# Rapid response to natural disasters in Southeast Asia using the Advanced Rapid Imaging and Analysis (ARIA) system


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ARIA

Sentinel Asia

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

EARTH OBSERVATORY OF SINGAPORE

# The Earth Observatory of Singapore – Our Mission

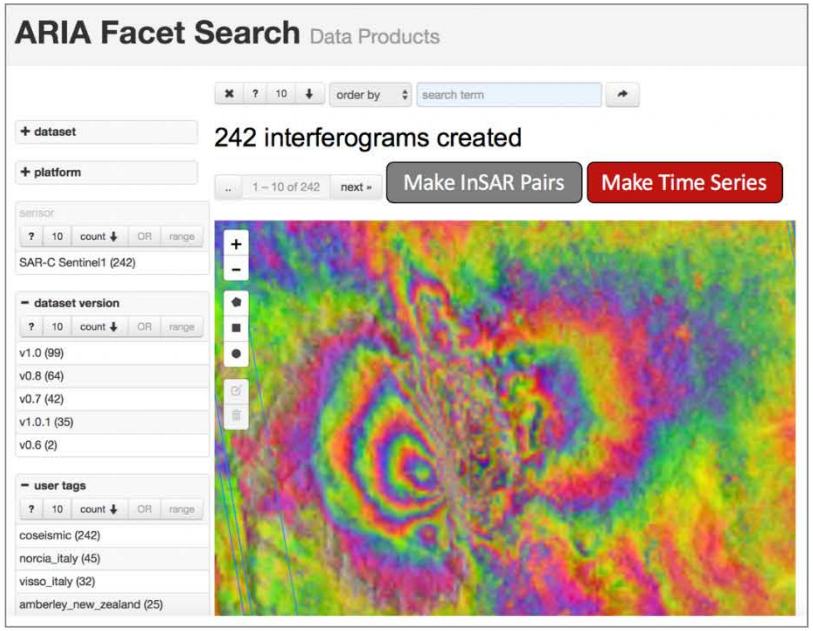


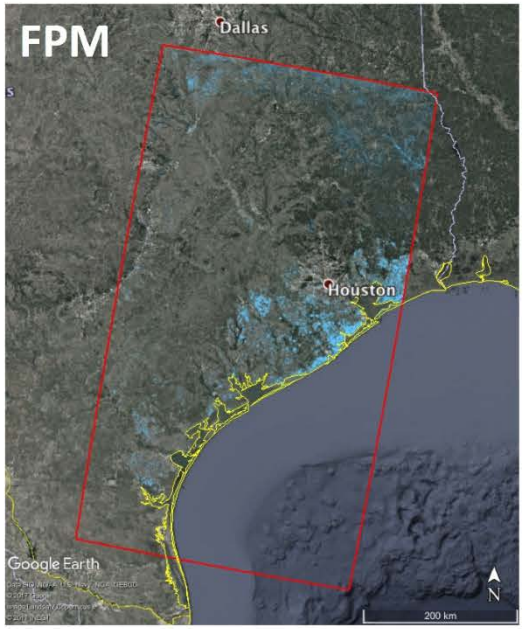
The Earth Observatory of Singapore conducts fundamental research on earthquakes, volcanic eruptions, tsunamis and climate change in and around Southeast Asia, towards safer and more sustainable societies.

# The ARIA system

- The Advanced Rapid Imaging and Analysis (ARIA) system was developed by JPL and Caltech to provide automatic processing of geodetic data for disaster response and monitoring

- The ARIA system will create automatically generated interferograms, deformation time-series, and do pre-processing for production of Flood Proxy Maps and Damage Proxy Maps.

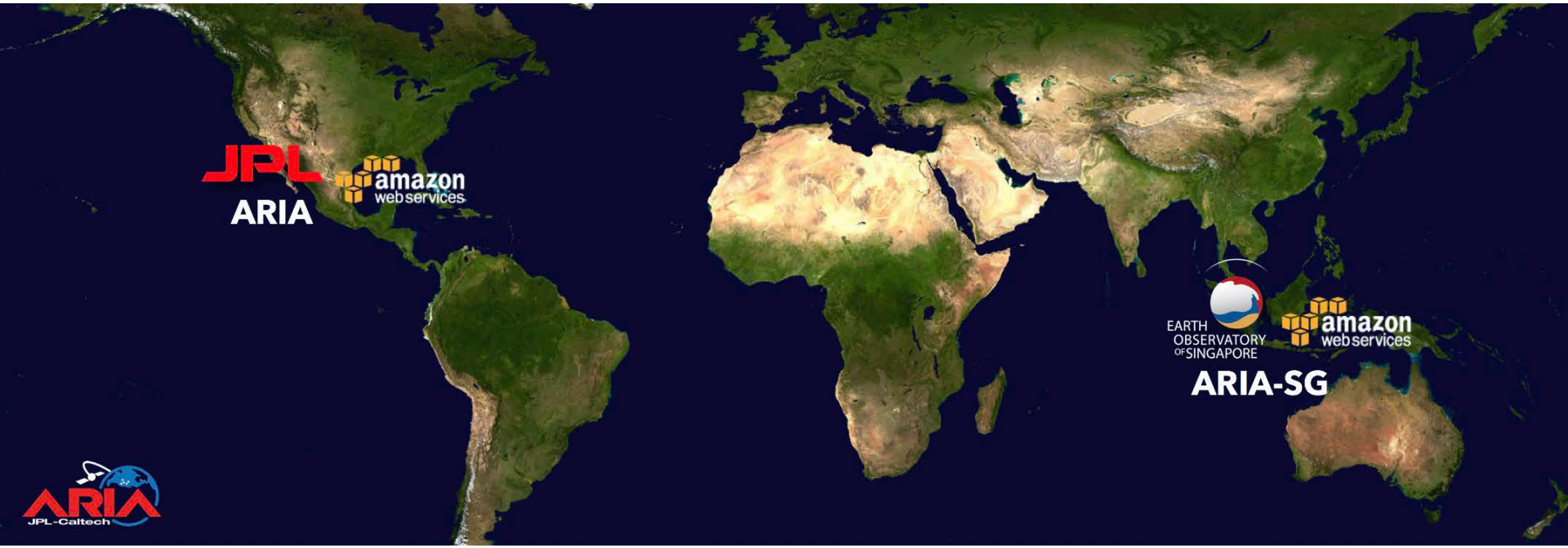



# Our vision for this project



- We are cloning the ARIA system to EOS, to use for monitoring natural hazards and responding to disasters in SE Asia.
- We will work closely with responding agencies and other stakeholders to provide the most useful products possible.
- We will innovate the processing techniques and algorithms to further automate and improve the system for regional needs.

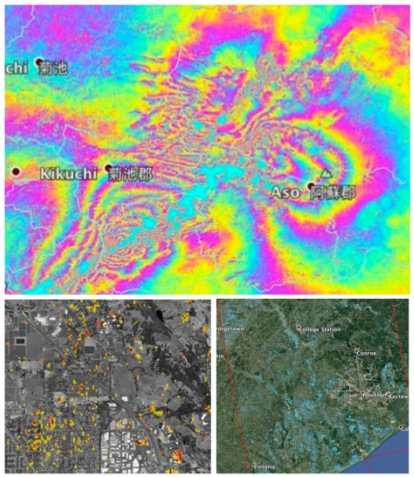


# ARIA: Main Features

## Automatic Data Intake

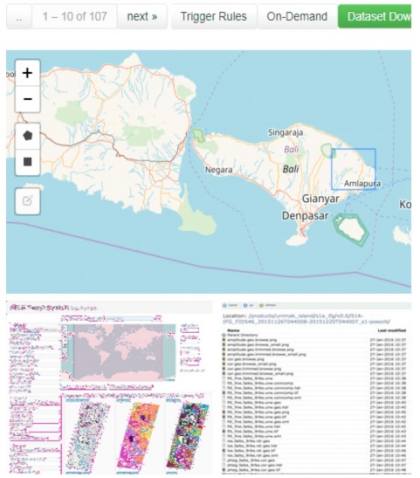
- Sentinel
- Orbit files
- Triggered download
- AOI download
- Keep-up download
- Centralized data archiving
- ALOS-2 (planned)

## Automatic Processing




- Interferograms
- Displacement time-series
- Damage Proxy Maps*
- Flood Proxy Maps*
- Centralized product archiving
- PS InSAR (planned)

## Visulization Interface




- Web-based GUI
- Facet search
- Machine learning capability
- Time-series visualization
- WebDAV-based data sharing

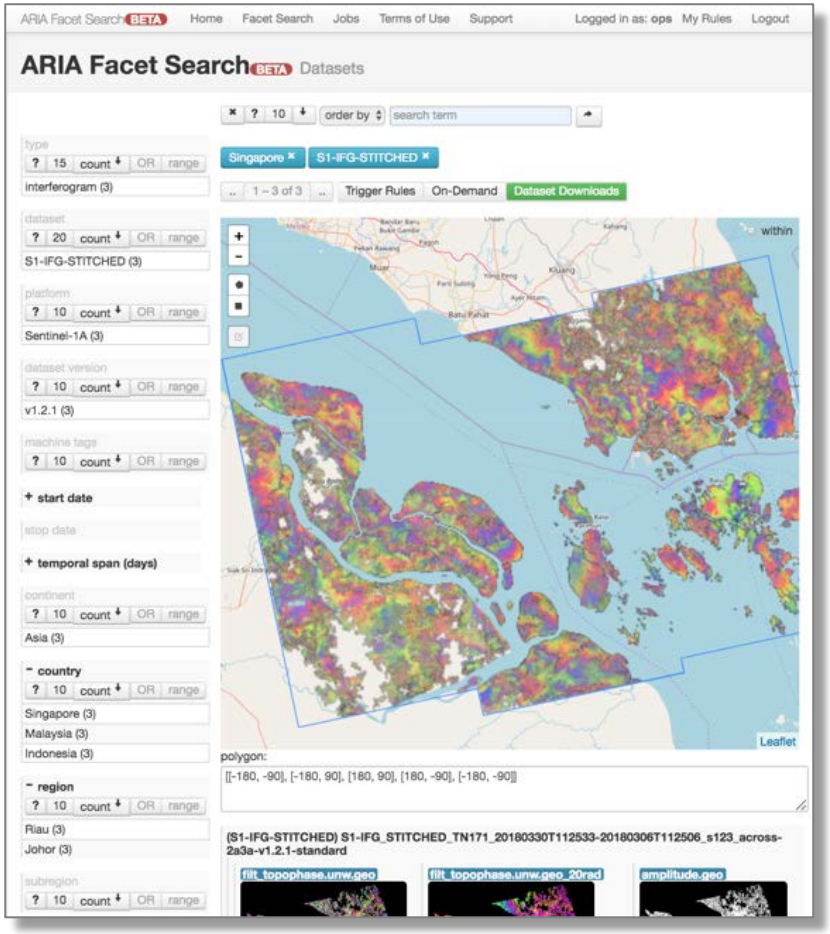
*Currently under JPL and EOS's joint development for full automation

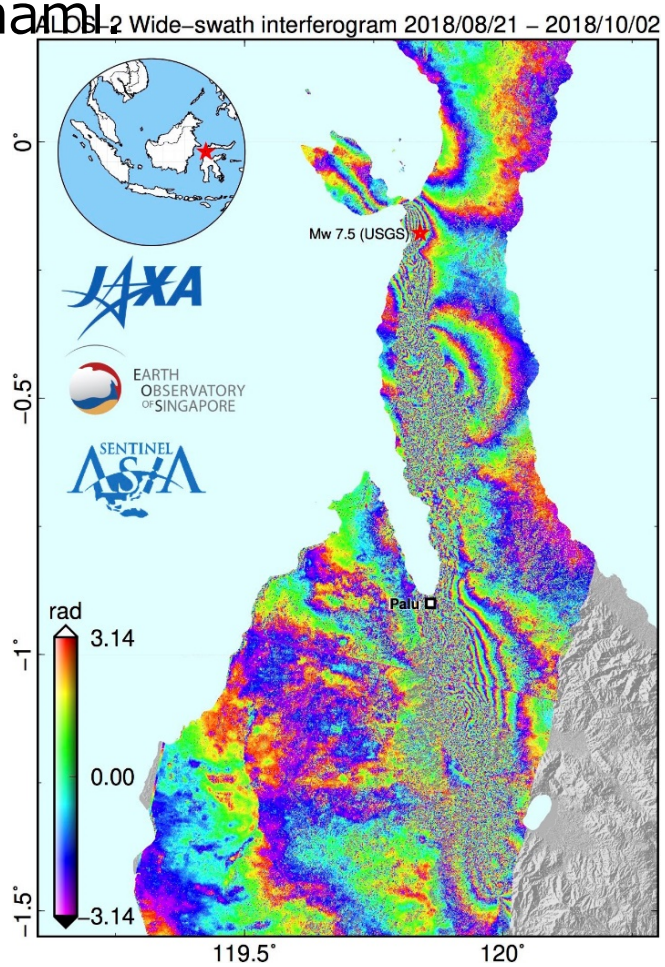
# Product Example: Interferogram



Interferograms help to measure the ground motion that generates earthquakes.

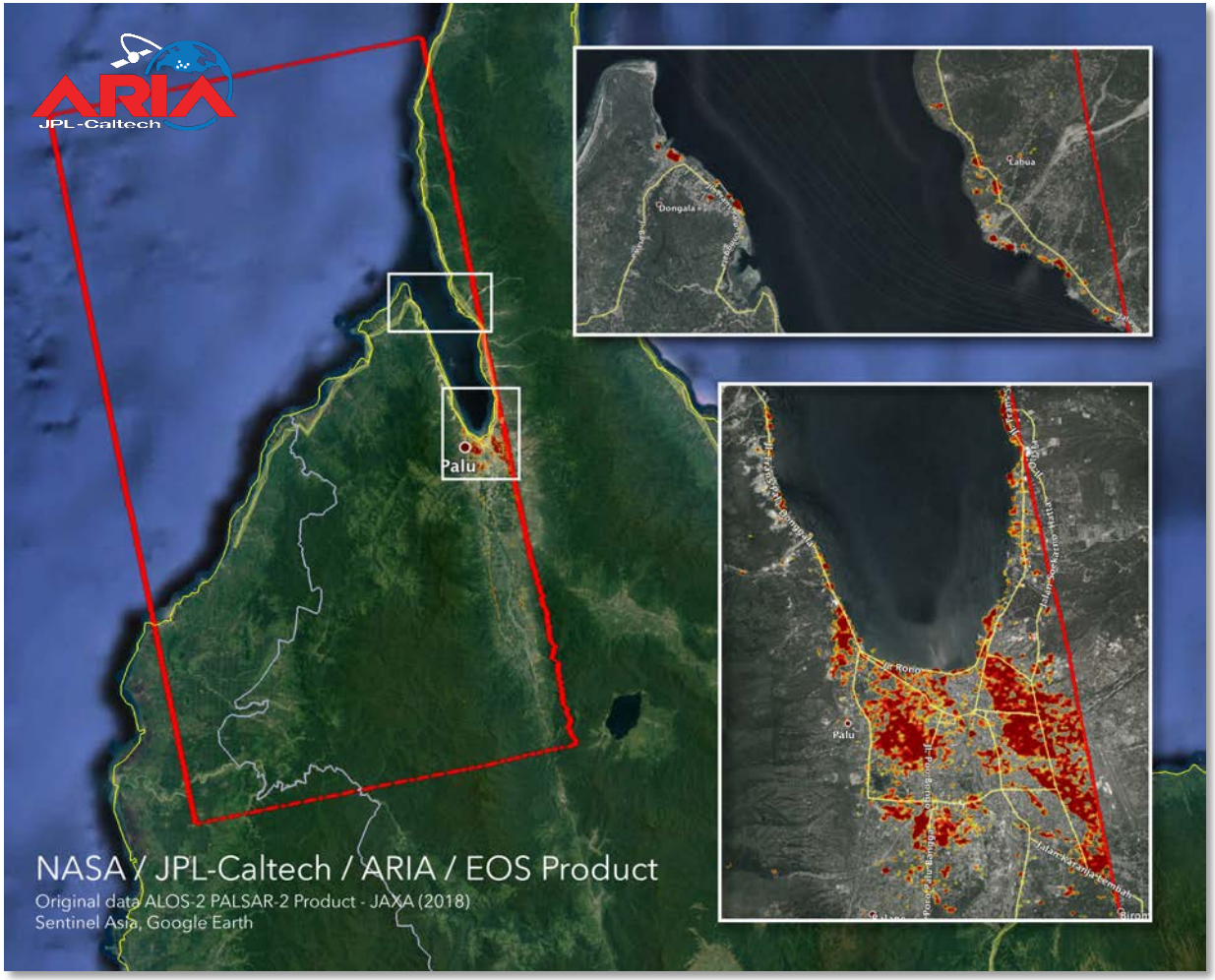
A first interferogram for the 2018 $M_w$ 7.5 Palu earthquake helped us determine the length and location of the fault rupture that generated the earthquake and tsunami.



# Product Example: Damage Proxy Map

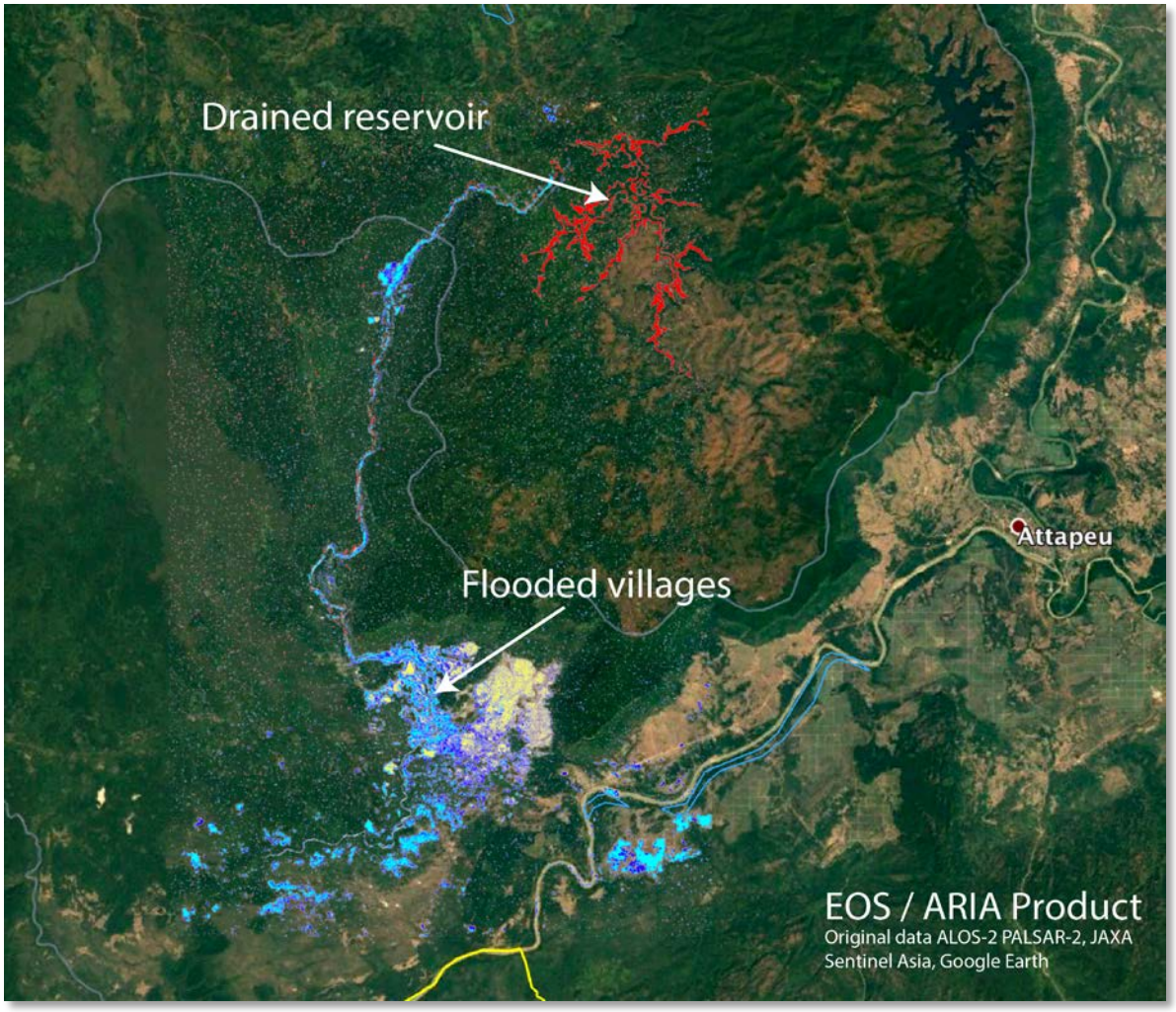
- This is a Damage Proxy Map (DPM) for the 28 Sept $M_w$ 7.5 Palu earthquake.
- This DPM was validated using a dataset assembled from media information and photos.
- Validation data is very important to make accurate DPMs



# Product Example: Flood Proxy Map



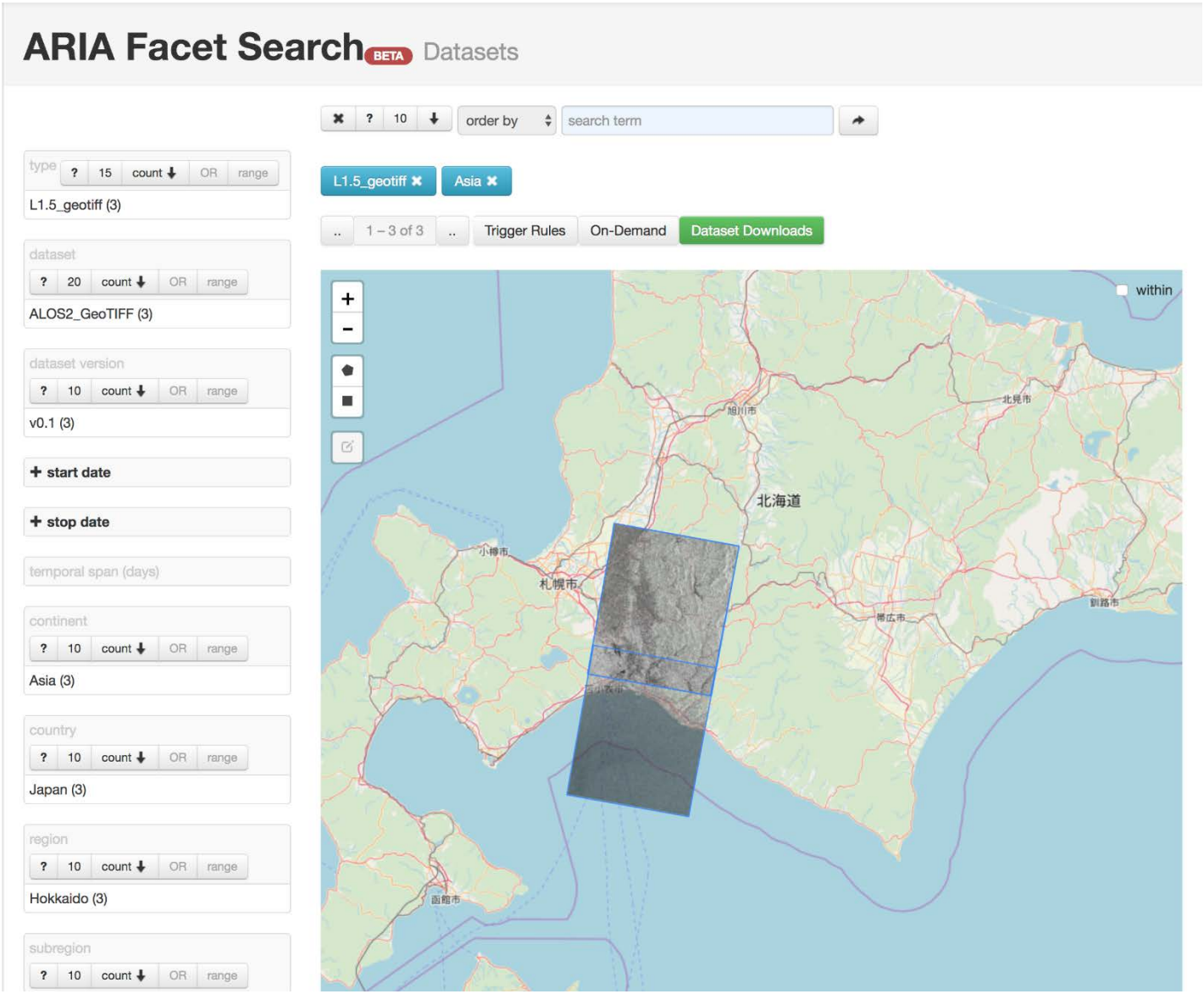
This FPM shows flood extent for the July 2018 Laos floods, which occurred after a dam collapsed.




Red pixels = Wet to dry ; Blue pixels = Dry to wet; Yellow pixels = Uncertain

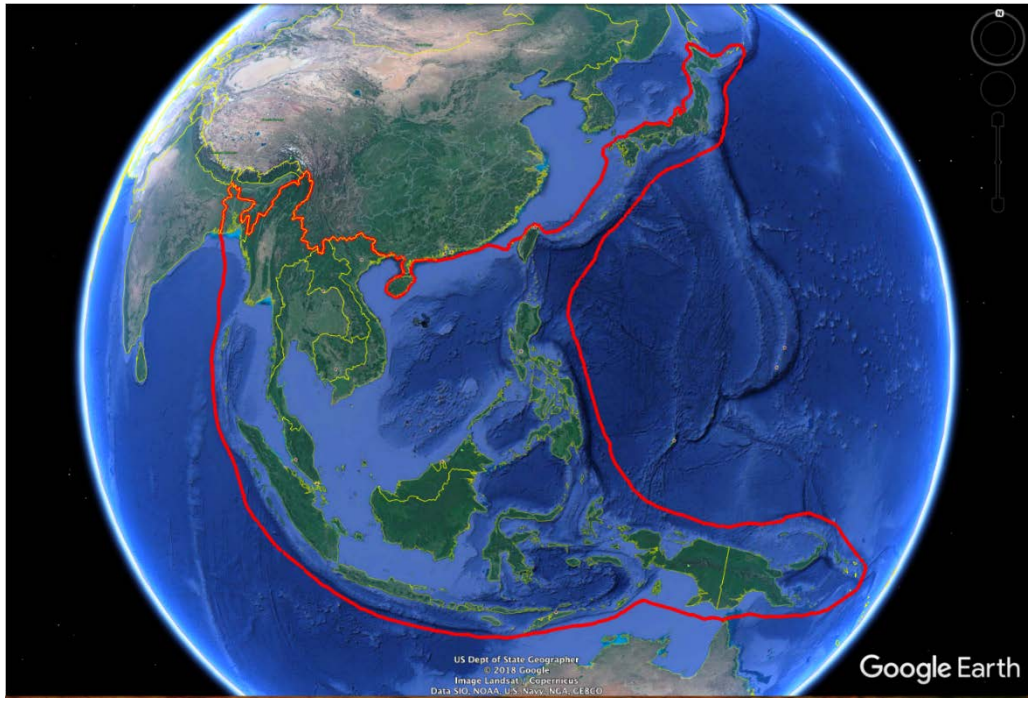
# Ongoing development: ALOS-2 ingestion into ARIA





# Update: Sentinel-1 SLC data for the region in the AWS cloud

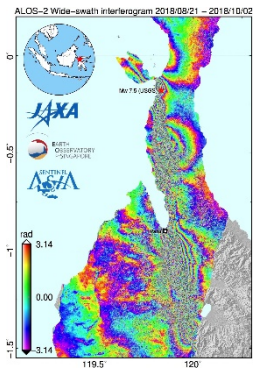





- We will work with Amazon Web Services (AWS) to host Sentinel-1 Single Look Complex (SLC) data as an open data set in the AWS cloud.
- The Area of Interest (AOI) for S1 SLC includes SE Asia, Taiwan, and Japan.
- This will solve download latency issues

# Summary






We have successfully cloned the JPL/Caltech ARIA system to Singapore.

ARIA automatically generates interferograms for Sentinel-1 data. We are working to do the same with ALOS-2 data


Generation of automatic DPMs and FPMs by the ARIA system is still under development


In collaboration with AWS we will host Sentinel-1 data covering SE Asia, Taiwan and Japan in the AWS cloud.