USGEO Satellite Needs Working Group (SNWG)
Radar Workshop

July 7 - 8, 2020

9 am to 1:30 pm Pacific / Noon to 4:30 pm Eastern

The SNWG agencies collect Earth observation data needs for consideration by NASA in current programs and future missions. The workshop will: 1) describe the upcoming NASA-ISRO Synthetic Aperture Radar (NISAR) mission and its science capabilities, 2) discuss the benefits and proposed set of science-derived products associated with the higher resolution and greater radar polarimetric diversity data collected over North America that was enabled by the 2016 SNWG process, and 3) provide a forum for the SNWG and other Federal agencies to be part of NASA's product and mission planning process, that considers an array of science and operational applications, to inform NASA's Surface Deformation and Change (SDC) mission. SDC is NASA's SAR Mission that will follow NISAR.

Workshop Goals – Day 1

OMB fund a new downlink station for the NISAR Mission to collect high-resolution (~7x7 m) data over North America with greater polarimetric diversity specifically as part of the SNWG process that supports a wide variety of Agency's satellite needs.

1. Review the SNWG Process
2. Describe the SNWG 2016 and 2018 Cycles activities and products
3. Provide an update on what will be enabled by the added NISAR downlink
4. Preview NASA's next SAR satellite that will follow NISAR – SDC – *Surface Deformation and Change*

Workshop Goals – Day 2

The 2017 Decadal Survey identified the need for the Surface Deformation and Change '*Designated Observable*' SAR satellite that will follow NISAR that will advance our understanding of "*Earth surface dynamics from earthquakes and landslides to ice sheets and permafrost*".

1. Overview of the SDC Architecture Study
2. Describe potential architectures
3. Discuss agency observational priorities
4. Identify potential agency observational gaps that could be considered in the SDC Study

Workshop Agenda – Day 2

EDT	PDT	Time	Topic	Presenter
12:00 PM	9:00 AM	0:15	Introduction / Goals of the Day	Paul Rosen, NASA/JPL
12:15 PM	9:15 AM	0:30	SDC SATM and Process	Ala Khazendar, NASA/JPL
12:45 PM	9:45 AM	0:30	SDC Potential Architectures + Downselection Process	Steven Horst, NASA/JPL, Batu Osmanoglu, NASA/GSFC
1:15 PM	10:15 AM	0:15	BREAK	
1:30 PM	10:30 AM	2:00	Lightning Presentations by Participants on Future Needs	Agency Representatives
3:30 PM	12:30 PM	1:00	Q&A Discussions on Priorities / SATM and Architecture Feedback	Bawden/Osmanoglu/Khazendar
4:30 PM	1:30 PM	0:15	ADJOURN	

Workshop Agenda – Day 1

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12:00 PM	9:00 AM	0:10	Welcome and Introductions	Greg Snyder, USGS; Gerald Bawden, NASA HQ
12:10 PM	9:10 AM	0:30	NISAR SNWG-relevant Status, and Goals for the Days	Gerald Bawden, NASA HQ
12:40 PM	9:40 AM	1:00	Agency Needs from Past Surveys	Steve Wall, NASA/JPL; Gerald Bawden, NASA HQ
1:40 PM	10:40 AM	0:20	Agency Needs: Convergence/Divergence	Paul Rosen, NASA/JPL; Steve Wall, NASA/JPL
2:00 PM	11:00 AM	0:15	BREAK	
2:15 PM	11:15 AM	1:00	NISAR Capabilities and Gaps	Paul Rosen, NASA/JPL
3:15 PM	12:15 PM	0:15	Discussion (as needed)	All
3:30 PM	12:30 PM	1:00	SDC Overview and Capabilities not covered by NISAR left to SDC	Paul Rosen, NASA/JPL
4:30 PM	1:30 PM		ADJOURN	

Satellite Needs Working Group (SNWG)
NISAR and SDC Virtual Workshop
July 7-8, 2020

Gerald Bawden, Ph.D.
NASA Principal for SNWG
Program Scientist for NISAR/SDC Study
Earth Science Division (ESD)
Science Mission Directorate (SMD)
National Aeronautics and Space Administration (NASA)
07 July 2020

Outline

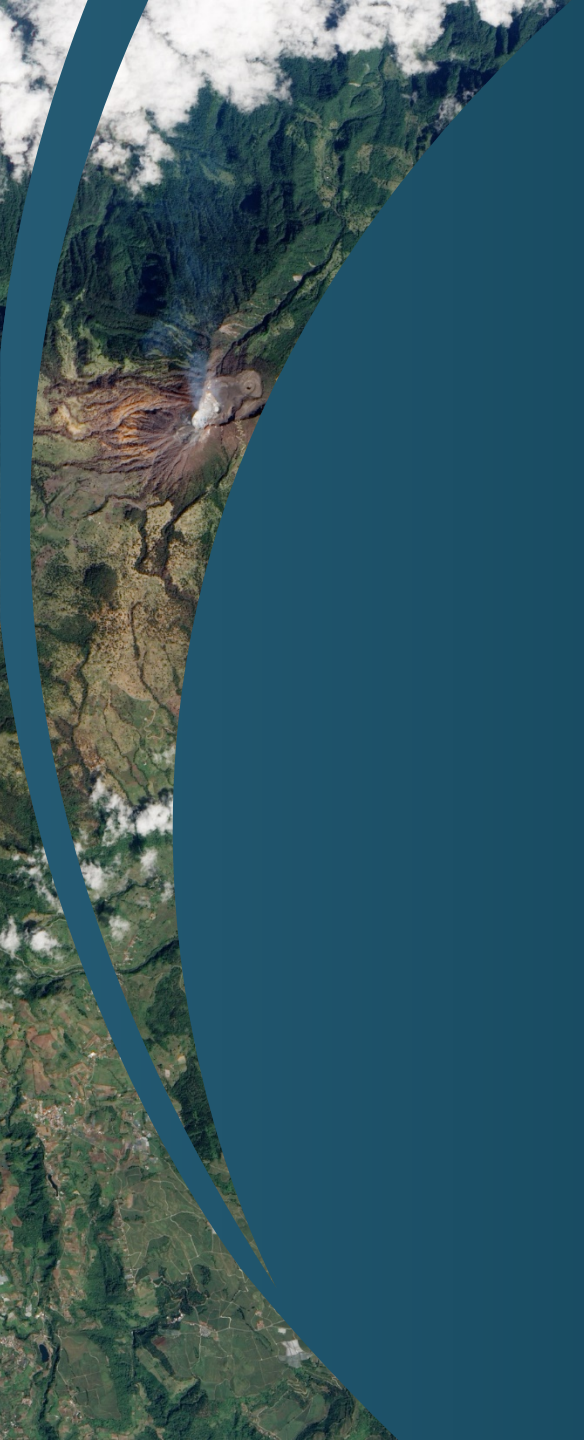
- Satellite Needs Working Group (SNWG) Overview
- SNWG Agency Representatives
- 2020 SNWG Survey
- 2016 Federal-civil Satellite Needs Assessment
- 2018 Federal-civil Satellite Needs Assessment
  - Proposed products
  - Proposed satellite radar (SAR) activities

USGEO's Satellite Needs Working Group is tasked with surveying the satellite needs of civil agencies

This process allows Federal departments and agencies to communicate their Earth observation satellite* measurement or product needs to NASA and other space-based Earth observation providers.

Information gathered during this process will be used to influence NASA's decisions on future sensors placed into orbit, new data products, and new data delivery strategies.

* NOAA weather satellites are explicitly not included in this process



Context and Reporting

National Science and Technology Council (Cabinet-level)

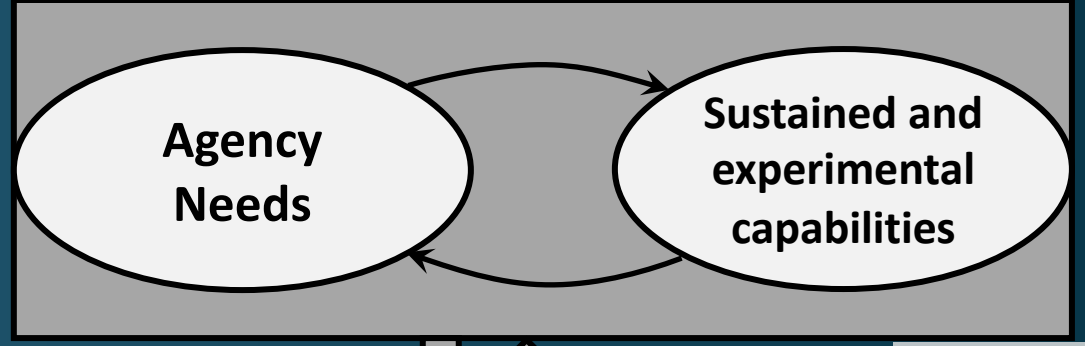
Committee on Environment

U.S. Group on Earth Observations Subcommittee

Satellite Needs Working Group

Every 2 years

SNWG survey



2. SNWG members reach out to their agencies and acquire responses

1. SNWG develops a survey

Satellite Needs Working Group (SNWG)

OMB

3. **Vetted** responses are sent to USGEO

Vetted Needs

Assessment

For information

USGEO
Concurrence

Agencies

6. NASA responds to the agencies

Budget request or reclama as needed

OMB

Formal submission

Assessment

OSTP

4. USGEO sends surveys to NASA

5. NASA evaluates the surveys and formulates responses

Other Providers

6. NASA works with OMB

Current SNWG agency representatives

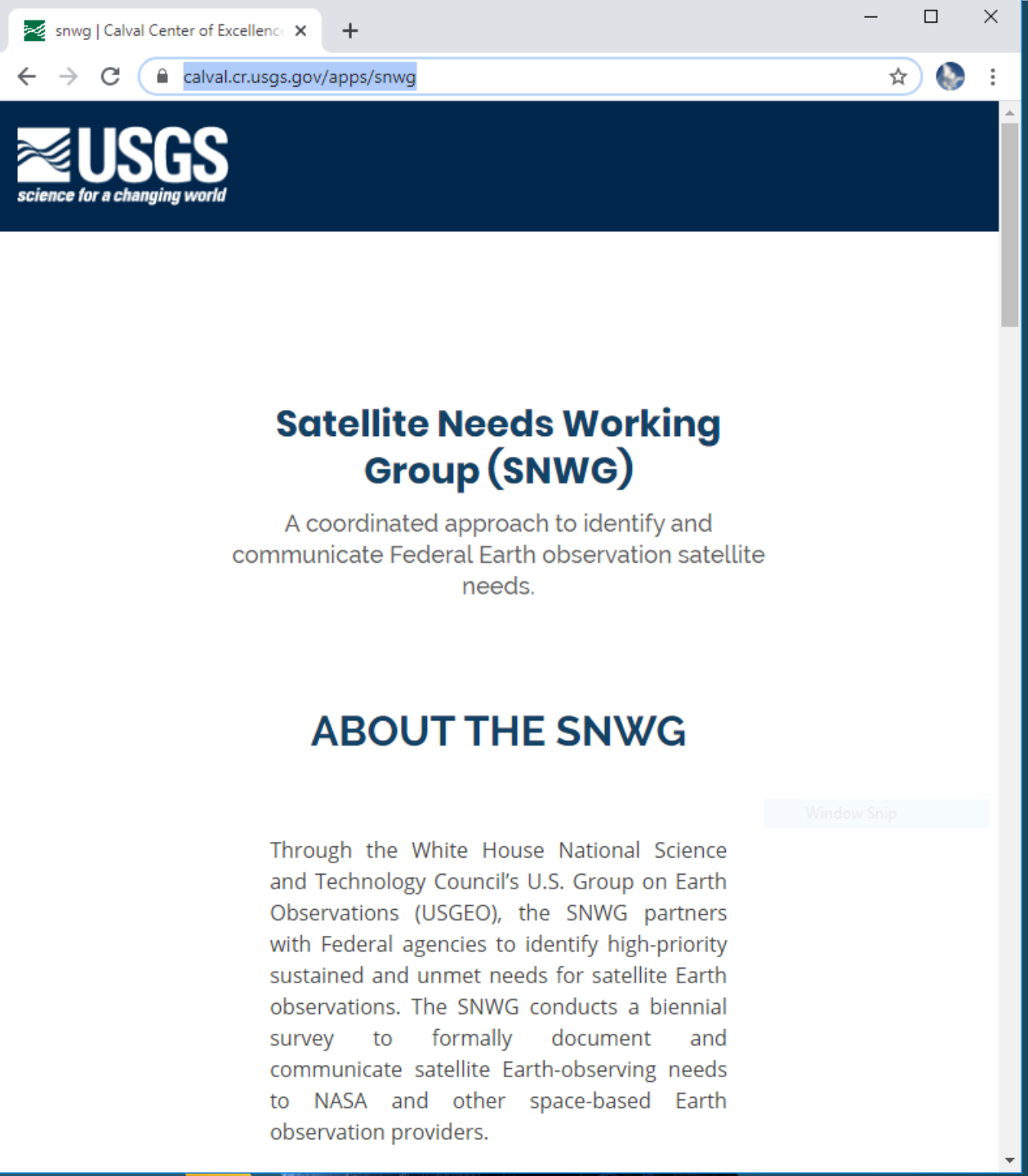
Department of Energy
Shaima Nasiri (Co-Chair)
USDA
Rick Mueller (Co-Chair)
Kevin Hunt
Department of Commerce-NOAA
Jason Taylor
Flavio Iturbide
Department of Commerce-Census
Peter Reid
Department of Homeland Security
Chris Brehany
Lee “Pepper” Spaulding
EPA
Jim Szykman

NASA
Sandra Cauffman
Gerald Bawden
Department of State
Fernando Echavarria
USAID
Michael Crino
Department of Interior-USGS
Greg Snyder
National Science Foundation
Greg Anderson
Department of Defense-Navy
Wayne Estabrooks
Caroline Wiernicki
Department of Defense-NGA
Scott Szymanski

Additional key participants:
Derrick Lampkin (NASA), Gifford Wong (STPI), Jennifer Kroeger (STPI), Wade Price (NOAA/USGEO)

SNWG 2020-2021 "Round 3" survey timeline

6/3/2020	Kickoff meeting for Round 3
6/3/2020 – 8/7/2020	Round 3 survey is open for submissions. SME experts interact with SNWG and NASA. Agency timelines may be shorter.
8/10/2020 – 8/31/2020	Agencies work internally with submitters and submissions to ensure quality and facilitate internal review. (Flag submissions that should not go forward)
9/1/2020	Submissions are sent to USGEO. USGEO sends submissions to Agency leadership for approval (senior review)
9/21/2020	Agency approval due to USGEO.
10/1/2020	USGEO transmits surveys to NASA



Visit the SNWG Survey Webpage

The survey landing page at
https://calval.cr.usgs.gov/apps/snwg

Background

Instructions for accessing survey

SNWG contacts

Kick-off presentations

Sample survey

2016 Needs Submitted by Agency and Department

DHS 1
DOC 8
DOE 13
DOI 26
EPA 5
NSF 1
USAID 9
USDA 14

Agency		Count
Agriculture Research Service	USDA	2
Bureau of Land Management	DOI	3
Bureau of Reclamation	DOI	1
Environmental Protection Agency		5
Farm Service Agency	USDA	1
Federal Emergency Management Agency	DHS	1
Foreign Agricultural Service	USDA	3
Forest Service	USDA	3
National Agriculture Statistics Service	USDA	1
National Oceanic and Atmospheric Administration	DOC	8
National Science Foundation		1
Natural Resources Conservation Service	USDA	2
Department of Energy	DOE	13
Risk Management Agency	USDA	2
U.S. Agency for International Development		9
U.S. Fish and Wildlife Service	DOI	5
U.S. Geological Survey	DOI	17
Grand Total		**77**

U.S. Agency for International Development (USAID) **National Science Foundation (NSF)** **Environmental Protection Agency (EPA)**
National Oceanic and Atmospheric Administration (NOAA) **Department of Commerce (DOC)** **Federal Emergency Management Agency (FEMA)**
Department of Homeland Security (DHS)
Department of Interior (DOI): Bureau of Reclamation: BR Bureau of Land Management: BLM U.S. Fish and Wildlife Service: USFWS
U.S. Geological Survey (USGS): Agriculture Research Service: ARS Farm Service Agency: FSA Foreign Agricultural Service: FAS Forest Service: USFS
National Agriculture Statistics Service: NASS Natural Resources Conservation Service: NRCS Risk Management Agency: RMA

NASA Funded Activities Resulting from the 2016 SNWG Cycle

- NASA's Earth Science Division budget for FY19-FY24 supports the following activities requested by the SNWG other-agency process:
  1. Archive and distribution of *historical Airborne Data products*
  2. Archive/maintenance/distribution of *Landsat and Sentinel 2 harmonized products*
  3. Support to the user community for *NGA products*, including the user services (i.e. vetting users to ensure they meet the NGA EULA) and distributing products
  4. *NISAR's Quad Pol 40 MHz* mode to manage downlink to any added stations that may be necessary
- SNWG support to other agencies in accessing the requested data

2016 Satellite Needs – NASA ESD Update

4. NISAR Quad Pol 40 MHz

The SNWG Augmentation for NISAR added 9 Tbits/day of downlink capacity through the addition of a new NISAR downlink station. This enabled the collection of high-resolution (7 x 7 m) imagery over North America in quasi-quad-pol mode.

SNWG-18 Survey By Agency

Department/Agency		No. of Survey Forms Under Review
National Science Foundation	Division of Atmospheric and Geospace Sciences	1
Department of Homeland Security	Management Directorate	1
Environmental Protection Agency	Office of Air & Radiation	2
Department of Energy	Bureau of Environmental Research (BER)	9
Department of Interior 41	Bureau of Land Management (BLM)	3
	Bureau of Ocean and Environmental Management (BOEM)	1
	Bureau of Safety and Environmental Enforcement (BSEE)	1
	Fish and Willife Service (FWS)	9
	National Park Service (NPS)	4
	Office of Surface Mining Reclamation and Enforcement (OSMR	2
	Bureau of Land Reclamation (USBR)	2
	United States Geological Survey (USGS)	19
Department of Commerce	National Oceanic and Atmospheric Administration (NOAA)	11
Department of Agriculture 14	Agriculture Research Service (ARS)	3
	Foreign Agriculture Service (FAS)	1
	Forest Service (FS)	4
	Farm Service Agency (FSA)	1
	National Agriculture Statistics Service (NASS)	3
	Natural Resources Conservation Service (NRCS)	1
	Risk Management Agency (RMA)	1

Number of SNWG Satellite Need Forms received: 79

Total number of satellite platform (Aqua, Terra, Landsat, Sentinel, Worldview, etc.) requests: 250

Proposed Activities Identified in the 2018-19 Satellite Needs Working Group Analysis

ID #	Summary of Proposed Activity
# 1	Global NISAR 200 m soil moisture product – proposed in SNGW-16 cycle
# 2	Global Surface Water Extent – products from 8 satellites
# 3	Water quality assessment using OLCI
# 4	Land Surface Change Detection - optical & radar products
# 5	Land Surface Deformation Detection
#6	Radiation & clouds observations at SatCORPS
#7	Atmospheric composition using GEOS-5
# 8	Low latency freeboard & ice thickness over the Great Lakes from IceSat-2
# 9	Animal Tracking

Proposed Activity # 1
Global 200 m NISAR Soil Moisture Product

Unfulfilled from the 2016/17 Satellite Needs Working Group Cycle

Need IDs: 003, 006, 011, 012, 013, 015, 019, 028, 037, 056, 061, 072, 081, 083

Background: The 2016-17 SNWG assessment identified that a high-resolution soil moisture product (current SMAP-Sentinel product is 3 km) would be of immediate interest to a number of agencies: as per OMB's direction the product was not supported in 2017. The 2016-17 SNWG process supported the increased downlink bandwidth to collect high-resolution (7 m x 7 m) quasi-quad-pol NISAR L-band SAR data that will enable the potential development of a global 200 m NISAR soil moisture product.

Proposed Activity: *NASA would develop a well-calibrated and validated high-resolution soil moisture product* (200 m globally except for the Sahara, when an estimated 400 m product would be generated associated with challenges of measuring soil moisture in dry sand). This product would be generated on average twice every 12 days utilizing modified SMAP algorithms – more frequent observations at higher latitudes.

The significance of the 200 m product is that its size more closely aligns with the size of agriculture fields, forest, burn areas, etc. thereby supporting a greater number of agencies' scientific and modeling needs.

Proposed Activity # 2
Surface Water Extent

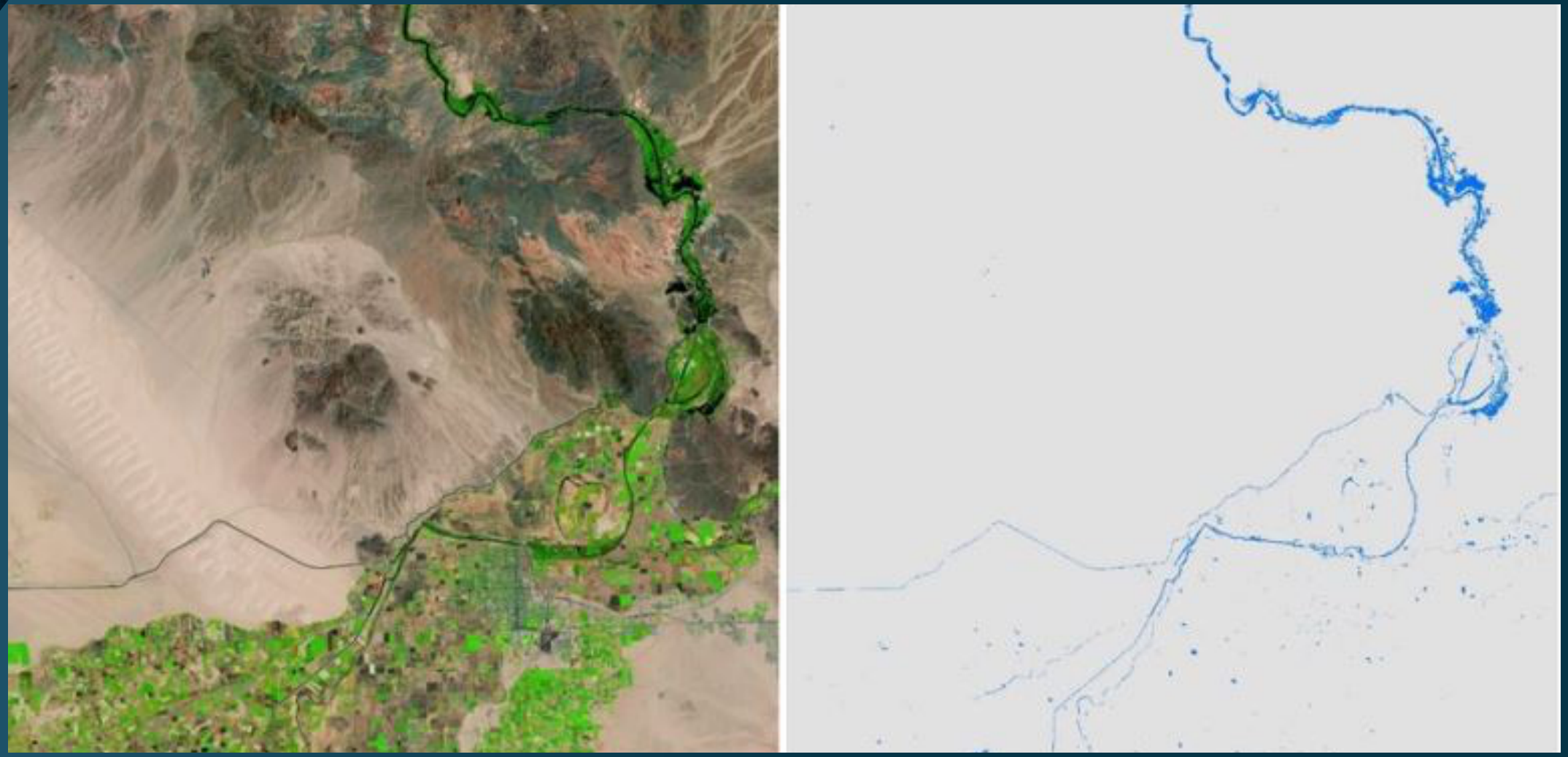
Need IDs: 001, 003, 005, 006, 008, 012, 013, 015, 017, 021, 023, 028, 032, 047, 061, 071, 072, 077, 081

Background: The EROS Data Center recently released the Dynamic Surface Water Extent (DSWE) product that identifies surface water in Landsat pixels. The data are available at 30-m resolution over the conterminous U.S., Alaska, and Hawaii. This approach needs cloud-free imagery and does not measure surface water extent beneath vegetation.

Proposed Activity: NASA proposes a SNWG-18 Global Surface Water Extent (GSWE) product that would: a) in partnership with the USGS, expand the DSWE product line to include global coverage with Landsat data, b) develop a global SWE product with Sentinel-2 optical imagery using the DSWE algorithms that are optimized for Sentinel-2 imagery, c) develop a global radar/SAR SWE product from Sentinel-1 imagery, d) develop a global SWE product from NISAR, and e) develop a harmonized product that combines these products with SWOT surface water extent products.

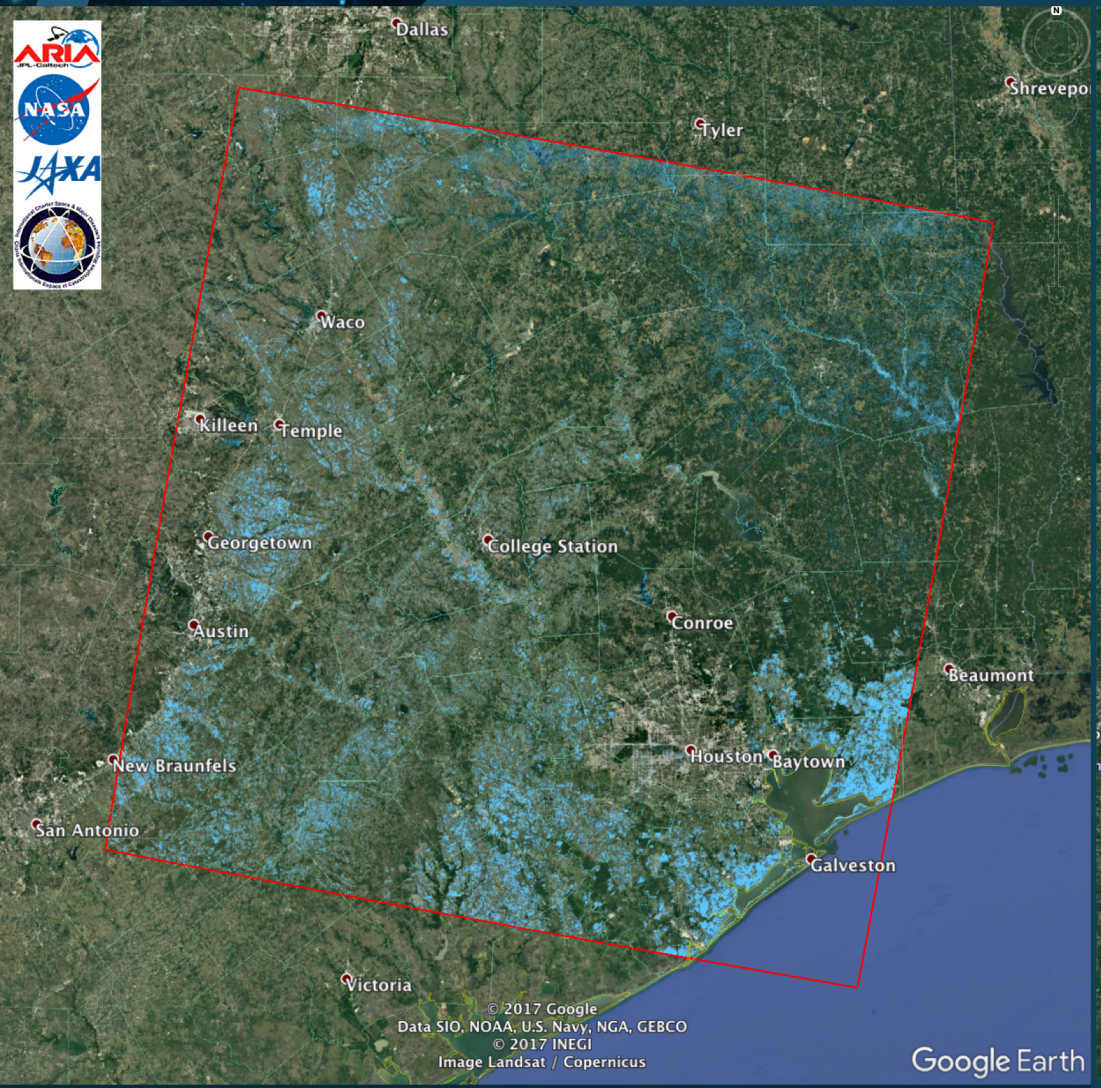
The inclusion of radar data will enable the identification of surface water extent beneath vegetation and in cloudy conditions. By the year 2022, the proposed harmonized SWE product will integrate data from 8 satellites and has the potential of providing surface water extent products every 1-2 days, depending on cloud conditions. Water extent products are especially needed during significant flooding events.

Landsat – Dynamic Surface Water Extent

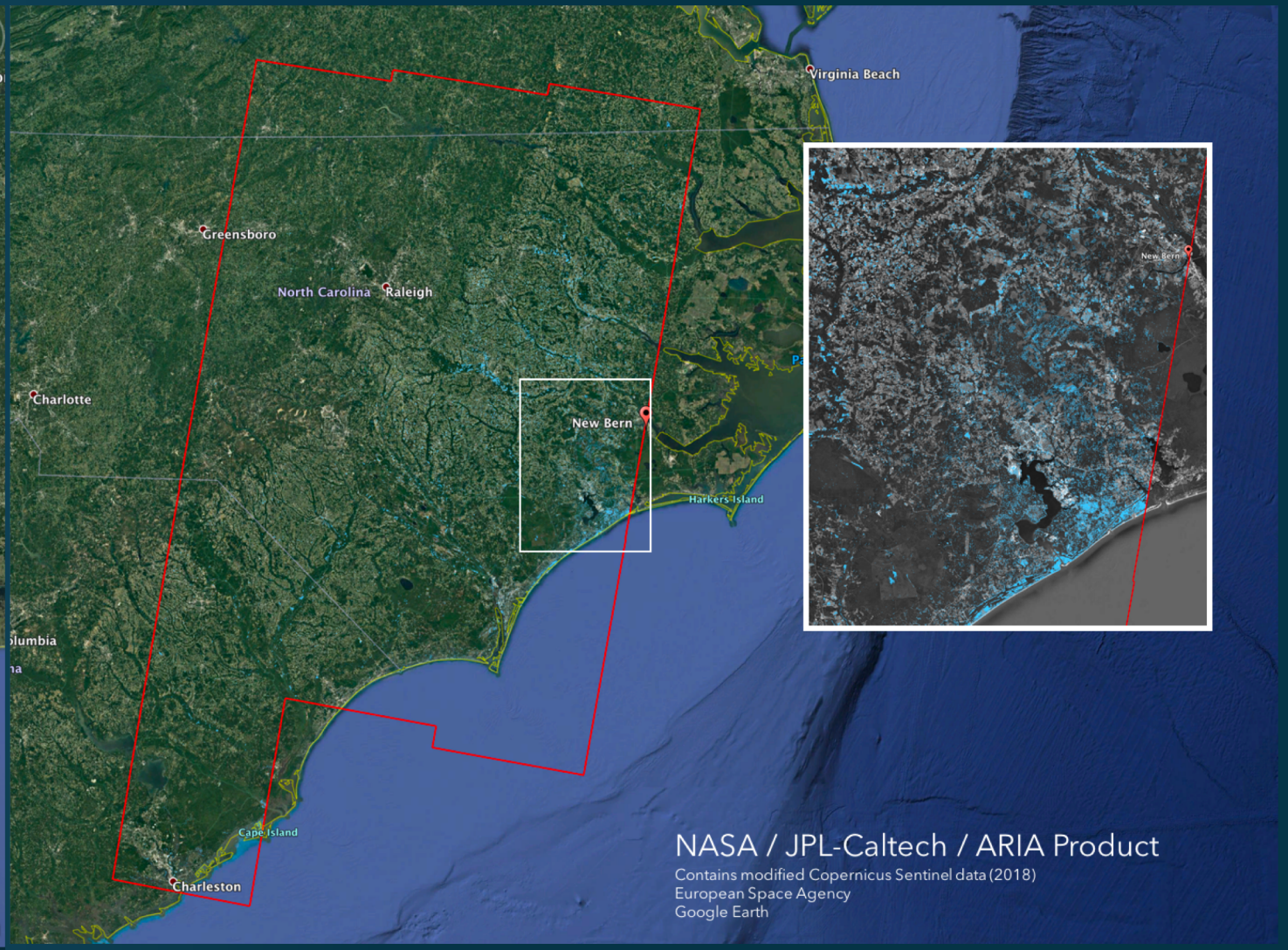


Northeast of Yuma, AZ of Landsat Surface Reflectance (SR) Analysis and Landsat Level-3 Dynamic Surface Water Extent (DSWE) tile-based image (right Image): Landsat 7, August 16, 2000.
John Jones - USGS

SAR (radar) – Flood Extent



Hurricane Harvey – ALOS-2 SAR image August 2018.
Sang-Ho Yun, JPL – ARIA Team



Hurricane Florence – Sentinel 1 SAR image Sept 2018.
Sang-Ho Yun, JPL – ARIA Team

Proposed Activity # 4
Land Surface Disturbance/Change Detection

Need IDs: 001, 002, 003, 004, 005, 014, 017, 020, 030, 059, 061, 063, 064, 071, 076

Background: The ability to know when and when the land surface has changed is important to a number of agencies for early detection and mitigation.

Proposed Activity: *The proposed product would identify land surface change on a sub-weekly scale with a spatial resolution of 10 m to 30 m and would produce separate optical (Landsat and Sentinel-2) and radar (Sentinel-1 and NISAR) products and a combined changed detection product.* Optical change detection is sensitive to color changes such as vegetation health and human activity, where the radar change detection approaches are sensitive to structural changes in vegetation and changes to the land surface from natural and anthropogenic processes. The combined product approach leverages the strengths of both approaches and provides an independent check.

It is important that these products are continuously produced to separate normal seasonal changes from sudden and unexpected events.

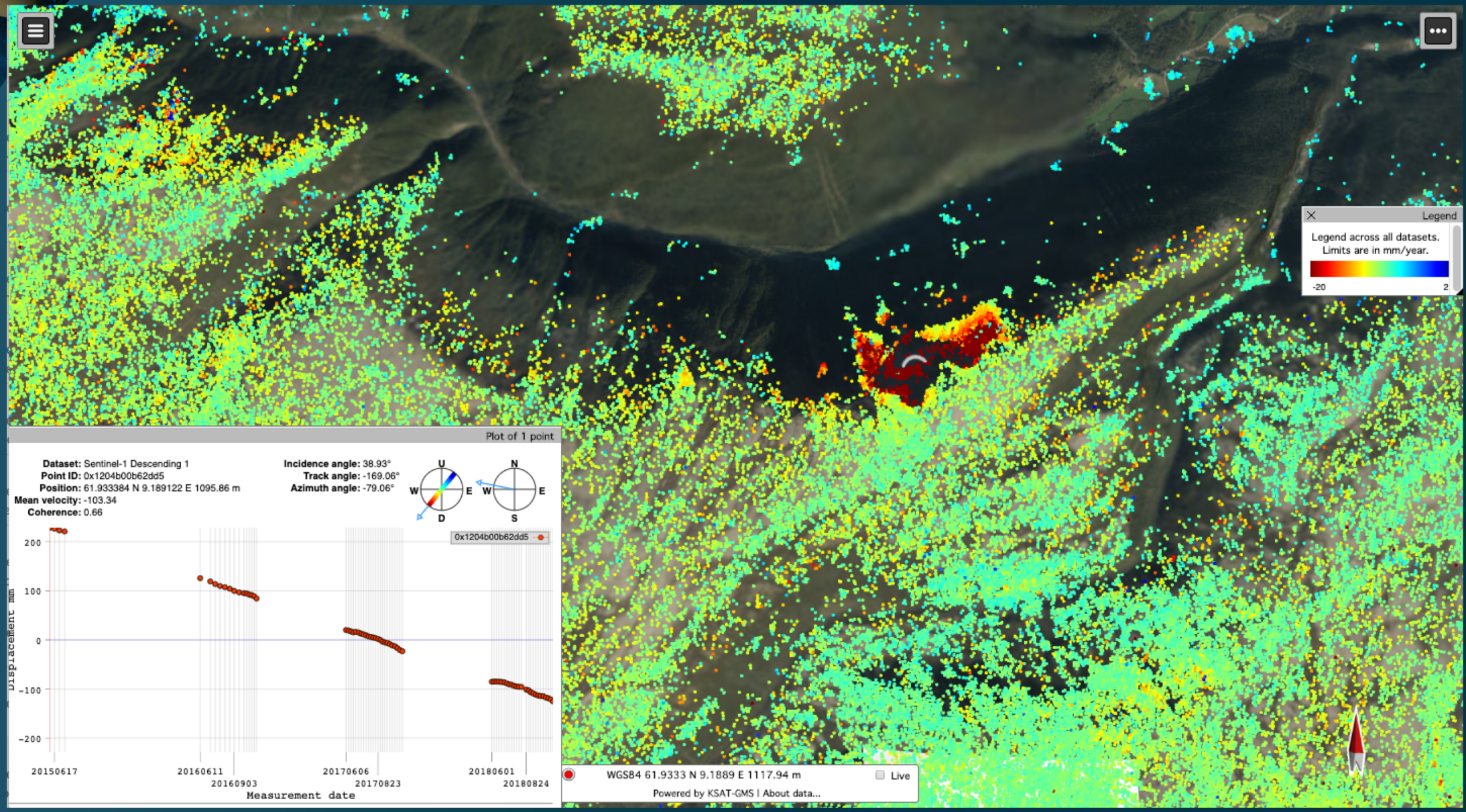
Proposed Activity # 5
Land Surface Deformation Detection

Need IDs: 003, 004, 005, 020, 025, 059, 061

Background: Knowing where and when the land surface moves/deforms is vital to: mitigate the loss of life associated with catastrophic natural hazards; protect critical infrastructure by identifying structural and land surface instabilities; assess the long-term stability of restoration and mining sites; understand/mitigate triggered hazards following major fires and other natural disasters; and assess urban development near or beneath unstable rock.

Proposed Activity: *NASA would implement a North America and US Territories land surface deformation detection product (i.e. landslides, sinkholes, land subsidence, permafrost motion, volcanic unrest, earthquakes, and others) using the Sentinel 1 C-band radar imagery* that is mirrored at the Alaska Satellite Facility. The product would be improved when data from NISAR becomes available, enabling the ability to detect land surface deformation in more challenging regions such as dense vegetation and steep topography where the Sentinel-1 C-band data will have limited applicability. The European Space Agency is developing a similar product for Europe.

Proposed Activity # 5 – Land Surface Deformation Detection



Geological Survey of Norway https://insar.ngu.no/

Workshop Agenda – Day 1

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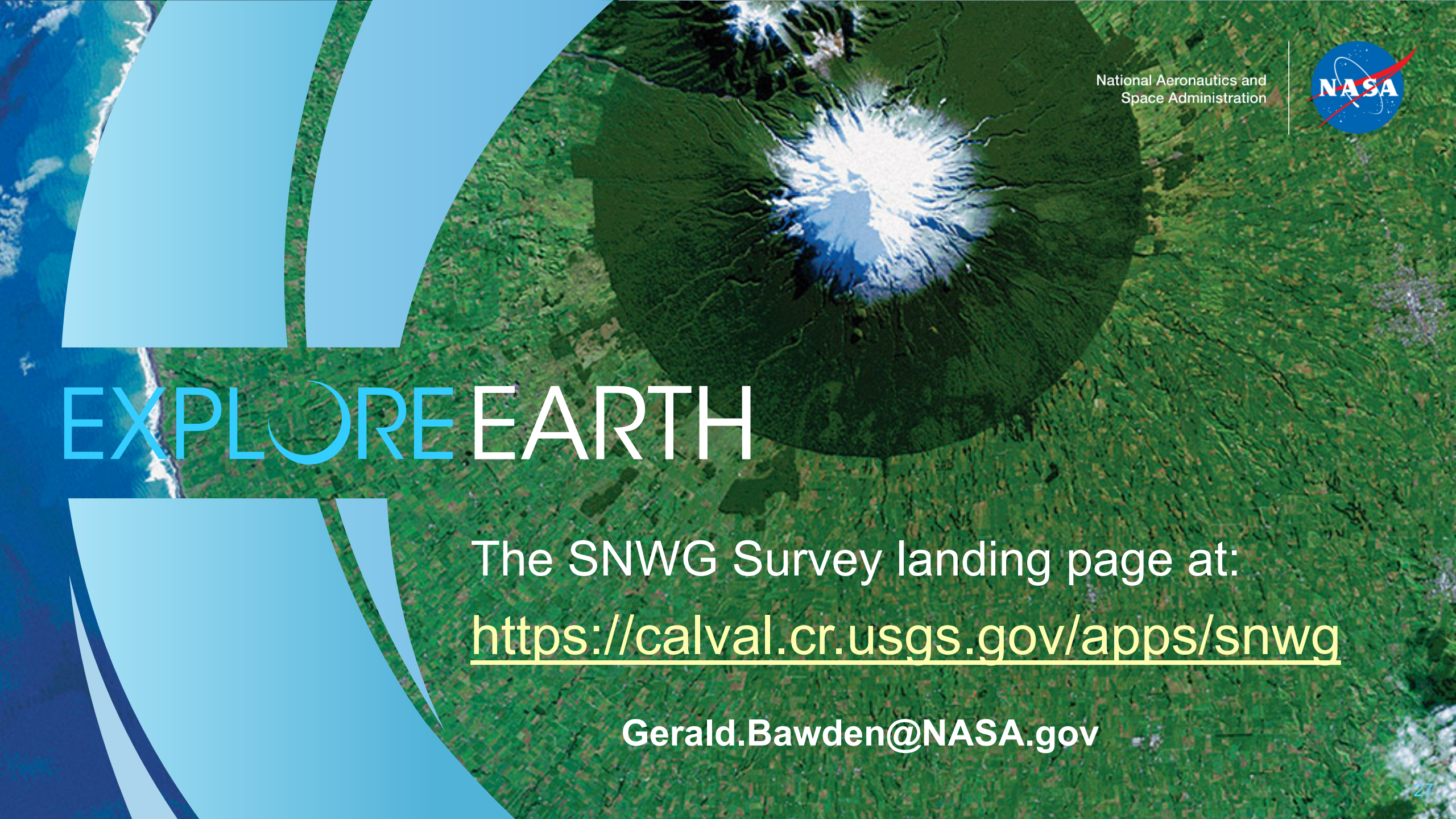

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https://calval.cr.usgs.gov/apps/snwg

Gerald.Bawden@NASA.gov