- Flooded Buildings infrastructure
- flooded areas
- Normal river and water bodies
- Other changed buldings
- Unchanged, other

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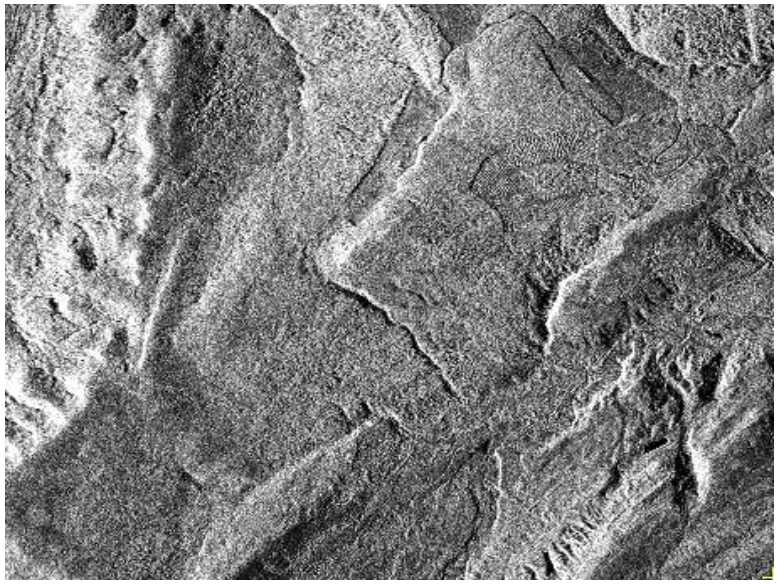
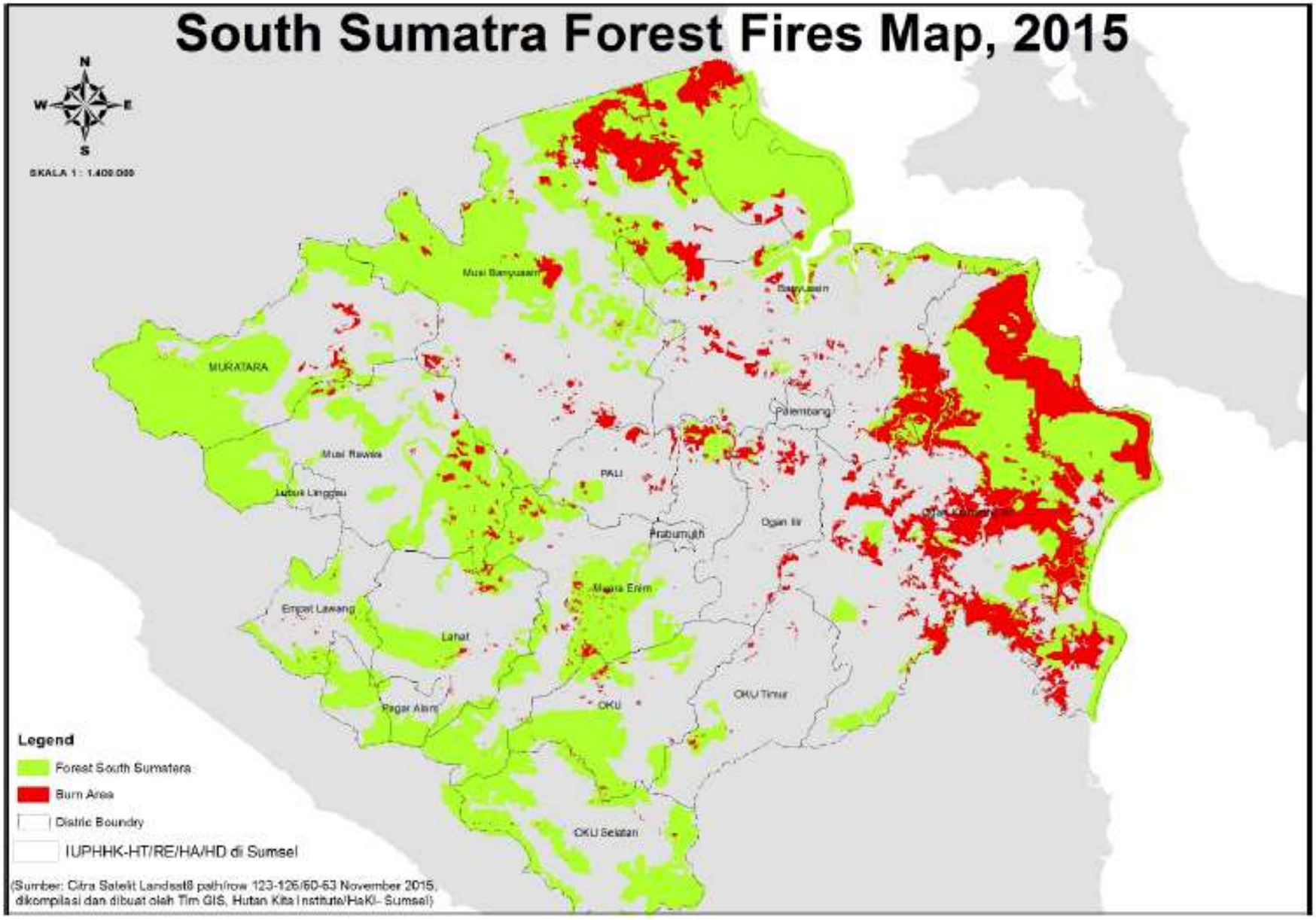
Forest Fire Scar Mapping

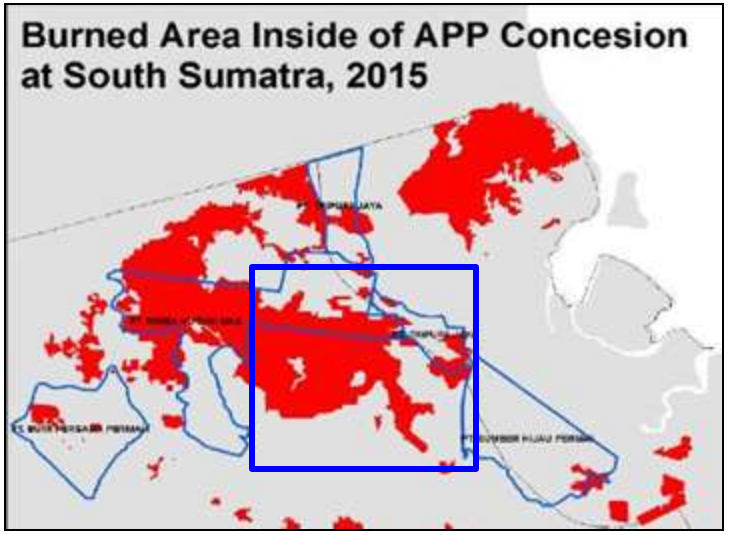
- During an active fire, it is usually difficult to detect the fire with SAR
- After the fire (~ weeks), the forest-canopy damage can be detected, so the fire scar can be mapped.
- Fire scars can be detected for years after the fire.



August 2014, pre-fire

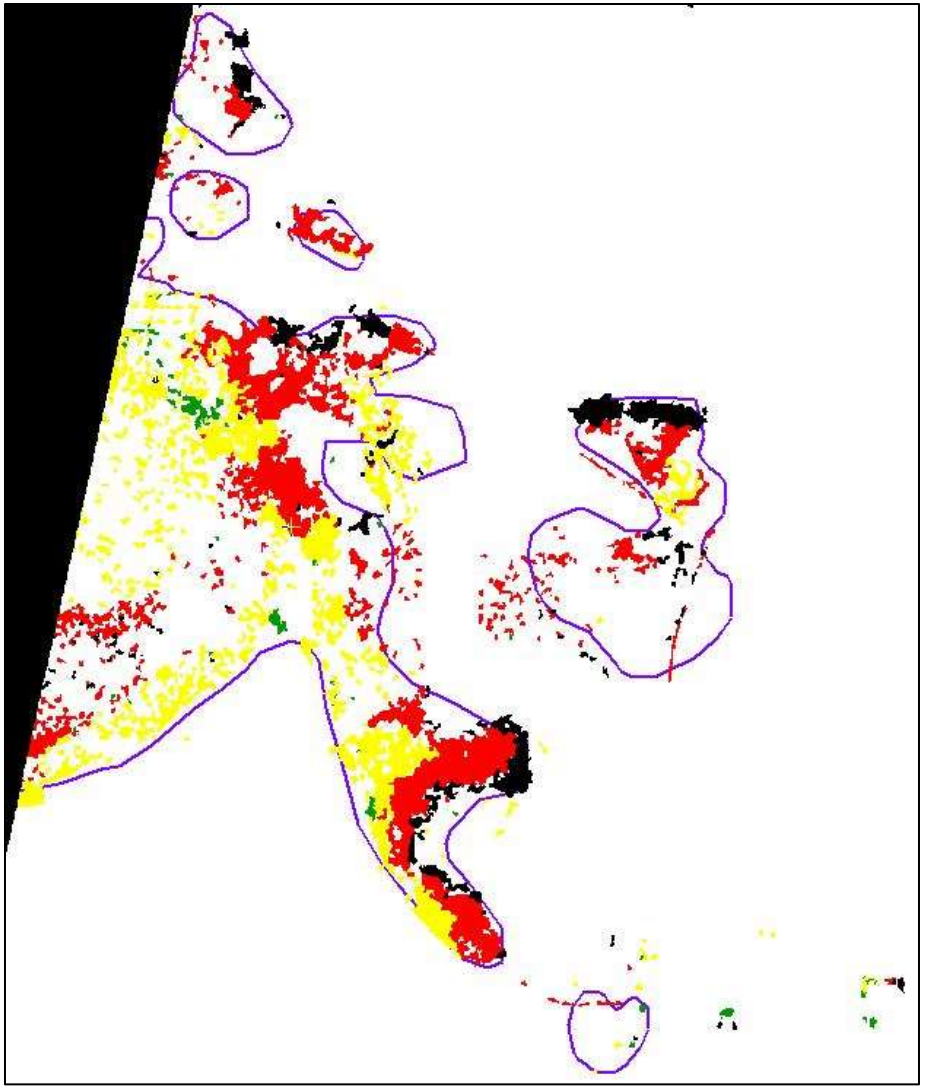
August 2015, post-fire





- Example of RADARSAT-2 imagery that was acquired to detect and map fire scars. The colours correspond to different images acquired between June and November 2015.

- The areas of changes (right) correlate with fire locations (top).

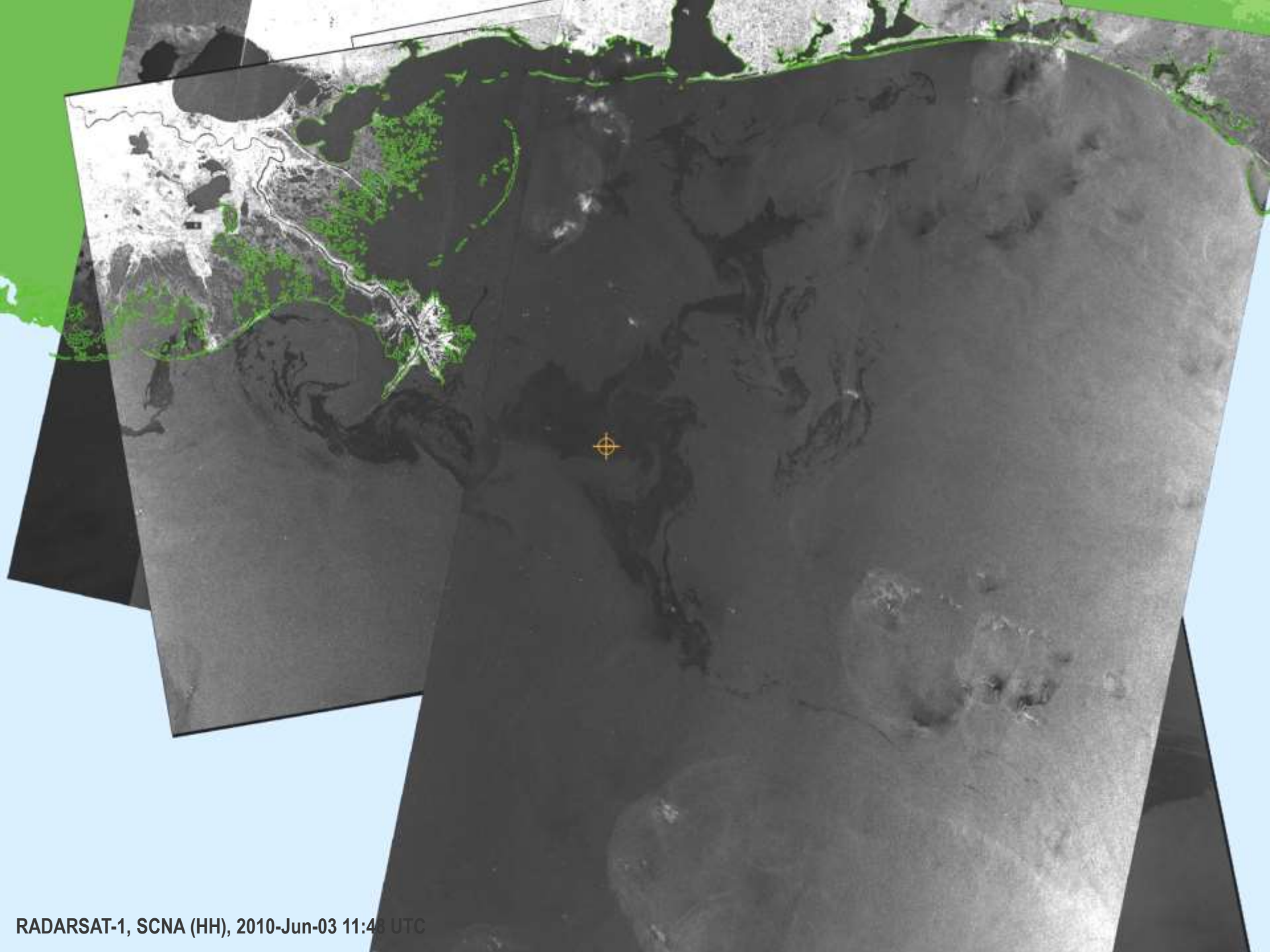


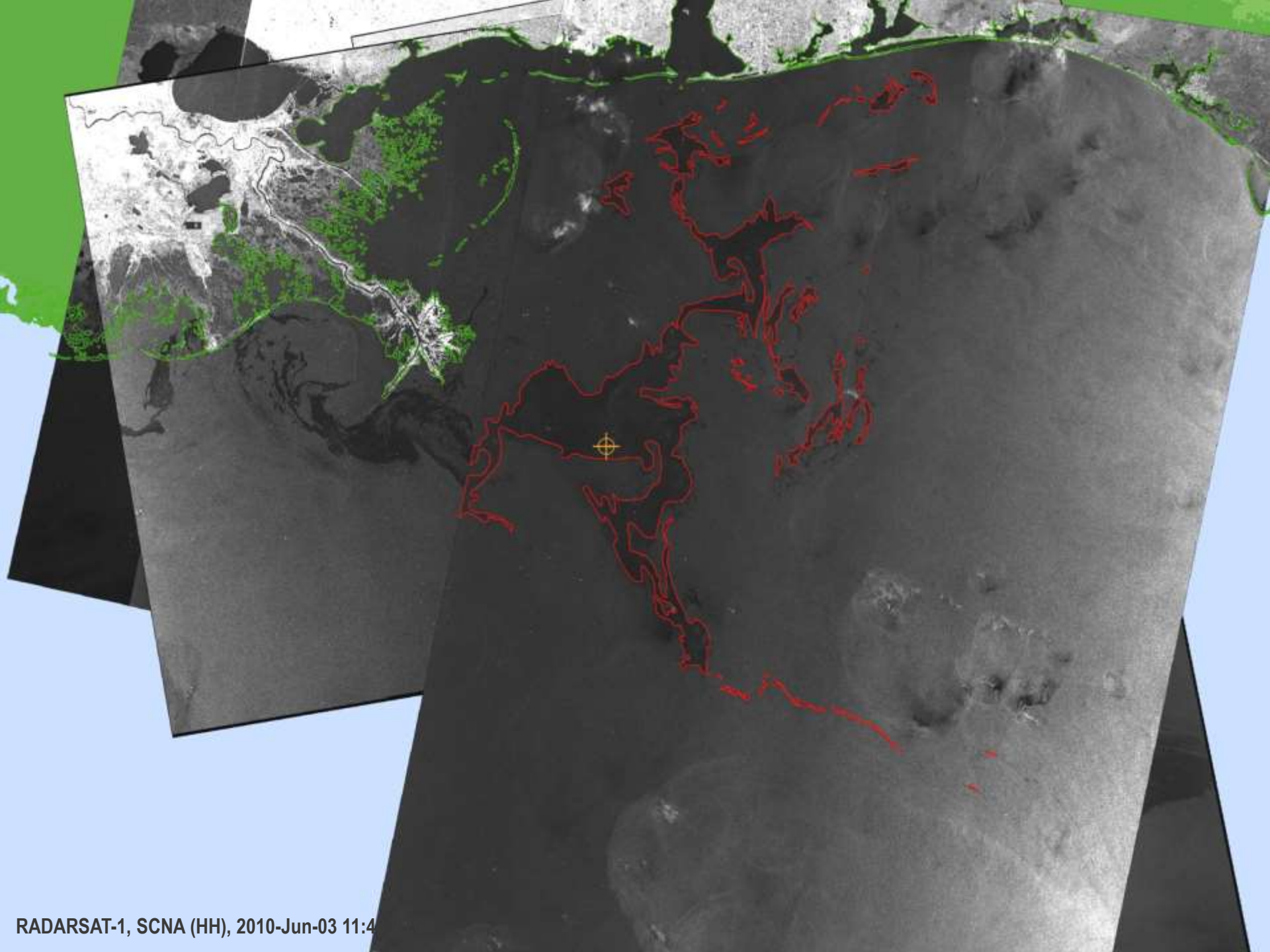
Green (June 22-Aug 9), Yellow (Aug 9 – Sept 26), Red (Sept 26 – Oct 20), and Black (Oct 20 – Nov 13).

Slick Detection

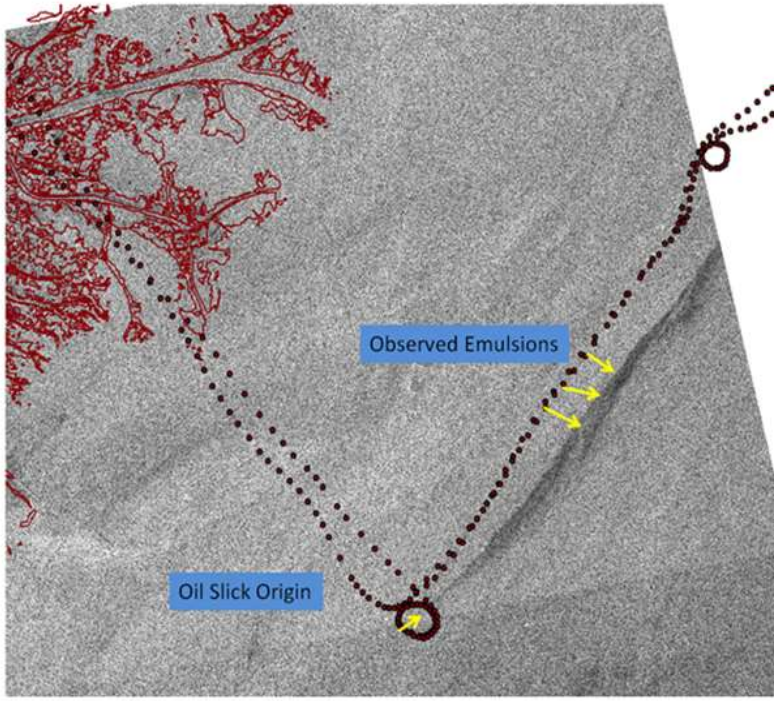
- Good understanding of slick detection which depends on:
  - Radar parameters
  - Environmental conditions
  - Oil characteristics
- Semi-automatic approaches give effective results
- Skilled analysts improve information:
  - Mitigate false positives
  - Assign confidence / classification levels

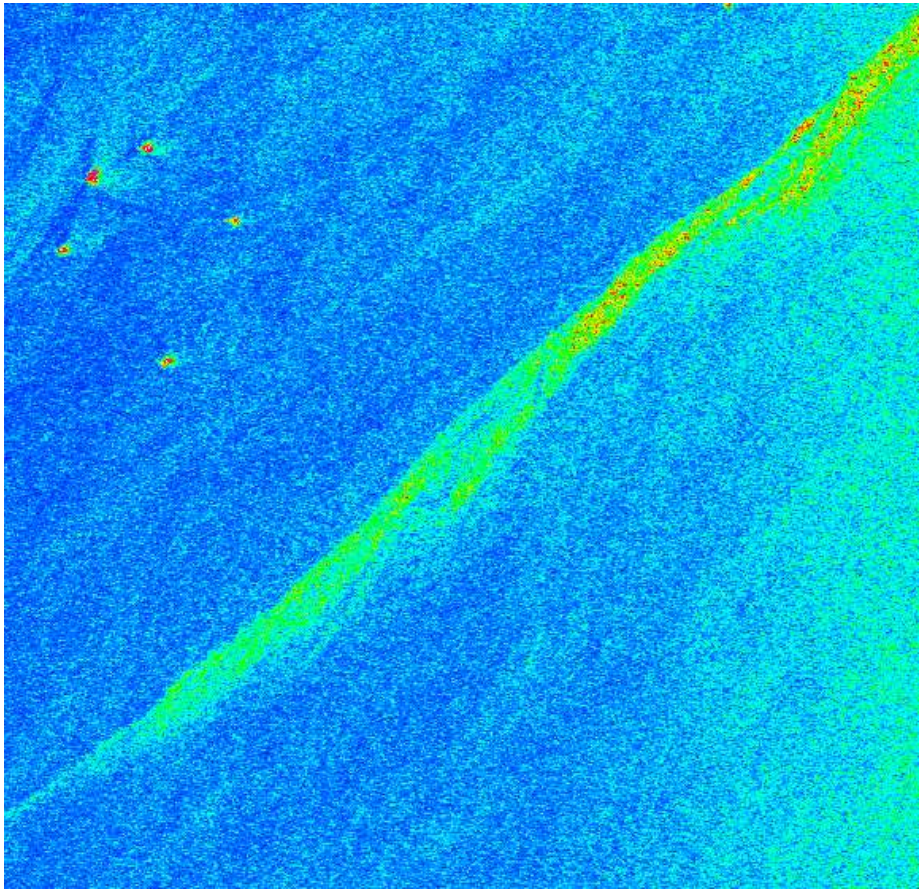
RADARSAT-2 image showing oil from offshore drilling platform. The oil appears as a dark tone and the offshore platforms appear as bright targets


RADARSAT-1, SCNA (HH), 2010-Jun-03 11:48 UTC


RADARSAT-1, SCNA (HH), 2010-Jun-03 11:4

Detection of Emulsified Oil





- RADARSAT-2 image showing the location of emulsified oil from the Taylor Energy slick based on aerial observations (left) and the detection of emulsified oil (red area) using the polarimetric entropy (right).

Summary

- RADARSAT-2 is a flexible sensor that provides multiple imaging modes for disaster management
- Data can be acquired, processed, and disaster-management information products produced and delivered within hours
- Information products for disaster management need to be:
  - Interpretable
  - Interactive → connect with Big Data
  - Timely
- Looking forward, the RADARSAT Constellation Mission, scheduled for 2018 launch, will provide daily imaging via a three SAR-sensor constellation.

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