Disasters Scenarios: Landslides and Earthquakes

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Learning Objectives

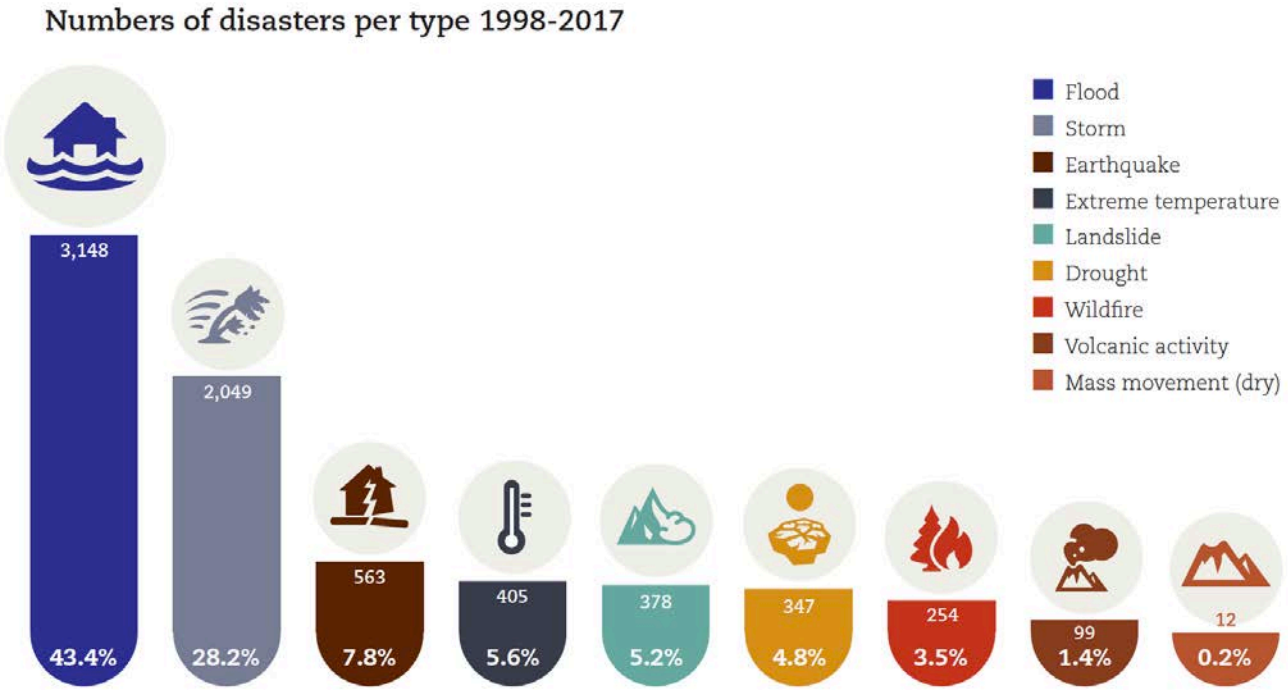
- How to access data relevant to landslide and earthquake impact
- Learn about the characteristics of the data
- Learn how to interpret the data

Session Outline

- Earthquake and Landslide Impacts
- Potential Problems to Address
  - What areas have been affected by an earthquake?
  - What areas have been damaged by an earthquake?
  - What areas are at risk for landslides?
  - What is the landslide impact?
- Other potential applications

Earthquake Impacts

- A 2018 report by the UN looked at economic & human losses as a result of disasters: https://www.unisdr.org/2016/iddr/IDDR2018_Economic%20Losses.pdf
- Earthquakes were the 3rd most common disasters, but responsible for 56% of deaths



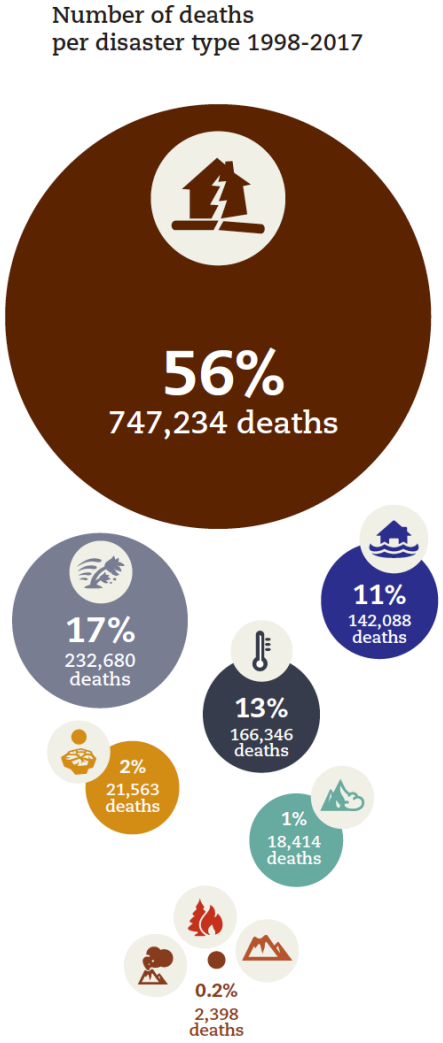
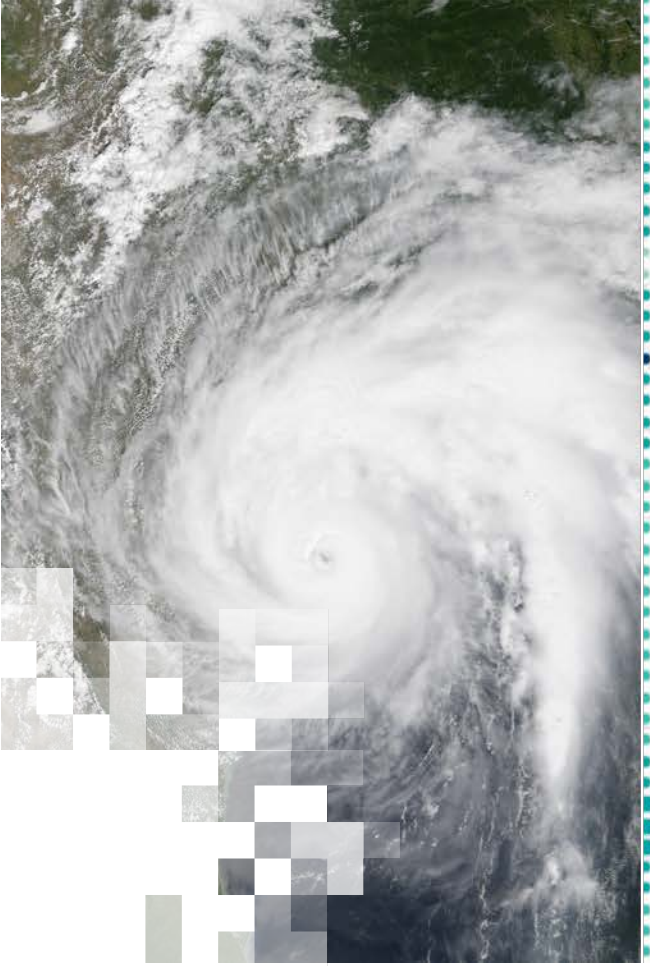
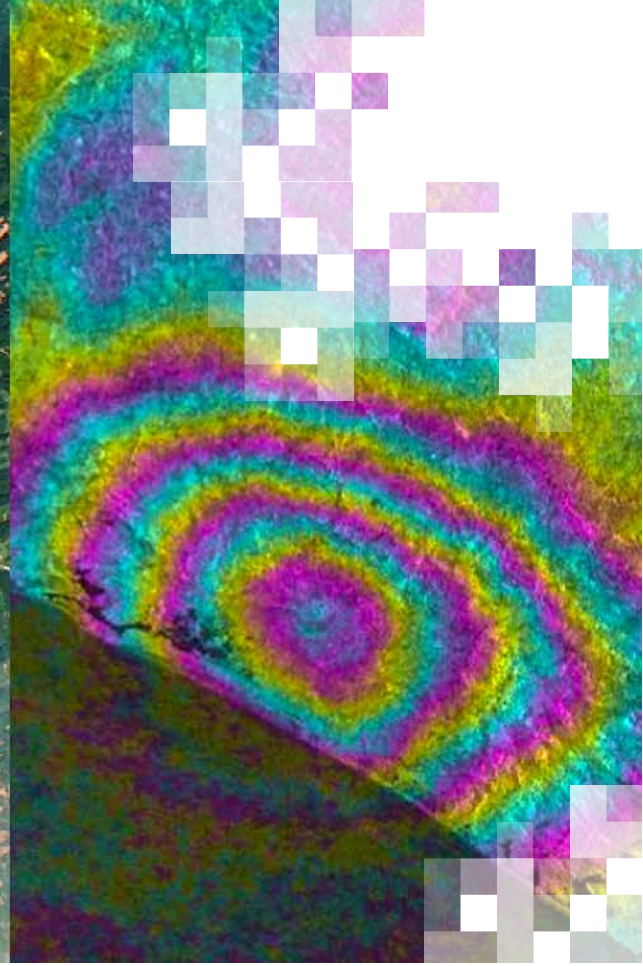


Image Credits: CRED & UNISDR

ARSET Trainings of Interest

- Advanced Webinar: Radar Remote Sensing for Land, Water, & Disaster Applications
  - ARSET offered an advanced, online training in August 2018
  - Eight hour training
  - Available at: https://arset.gsfc.nasa.gov/disasters/webinars/advanced-SAR-18

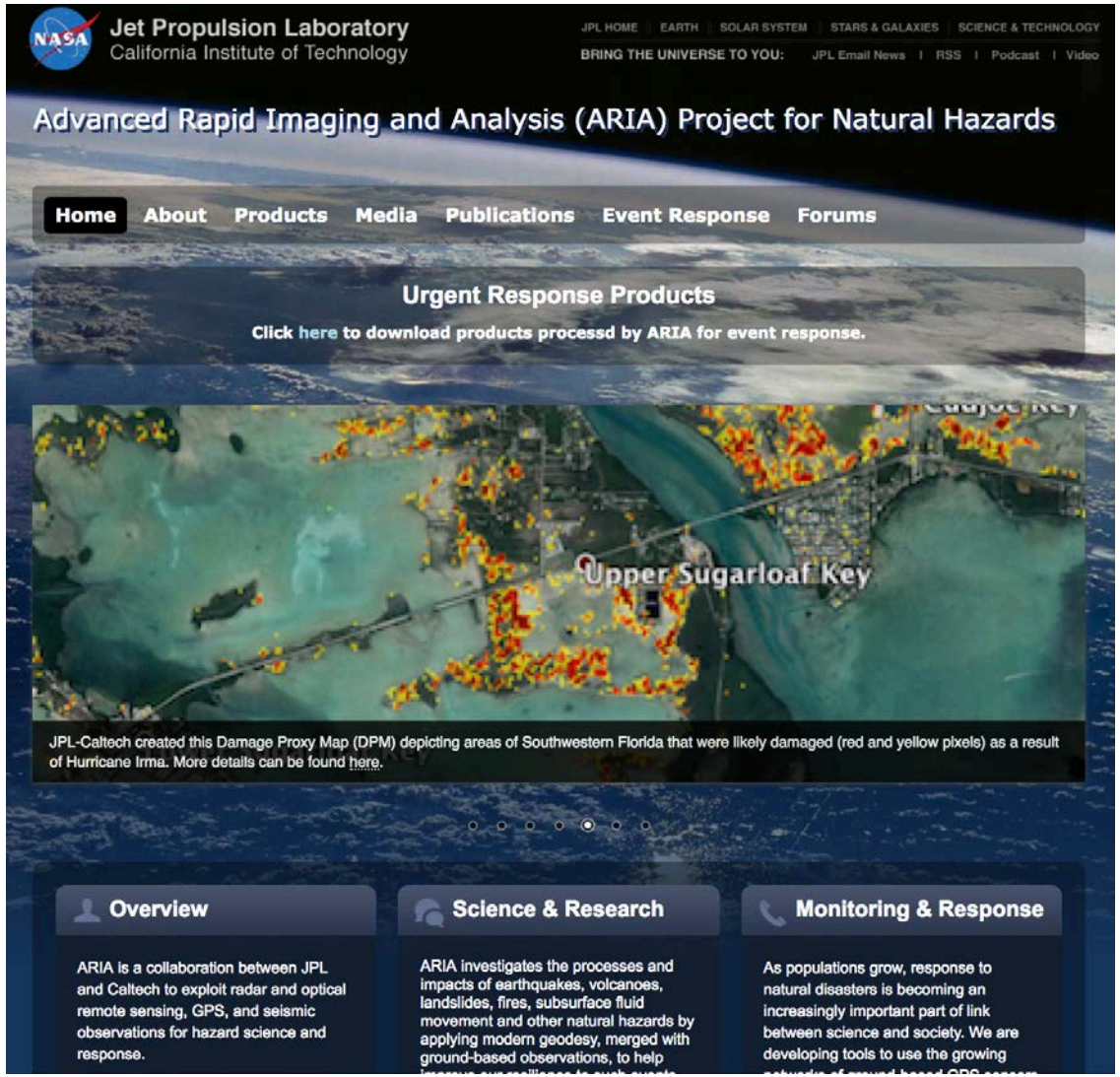




Identify Areas Affected by an Earthquake

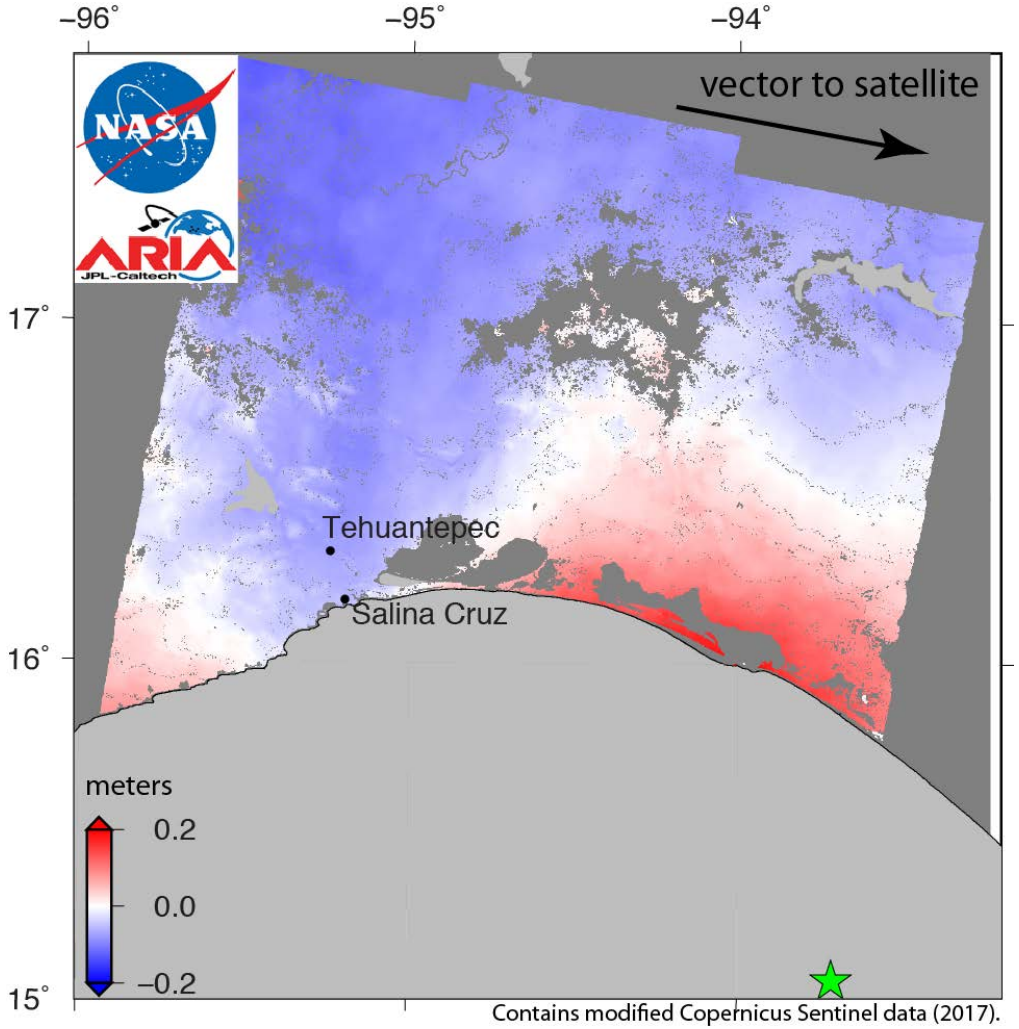
Advanced Rapid Imaging and Analysis (ARIA) for Natural Hazards

- NASA/JPL project that uses Interferometric Synthetic Aperture Radar (InSAR) and Differential Global Positioning Systems (DGPS) to provide imagery to respond to natural disasters
- Analysis done on a disaster-by-disaster basis
- Available at: https://aria.jpl.nasa.gov/



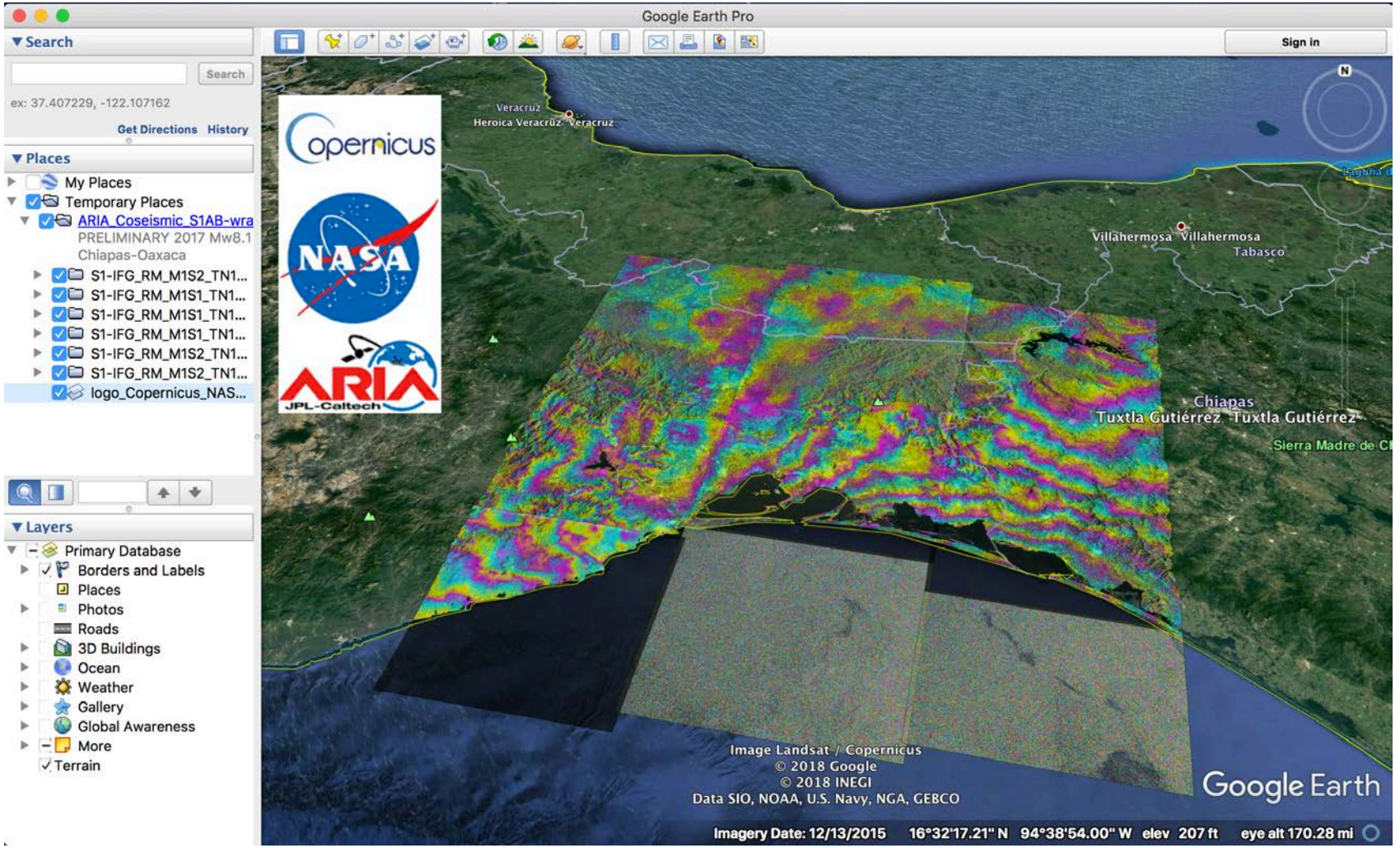
Example: Magnitude 8.1 Chiapas Earthquake, Sept 2017

Ground Movement



Example: Magnitude 8.1 Chiapas Earthquake, Sept 2017

Interferogram, Displayed in Google Earth



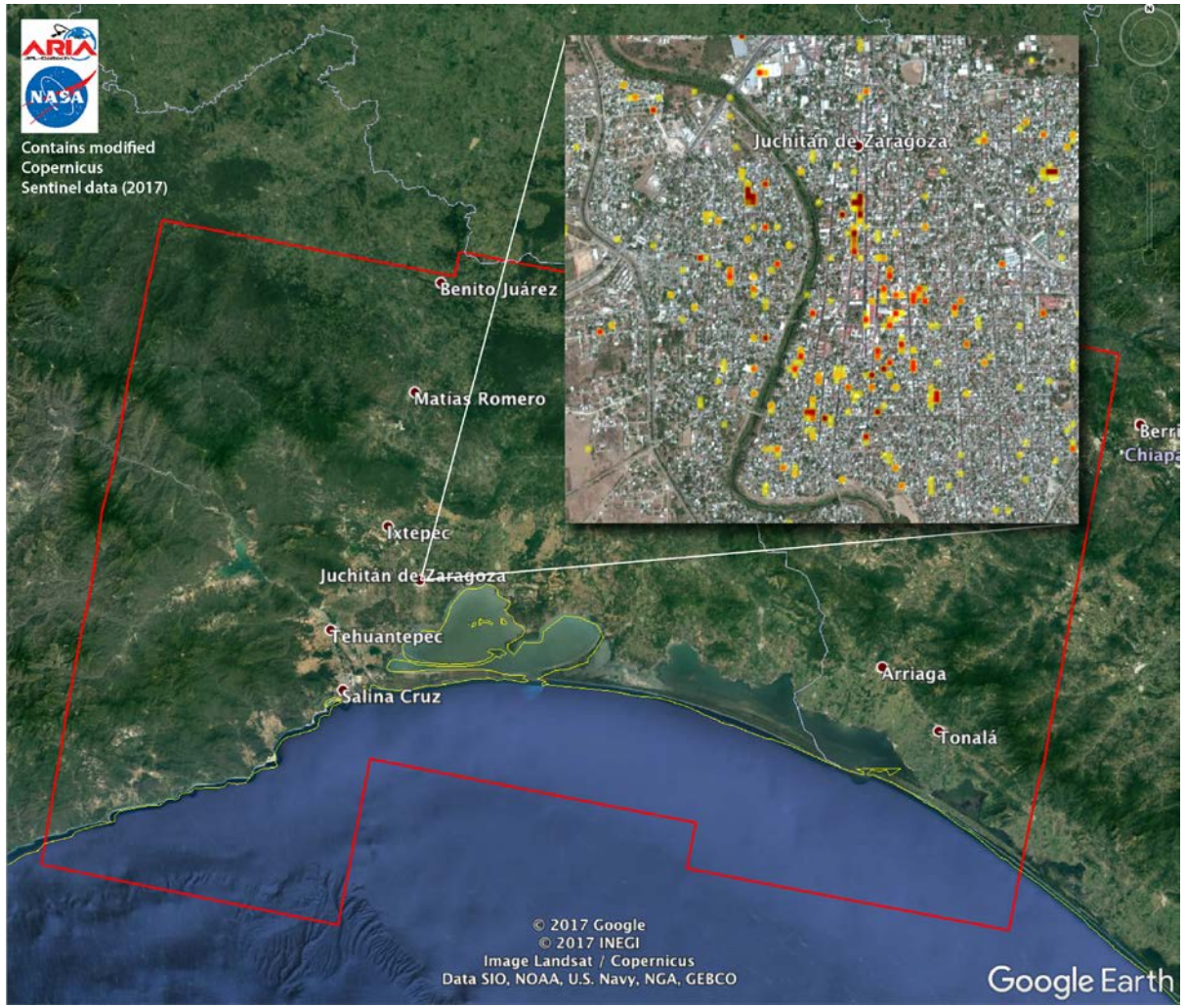
Assessing Earthquake Damage

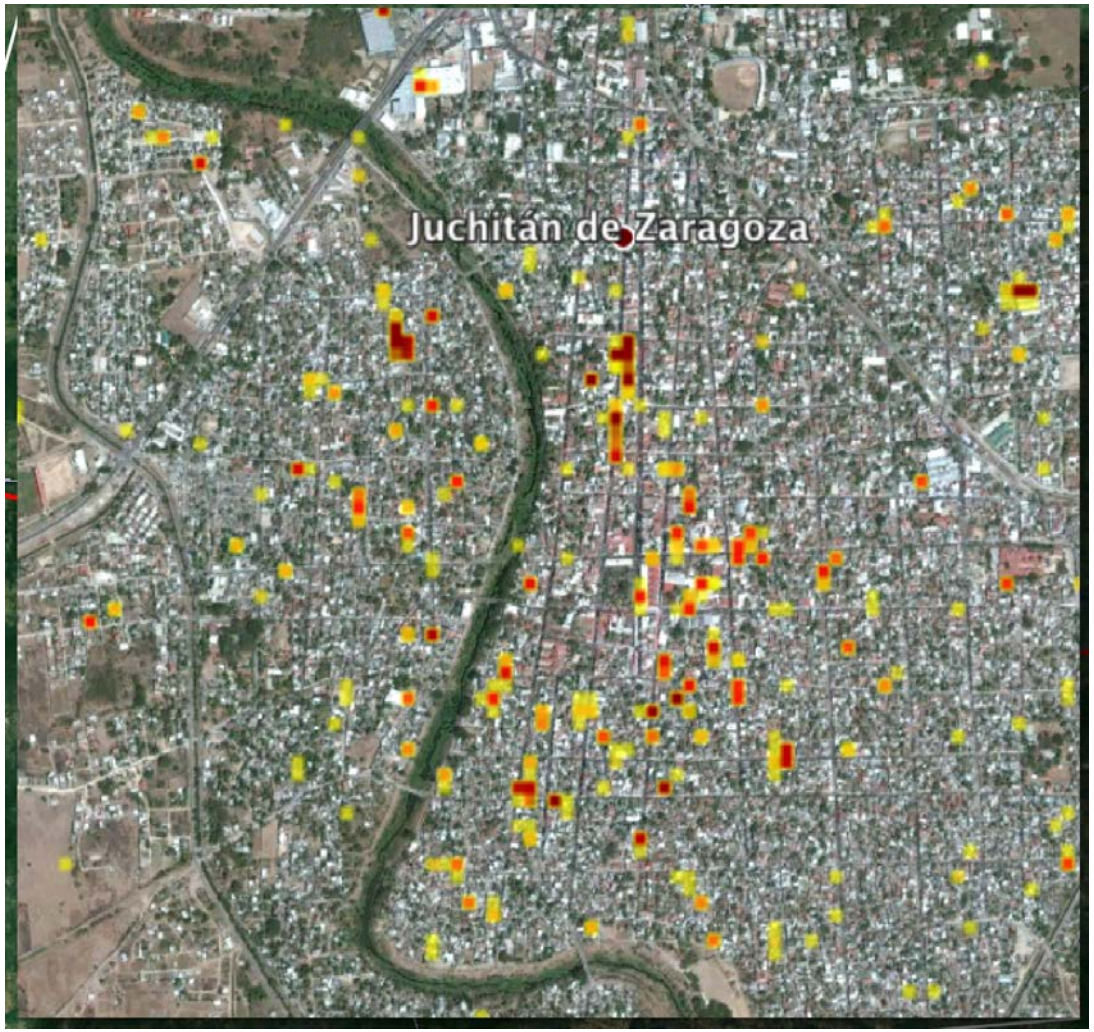
ARIA Damage Proxy Map

- On a disaster-by-disaster basis, the ARIA team creates a map that indicates significant ground surface change
- Preliminary validation can be done by comparing SAR images and optical satellite imagery
- These maps can be used as guidance to identify damaged areas

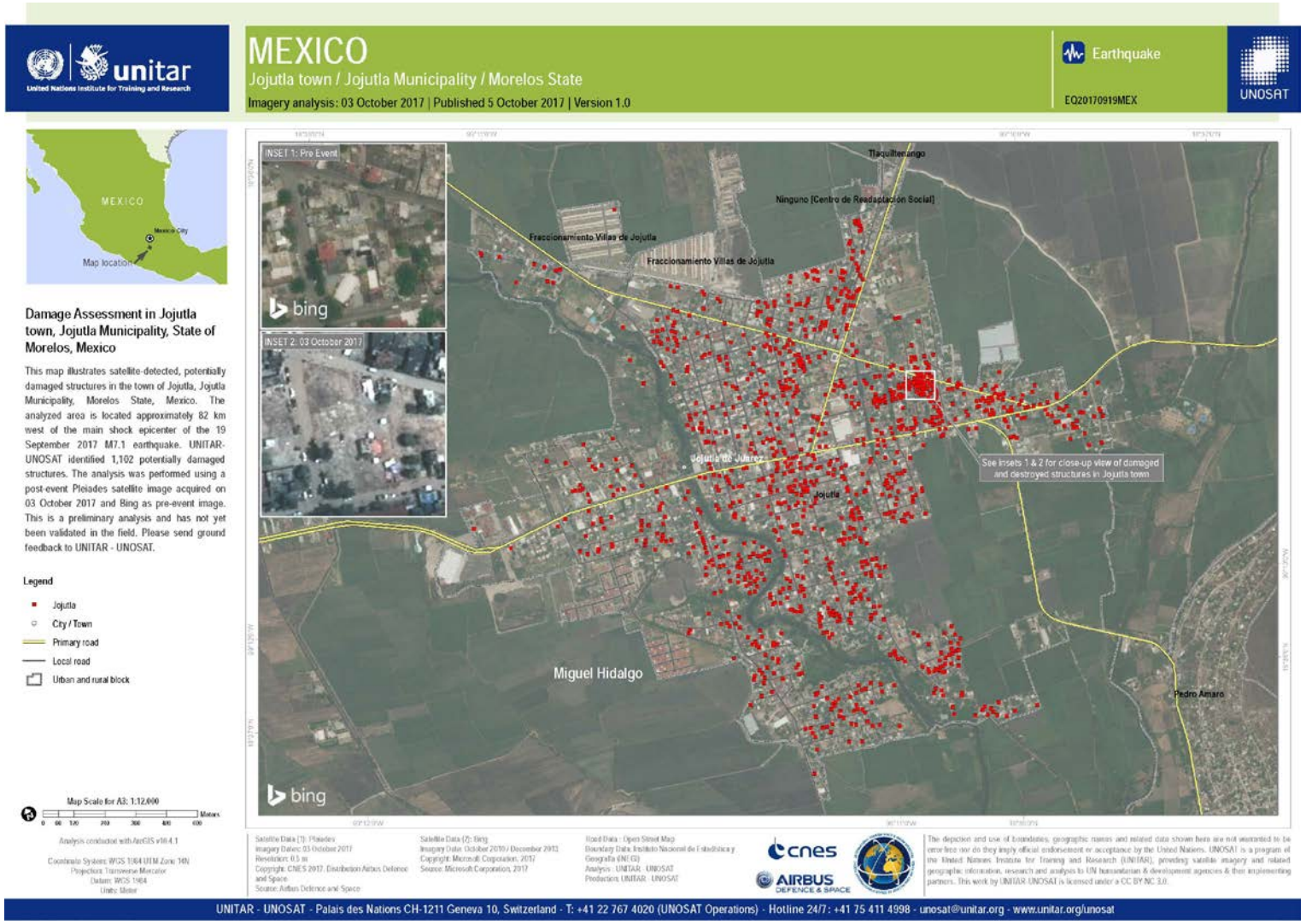
Example: Magnitude 8.1 Chiapas Earthquake, Sept 2017

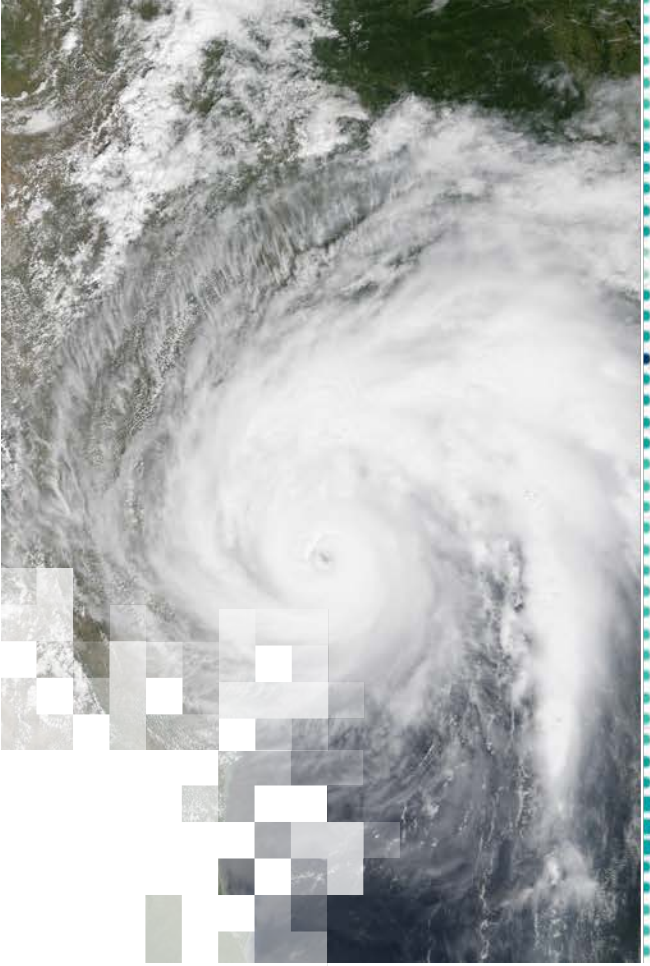
Damage Proxy Map

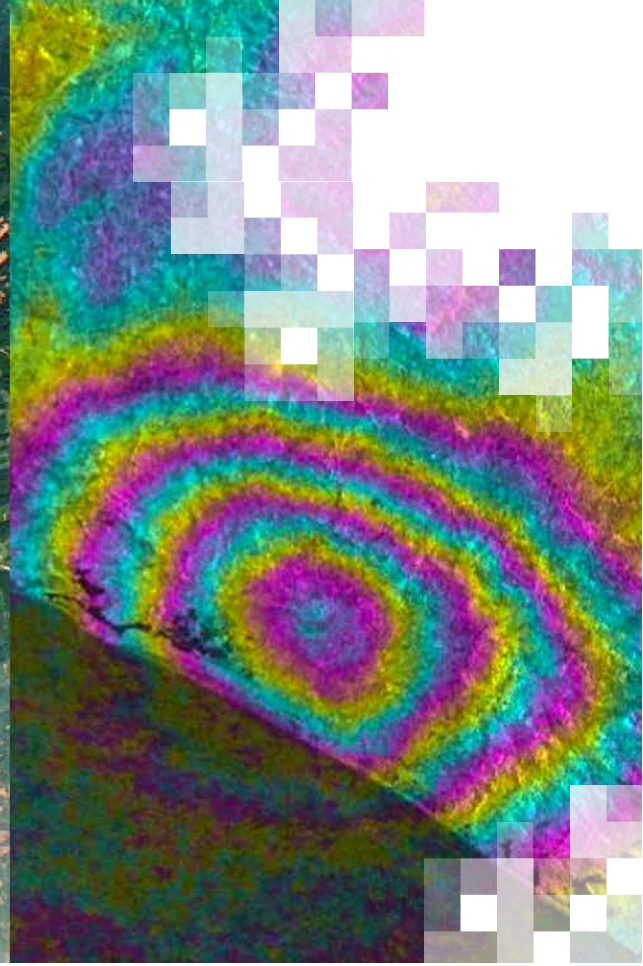




International Charter Damage Assessments

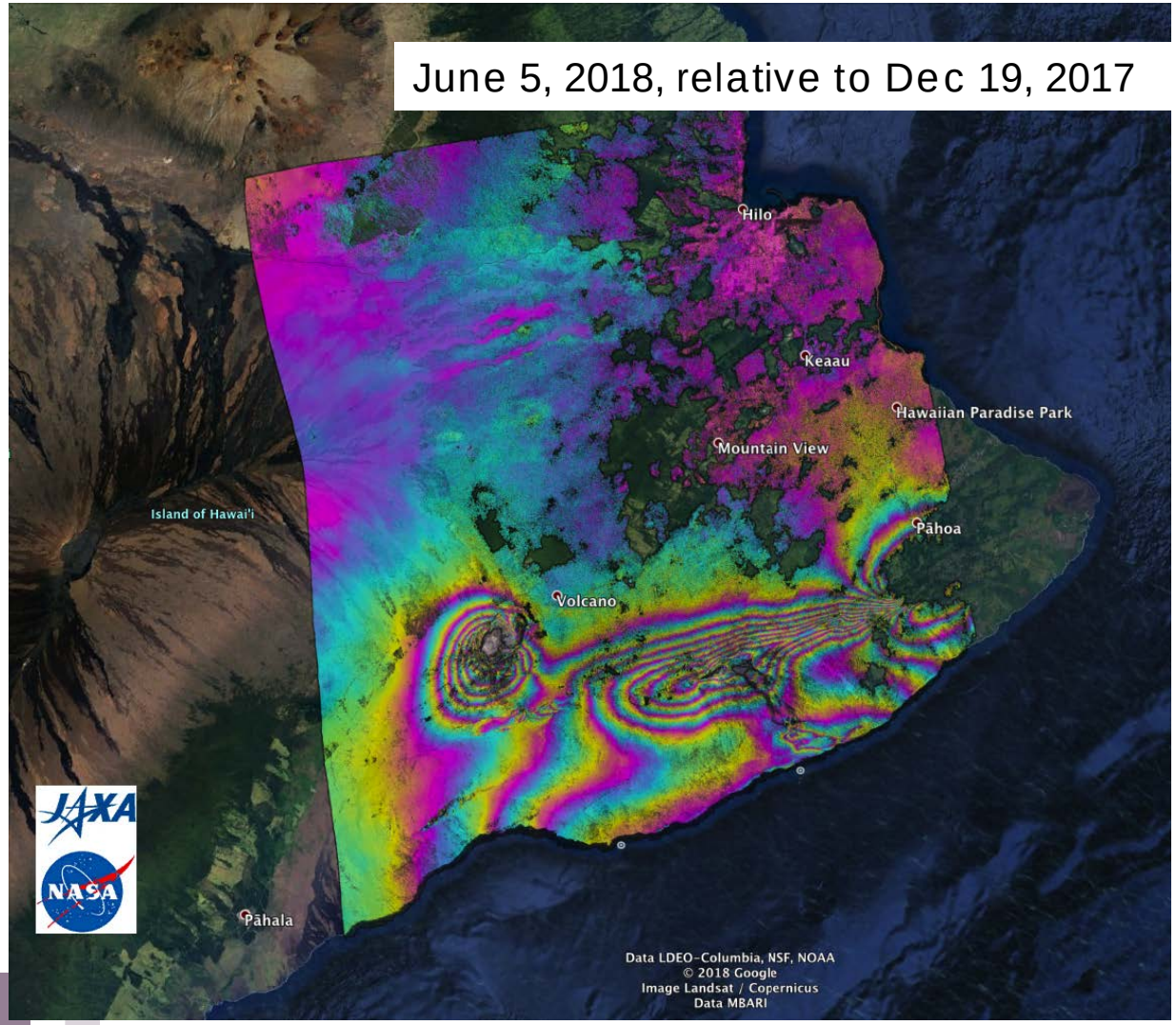


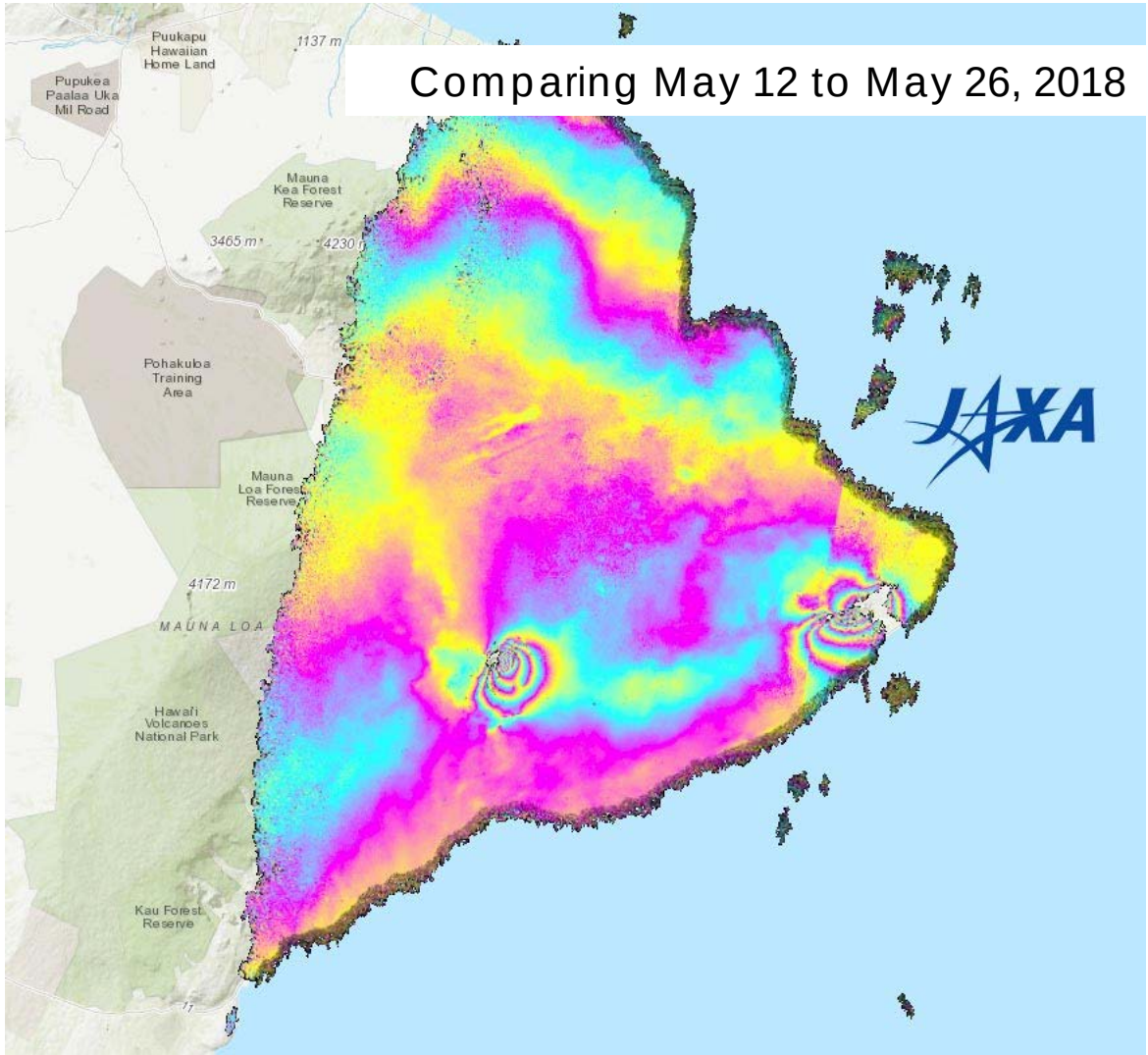




Other Surface Deformation Related Applications

2018 Kilauea Volcanic Eruption



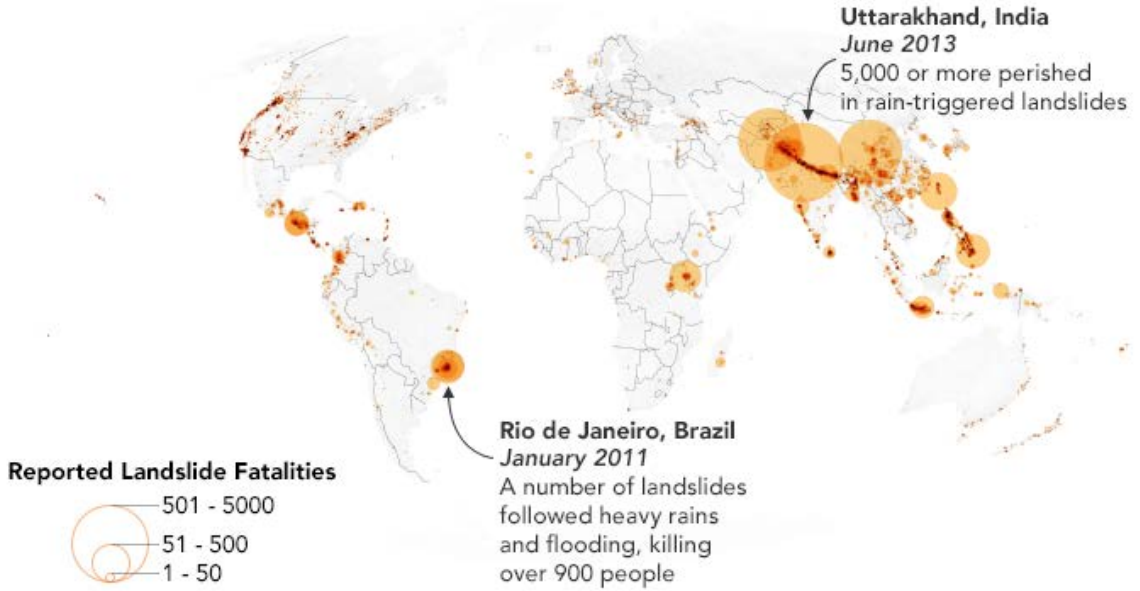



Houston
Corpus Christi
Soil Moisture on August 27 (cm³/cm³)
0.0
≥0.4
Difference from August 19
Little to no change
Major increase
Landslides

Landslides

Landslide Impacts

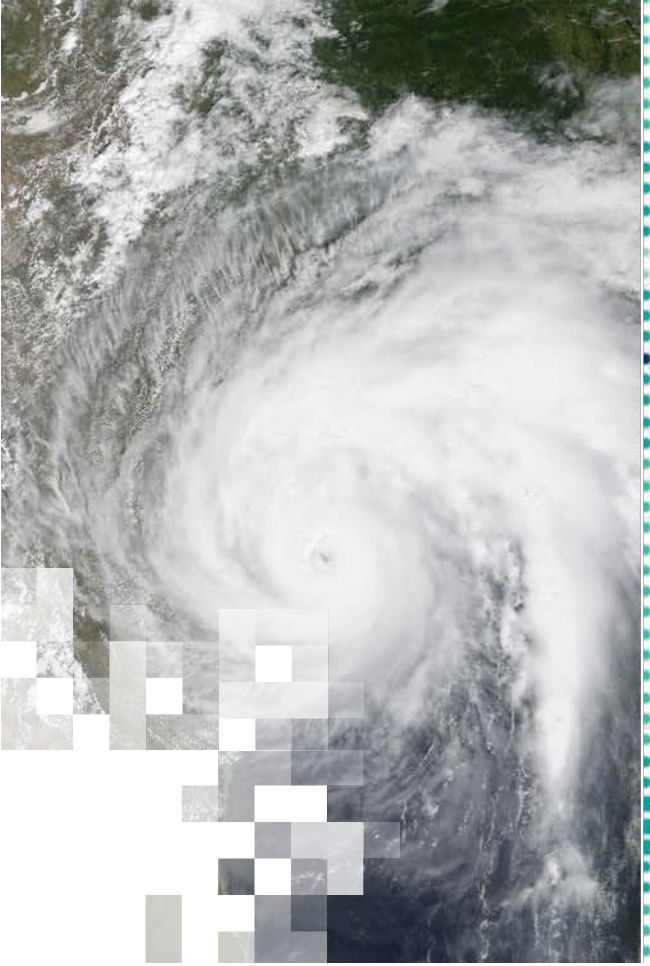
- Landslides can be triggered by:
  - rainfall
  - earthquakes
  - mining
  - volcanoes
  - freeze-thaw, snowmelt
- Landslides have killed 26,000+ people worldwide since 2007 (~3,700/year)

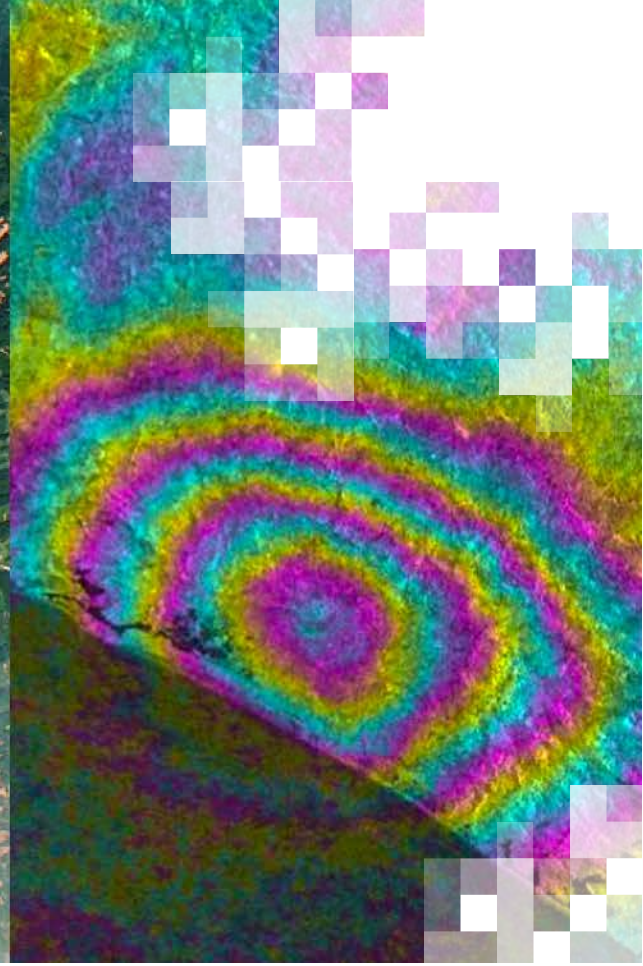


Text credit: Dalia Kirschbaum, 2016 ARSET presentation. Image: reported landslide fatalities, from 1988-2017. Credit: NASA Earth Observatory

ARSET Trainings of Interest

- Using NASA Remote Sensing for Disaster Management
  - An introductory, online training provided June 2016
  - Four-hour training
  - Landslides were covered in Session 4
  - Available at: https://arset.gsfc.nasa.gov/disasters/webinars/disaster-overview-2016



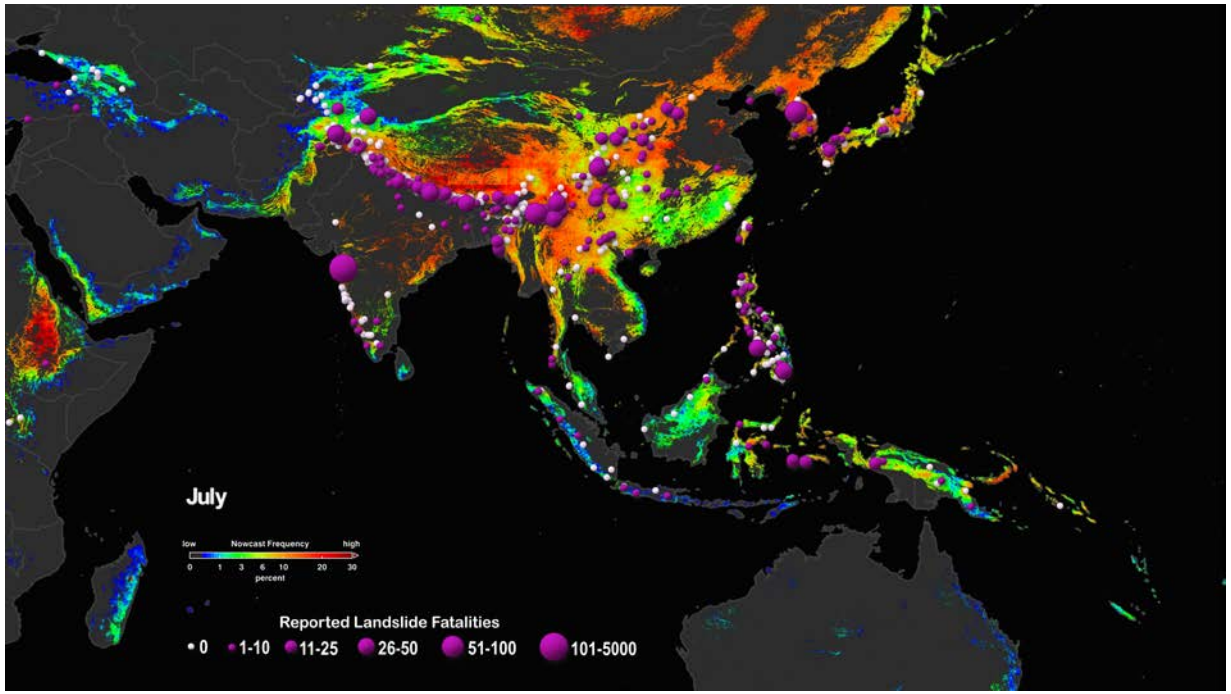


Areas at Risk

Landslide Hazard Assessment for Situational Awareness (LHASA)

- Rainfall is the most common trigger of landslides
- LHASA looks at current precipitation data and rainfall over the past 7 days
- In high precipitation areas, it then looks at the terrain, including:
  - roads
  - forest loss
  - tectonic faults
  - weak bedrock
  - steep hillsides

  https://pmm.nasa.gov/applications/global-landslide-model



A close-up view of the potential landslide activity during July in Southeast Asia as evaluated by NASA's Landslide Hazard Assessment model for Situational Awareness model. Overlaid on top are reported landslide fatalities dating back to 2007.

Global Landslide Nowcast

- Available:
  - In the NASA Disasters Portal: https://maps.disasters.nasa.gov
  - On the Precipitation Measurement Mission website: https://pmm.nasa.gov/precip-apps

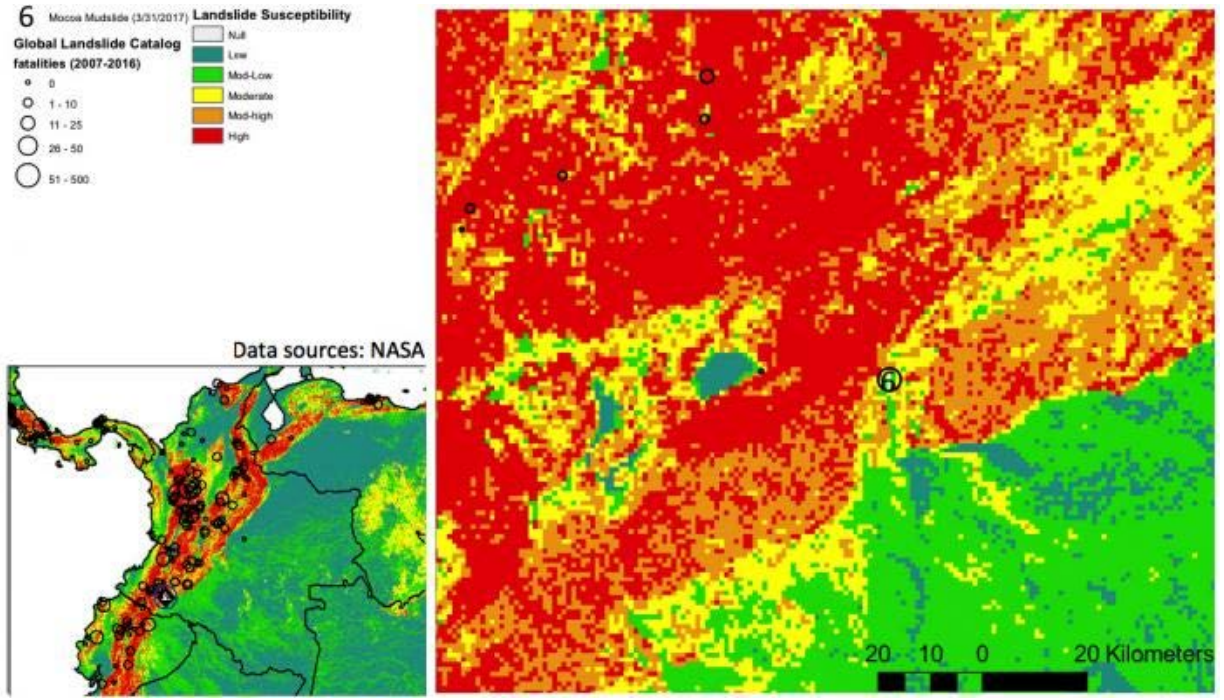
Pro: data loads quickly, can download data in other formats
Con: it can be more challenging to manipulate the visualizations

Pro: layers (including landslide nowcast, precipitation) are easier to manipulate
Con: it can take a long time for visualization layers to load

Global Landslide Nowcast

- Available:
  - In the NASA Disasters Portal: https://maps.disasters.nasa.gov
  - On the Precipitation Measurement Mission website: https://pmm.nasa.gov/precip-apps
- Nowcast Reports are also available at https://disasters.nasa.gov/landslides

Example: 2017 Mudslide in Colombia

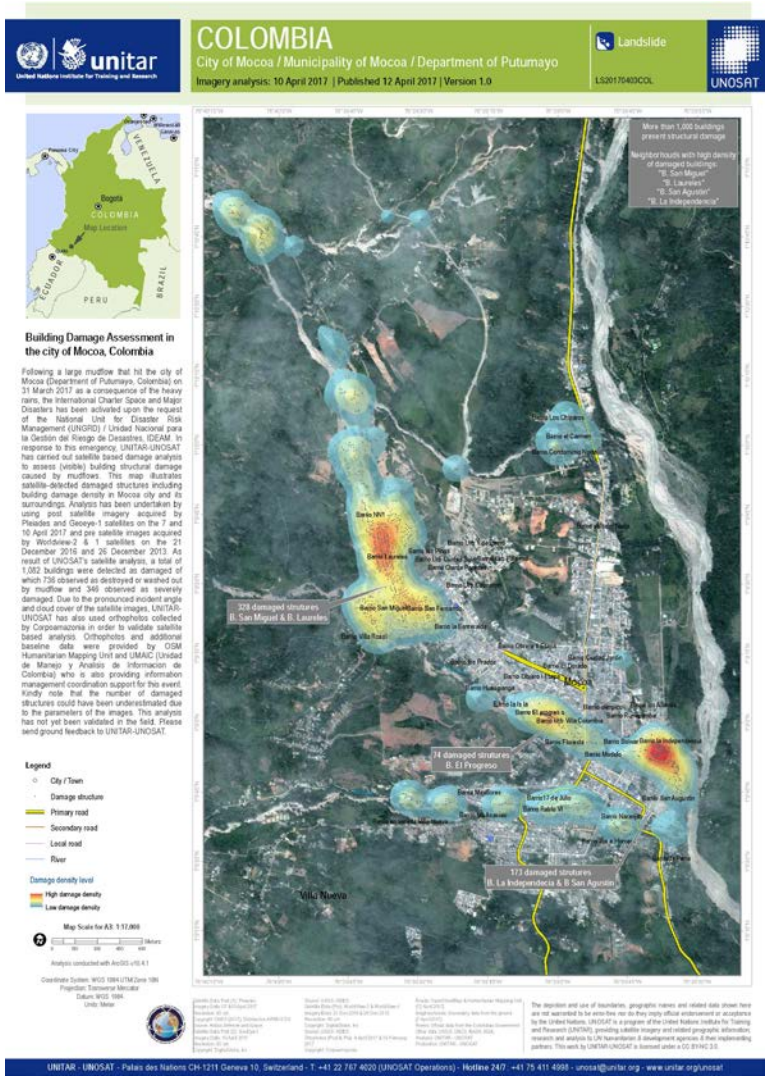


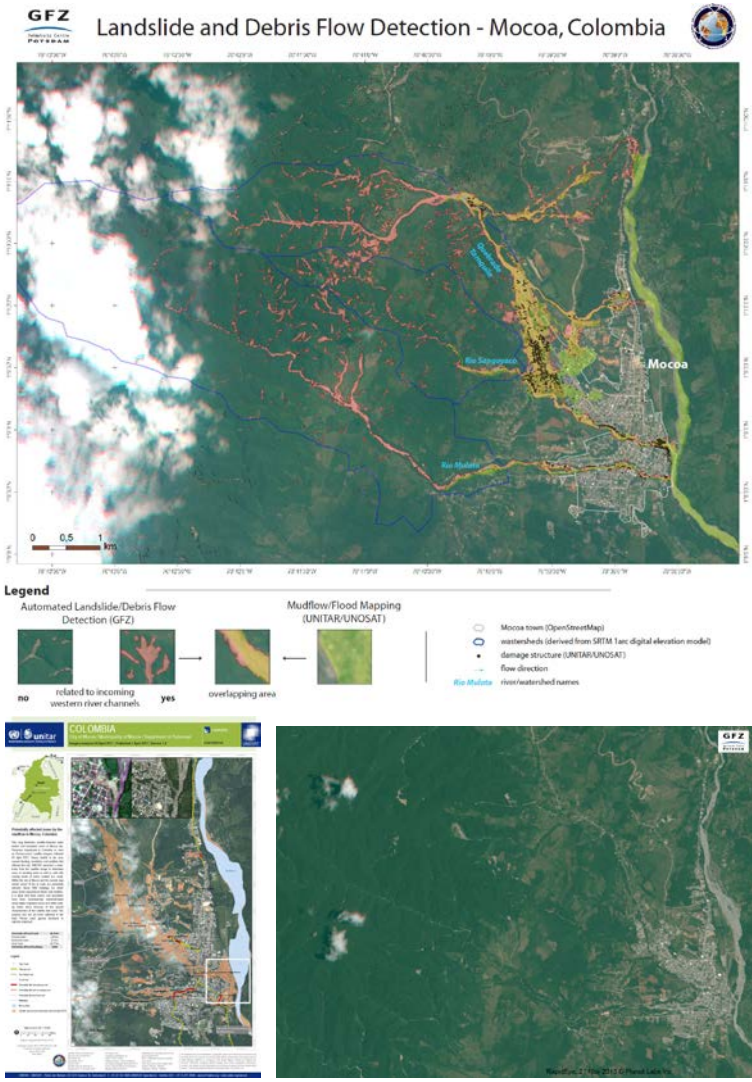
NASA Precipitation Measurement Mission website: https://pmm.nasa.gov/extreme-weather/deadly-flooding-rains-near-mocoa-colombia-measured-imerg

Landslide Nowcast: https://disasters.nasa.gov/landslides/

Example: 2017 Mudslide in Colombia

- Listed as a flood event, but includes products on landslide and mudflow
- Can be found either in:
  - the activation list: https://disasterscharter.org/web/guest/charter-activations
  - the Disasters charter map: https://cgt.disasterscharter.org/





Global Landslide Catalog

- Feeds into the global Landslide Hazard Assessment for Situational Awareness (LHASA) and Global Landslide Nowcast
- Identifies rainfall-triggered landslide events
- Available at: https://data.nasa.gov/Earth-Science/Global-Landslide-Catalog/h9d8-neg4