Welcome to the EarthScope Geodetic Imaging (WInSAR) Business Luncheon!

December 13, 2023

NSF USGS science for a changing world NASA

GAGE SAGE

Operated by EarthScope Consortium

History

Founded in 1999 at SCEC

WInSAR helps coordinate requests for data acquisition and for data purchase, aiding individual investigators by simplifying interactions with data providers and with government agencies funding science, including NASA, NSF, and the USGS.

2005 WInSAR RFP

Information for Potential WInSAR Host Organizations and Request for Letter Proposal

WInSAR is a consortium of universities and research laboratories established by a group of practicing scientists and engineers to facilitate collaboration in, and advancement of, Earth science research using radar remote sensing. WInSAR helps coordinate requests for data acquisition and for data purchase, aiding individual investigators by simplifying interactions with data providers and with government agencies funding science, including NASA, NSF, and the USGS.

2005 UNAVCO RFP response

Proposal to Host WInSAR at UNAVCO

Submitted to

WInSAR Steering Committee
Howard Zebker, Chair
Department of Geophysics
Stanford University
Mail Code 2215
Stanford, CA 94305-2215

Submitted by

UNAVCO
William Prescott, President
David Phillips, GeoEarthScope Project Manager
6350 Nautilus Drive
Boulder, CO 80301-5553

30 September 2005

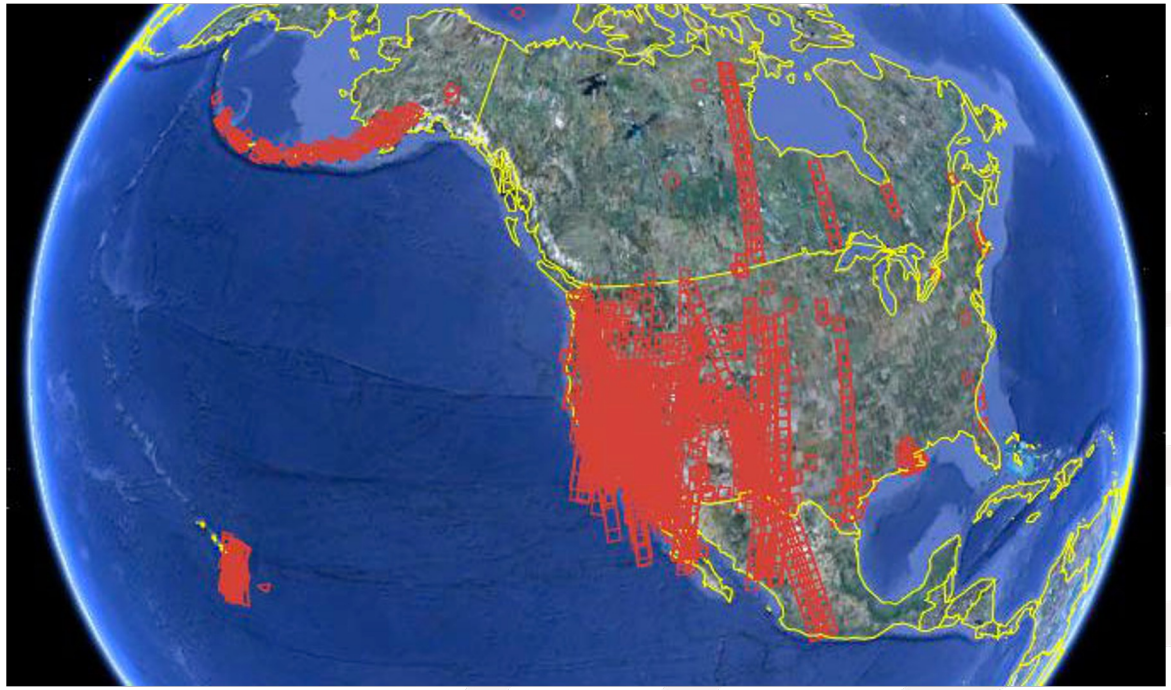
WInSAR
Western North America Interferometric Synthetic Aperture Radar Consortium

The WInSAR Community

329 WInSAR Institutional Members:

- 114 Full
- 18 Adjunct I
- 197 Adjunct II

**32 WInSAR members total in 2005*



WInSAR ESA collection

2201 Registered Users

Archive = **200 TB** of data available for download (ESA, CSA, DLR, ASI, JAXA)

Seamless SAR Archive (SSARA) Data Search and Access

InSAR Products available via WInSAR!

Query Form

Select BBOX

Platform:	
Absolute Orbit:	
Relative Orbit:	
Frame:	
Start Date:	
End Date:	
Beam Mode:	
Swath:	
Flight Direction:	
Look Direction:	
Polarization:	
Processing Level:	INTERFEROGRAM
Collection:	
Max. Results:	1000

Search

SAR (100)

Collection	Platform	Absolute O…	Start Time	Stop Time	Relative Orbit	First Frame	Final Frame	Beam Mo…	Swath	Flight Direct…	Lool
WInSAR ESA			2016-05-24 18:00:00.000	2016-08-30 18:00:00.000	92	0	0			d	R
WInSAR ESA			2016-05-24 18:00:00.000	2016-08-30 18:00:00.000	92	0	0			d	R
WInSAR ESA			2016-05-24 18:00:00.000	2016-08-30 18:00:00.000	92	0	0			d	R
WInSAR ESA			2016-05-24 18:00:00.000	2016-08-30 18:00:00.000	92	0	0			d	R

Tools for uploading: https://www.unavco.org/gitlab/unavco_public/insar-product-archive

WInSAR

WInSAR is operated by UNAVCO/EarthScope under GAGE (Geodetic Facility for the Advancement of Geoscience (GAGE)) Cooperative Agreement. Oct. 2018 – Sept. 2025. WInSAR supported by NSF & NASA.

Activities (*present*):

- Archive operations & maintenance = tasking, data ordering, automated data ingestion.
- **Role-based user authentication for data sharing**
- Website/portal and user community support
- ISCE software access management
- **Community short course support**
- **Annual Business Lunch at AGU**
- Project management and Executive Committee support

Activities (*past*):

- Data purchasing (esp during GeoEarthScope)
- Open data advocacy on behalf of the InSAR science community w/ space agencies. Supersites support.
- Enhanced data search and federated access (SSARA - supported by NASA ROSES ACCESS)

2022 Townhall report

Recommendations for future actions:

- Make WInSAR an integral part of EarthScope, rather than a separate consortium.
- Expand vision to include “geodetic imaging” more generally.
- Improve community activities with an eye toward inclusion and equity.
- Unify data access with other EarthScope systems.
- Enable archiving & DOIs for time series and other derived products
- Enhance SSARA for federated search.
- Advocate for open data, talk to commercial SAR operators about access to archival data.

Document:
https://docs.google.com/document/d/14K60OsPgZXrGaxnSaAiQEgpI2YXy8dHqYPn7-5dpGpY/edit?usp=sharing

Commercial SAR data

GAGE SAGE Operated by EarthScope Consortium

Registry of Open Data on AWS

Umbra Synthetic Aperture Radar (SAR) Open Data

earth observation | geospatial | image processing | satellite imagery | stac | synthetic aperture radar

Description

Umbra satellites generate the highest resolution SAR imagery ever offered commercially from space (better than 25 cm / 10 inches). SAR satellites can capture images at night, through cloud cover, smoke and rain. SAR is unique in its abilities to monitor changes. The Open Data Program (ODP) monitors ten diverse locations around the world. Updated frequently with new images. ODP enables users to analyze the time-series data to detect changes in each location. If you have a suggestion for a new location, feedback on the dataset, or any questions, contact us at umbra.space/open-data.

Update Frequency

New data is added regularly

License

CC by 4.0. See link for additional details.

Documentation

https://help.umbra.space/kb/en

Managed By

UMBRA

See all datasets managed by Umbra.

Contact

help@umbra.space

How to Cite

Umbra Synthetic Aperture Radar (SAR) Open Data was accessed on `DATE` from https://registry.opendata.aws/umbra-open-data.

Resources on AWS

Description
Umbra Spotlight collects including GEC, SICD, SIDD, CPHD data and metadata

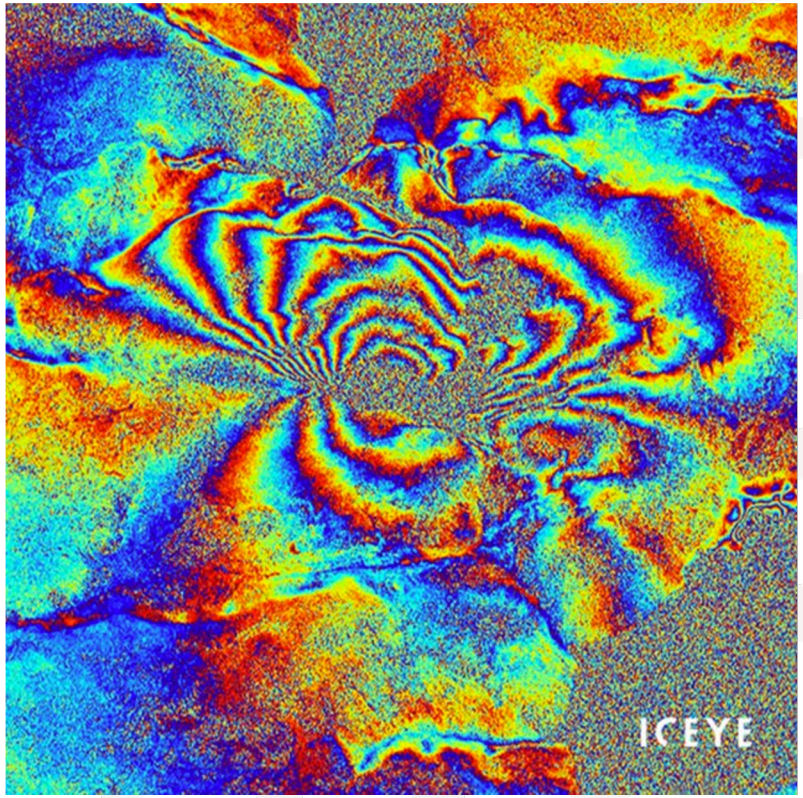
Resource type
S3 Bucket

Amazon Resource Name (ARN)
`arn:aws:s3:::umbra-open-data-catalog`

AWS Region
`us-west-2`

AWS CLI Access (No AWS account required)
`aws s3 ls --no-sign-request s3://umbra-open-data-catalog/`

Explore
Browse Bucket
STAC Browser



The Future of WInSAR

GAGE and other awards to EarthScope will provide support for the following previously WInSAR-branded activities:

1. InSAR short courses (e.g., the InSAR Processing and Theory with GMTSAR, and the InSAR Processing and Analysis (ISCE+) short courses)
2. Annual luncheon at the AGU meeting
3. Data download, storage, and sharing of PI restricted datasets from ALOS-2, TSX, and CSK
4. Seamless SAR Archive tools (SSARA) for federated search and access to SAR data
5. InSAR Product Archive for publication of InSAR pairwise and time series products

The Future of WInSAR

Practical Implications:

Going forward the DPSAC will provide governance for SAR / geodetic imaging activities.

Rebranding and web-content update to begin merging many of the WInSAR-related pages into the EarthScope website.

Revisit license terms with space agencies for existing data.

Data Products and Services Advisory Committee

The Data Products and Services Advisory Committee advises on data and metadata distribution, standards, and quality for all geophysical data and data products in EarthScope Consortium's Data Services.

Member/Organization	Term Start/Term End
Angelyn Moore (Chair) Jet Propulsion Laboratory/Caltech	January 2023/December 2024
Jonathan Ajo-Franklin Rice University	January 2023/December 2023
Noel Bartlow University of Kansas	January 2023/December 2024
Frossie Economou LSST (Vera C Rubin Observatory)	January 2023/December 2024
Mike Floyd Massachusetts Institute of Technology	March 2023/December 2025
Ved Lekić University of Maryland	January 2023/December 2023
Eric Lindsey University of New Mexico	January 2023/December 2023
Natalia Ruppert Alaska Earthquake Center, UAF	March 2023/December 2025
Zack Spica University of Michigan	March 2023/December 2025
Tonie van Dam (BoD Liaison) University of Utah	January 2023/December 2023

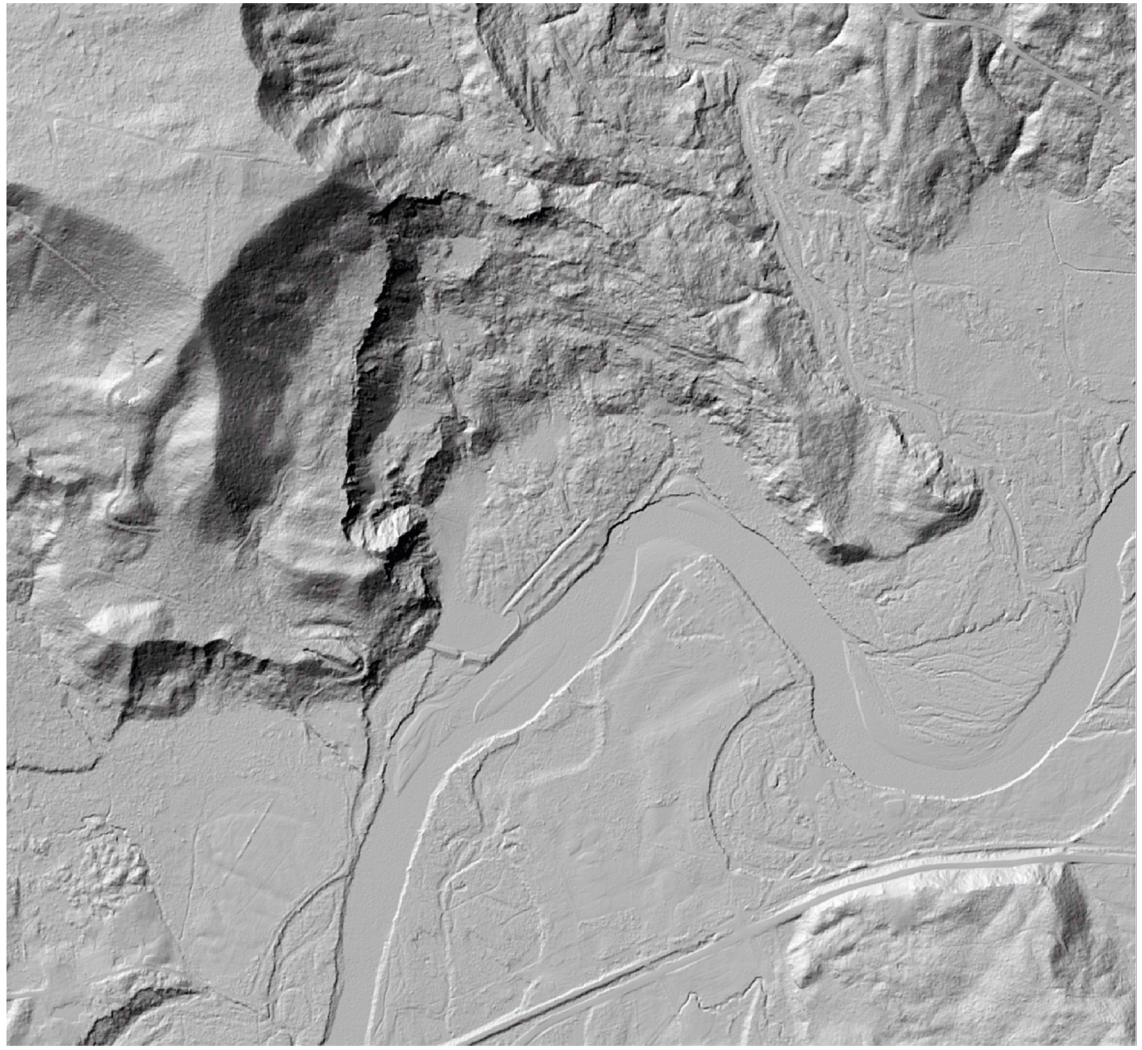
The future of WInSAR

New hire:

Kang Wang - currently at UC Berkeley Seismology Lab.

Starting January 2nd with a focus on SAR at EarthScope.

Other types of geodetic imaging data



2014 Oso Landslide, WA

Expand future luncheons to encompass other geodetic imaging data types and resources?

- Topography & topographic change
- Pixel tracking

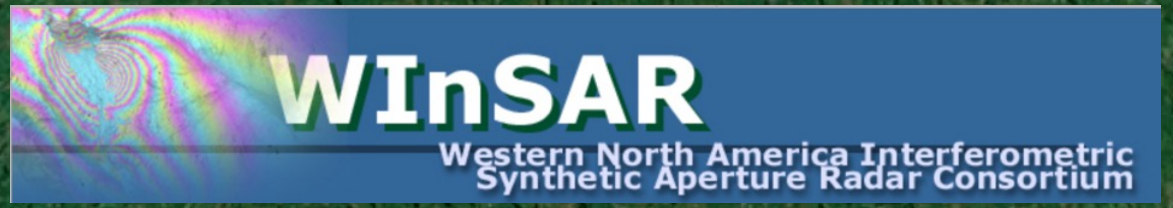
Updates from orgs such as:

National Aeronautics and Space Administration

NASA

EXPLORE EARTH

NASA's Final Brief to

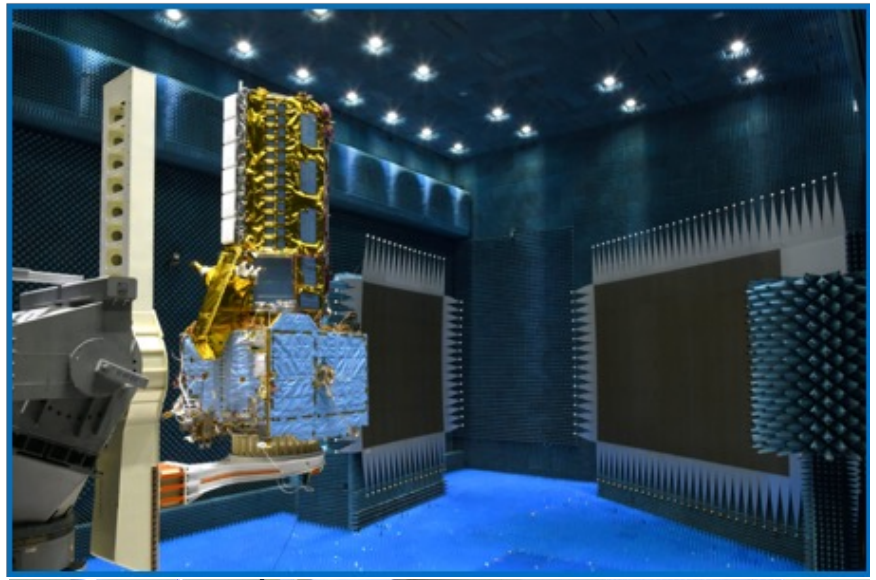


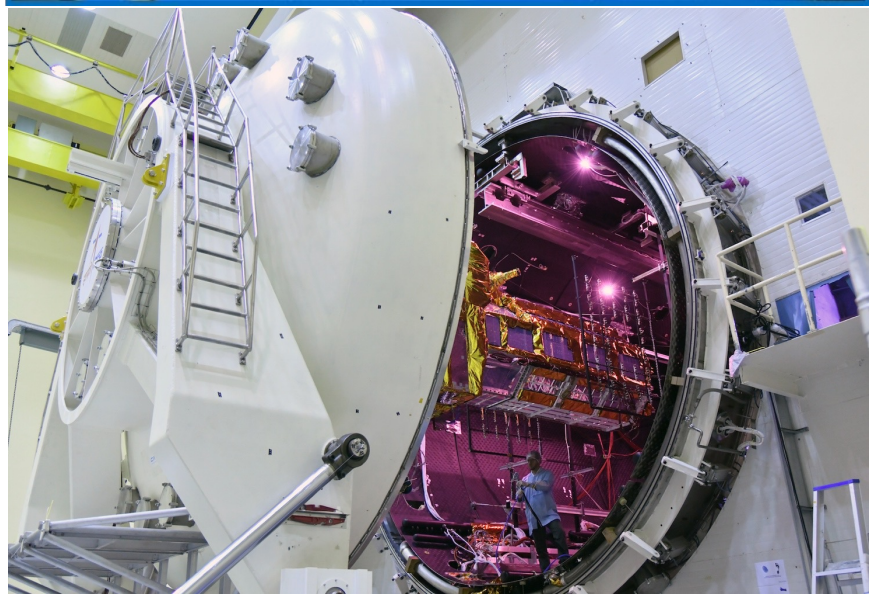
Gerald Bawden, Ph.D.

Earth Science Division, NASA HQ

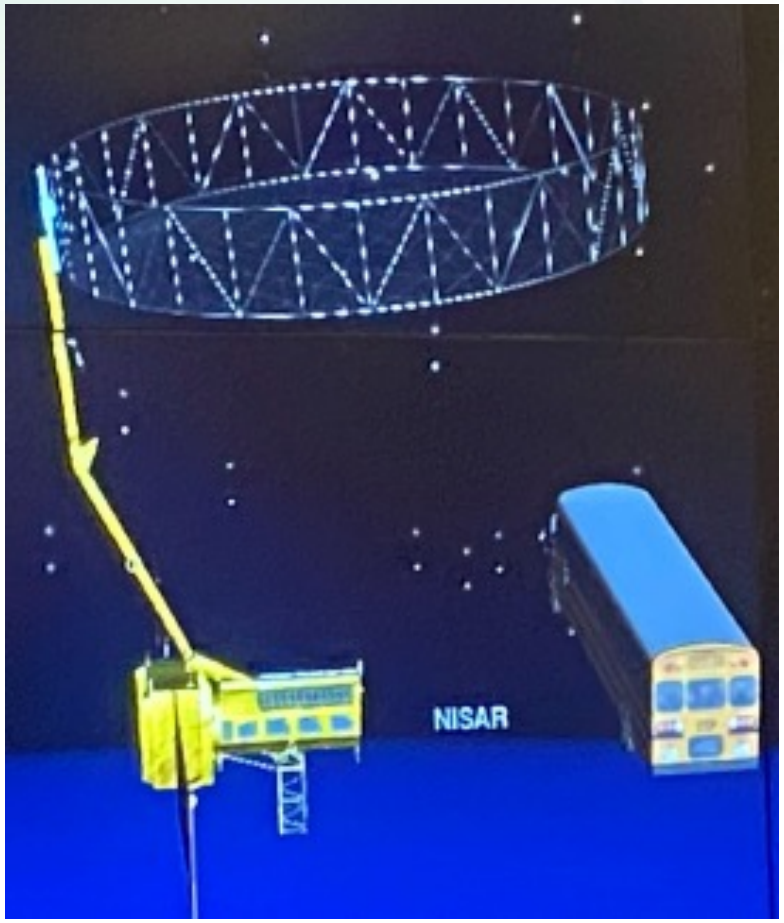
AGU2023
San Francisco
December 13, 2023

NISAR is 99.9% Completed and Tested
T-109 days





- **Launch planned for March 30, 2024**
- NISAR is in its final phase of integration in India
- First light images 2-3 months after launch
- Science operations 3 months after launch
- Global products to Level 2 will be fully and openly available to the global community
- NISAR data/products @ Alaska Satellite Facility
- Science preparation and ISCE3 – Paul Rosen update
- Go to NISAR and ASF webpages for more information on how to get ready for NISAR:
  - https://nisar.jpl.nasa.gov/
  - https://asf.alaska.edu/
- ***NISAR Town Hall at AGU Thu Dec 14 Moscone West 2008 6:30-7:30 PM***



NASA Headquarters Update

- NISAR will be the first Mission of NASA's new Earth System Observatory (ESO) with **Surface Deformation and Change (SDC)** to follow NISAR
- ESO seeks to advance our understand of complex Earth process concurrent measurements from multiple platforms.
- **The SDC architecture down-selection process will be after 'lessons learned from NISAR' and after the next Decadal Survey is released**
- UAVSAR will be rebranded/modernized as AirSAR-NexGen – Yunling Lou
- OPERA: exciting SAR and optical products – David Bekaert
- RCM data: 60m and coarser no longer requires a "Vetted Users License"
- NASA-JAXA Activities – ASF Update
  - ASF ALOS-1/PALSAR-1 global mirror
  - ASF ALOS-2/PALSAR-2 SCANSAR global data mirror
  - JAXA-NASA US Gov. (+USGS, NOAA) ALOS-2 research collaboration
    - https://forms.gle/pTX1aoWZBk85gJqv9

NISAR Operations Science Team: NISAR-OST
Proposals are due February 21,2024

The NISAR-OST will not support hypothesis/question driven science!

The post-launch NISAR *Operations* Science Team will be responsible for executing the ConOps plan:

- Continued calibration/validation of NISAR data to ensure that NISAR is meeting the L1/L2 requirements for each discipline
- Overseeing fieldwork and updating the NISAR ATBDs/Science Handbook as we gained new insights
- Develop new NISAR algorithms that have the potential to be implemented as:
  - An on-demand processing capability in the cloud
  - Open Source Science - Jupyter Notebooks supporting science and applications needs
- Provide guidance on NISAR's collection strategy: tradeoffs among the disciplines/applications

The NISAR Operations Science Team will begin approximately 6 months after the launch of NISAR and will continue the effort of the current NISAR Science Team. https://nspires.nasaprs.com

The NISAR-OST will support the operational needs of NISAR and will seek to develop new innovative NISAR products and capabilities.

NISAR *Research and Applications* Science Team: NISAR-RAST -- ROSES-2024

The NISAR-SAT supports hypothesis/question driven science where NISAR data are essential to advance the science objectives.

The NISAR-RAST will be an open solicitation that seeks new and innovative research with NISAR data. Emphasis will be on NISAR's core science disciplines, but will by open to proposals that will advance our understanding of Earth Science.

- Solid Earth
- Cryosphere
- Ecosystems/Terrestrial Ecology
- Hydrology/Soil Moisture
- Agriculture/Wetlands
- Permafrost
- Numerous Applications

The NISAR-RAST solicitation is anticipated to open following the launch of NISAR and will close after approximately 6 months of NISAR science data has been available. The NISAR *Research* Science Team projects likely will begin in the Spring of 2025.

https://nspires.nasaprs.com

Dec. 13, 2023

WINSAR MEETING
FALL AGU 2023

NISAR Mission and ISCE Update

Paul A. Rosen
Project Scientist, Jet Propulsion Laboratory, California Institute of Technology
http://nisar.jpl.nasa.gov

Science Preparations for Launch

- Release of sample data products (nisar.jpl.nasa.gov/data)
- Data processing workshop at Caltech in late March 2024 (to be scheduled)
- Launch in March/April 2024
- First light images 2-3 months after launch
- Open access to all data as soon as it is serviceable
  - meets formatting requirements with sufficiently complete and correct metadata
  - marked appropriately relative to its quality (pre-calibrated, pre-validated, etc.)
- Available through ASF DAAC
- Operational latency of products will be 1-2 days, faster for urgent response
- Learn more at the NISAR Town Hall at AGU Thu Dec 14 Moscone West 2008 6:30-7:30 PM

ISCE3 Status

- ISCE3 was written to support NISAR operational processing (Heresh Fattahi's poster was on Tuesday)
- Processes NISAR data from Level 0 to Level 2 products
- Public github contains latest release of operational code
- Conda package is available and updated with current version
- Operations release in Jan 2024

- Supports NISAR L-band data, ALOS-1 L0 Stripmap data, ALOS-2 L1 Stripmap data
  - Level-2 workflows have been heavily stressed with Sentinel-1 data
  - Readers and downstream workflows have been developed to process Sentinel-1 SLCs to geocoded SLC and RTC products (available as additional conda packages that work with isce3)
- Working on non-operational version for NISAR S-band data (not a project requirement)

- Testing underway within project and with science team
- Expect support for other sensors to come in the future

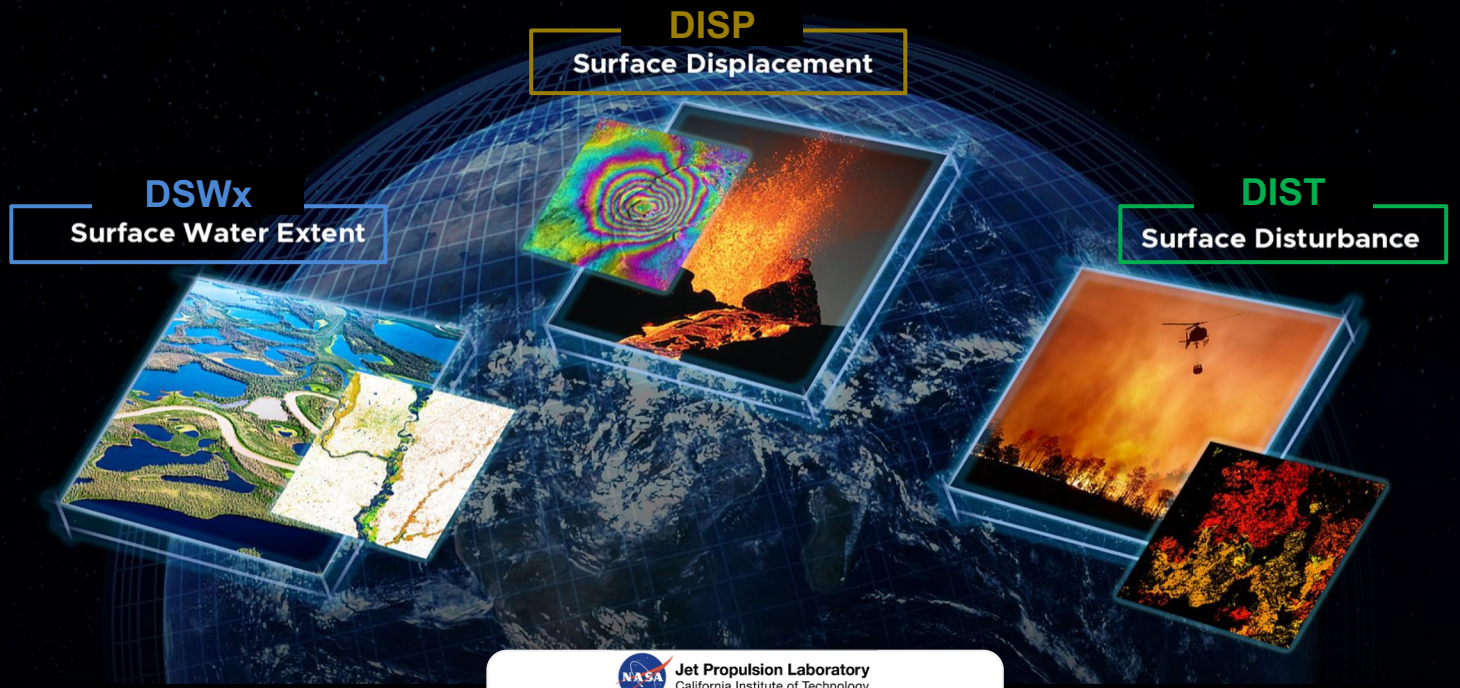
Observational Products for End-Users from Remote Sensing Analysis (OPERA)

OPERA

National Aeronautics and Space Administration

NASA

OPERA is funded to create **analysis ready *data products*** that directly address the needs of multiple U.S. Federal Agencies determined by Satellite Needs Working Group (SNWG) survey.



David Bekaert[1] on behalf of OPERA team
[1]Jet Propulsion Laboratory, California Institute of Technology

Jet Propulsion Laboratory
California Institute of Technology

USGS · NASA Goddard Space Flight Center · UAF University of Alaska Fairbanks · SMU · EarthScope Consortium · GLAD

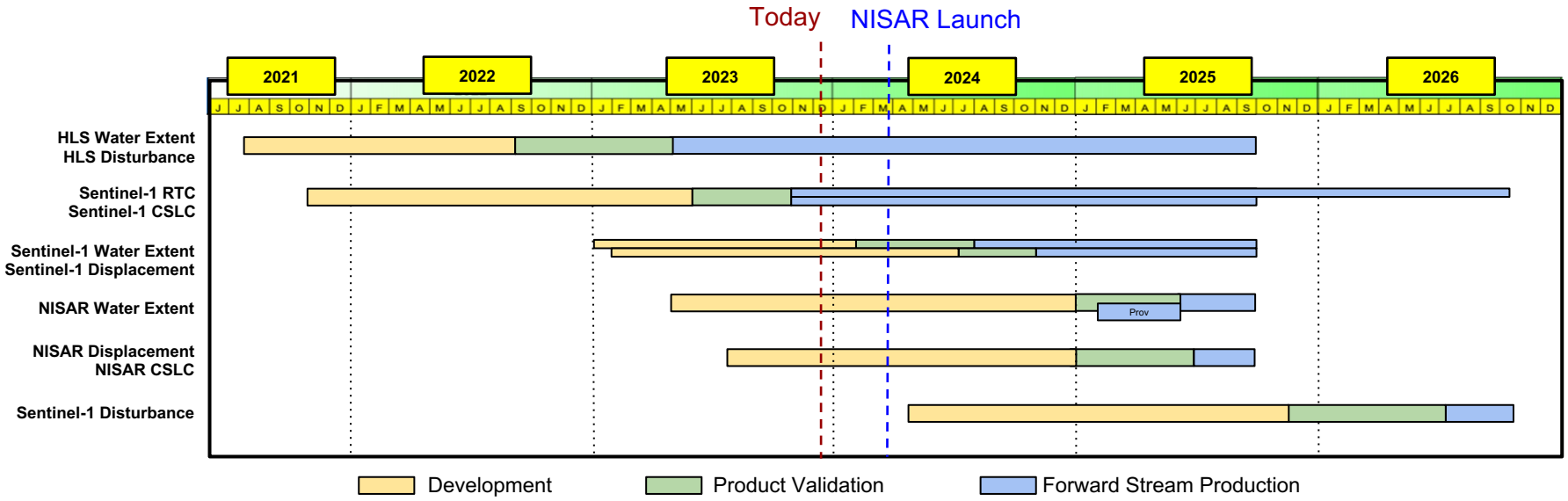
OPERA Team

National Aeronautics and Space Administration

www.jpl.nasa.gov/go/opera
www.nasa.gov

Schedule

National Aeronautics and Space Administration



A ***notional*** **Vertical Land Motion (VLM)** product proposed under SNWG 2022 cycle

- Staggered release to get products to users ASAP.

- On average 2 years from development to production.

- Four products in production.

Product Details: A SAR focus

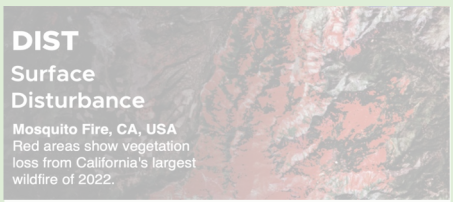
National Aeronautics and Space Administration

Level-3 products

- **Description:** Maps surface water using optical (HLS) and SAR imagery (S1, NISAR)
- **Coverage:** Near-global
- **Temporal resolution:** every few days
- **Spatial Resolution:** 30 m
- **Product Record Begins**: Apr. 2023 (HLS), Jul. 2024 (S1), May 2025 (NISAR)
- **Access**: PO.DAAC

Available now !

DSWx-SWOT
(delayed until further notice)



- **Description:** Maps vegetation disturbance using optical (HLS)
- **Coverage:** Near-global
- **Temporal resolution:** every few days
- **Spatial Resolution:** 30 m
- **Production Begins:** Feb. 2023 (HLS)
- **Product Record Begins:** Feb. 2023 (HLS)
- **Access**: LP DAAC

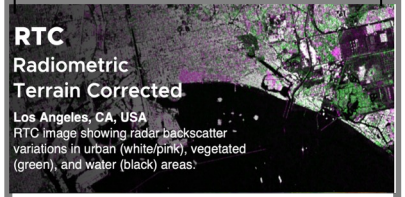
Available now!

***NEW product*:** SAR disturbance from S1

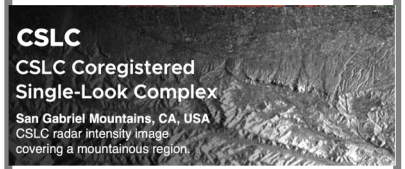
- **Description:** Maps surface displacements using SAR in LOS (S1 and NISAR)
- **Coverage:** North America
- **Temporal resolution:** 6, 12, or 24 days
- **Spatial Resolution:** ≤ 30 m
- **Product Record Begins:** Apr. 2014 (S1), TBD NISAR
- **Production Begins:** Oct. 2024 (S1) Jul. 2025 (NISAR)
- **Access**: ASF DAAC

Notional product: vertical + horiz. DISP products from S1 A/B

Level-2 products



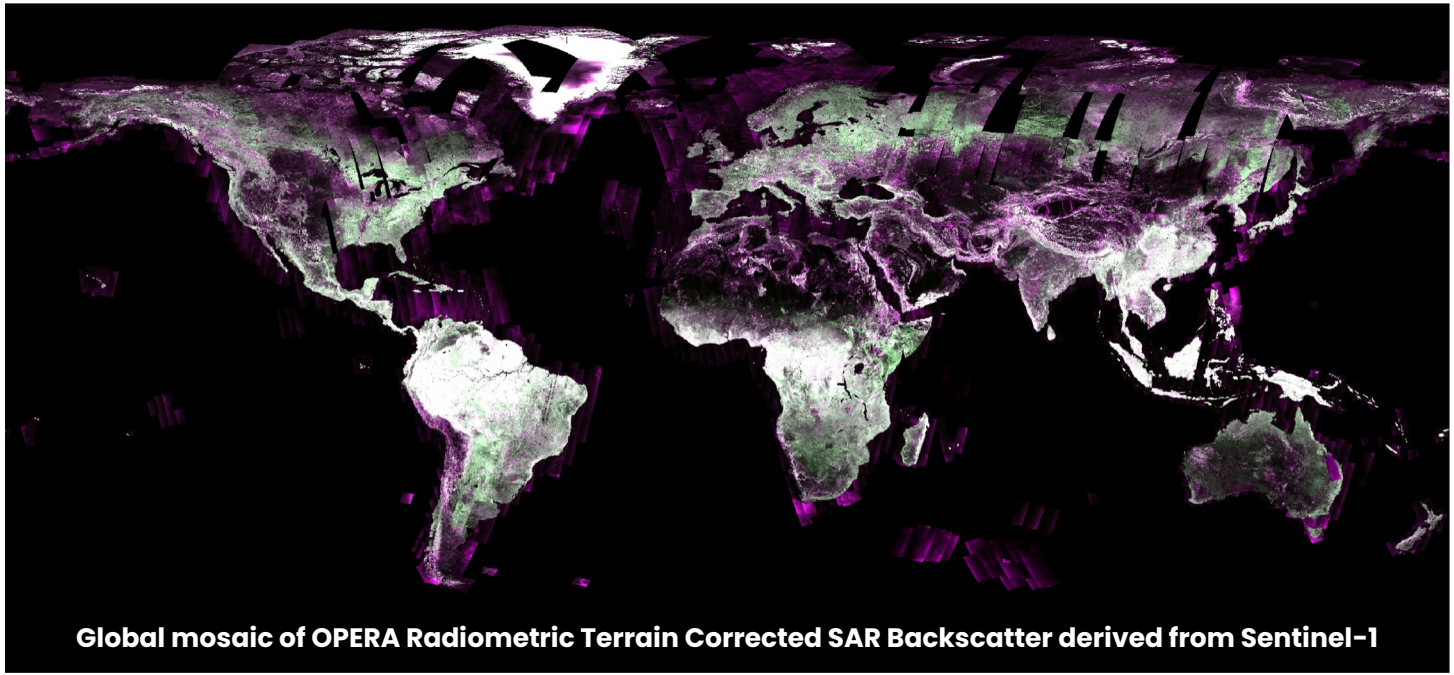
- **Description:** S1 radar backscatter corrected for the topography. Basis for the DSWx-S1 products.
- **Coverage:** Near-global
- **Spatial Resolution:** 30 m
- **Product Record Begins:** Oct. 2023
- **Production Begins:** Oct. 2023



- **Description:** Geocoded and coreg. S1 and NISAR SLC. Basis for all the DISP products.
- **Coverage:** North America
- **Spatial Resolution:** ≤ 10 m
- **Product Record Begins:** Apr. 2014 (S1) and TBD (NISAR)
- **Production Begins:** Oct. 2023 (S1), TBD (NISAR)

RTC-S1 SAR Backscatter

National Aeronautics and Space Administration



Global mosaic of OPERA Radiometric Terrain Corrected SAR Backscatter derived from Sentinel-1

Download OPERA RTC via ASF DAAC

ASF vertex

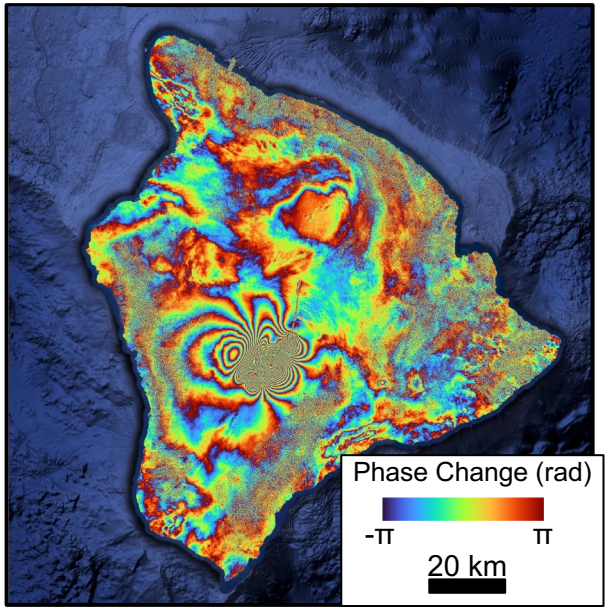
https://search.asf.alaska.edu/#/

Near-global RTC-S1 data are in production since Oct. 8, 2023.

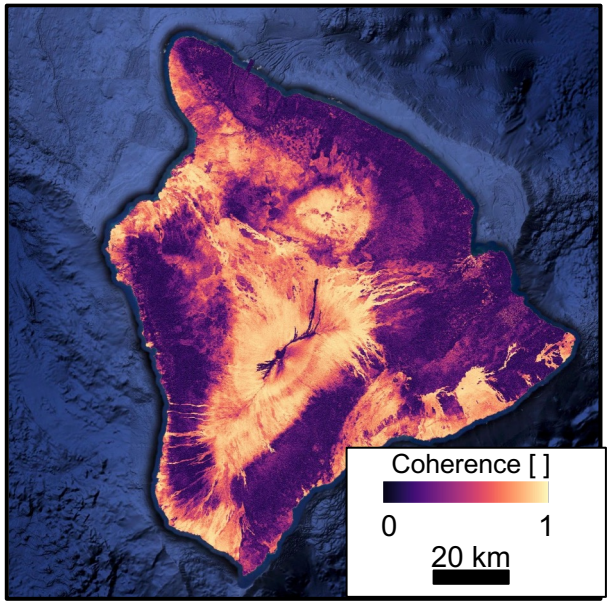
CSLC-S1

National Aeronautics and Space Administration

Interferogram from CSLC-S1



Coherence from CSLC-S1



Download OPERA CSLC via ASF DAAC

ASF vertex

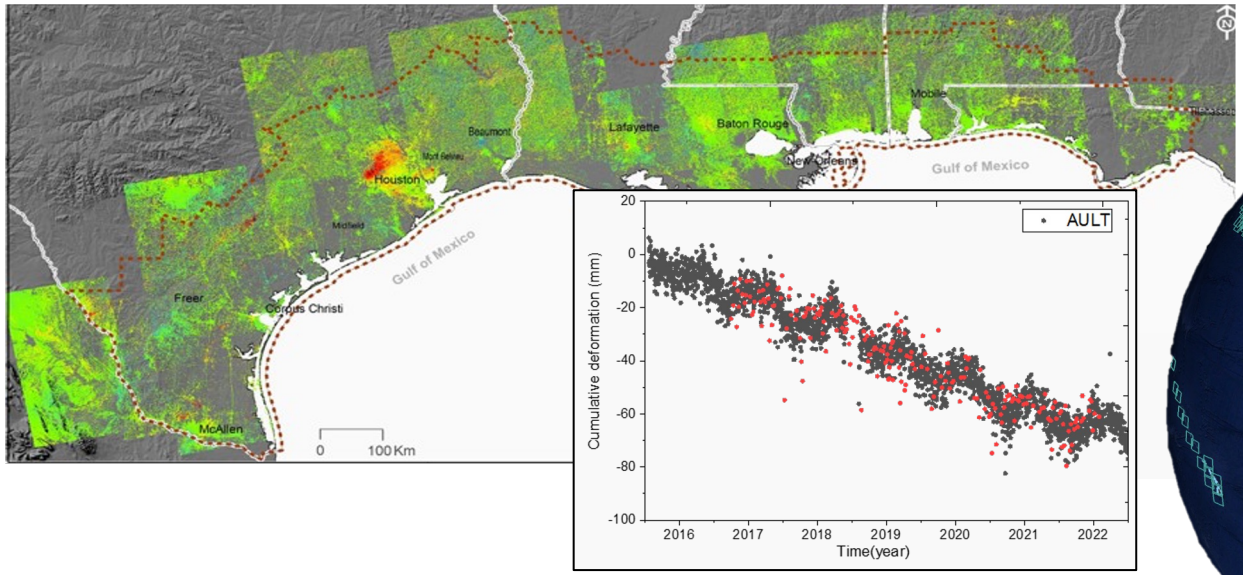
https://search.asf.alaska.edu/#/

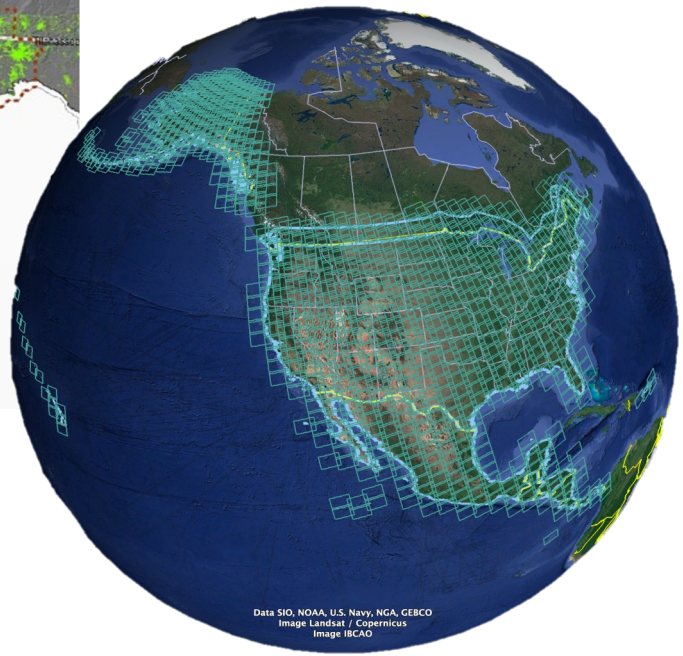
North America CSLC-S1 data are in production since Oct. 8, 2023.

DISP-S1

National Aeronautics and Space Administration

Combination of Persistent and Distributed Scatterer time-series





North America DISP-S1 data are expected in Fall 2024

Products will be distributed through ASF DAAC

Left credit: Zhong Lu et al, Southern Methodist University

Fourth OPERA workshop

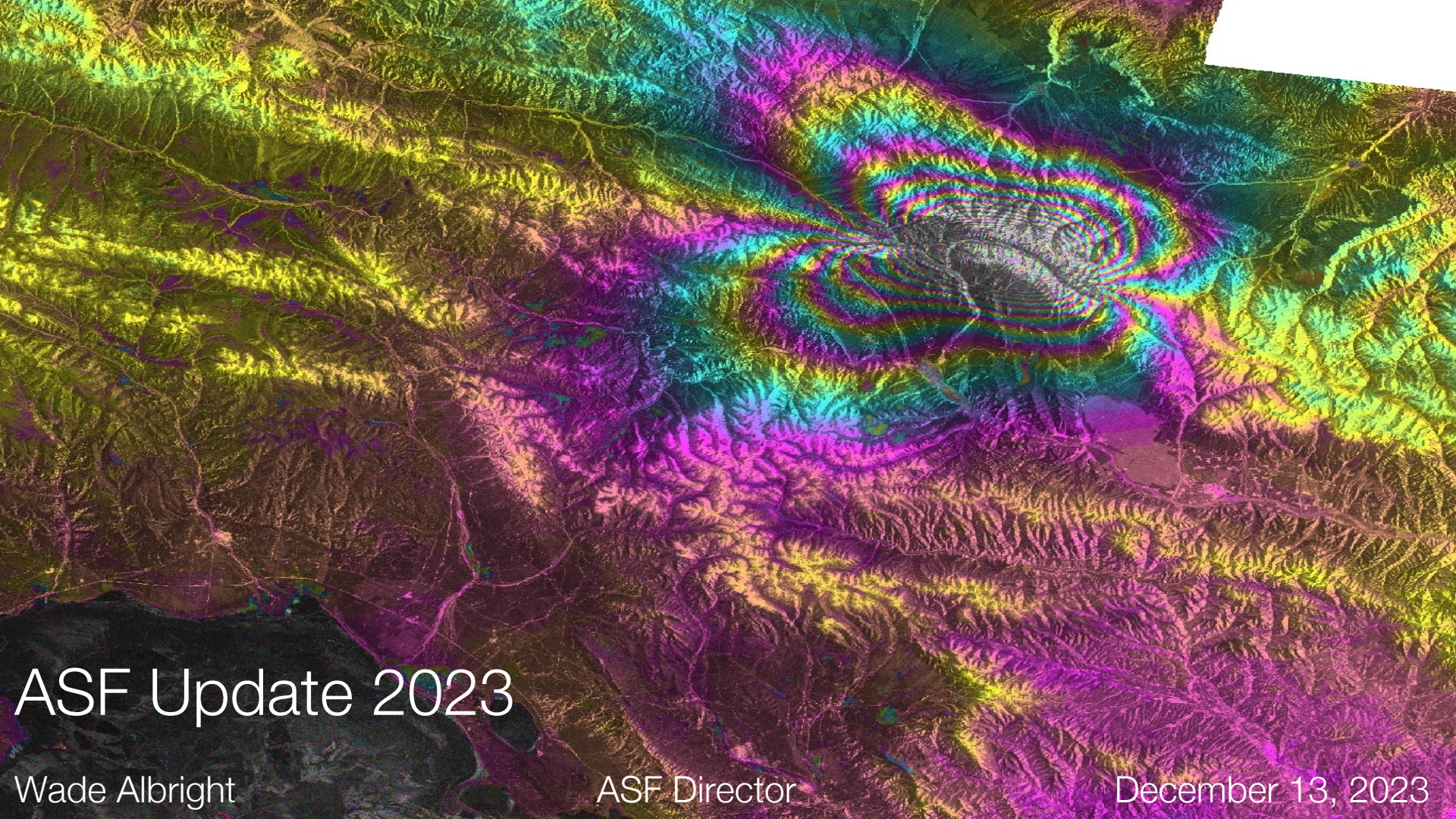
National Aeronautics and Space Administration

- July 19, 2024 in San Diego, CA
- Hybrid meeting set-up
- Collocated with the annual ESRI user conference
- Free and open registration

Register Today!

https://www.jpl.nasa.gov/go/opera/opera-workshops/fourth-workshop

Email: opera.sep@jpl.nasa.gov



ASF Update 2023

Wade Albright

ASF Director

December 13, 2023

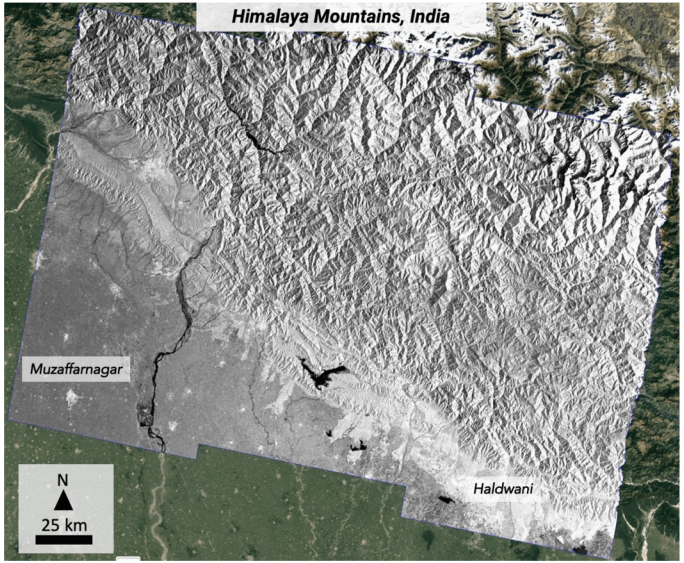
Preparing for NISAR

- Ingest pipeline complete
- Load tests
  - Completed ingest load testing
  - Preparing for distribution load testing
- Initial Services
  - Subsetting
  - Mosaicking
  - Conversions to multiple file formats

The JPL SDS and ASF are ready for NISAR

OPERA Products

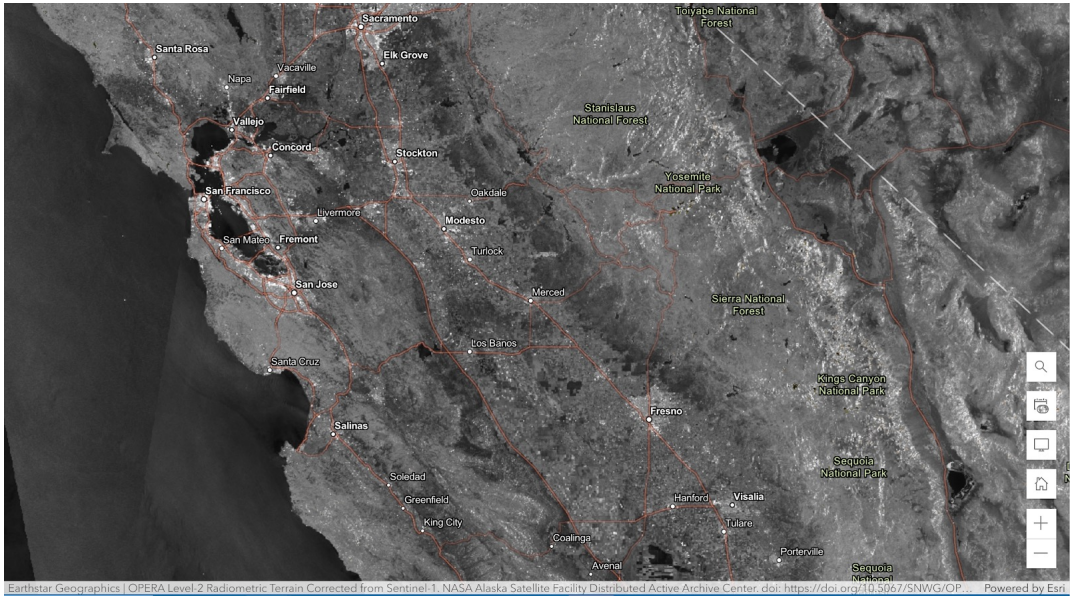
- Sentinel-1 CSLC & RTC are now available
- Coverage
  - CSLC cover North America
  - RTC near-global (not over Antarctica)
- RTC available via Image Services on EGIS
- Sentinel-1 Displacement products available in Fall of 2024
- NISAR Displacement products available Fall of 2025



Cloud-Optimized Access for OPERA S1 RTC

EGIS Image Services

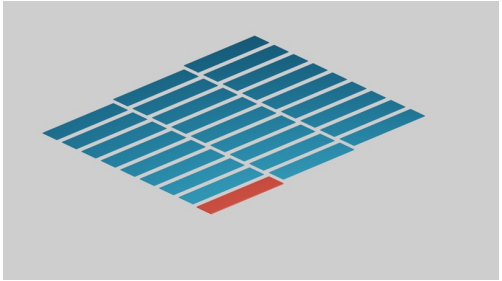
Explore the OPERA RTC-S1 products interactively in a web map using image services hosted by Earthdata GIS (EGIS).

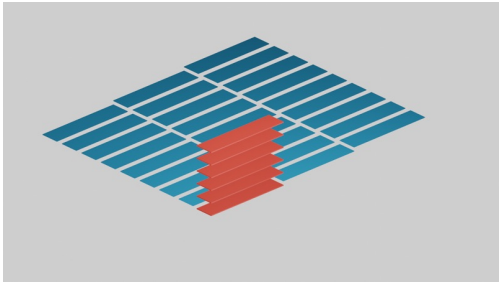


RTC Product Information

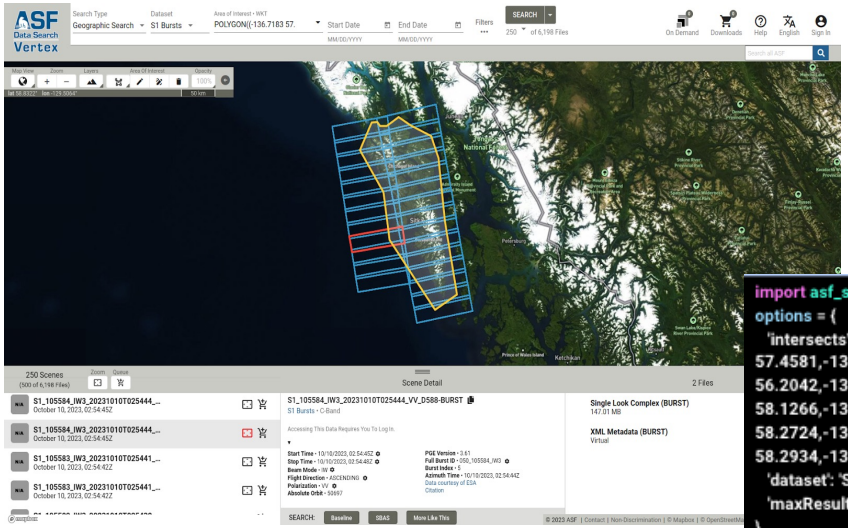
Sentinel-1 Bursts: Bite-sized, Consistently Framed SLC data

Bursts enable easier data access





S1 Bursts in Vertex..



and Programmatically

```
import asf_search as asf
options = {
  'intersectsWith': 'POLYGON((-136.7183 57.9598,-136.1427
57.4581,-135.9913 56.8778,-134.8806 56.0128,-134.3454
56.2042,-134.6382 57.0979,-134.7998 57.8686,-134.9768
58.1266,-135.4833 58.2547,-135.7731 58.3503,-135.9888
58.2724,-136.0629 58.2476,-136.2247 58.2476,-136.2932
58.2934,-136.4313 58.2883,-136.7183 57.9598))',
  'dataset': 'SLC-BURST',
  'maxResults': 250
}
results = asf.search(**options)
print(results)
```

S1 Frames are big : ~ 250 km

Burst SLC data Documentation

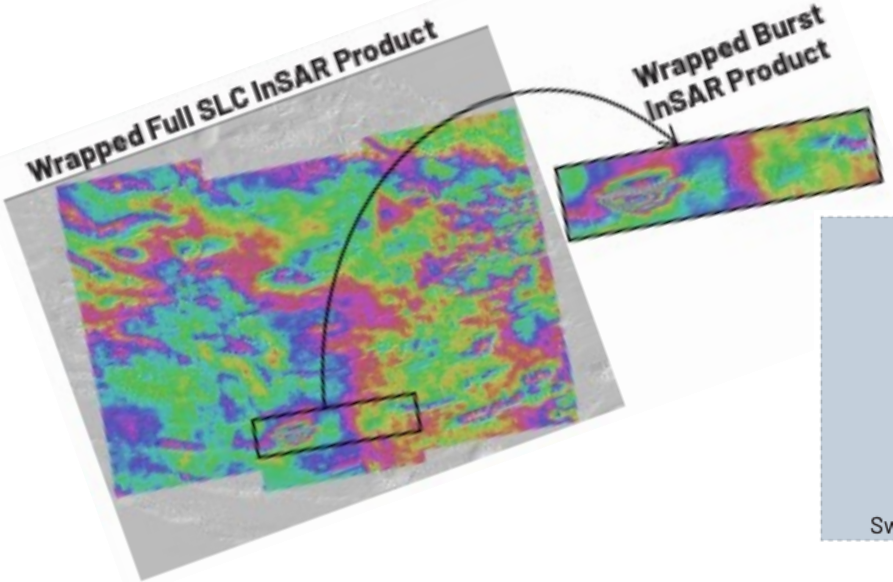
Burst-Based InSAR Available in HyP3

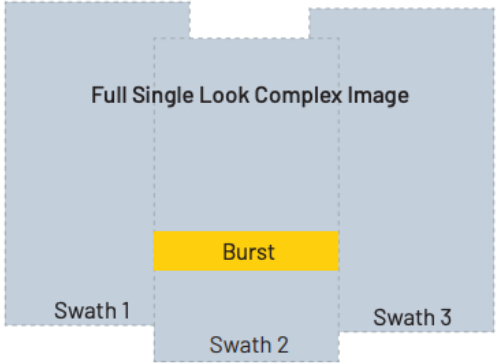
TRY IT!

	Full SLC	Single Burst
Free On-Demand	✓	✓
Vertex Support	✓	✓
Python SDK	✓	✓
MintPy Compatible	✓	✓
Fully Open-Source	✗	✓
InSAR Processor	Gamma	ISCE2
Avg. Scene Size	250x180 km	90x20 km
Processing Speed	43 min	7 min
Smallest Multilook	10x2 (40m pixel)	5x1 (20m pixel)
Scene Overlap	Partial	Full
Catalog Size	Entire Archive	Post 6/9/23*
Unwrapping Context	Large	Small

Unlike full SLC, bursts are co-geolocated

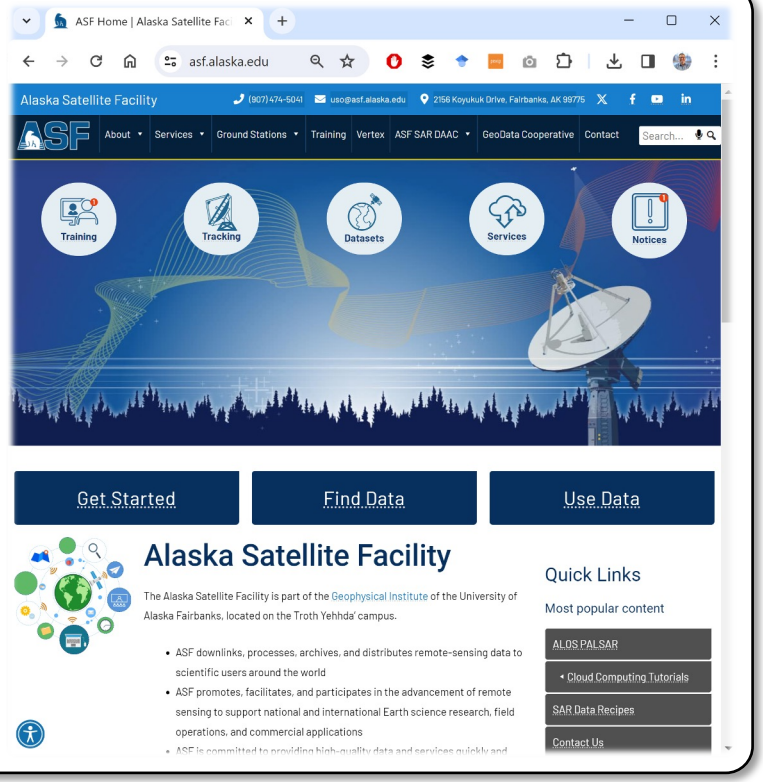
Burst-Based MintPy Tutorial



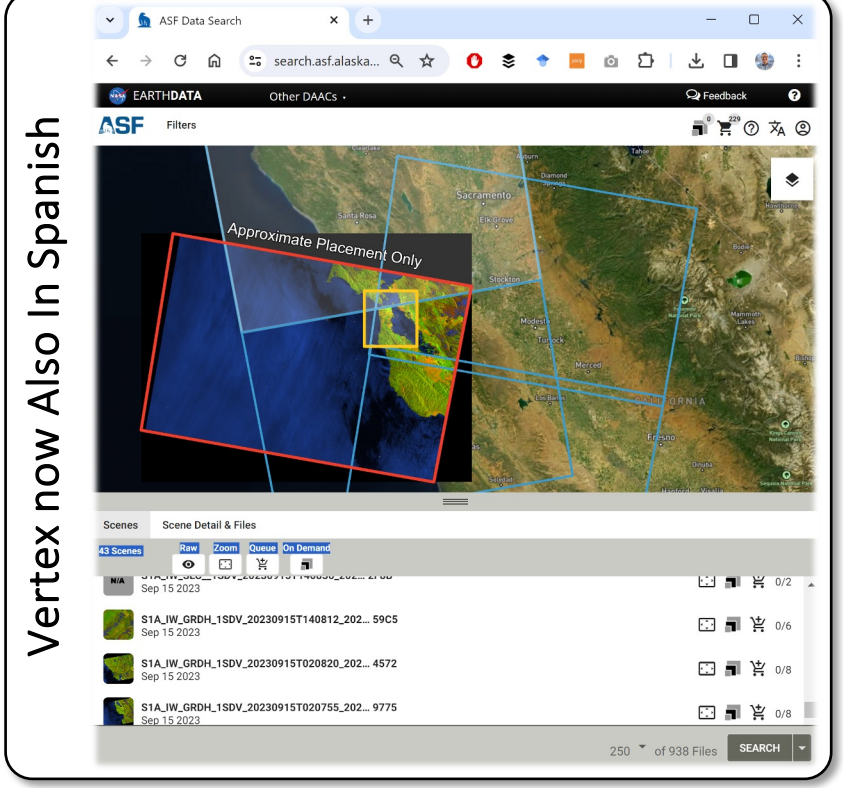


Interface Updates

New Website Design



Vertex now Also In Spanish



QUESTIONS ?

Visit our UAF/GI
Booth #432
@ AGU
Next to NASA

Contact ASF at:
uso@asf.alaska.edu
www.asf.alaska.edu

UAVSAR Update

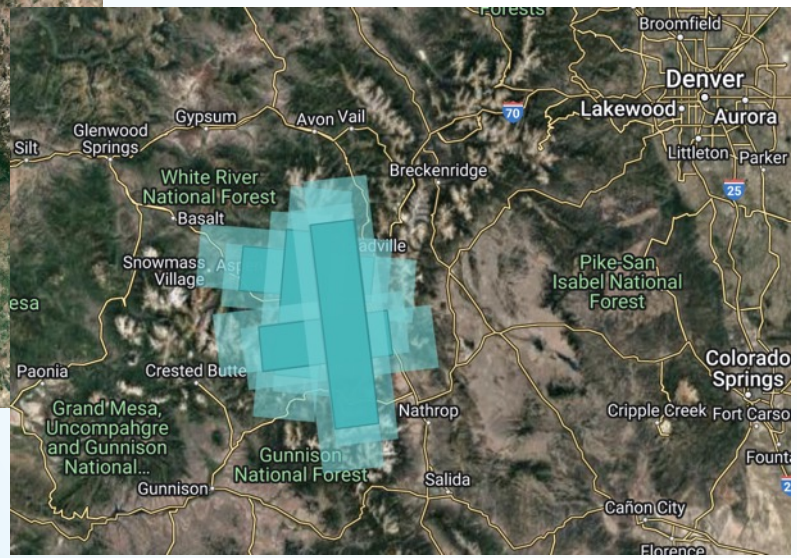
UAVSAR Project Manager: Yunling Lou

WINSAR Meeting, December 13, 2023

UAVSAR Landslide Observations in 2023

L-band

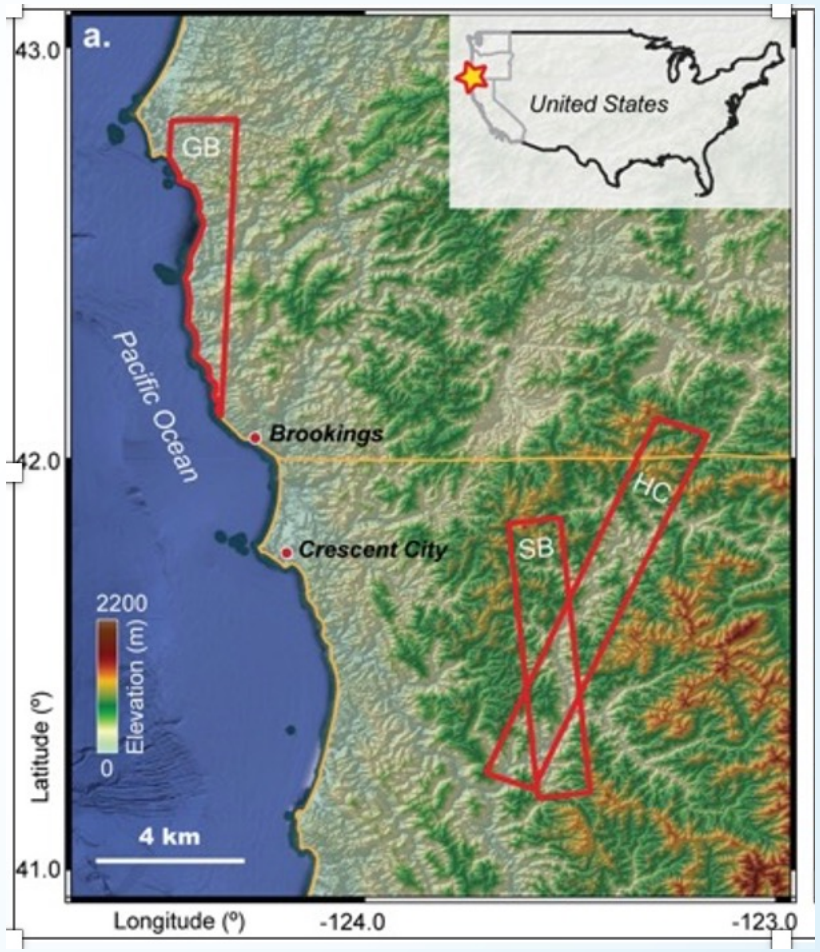
Slow-moving Landslides at Hayward Fault and Eel River



Deep-seated landslides in Sawatch Range, CO

P-band

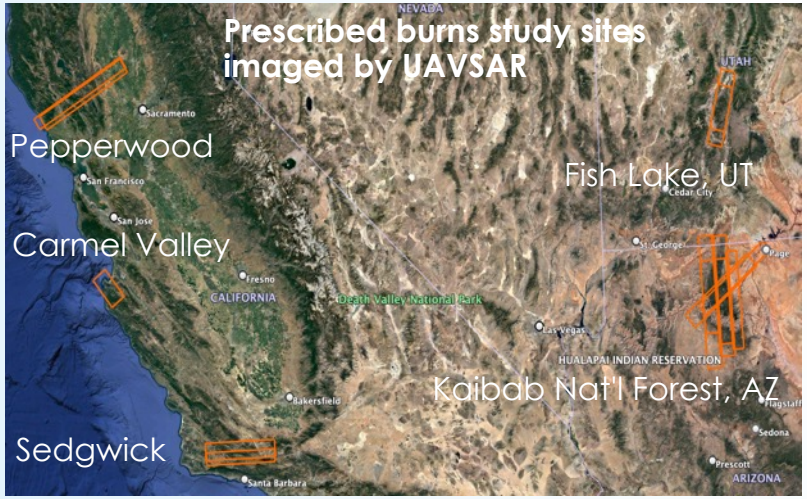
Deep-seated landslides in Pacific Northwest



UAVSAR's FireSense/FASMEE Fall 2023 Campaign

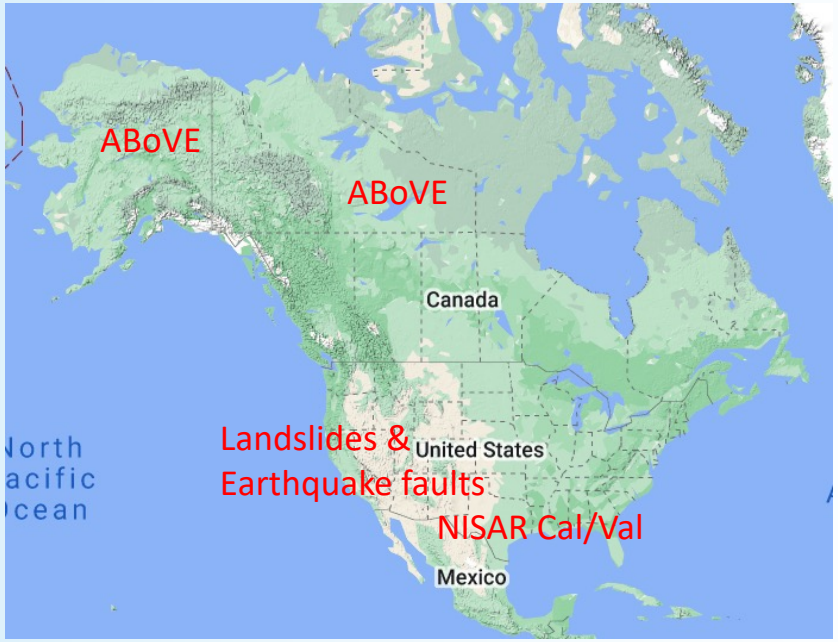
FireSense and FASMEE projects (Fire and Smoke Model Evaluation Experiment)

- Validate UAVSAR measurements with FASMEE field measurements of fuel load, using L-band SAR products to estimate biomass change pre- and post-burns.
- Validate UAVSAR measurements of fuel moisture with FASMEE field measurements using an established SAR soil moisture retrieval algorithm.
- Develop gap-filling fuel load and moisture products to integrate into existing platforms and prepare end users for NISAR products.



Planned UAVSAR Campaigns in 2024

- Busy year supporting ABoVE, R&A studies, NISAR post-launch Cal/Val activities, and technology demonstration



August (ABoVE), solid earth studies throughout the year

Nov/Dec

May (P-band), July (L-band)

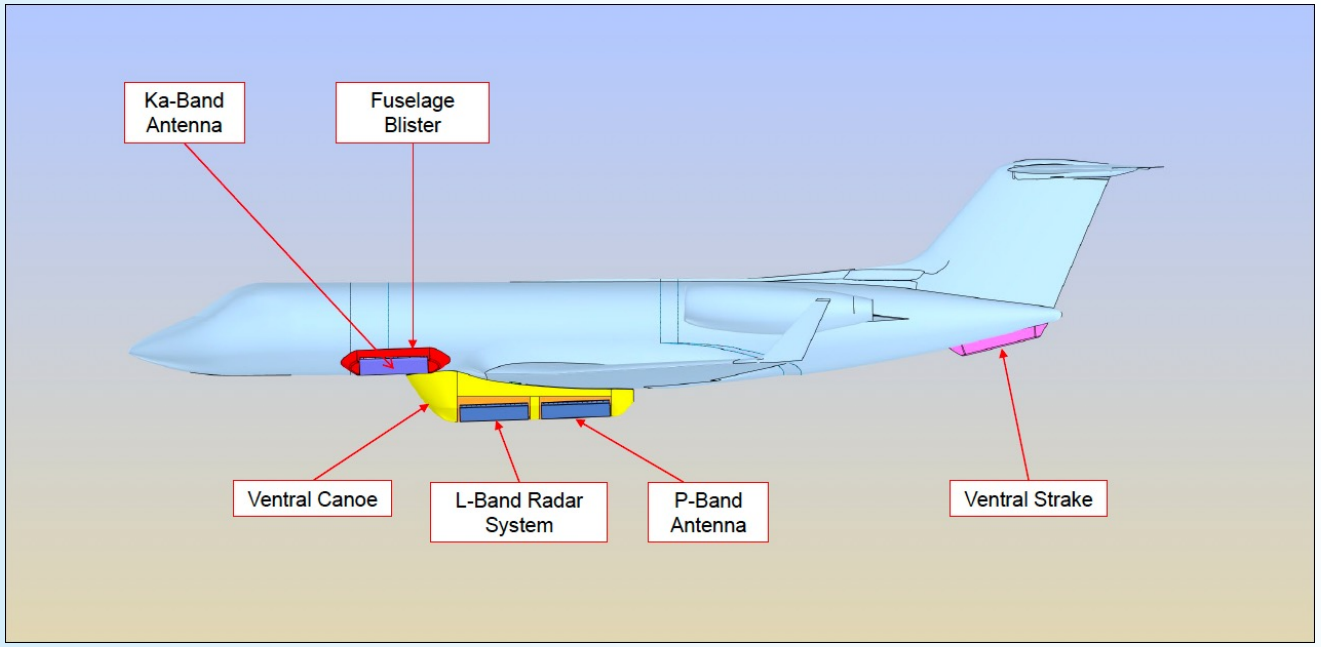
Accepting flights requests for any of the areas mentioned here

UAVSAR-NextGen Status

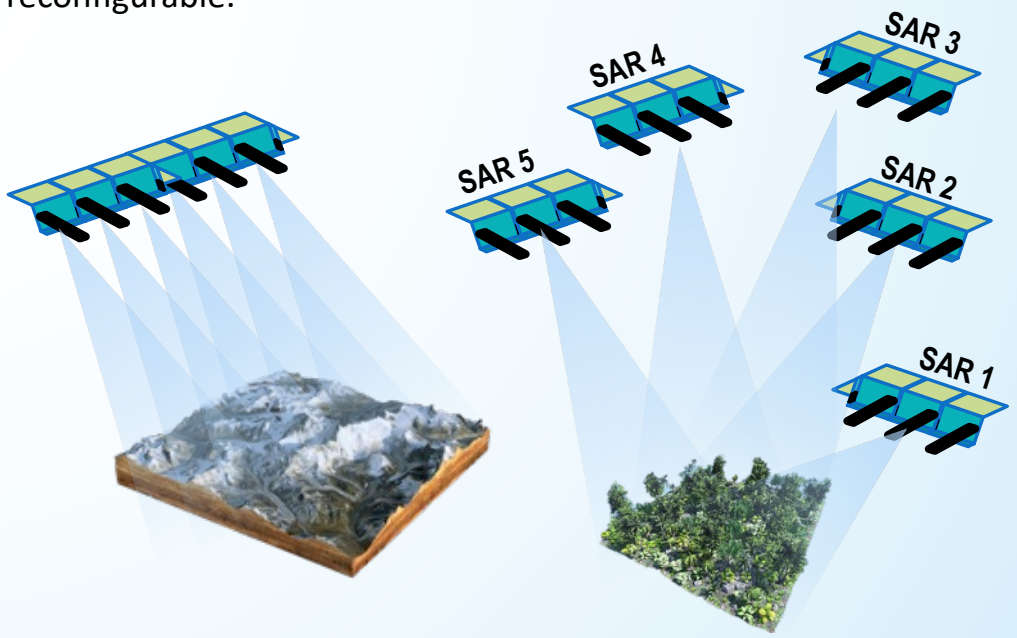
NextGen Objectives

- Ensure robustness of current capabilities; acquired a G-IV towards NextGen development
- Modernize UAVSAR capabilities so that it could be a testbed to push the envelope of future technologies that will enable future decadal surveys to make new measurements
- **Demonstrate flexible onboard digital beamforming synthetic aperture with UAVSAR**

G-IV AIRSAR-NG Concept, aircraft mod. in 2024



IIP concept with docked CubeSats to form a distributed aperture: Master-Sat performs digital beamforming and data downlinking for the Node-Sats. Flexible SAR aperture is expandable and reconfigurable.



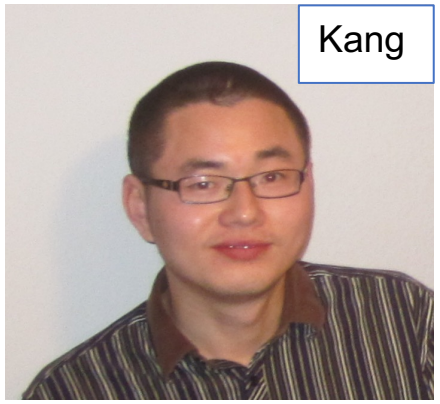
GMTSAR Progress - 2023

Developers: Xiaohua (Eric) Xu, Katherine Guns, **Dunyu Liu, Ann Chen**, David Sandwell, Paul Wessel, Robert Mellors, Eric Lindsey, Meng (Matt) Wei, Katherine Materna, Alexey Pechnikov, . . .
Funding: NSF Cyberinfrastructure, 3 years, UT Austin and SIO
GitHub: https://github.com/gmtsar

Milestones:

- Developing Python modules to replace the shell scripts and Jupyter notebooks for the example cases.
- Textbook is nearing completion with Cambridge open access contract.
- Developed on-line documentation - https://gmtsar.github.io/documentation/index.html
- Developed a Docker image of the stable C-shell version.
- Added a pre-processor for NISAR and Gaofen-3 satellite and their corresponding processing chains.
- Added GMT DEM generation script utilizing remote dem data.
- Added automated orbit downloading scripts.
- Added robust linear regression option for the time series module in the software.
- **Hosted a virtual EarthScope/GMTSAR short course with 343 students spanning June-July 2023**

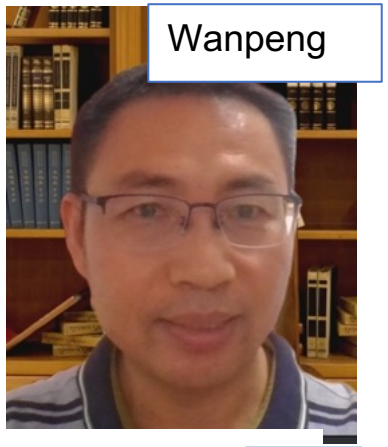
GMTSAR Instructors/ Staff - 2023


Kang


Kathryn


Katherine


Wojciech


Wanpeng


Katia

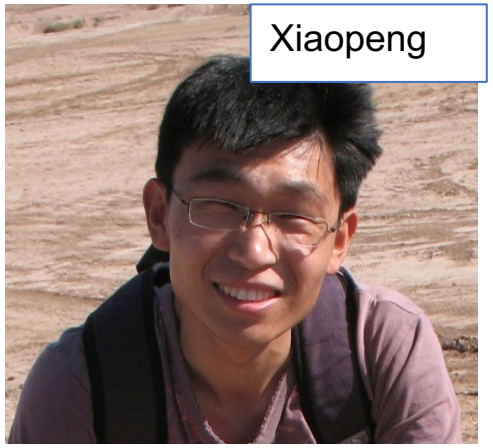

Xiaohua

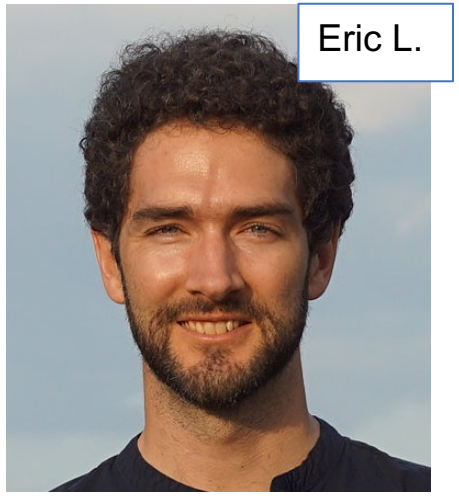

David


Matt


Wei


Wes

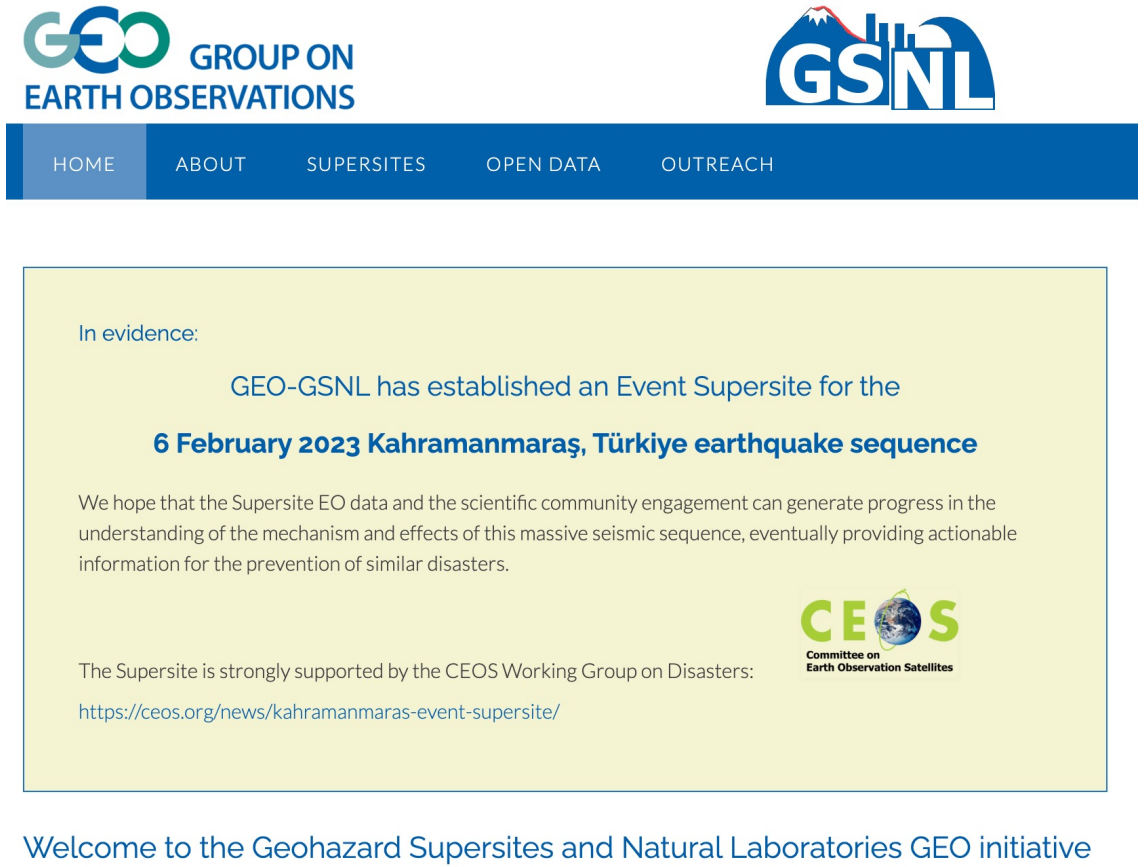

Xiaopeng


Eric L.


Melissa

Stefano Salvi
INGV
Chair of the Geohazard Supersites and Natural Laboratories

GEO initiative geo-gsnl.org



……Since UNAVCO now is fused in EarthScope, we would need to establish new contacts. Before it was mainly Chuck Meertens who supported GSNL.

What we would need is a way to provide easy access to the Supersite data, for instance through the SSARA archive of UNAVCO, if they maintain it, and some support for training in InSAR processing for students from developing countries Supersites.

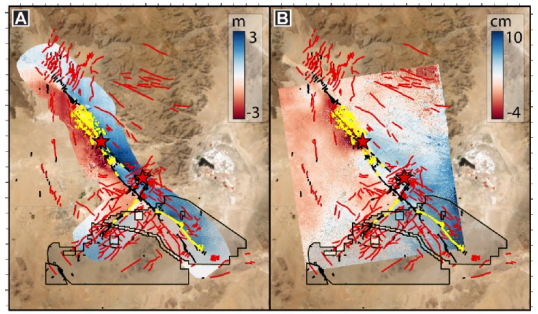
Geohazard Supersites and Natural Laboratories

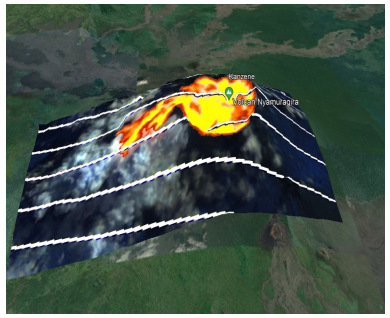
As of 2023: 13 Supersites and 1 Natural Laboratory + 1 Event Supersite.

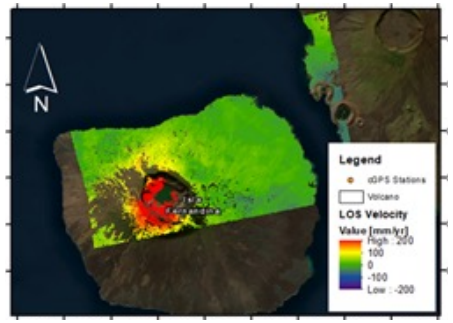
All together they receive 3-4000 images per year (X, L-band SAR, VHR optical) which become open for scientific research, together with local ground data. In most cases, the EO data are fundamental for operational hazard monitoring.

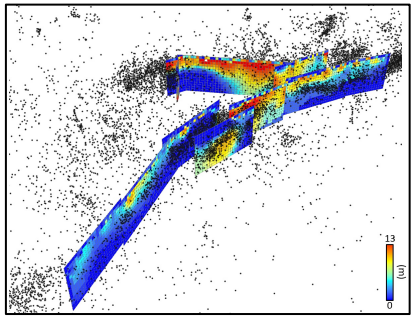
GSNL is constantly seeking support to develop scientific/monitoring capacities at the 3 Supersites in developing countries (Ecuador , Nicaragua, D.R. Congo).

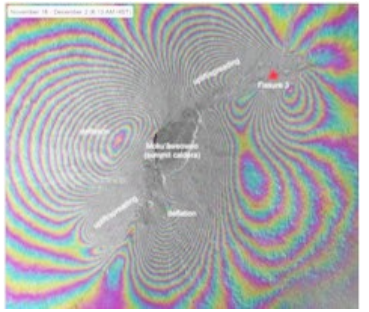
If EarthScope is able to help, we can discuss the possible ways offline.





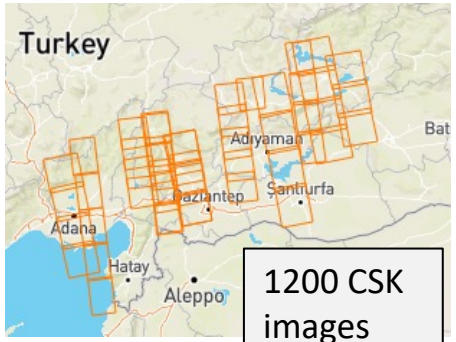






The Kahramanmaraş Event Supersite (see gsnl.org)

A large amount of X- and L-band SAR data, as well as VHR Pleiades optical imagery, have been acquired.



1200 CSK images

3700 SAOCOM images

EO data access for the Kahramanmaraş Event Supersite

The Kahramanmaraş Supersite is strongly supported by the Space Agencies participating to the CEOS Working Group on Disasters

https://ceos.org/news/kahramanmaras-event-supersite/

The following EO data are available for scientific use.

COSMO-SkyMed stripmap images

ASI post-seismic interferometric acquisition plan for COSMO-SkyMed satellites (repeat pass:16 or 24 days):

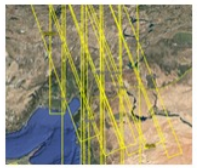
The CSK-CSG data are distributed through the **Geohazard Exploitation Platform- GEP**, under the folder Turkey EQ 2023

You can freely browse through the archive, but to be able to download the data, you have to follow the procedure described **here**

Note that before the event there were only a limited number of frames acquired over the area.

SAOCOM stripmap images

ASI interferometric acquisition plan for SAOCOM:



The SAOCOM data are distributed through the ASI SAOCOM data hub., but can be browsed also from the CONAE catalog.

To be allowed to browse and download the data from the ASI SAOCOM data hub, you need to register your membership (join the license to use the data). To do this you should go to https://www.asi.it/en/earth-science/saocom/ and follow the procedure explained in the Membership guide.

If you find the guide too dispersive, read below for a quick way to register (please have patience and read to the end...):

Read more

Pléiades Very High Resolution optical images

CNES will provide access to a quota of 5000 sq/km of new Pléiades VHR acquisitions.

Please contact the Supersite coordinators if you are interested in using these data for research.

Initial areas selected for acquisition are:

TerraSAR-X images

The German Space Agency, DLR, will provide access to 250 TerraSAR-X images over the Supersite area.

The data coverage will be decided by the Supersite coordinators. Please contact them if you need

Instructions for accessing the open EO data

GEO GROUP ON EARTH OBSERVATIONS

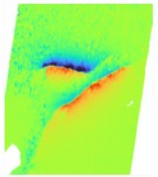
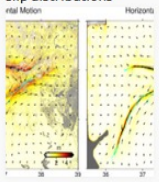
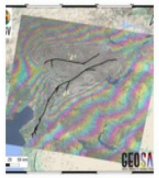
GSNL

HOME ABOUT SUPERSITES OPEN DATA OUTREACH

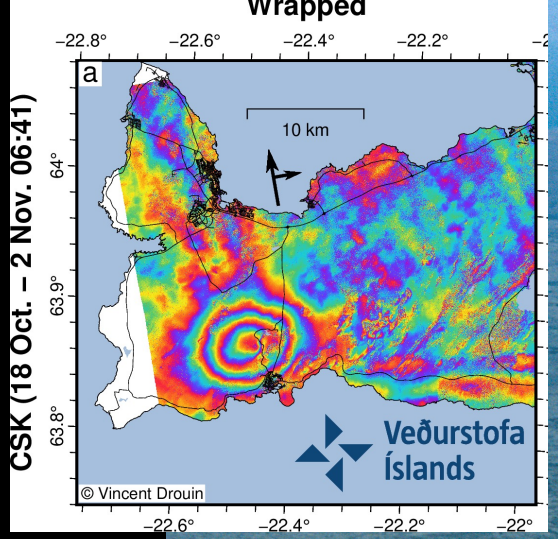
GSNL > CO-SEISMIC DISPLACEMENT FIELD

Co-seismic displacement field

Show 10 entries

ORIGIN	RESOURCE	HIGHLIGHT	
Canada Centre for Mapping and Earth Observation, Natural Resources Canada	Click here	Ground deformation from S1 and Radarsat-2 	2023-03-20
Ou, Q. et al., 2023	Click here	Strain, motion magnitude, 3D displacements, and surface slip distributions 	2023-03-15
GEOSAR Lab – INGV	Click here	Coseismic displacement from ALOS-2 InSAR 	2023-03-08
Operational Unit BEYOND Center of IAASARS/NOA	Click here	S1 InSAR products 	2023-02-24

Open sharing of early scientific results, with public access



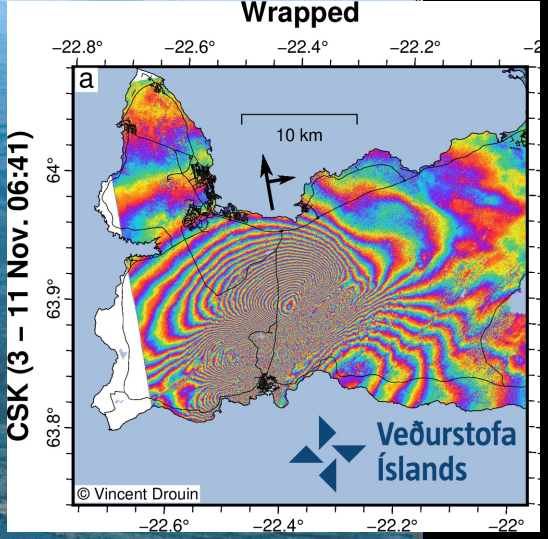
Reykjavík

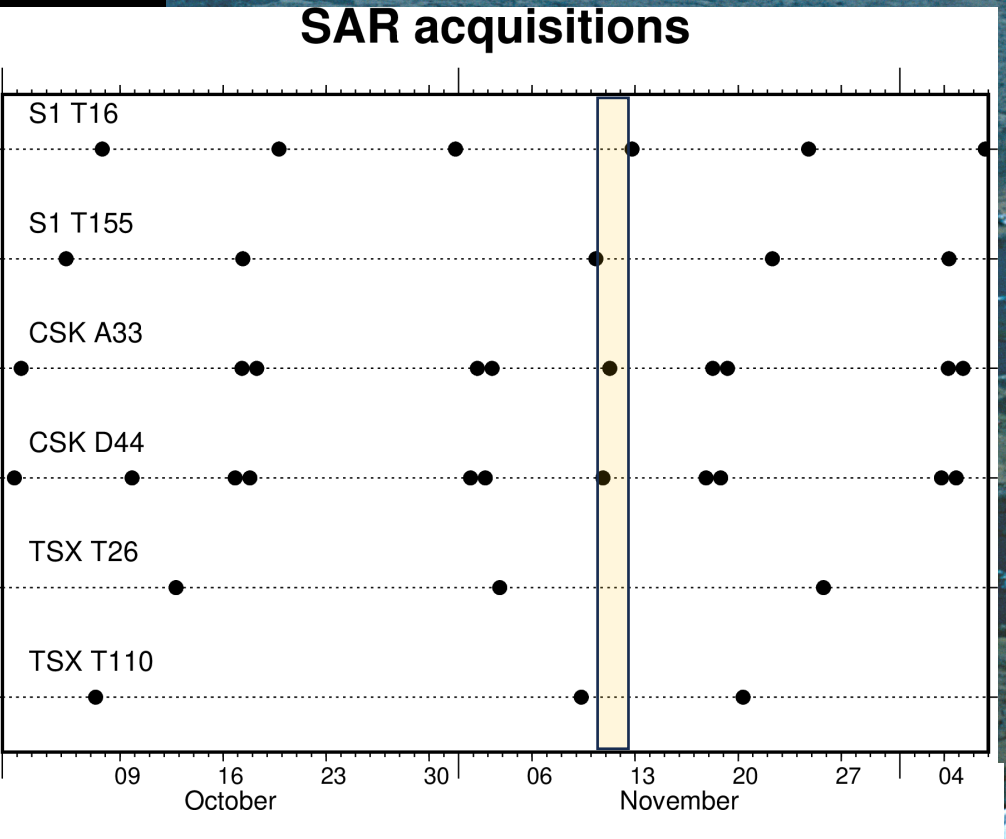
Fagradalsfjall

Area of inflation/deflation

Svartsengi
(Blue Lagoon)

Grindavík

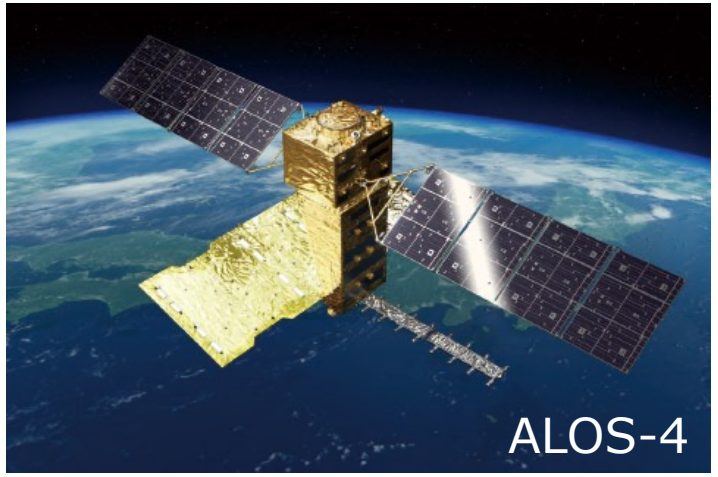




Approximate surface projection of dike in November 2023

Icelandic Volcanoes Supersite

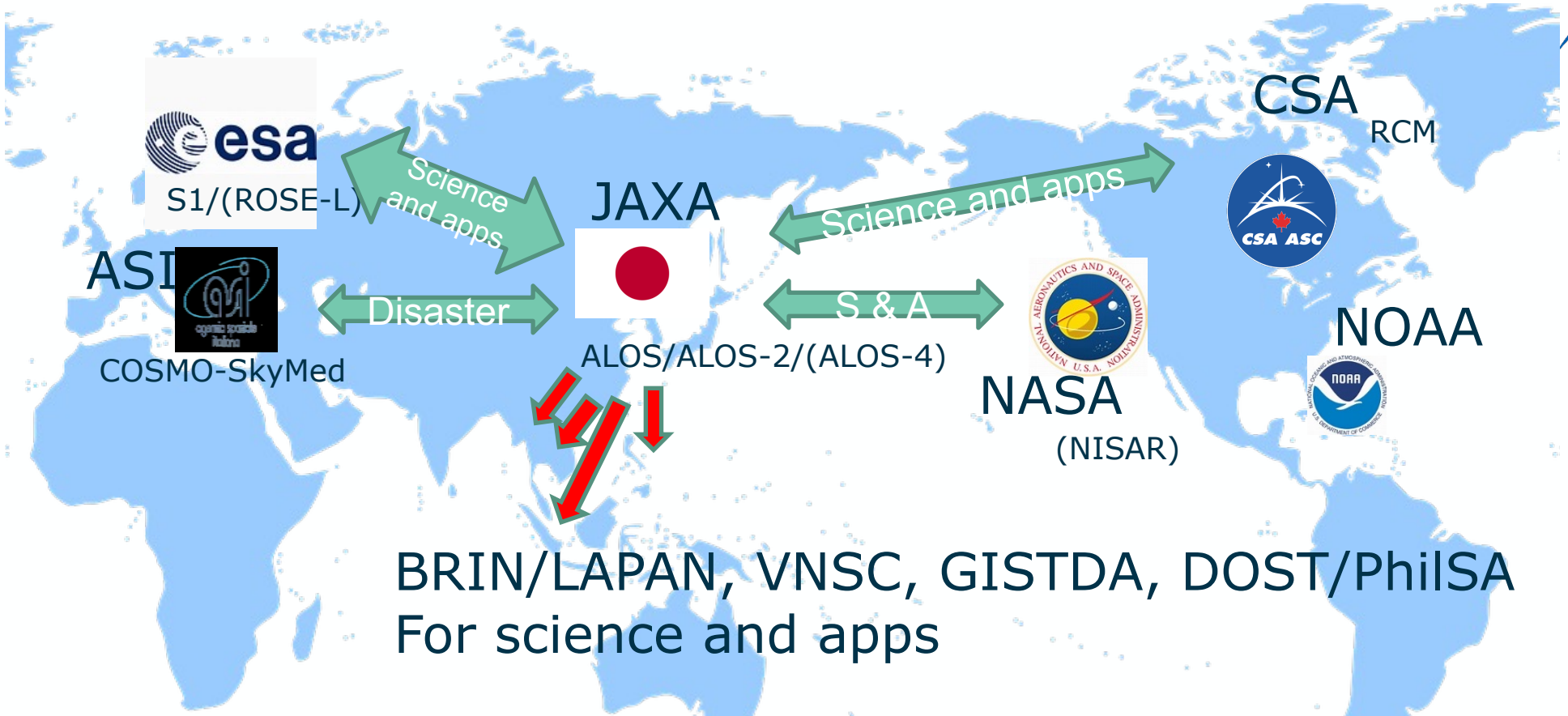
Photo: Oddur Sigurdsson
Icelandic Meteorological Office



Status Update of ALOS-2/4

Shin-ichi Sobue
JAXA Deputy Chief Officer of Earth Observation Missions

SAR international cooperation



COSMO-SkyMed

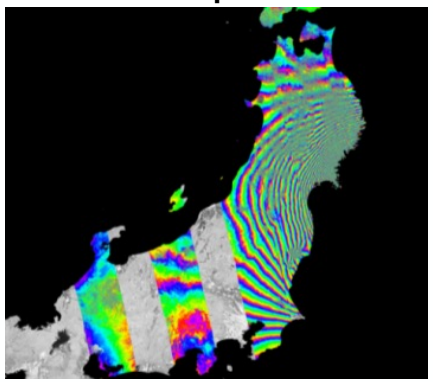
- Science and apps: Ocean (Sea Ice, ship, oil spill), Land use (agriculture, soil moisture, SWE, crustal deformation - volcano, subsidence, LULCC, forest) with disaster response

-> International SAR WS #3 will be held in Japan in November 2024 (TBD)

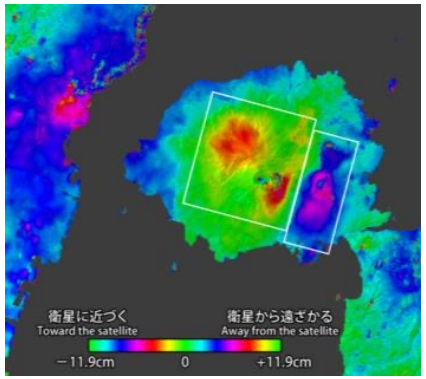
ALOS-2 Mission Objectives

Disaster monitoring

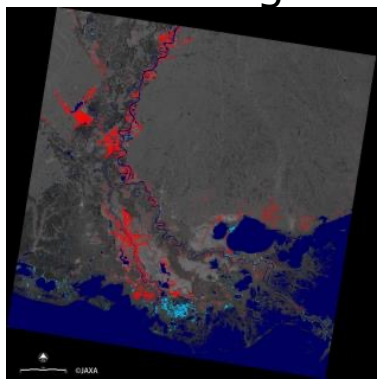
Earthquake



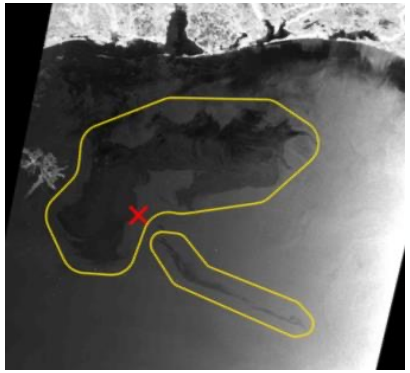
Volcano



Flooding

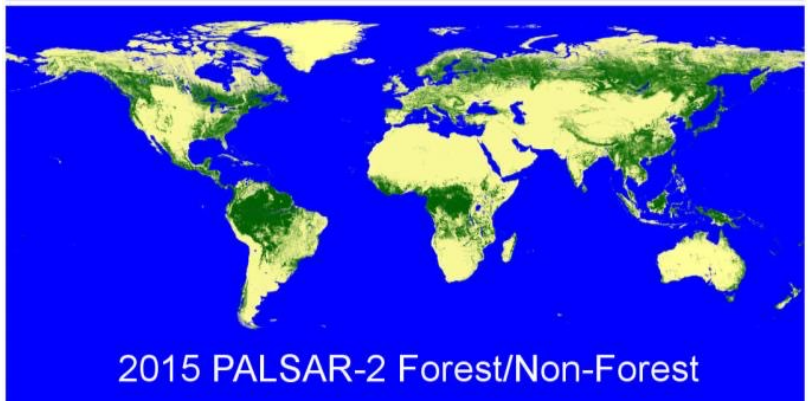


Ocean

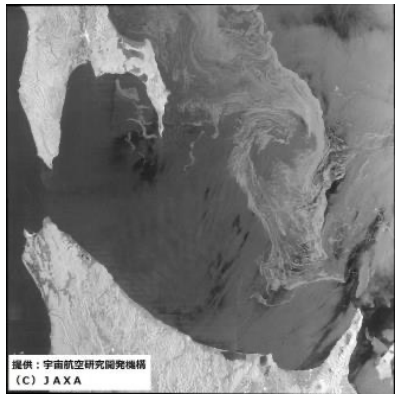


Environment and land management

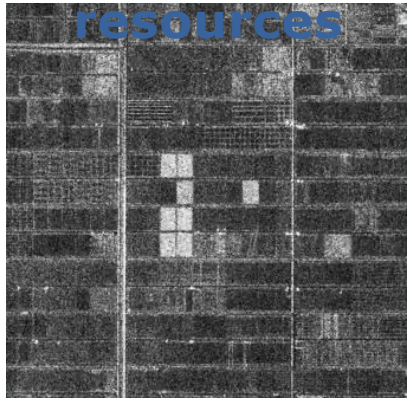
Forest and wetland



Ice

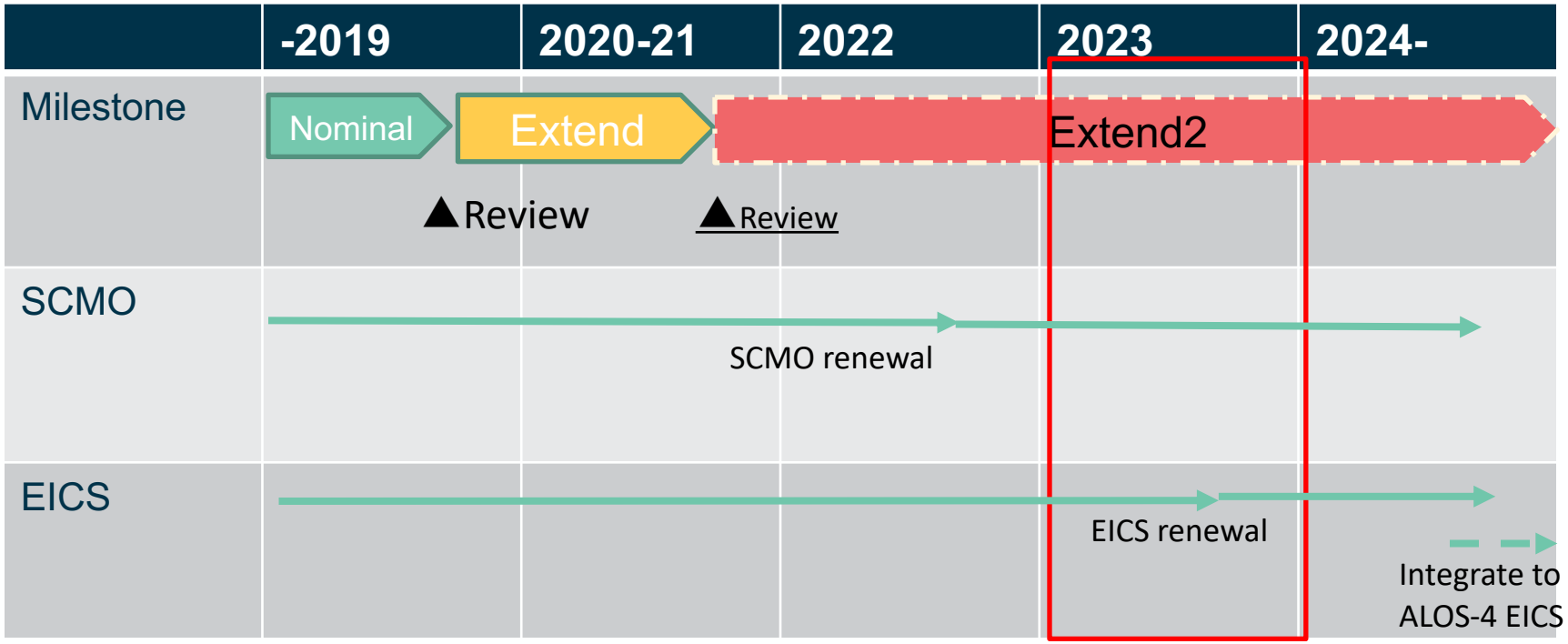


Agriculture & natural resources



3

ALOS-2 Extend observation phase



Target of ALOS-2 mission for 2023 operation

- 9 years continuous observation operation
- Archive global and continuous SM3 and WD1 observation with intensive time series observation in selected area including research and development to prepare ALOS-4 bi-weekly SM3 observation and promoting multi frequency observation in cooperation with ESA, CSA, ASI, NASA and other international partners.
- Develop one year overlap observation plan of ALOS-2 with ALOS-4

ALOS－2 system operation status summary

Subsystem	Status	Note
SAP	Green	-
EPS	Green	-
AOCS	Green	Earth sensor operation is suspend
Propulsion	Green	-
CDMS	Green	-
DT	Green	-
DRS	Green	August 5, 2017 DRTS operation was completed
MDPS	Green	System reset because of SEU
THERMAL	Green	-
PALSAR2	Green	System reset because of SEU

Cal/Val status: Green: https://www.eorc.jaxa.jp/ALOS-2/calval/calval_jindex.htm

Limitation of ALOS-2 operation in extend observation period

Duty cycle (maximum observation time per an orbit) will be reduced in extend observation period to continue to operate ALOS-2 with overlapping with ALOS-4 observation

- Until 2019.10.20 (137 orbit cycle)　Duty50%
- **From 2019.10.21 (138 orbit cycle) Duty30%**

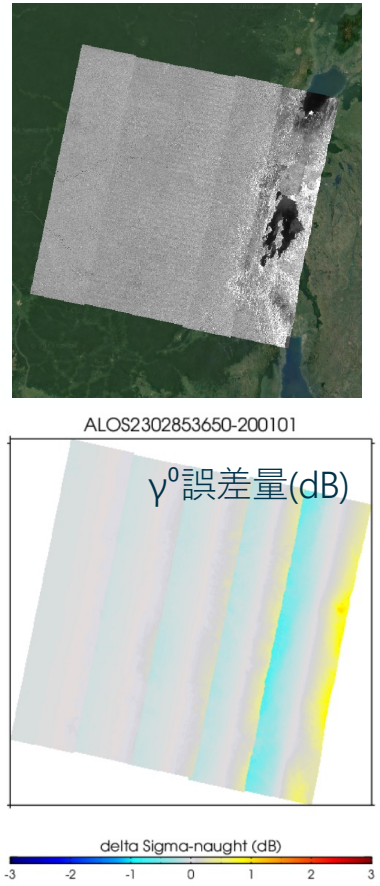
BOS was revised owing to reduce duty cycle with following points

- ✓ SM3 global observation (Two times per a year with high priority –> Once per a year with high priority and once per a year with low priority)
- ✓ Put high priority to un observed area with SM3
- ✓ Put high priority to selected area with intensive observation with SM1, SM2 and SM3 to promote Japanese L-SAR operational and research usage in cooperation with national and international partners

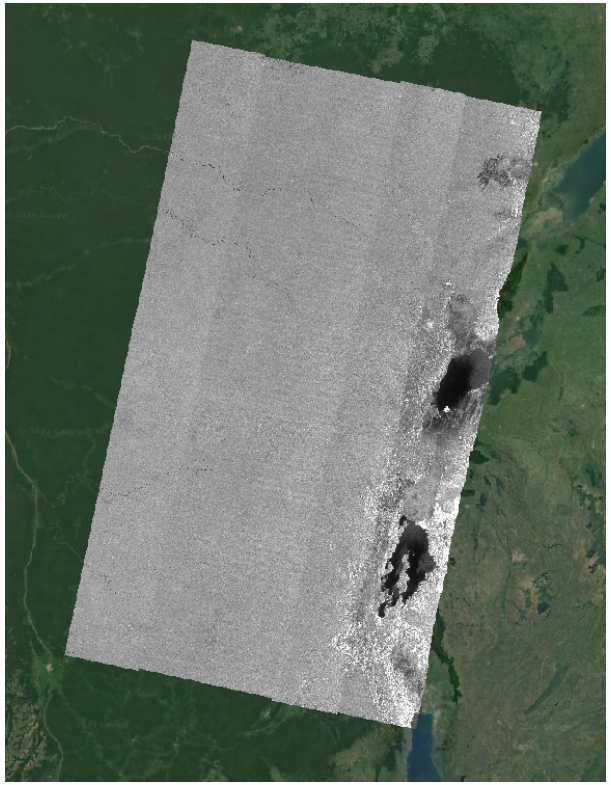
–> Need to revise observe priority and observation coverage

ALOS-2 ScanSAR L2.2 Stripe noise

Antenna pattern correction using ellipsoid height

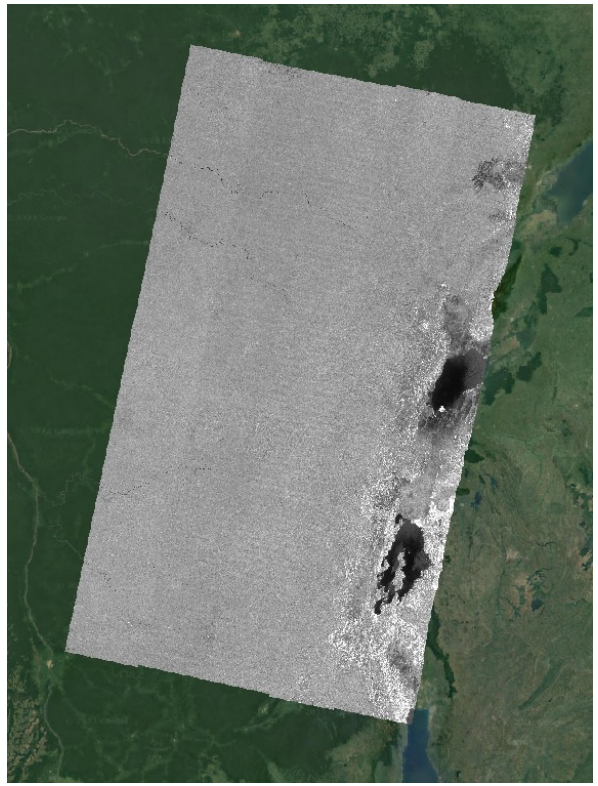


Full aperture：アンテナパターンずれ補正なし



スキャン間輝度の不連続が楕円体高の高い地域で明瞭

Full aperture：アンテナパターンずれ補正適用



スキャン間輝度の不連続が低減

- ✓ Confirm strip noise reduction with this ellipsoid height correction
- ✓ Will verify several data with this correction algorithm and will start reprocess of all ALOS-2 ScanSAR data on G-portal, GEE and AWS before the end of this JFY

ALOS series Open and Free Data

1. JAXA G-Portal
L1.1 ScanSAR Full aperture mode data is available free of charge from G-Portal.
* File size of L1.1 data is quite huge (30 GB for single polarization and 60 GB for dual polarization data).

How to download the data from G-Portal
https://www.eorc.jaxa.jp/ALOS/jp/dataset/images/open_and_free_howtouse_g-portal.gif

*** JAXA plans to limit 5 scenes per a day per a G-Portal user because a few users who order hundreds order data request from a single user makes long long stand by list to down load data.

2. Google Earth Engine for PALRSAR-2 ScanSAR CARD4L, FNF, MOSAIC with ALOS ANIVR-2 OLI
https://code.earthengine.google.com/18927a33b2f3197e12bdead34062581d

3. AWS Open Repository
Registry of Open Data on AWS
https://github.com/awslabs/open-data-registry/blob/main/datasets/jaxa-alos-palsar2-scansar.yaml
PALSAR-2 ScanSAR L1.1 and CARD4L (L2.2).

STAUS of ALOS-2 Cooperation

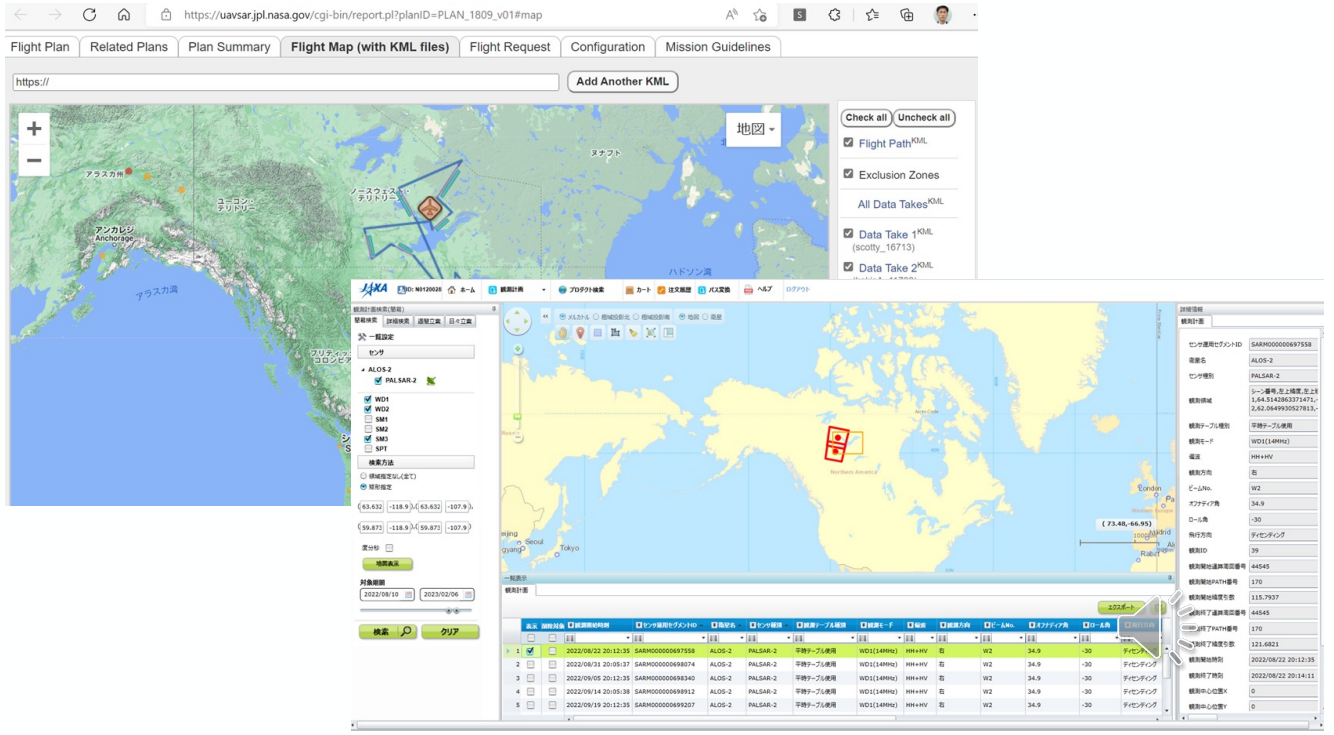
1. 823 scene of ALOS-2 observation data during April and October 2023 are delivered to NASA for joint research defined in PIP for the following topics
- 3.3.1. Polar Area/Sea Ice Monitoring
- 3.3.2. Forest and Wetland and Inundation Mapping

- 3.3.3. Ocean Monitoring
- 3.3.4. Soil Moisture
- 3.3.5. Monitoring Agriculture and Green House Gasses (GHG)
- 3.3.6. Natural Hazard Monitoring
- 3.3.7. Joint validation Algorithm development of SAR

2. Conference
- JAXA-NASA joint study report, IGARSS 2023, July

3. Way forward
- Enhance bilateral cooperation to promote SAR science and application cooperation including campaign projects observation (e.g. forest, cal/val, etc.)
- Promote Multilateral cooperation with NASA, CSA, ASI and VNSC under international SAR workshop framework with strong support by NASA to have #3 workshop in Japan in 2024

2023/4/1-2023/10/31	ESA	NASA	CSA
Cryosphere	81	152	91
Ionosphere	155	9	
Land (incl Soil Moisture)	902	53	1374
Forest and Wet		221	
Hazard		208	
Maritime	100		
Sea Ice	395	180	
Total	1633	823	1465



Grounding Zone Measurements from Spaceborne Interferometric SAR as a Crucial Descriptor of the Ice Ocean Interface of Glaciers

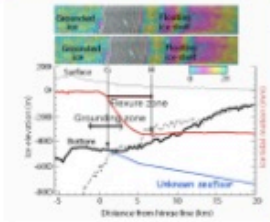
C15D-0614

Bernd Scheuchl[1], Eric Rignot[1,2], Jeremie Mouginot[1,3], Pietro Milillo[1,4], Seongsu Jeong[2], Hanning Chen[1], Enrico Ciraci[1], Virginia Brancato[2]

[1] University of California, Irvine; [2] NASA JPL; [3] Université Grenoble Alpes; [4] University of Houston;

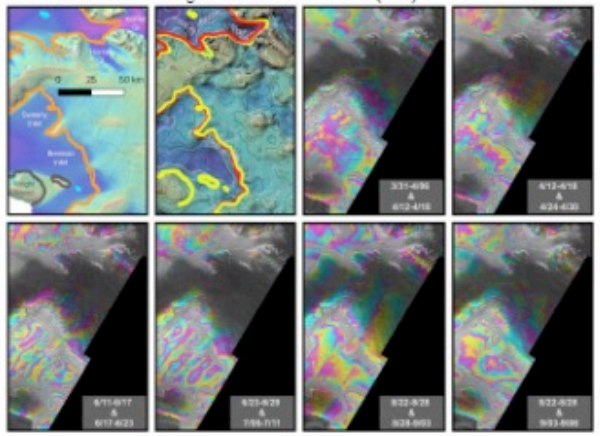
Background and Motivation

The ice-ocean interface of a glacier is a critical boundary and is described by the *grounding line* (GL), which delineates where ice detaches from the bed and becomes afloat and frictionless at its base. We use synthetic aperture radar (SAR) double difference interferometry to measure the GL position based on its sensitivity to differential tide state differences. Suitable data were sparse in the past, resulting in only a few GL collected for any given region in Antarctica. Current generation SAR missions acquire data suitable for GL measurements more frequently, enabling many GL delineations over the course of a year. Using this new wealth of data, we observe variations of the GL position at tidal cycles. This variation is significantly wider (typically 10 times) than expected from hydrostatic equilibrium. This short-term variation has an impact on the ice-ocean boundary and how it should be modeled.

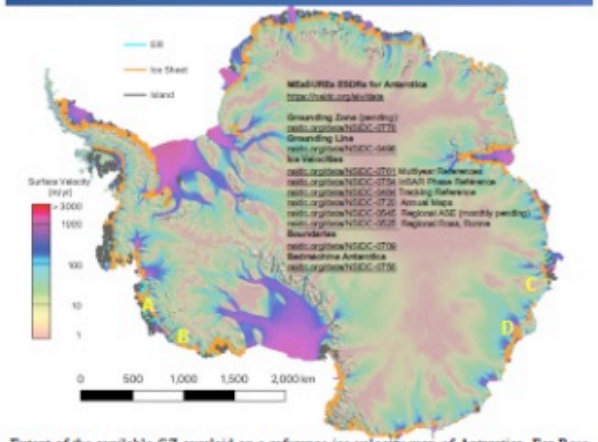


A double difference interferogram shows the flexing of the floating ice due to a difference in tide states in form of a band of dense fringes. The upstream bound of this fringe band is the GL. The location of the GL changes for different measurements. This is different from the flexure zone.

Example A: Kohler Glacier, Amundsen Sea Embayment and Eastern Getz Ice Shelf.
Double Difference Interferograms shown from Sentinel-1 (2018)



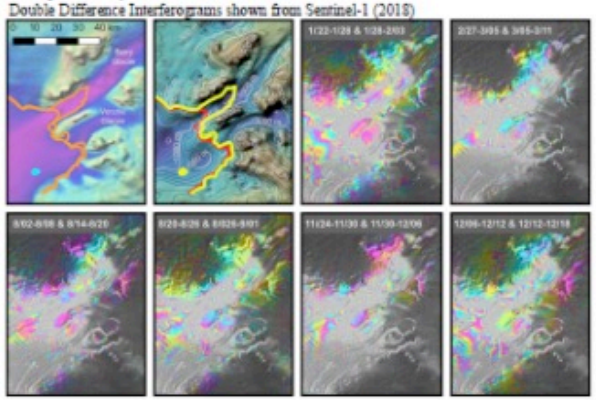
The Grounding Zone



Extent of the available GZ overlaid on a reference ice velocity map of Antarctica. For Ross and Ronne Ice Shelves not enough GL measurements are available.

We define the *grounding zone* (GZ) of a glacier as the short-term variability of GL positions at tidal cycles. Based on the frequency of GL measurements and Mohajerani (2021), we use data collected over one year to delineate the GZ. The primary data sources are the European Union Sentinel-1 mission for ongoing coastal coverage and the Italian Space Agency COSMO SkyMed constellation for targeted short-repeat acquisitions over fast glaciers.

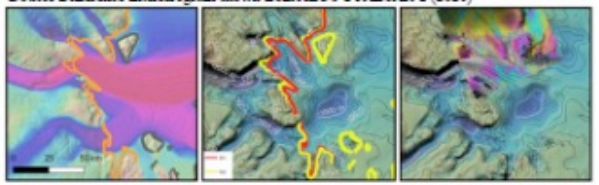
Example B: Berry Glacier, West Antarctica.
Double Difference Interferograms shown from Sentinel-1 (2018)



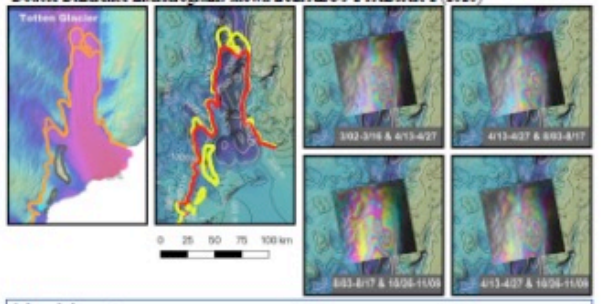
Implications

Evidence of tidal-frequency variation of the GL requires an update of the description of the ice-ocean interface. Our *grounding zone* product provides information of the areas susceptible to melt due to sea water intrusion at tidal frequencies. Publication of the GZ as Earth Science Data Record (ESDR) at NSIDC is pending, Product NSIDC-0778. The model of a fixed GL with zero melt should be replaced with one using a km-wide GZ with vigorous ice–ocean interaction. Changes of the GZ over time will be a better descriptor of glacier retreat. Ongoing SAR data collection with short-repeat orbit in coastal Antarctica are therefore crucial for GL measurements and the ability to map the GZ over time.

Example C: Denman Glacier, East Antarctica.
Double Difference Interferogram shown from ALOS-2 PALSAR-2 (2020)



Example D: Totten Glacier, East Antarctica.
Double Difference Interferograms shown from ALOS-2 PALSAR-2 (2020)



Acknowledgement:
This work was funded through the NASA MEaSUREs program and contains modified Copernicus Sentinel data 2018, processed by ESA. ALOS-2 PALSAR-2 data were made available by JAXA through the third Research Announcement (EO-RA3). MEaSUREs ESDR's are available at NSIDC.

GL and GZ related publications:

Chen et al. (in review): Grounding zone of Amery Ice Shelf, Antarctica, from differential synthetic-aperture radar interferometry. C22A-04

Ciraci et al., (in review): Melt regime in the kilometer-size grounding zone of Petermann Glacier, Greenland before and during a retreat. C15D-0603

Milillo et al., (2022): Rapid glacier retreat rates observed in West Antarctica. Nature Geoscience 15, no. 1

Mohajerani, et al. (2021): Automatic delineation of glacier grounding lines in differential interferometric SAR data using deep learning. Scientific reports, 11(1)

Brancato et al., (2020): Grounding line retreat of Denman Glacier, East Antarctica, measured with COSMO-SkyMed radar interferometry data. GRL, 47(7)

Milillo et al., (2017): On the short-term grounding zone dynamics of Pine Island Glacier, W.A., observed with COSMO-SkyMed interferometric data. GRL, 44(20)

Scheuchl et al. (2016): Grounding line retreat of Pope, Smith, and Kohler Glaciers, West Antarctica, measured with Sentinel-1a radar interferometry data. GRL, 43(16)

Li et al., Grounding line retreat of Totten Glacier, east Antarctica, 1996 to 2013. GRL, 42(19)

Rignot et al., (2014): Widespread, rapid grounding line retreat of Pine Island, Thwaites, Smith, and Kohler glaciers, West Antarctica, from 1992 to 2011. GRL, 41(10)

Rignot, et al., (2011):Antarctic grounding line mapping from differential satellite radar interferometry. GRL, 38(10)

Example of PALSAR-2 data used in the Algorithm to Retrieve High-Resolution Soil Moisture for the NISAR Mission.

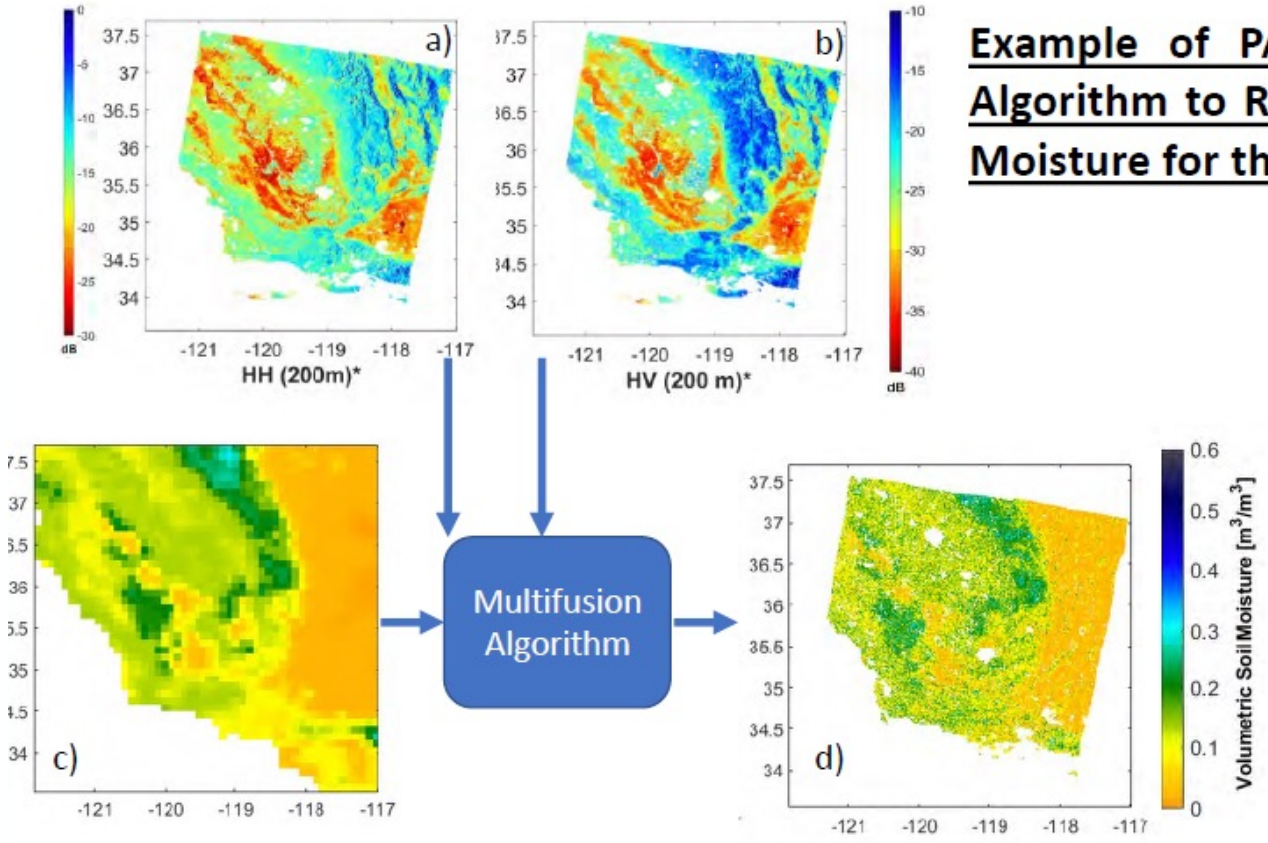


Fig.: (a) PALSAR-2 HH (200 m); **(b)** PALSAR-2 HV (200 m); **(c)** ERA5-Land soil moisture at a coarse resolution of ~9 [km], and; **(d)** High-resolution (200 m) soil moisture retrievals for the Southern California region (July 30, 2017).

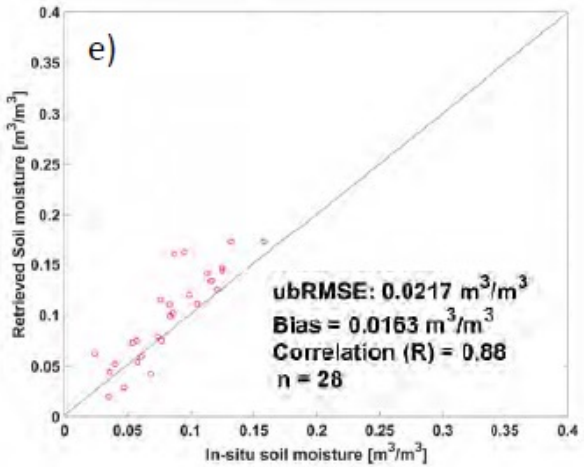
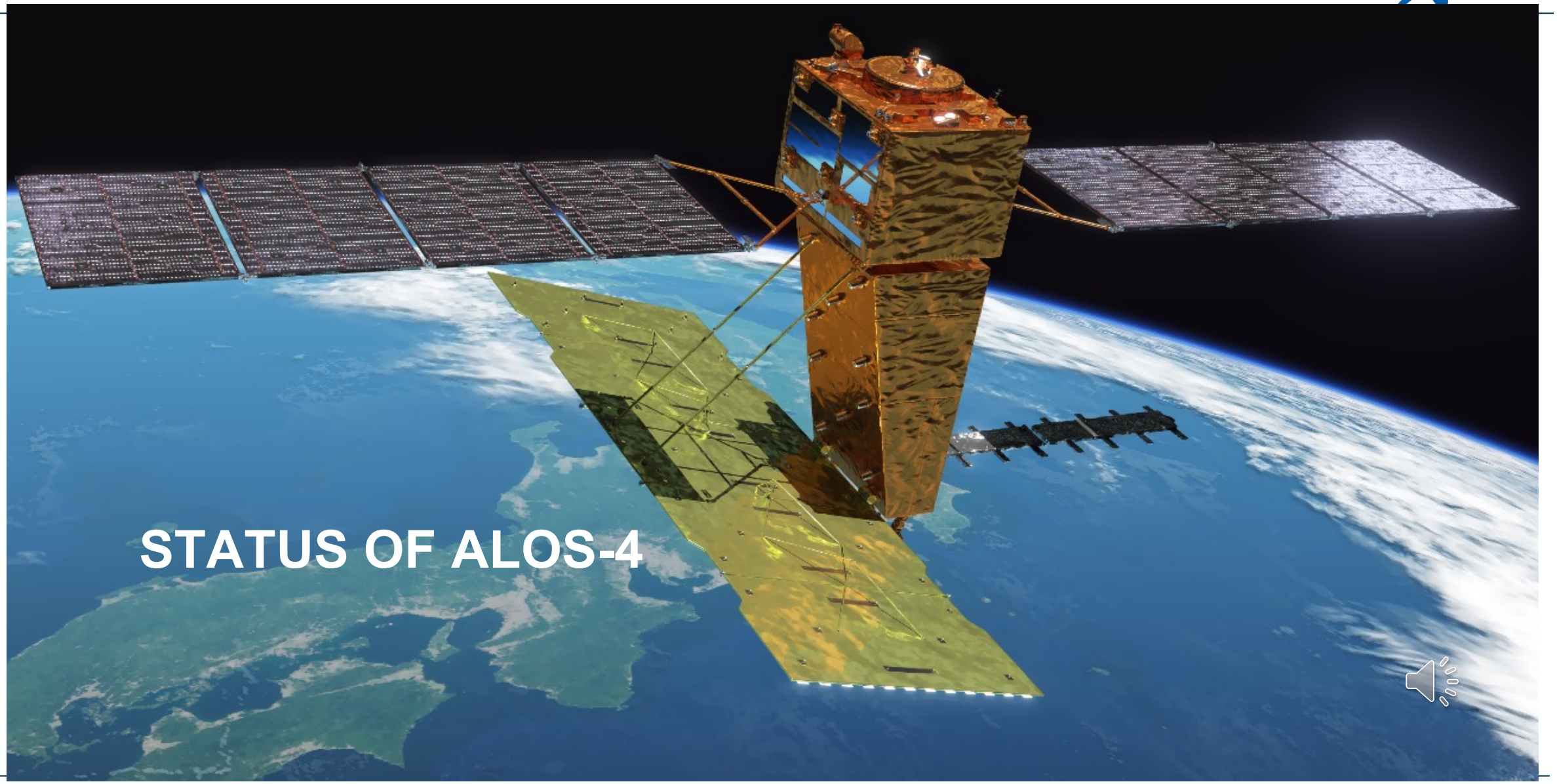
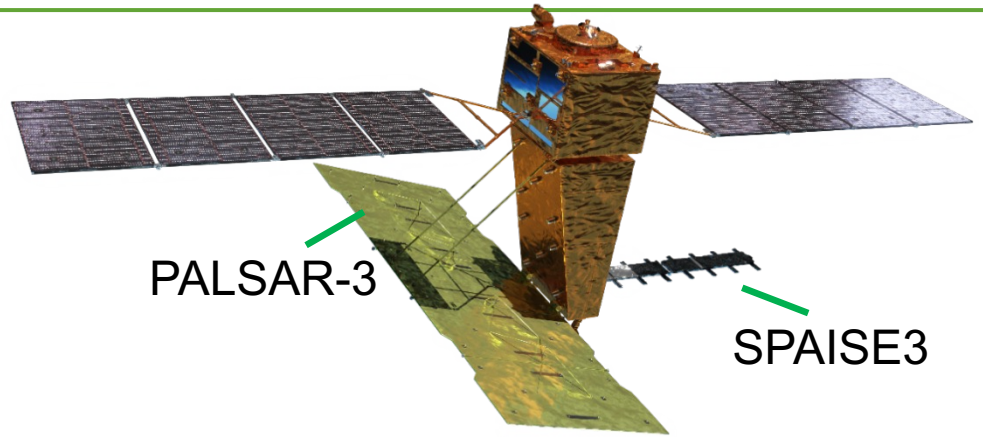


Fig.: **(e)** A comparison between the high-resolution (200 m) soil moisture retrievals and the in-situ soil moisture measurements over 28 in-situ location in Southern California, USA, for July 30, 2017.


STATUS OF ALOS-4

ALOS-4
Mission Objectives, System Overview

1. **Precise monitoring** of land deformation and subsidence using **InSAR**
2. **Continuation** and **enhancement** of **ALOS-2 mission** (all-weather disaster monitoring and forest monitoring, etc)
3. Exploring **new applications** such as large infrastructure monitoring using **InSAR time series analysis**
4. **Marine monitoring** by **SAR** and Automatic Identification System for ships (**AIS**)



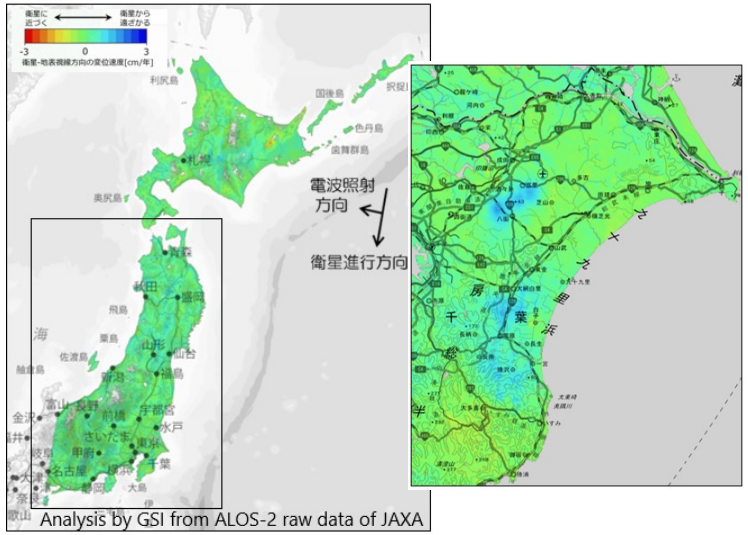
Orbit	**Same orbit as ALOS-2** ✓ Local sun time at descending: 12:00 ± 15 min. ✓ Revisit time: 14 day (15-3/14 rev/day)
Lifetime	**7 years**
Downlink	**1.8/3.6 Gbps (Ka-band)**
Mission Instruments	- **PALSAR-3** (Phased Array type L-band Synthetic Aperture Radar-3) - **SPAISE3** (SPace based AIS Experiment 3)
Prime contractor	Mitsubishi Electric Corporation

What does ALOS-4 aim for ?

More frequent/wider observation and enhancement of ALOS-2 mission
(emergency observation, long term SAR data archive, etc)
will boost data utilization and lead to being established in society.

✓ Monitoring of land deformation and subsidence

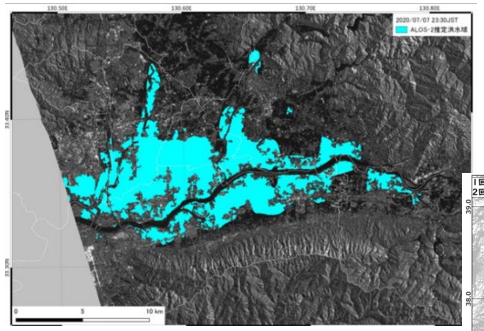
- More frequent time series analysis and precise monitoring for Japan



In-SAR time series analysis for Japan by Geospatial Information Authority of Japan (GSI)
(Browse service is available on the GSI web site.)

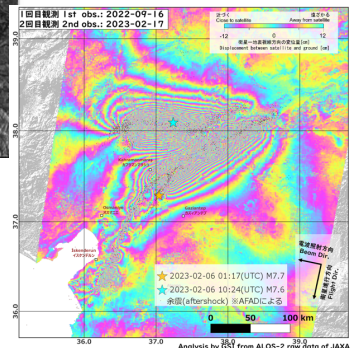
✓ Disaster Monitoring

- Wider observation to understand overall situation of a large-scale disaster



Estimated flood area by heavy rain fall in Kyusyu area, Japan (2020)

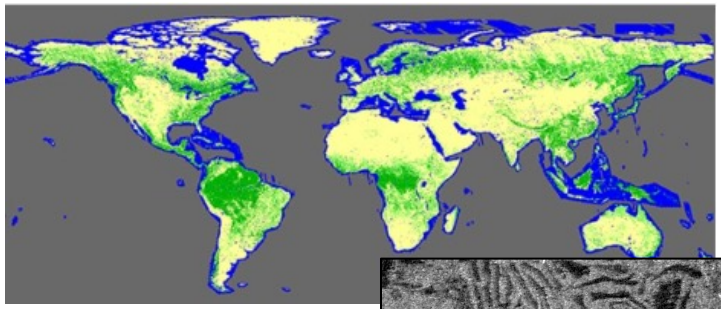
"Estimated flood area" products already released



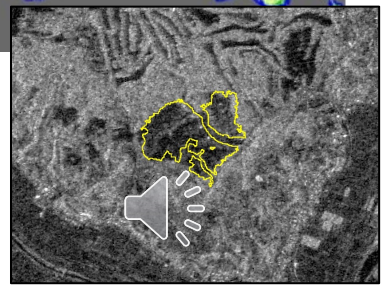
Crustal Deformation by Earthquake in Turkish (2023)
Analysis by GSI

✓ Forest Monitoring

- Long term archive of L-band SAR data
- Dual-pol observation for more precise monitoring in Japan

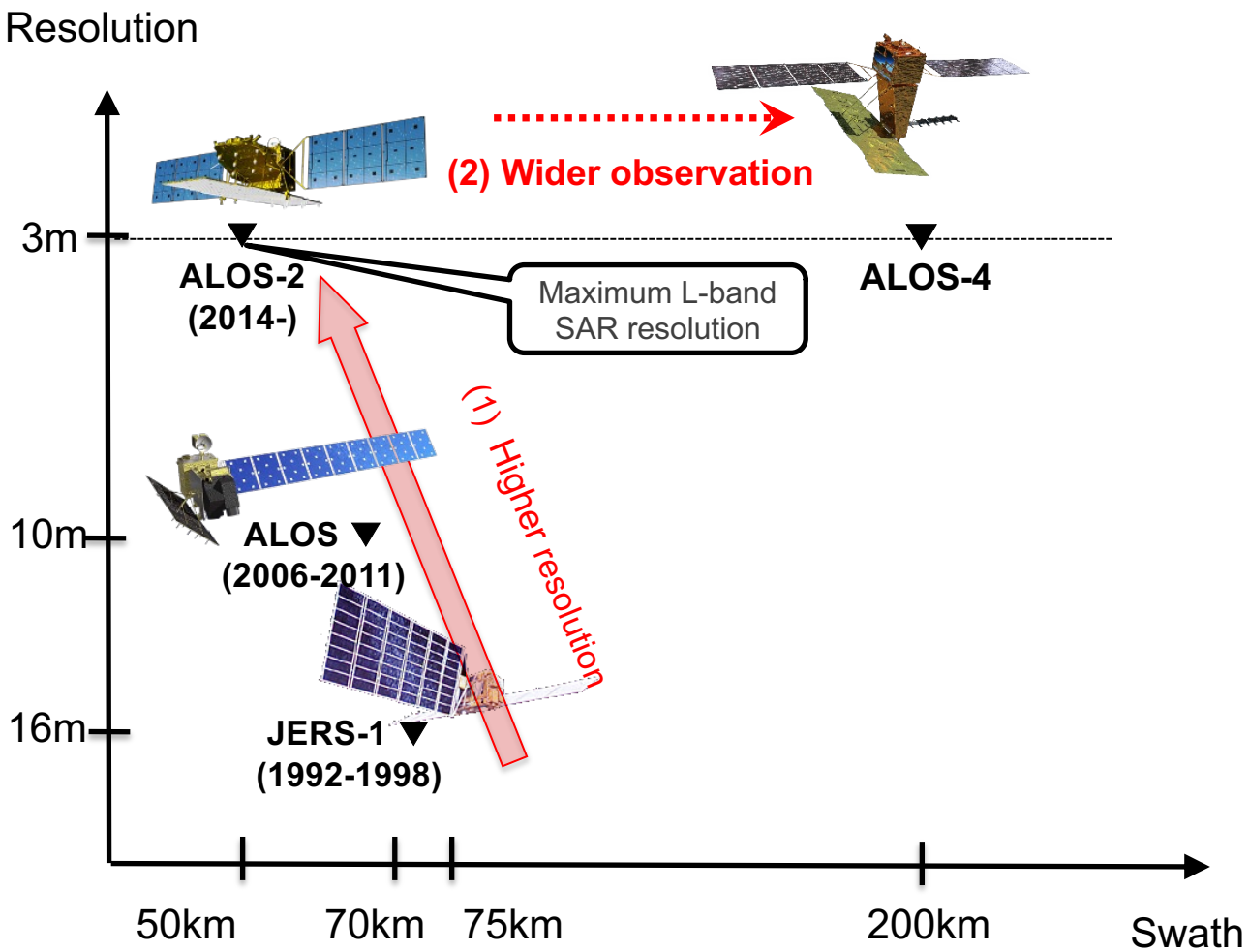


Global Forest/ non-Forest Map



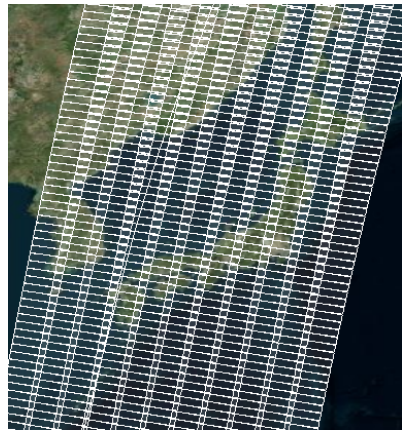
Deforestation detect information (provided to Ibaraki pref., Japan)

PALSAR-3 (1/2)



Coverage of 1 repeat cycle (14 days)

ALOS-4/PALSAR-3 (200 km)



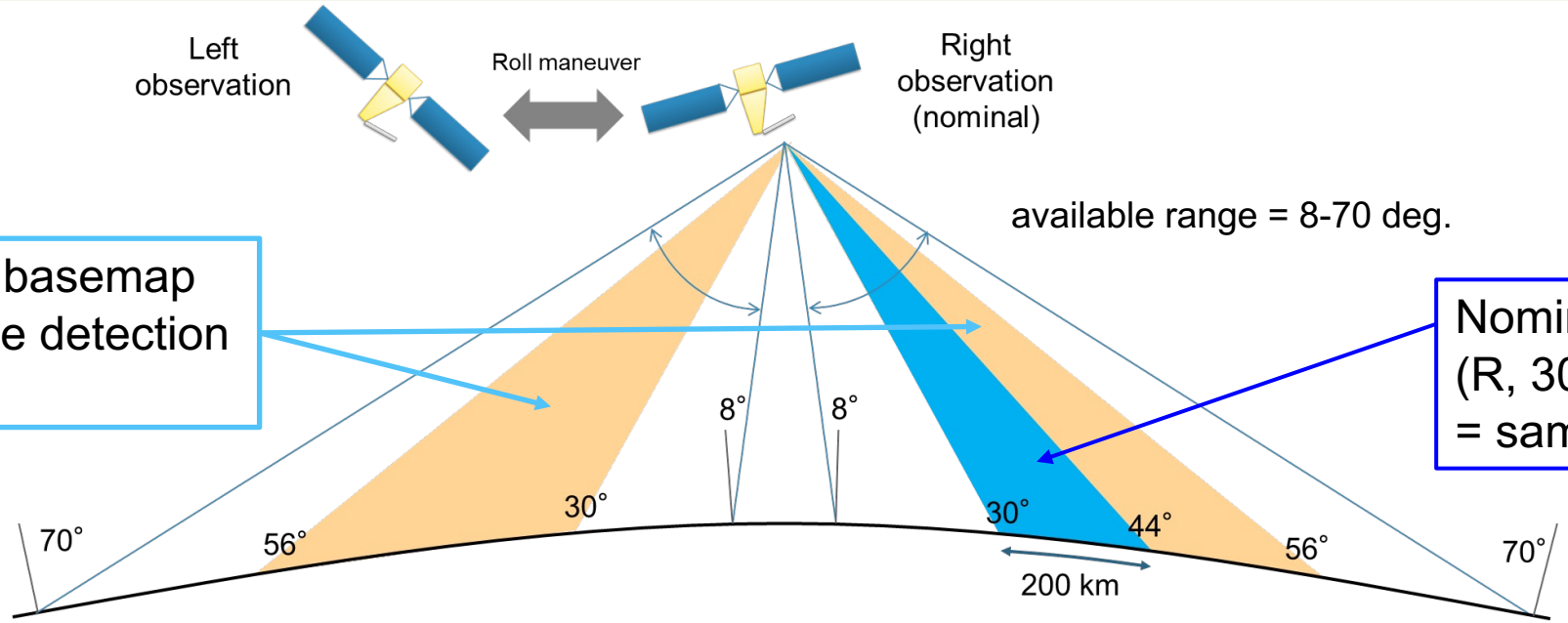
ALOS-2/PALSAR-2 (50 km)

Swath width of PALSAR-3/2

Modes	PALSAR-3	PALSAR-2
Stripmap (res. 3/6/10 m)	100-200 km	30-70 km
ScanSAR (res. 25m*)	700 km	350-490 km
Spotlight (res. 1 x 3 m)	35km×35km	25km×25km

*single look

PALSAR-3 (2/2)



InSAR capability between PALSAR-2 and PALSAR-3

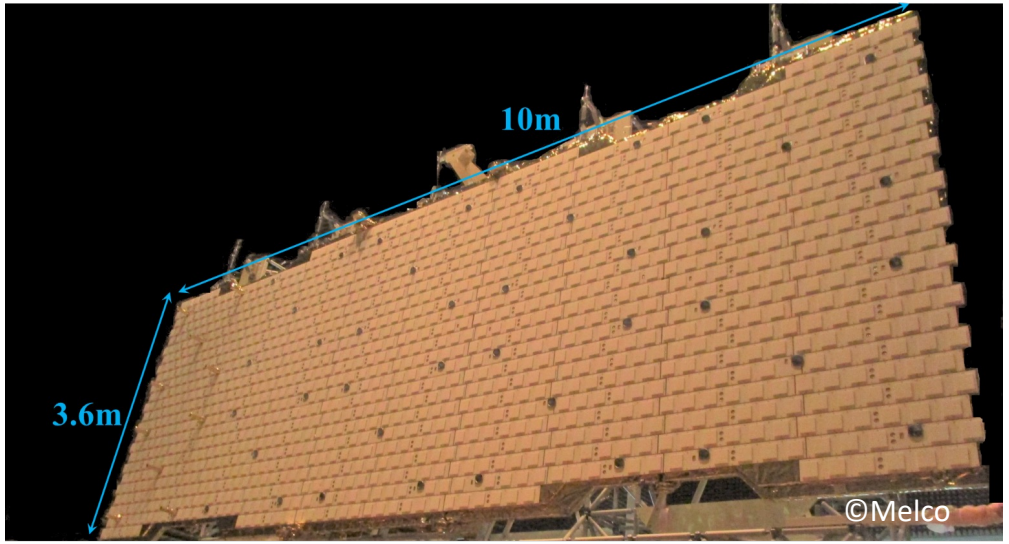
InSAR pair		PALSAR-3		PALSAR-2	
		Stripmap100/200 km	ScanSAR700 km	Stripmap50/70 km	ScanSAR350/490 km
PALSAR-3	Stripmap 100/200 km	○	○	○	○
	ScanSAR 700 km	○	○	○	×

- ✓ ALOS-4 reference orbit is the same as ALOS-2
- ✓ Controlling accuracy is within +/- 500 m (= small baseline)

PALSAR-3 and SPAISE3 Status

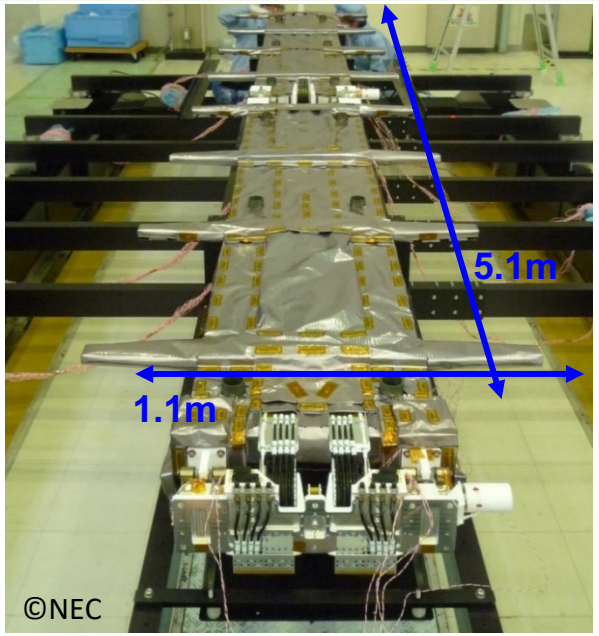
PALSAR-3
Flight Model

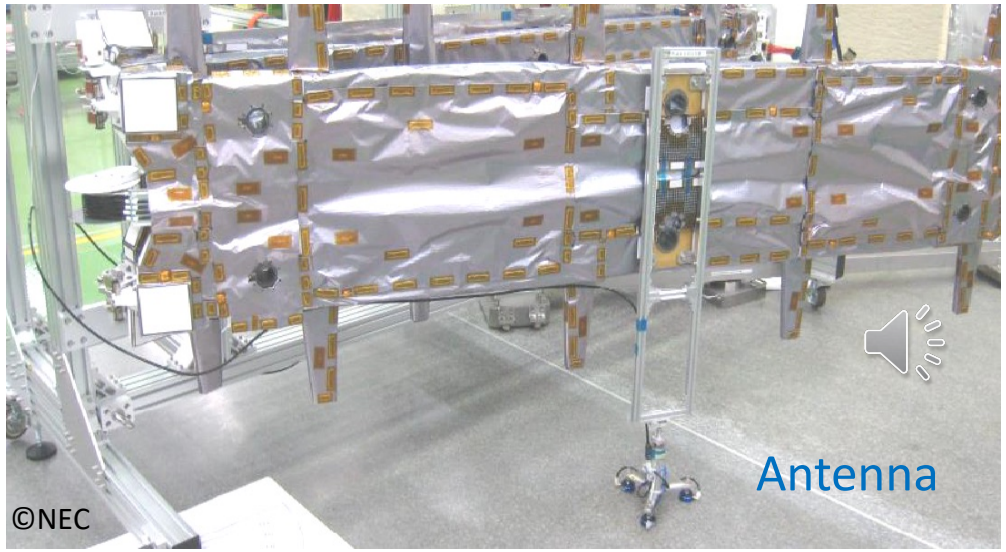
Thermal vacuum test



SPAISE3 Antenna
Flight Model

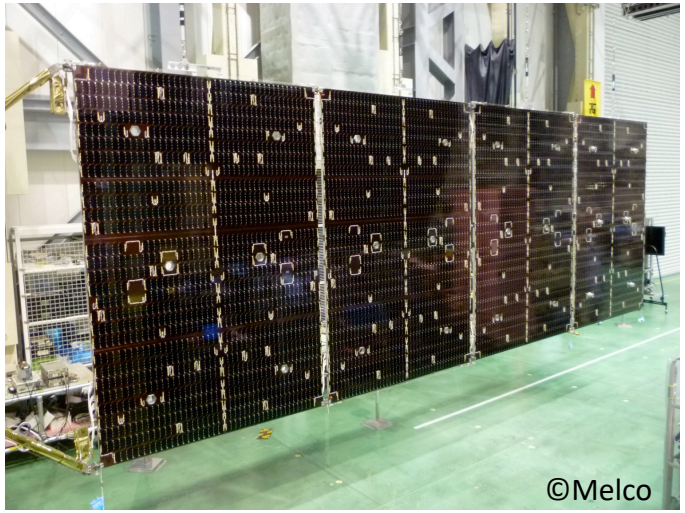
Thermal vacuum test





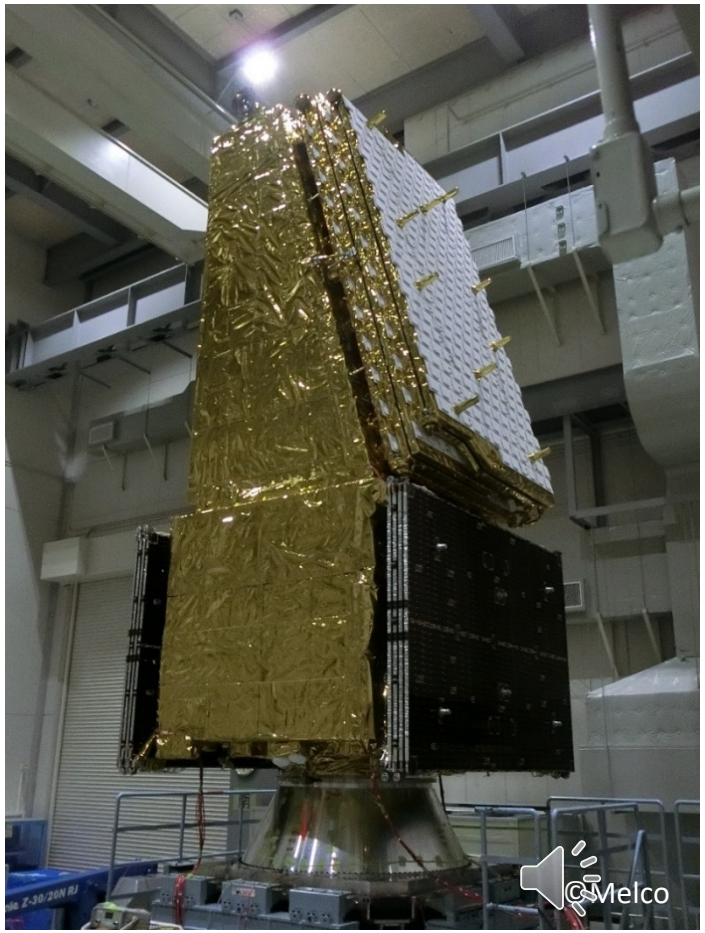
Satellite Status

ALOS-4 Flight Model



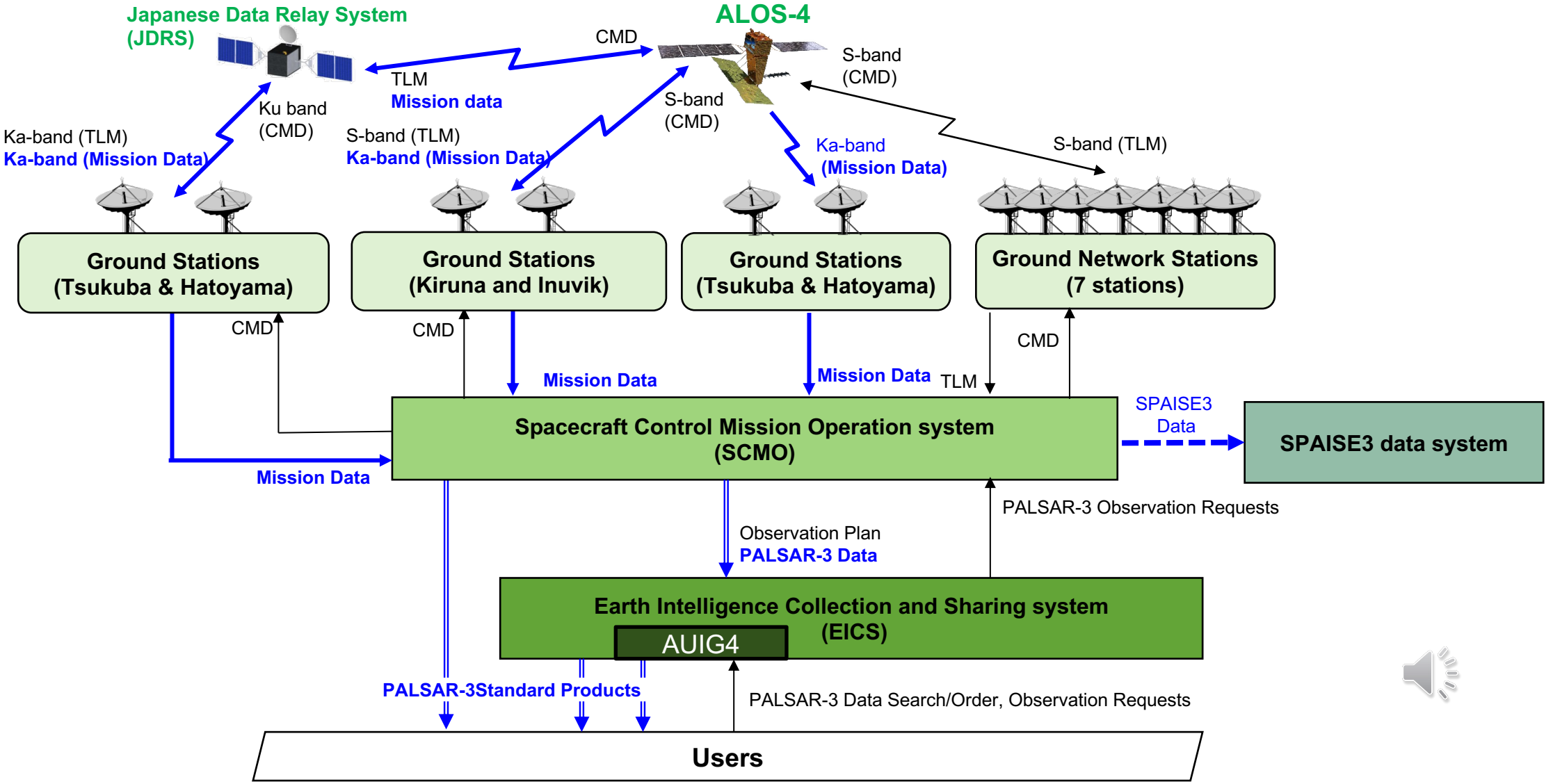
One of the solar array paddles

Thermal vacuum test

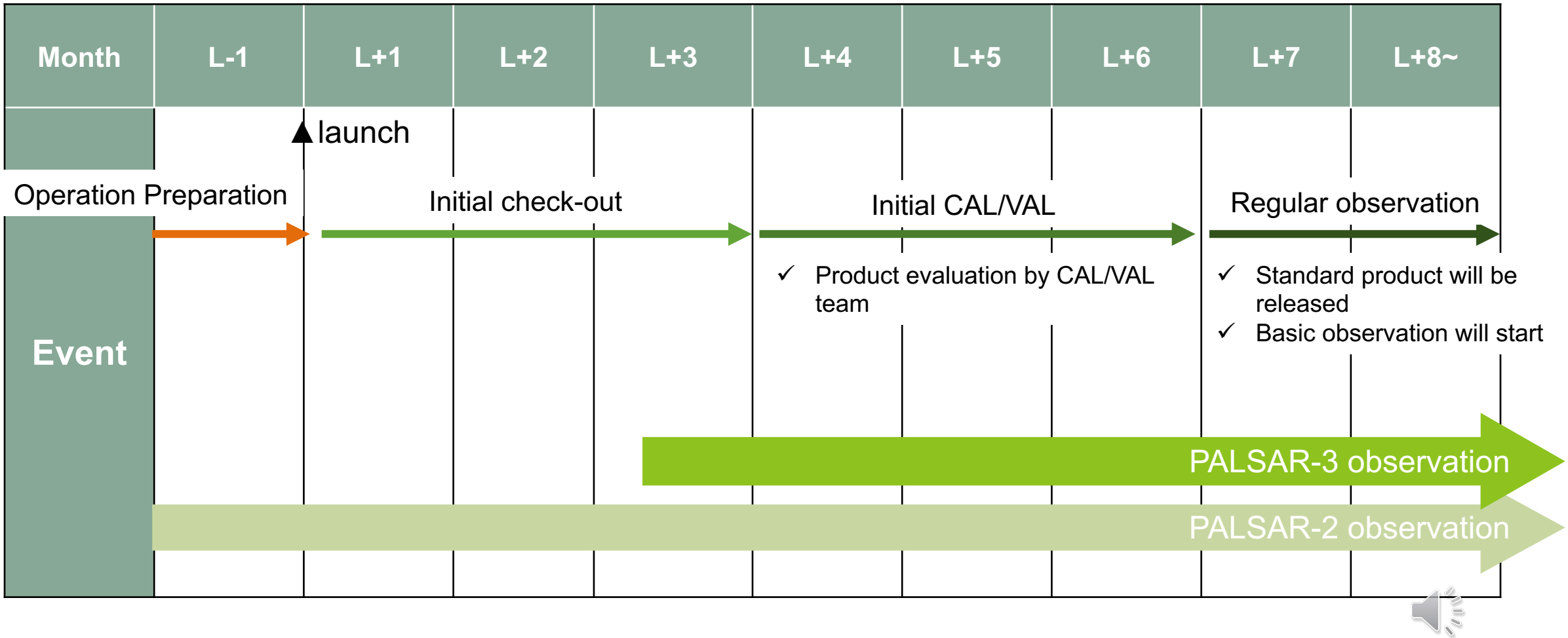


Microvibration test

ALOS-4 Ground System Overview



Operation Plan



ALOS-4

JAXA

ALOS-4 total systems are ready for launch and waiting for the preparation of H3 launch vehicle.