



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

Earth Observatory of Singapore

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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.

ARIA Facet Search Data Products

242 interferograms created

Make InSAR Pairs Make Time Series

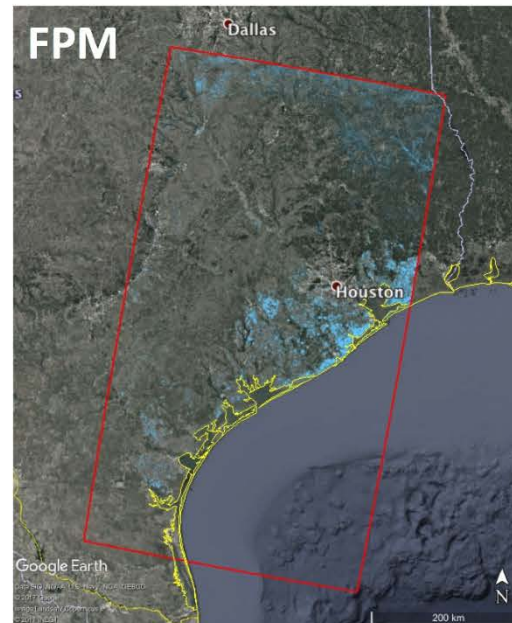
SAR-C Sentinel1 (242)

dataset version

- v1.0 (99)
- v0.8 (64)
- v0.7 (42)
- v1.0.1 (35)
- v0.6 (2)

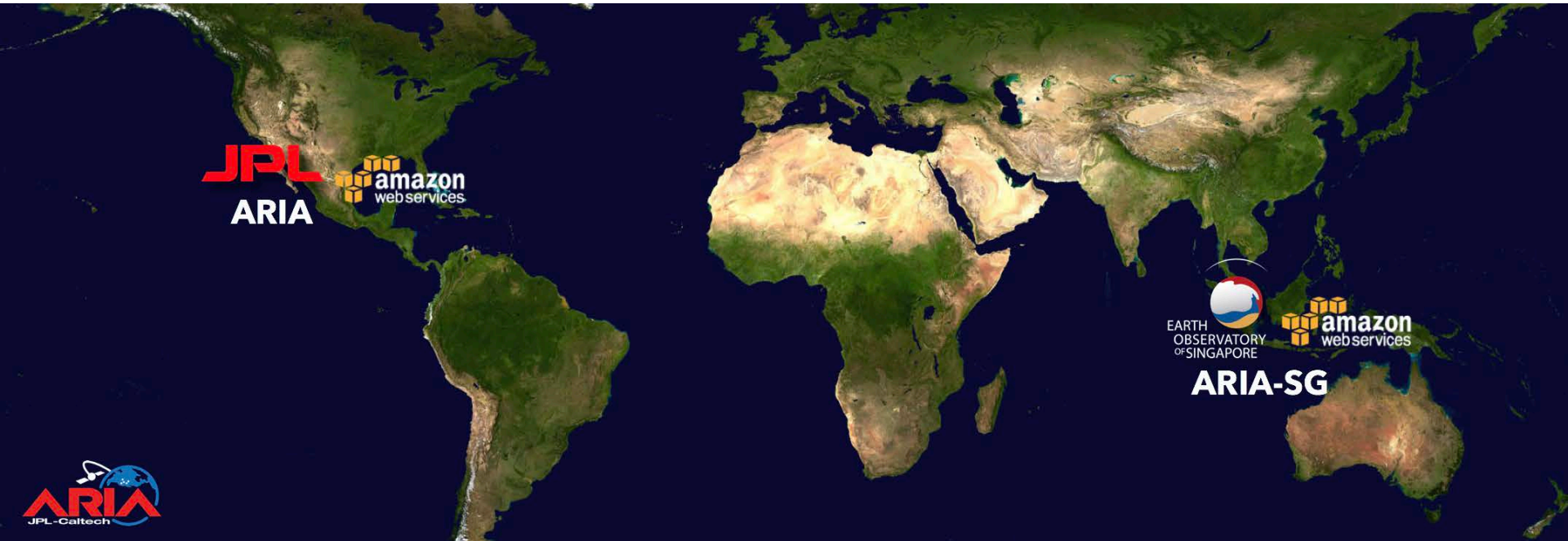
user tags

- coselsmic (242)
- norcia_italy (45)
- visio_italy (32)
- amberley_new_zealand (25)



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.

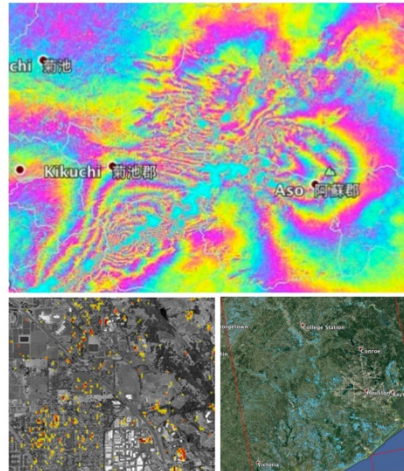


Automatic Data Intake



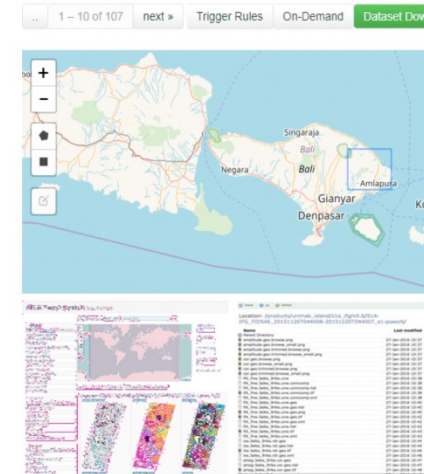
- Sentinel
- Orbit files
- Triggered download
- AOI download
- Keep-up download
- Centralized data archiving
- ALOS-2 (planned)

Automatic Processing



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

Visualization 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 Mw 7.5 Palu earthquake helped us determine the length and location of the fault rupture that generated the earthquake and tsunami.

ARIA Facet Search **BETA** Home Facet Search Jobs Terms of Use Support Logged in as: ops My Rules Logout

ARIA Facet Search **BETA Datasets**

type: Singapore * S1-IFG-STITCHED *

interferogram (3)

dataset: S1-IFG-STITCHED (3)

platform: Sentinel-1A (3)

dataset version: v1.2.1 (3)

machine tags: 10 count

start date

stop date

temporal span (days)

continent: Asia (3)

country: Singapore (3), Malaysia (3), Indonesia (3)

region: Riau (3), Johor (3)

subregion: 10 count

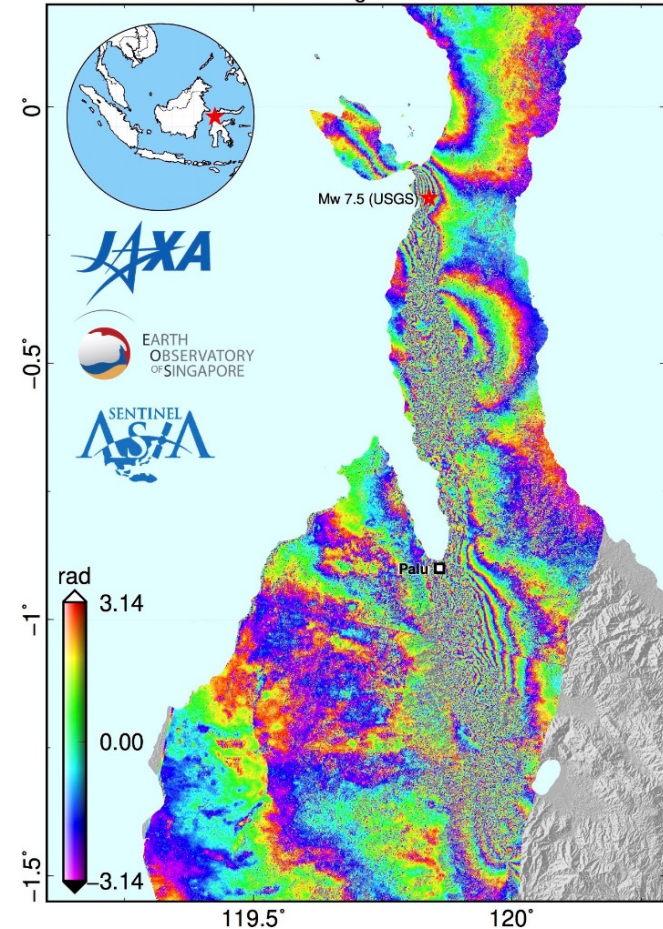
polygon: [[-180, -90], [-180, 90], [180, 90], [180, -90], [-180, -90]]

(S1-IFG-STITCHED) S1-IFG_STITCHED_TN171_20180330T112533-20180306T112506_s123_across-2a3a-v1.2.1-standard

fit_topophase.umw.aeo, fit_topophase.umw.aeo_20rad, amplitude.aeo

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

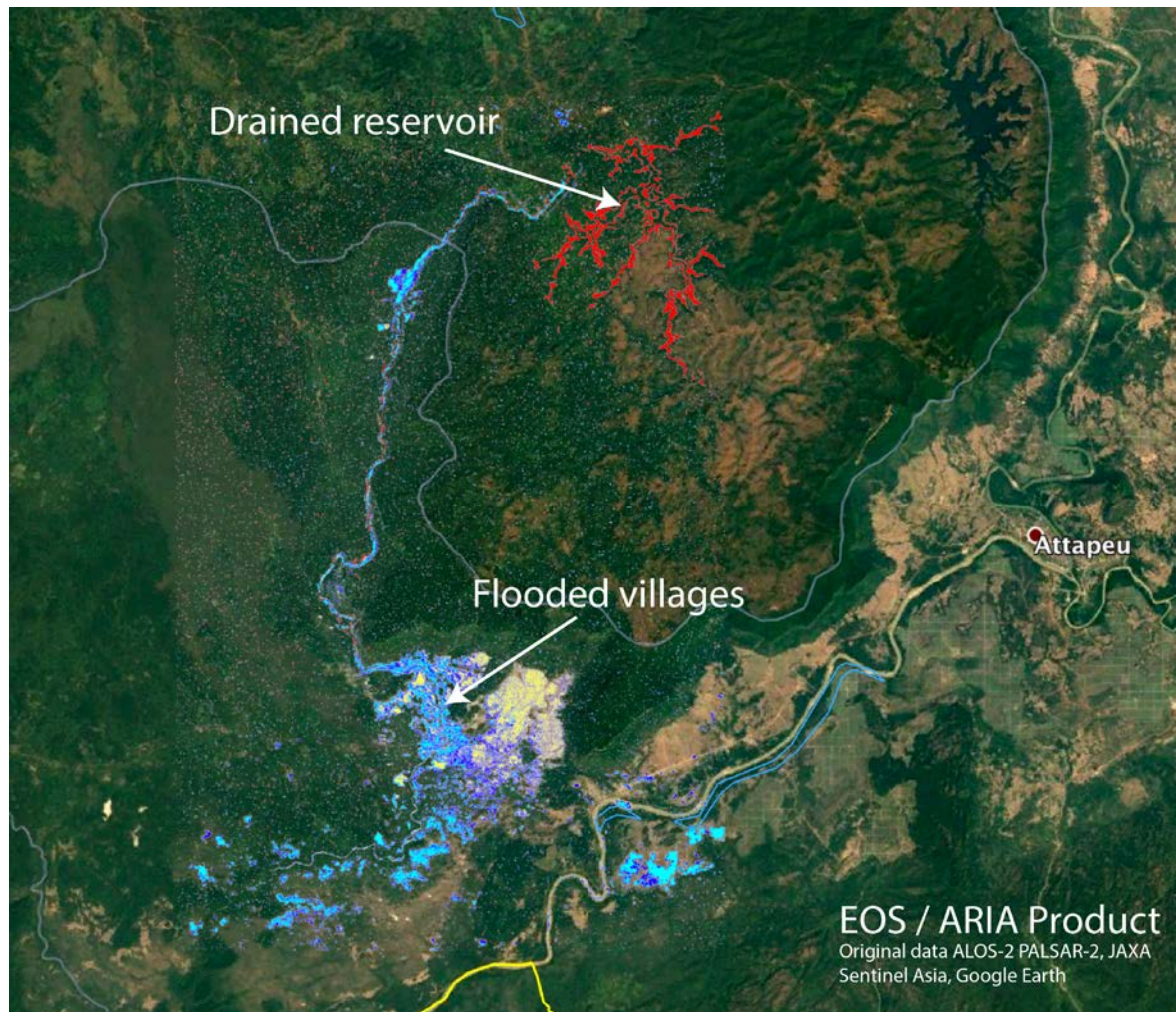
Figure 2 Wide-swath interferogram 2018/08/21 – 2018/10/02



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

ARIA Facet Search BETA Datasets

✕ ? 10 ↓ order by search term →

L1.5_geotiff ✕ Asia ✕

.. 1 - 3 of 3 .. Trigger Rules On-Demand Dataset Downloads

type ? 15 count ↓ OR range
L1.5_geotiff (3)

dataset ? 20 count ↓ OR range
ALOS2_GeoTIFF (3)

dataset version ? 10 count ↓ OR range
v0.1 (3)

+ start date

+ stop date

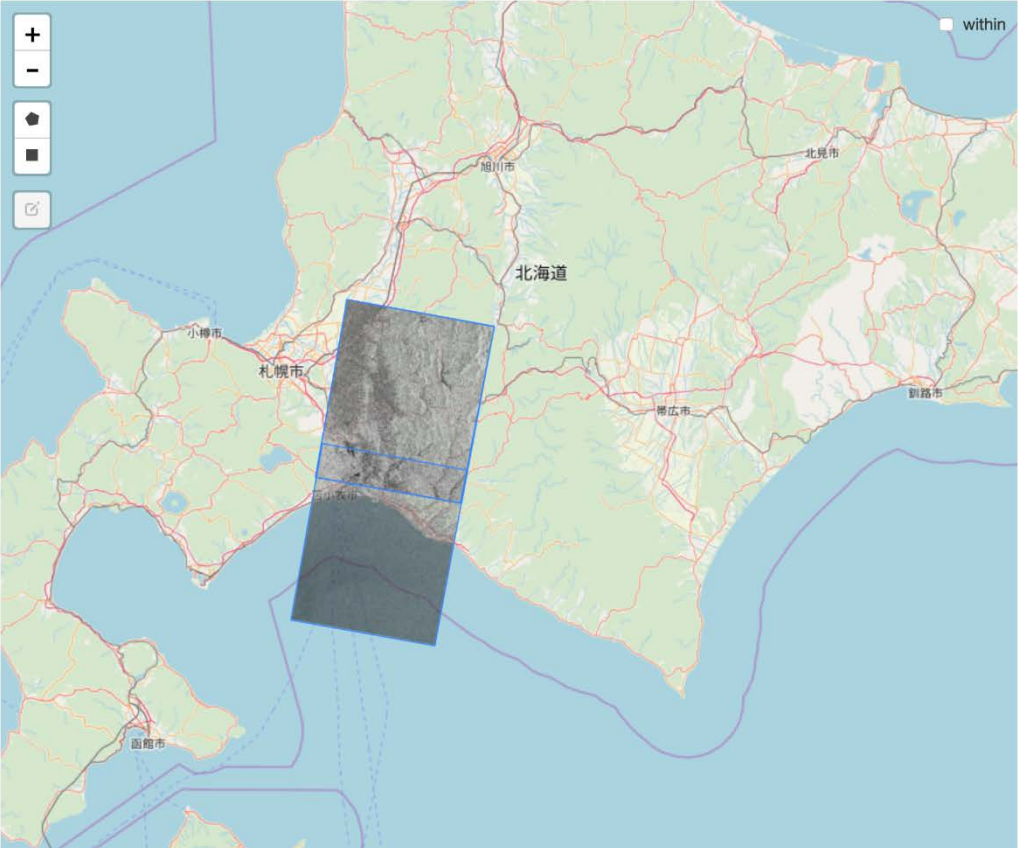
temporal span (days)

continent ? 10 count ↓ OR range
Asia (3)

country ? 10 count ↓ OR range
Japan (3)

region ? 10 count ↓ OR range
Hokkaido (3)

subregion ? 10 count ↓ OR range



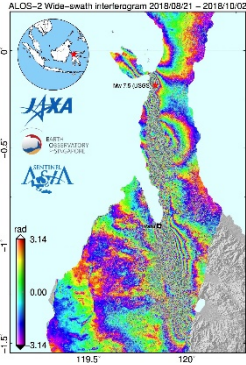
Map showing a satellite image overlay on a geographical map of Hokkaido, Japan. The map includes labels for cities (札幌市, 旭川市, 小樽市, 博多市, 北見市, 函館市) and the region (北海道). A blue box highlights a satellite image of a coastal area.



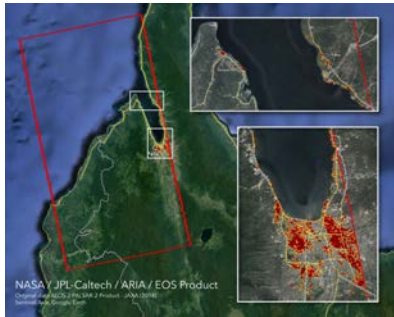
- We will work with Amazon Web Services (AWS) to host Sentinel-1 Single Look Complex (SLC) data as an open data set in the AWS cloud.
- The Area of Interest (AOI) for S1 SLC includes SE Asia, Taiwan, and Japan.
- This will solve download latency issues



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.