National Aeronautics and Space Administration

OPERA

Observational Products for End-Users from Remote Sensing Analysis

Fifth OPERA Workshop

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Development status of DSWx-NI

CL#25-3417

DSWx-NI Development status

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- Product Overview
- Algorithm Workflow
- Requirements
- Validation
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- Summary and Next Steps

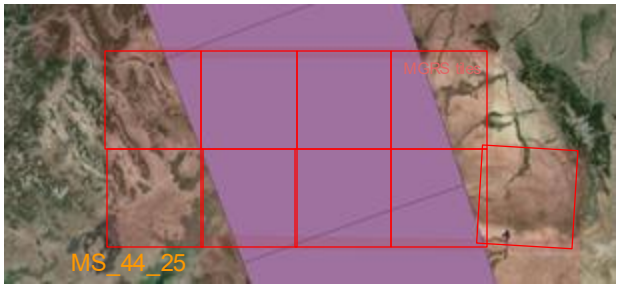
DSWx-NI Product Overview

OPERA's DSWx-NI product maps near-global, pixel-level extents of **open water** and **inundated vegetation** from NISAR SAR observations.

Description	Pixel-level extents of surface water and inundated vegetation	**Product Extent**	109.7 km x 109.7 km (MGRS tile)
Sensor	NISAR (L-band)	**Pixel Spacing (Northings x Eastings)**	30 m
Distribution	PO.DAAC	**File Format**	Cloud Optimized Geotiff (COG)
Sensor Temporal Sampling**	12 days	**Validated Release Date**	Oct. 2026

**All land-masses excluding Antarctica*
***Based on Sensor input data availability*

DSWx-S1 scaled to globe for Sentinel-1 acquisitions during November 2023

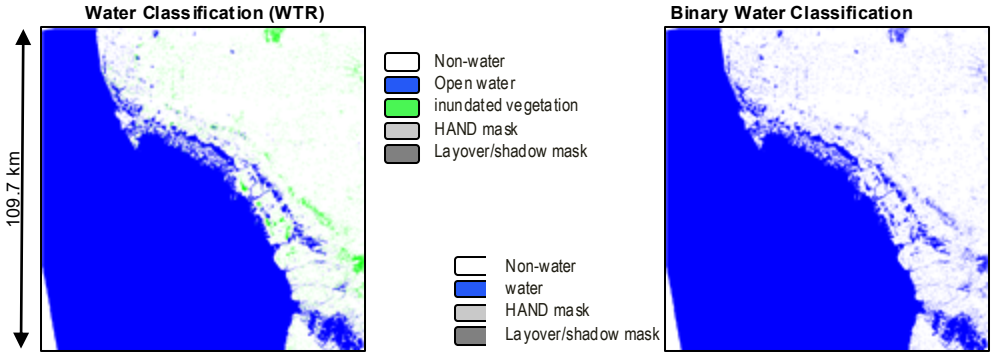


MGRS tiles (red boxes) and NISAR frame (purple) for DSWx-NI products

Classes in DSWx-NI Product

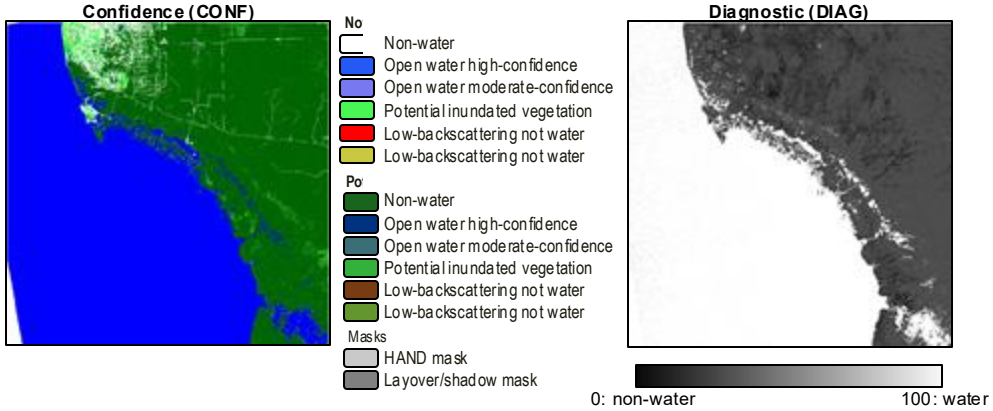
The WTR layer includes the following key layers:

- Non-water
- Open water (excludes ice and non-liquid states)
- Inundated vegetation
- Mask layers
  - Height Above Nearest Drainage mask (HAND)
  - Layover / Shadow mask



CONF layer includes more detailed classes for open water and inundated vegetation

- Split between “Potential wetland” vs “Non-potential wetland"
  - Not water
  - Open water high-confidence
  - Open water moderate-confidence
  - Potential inundated vegetation
  - Low-backscattering not water (bimodality test)
  - Low-backscattering not water (ancillary mask)



OPERA DSWx products

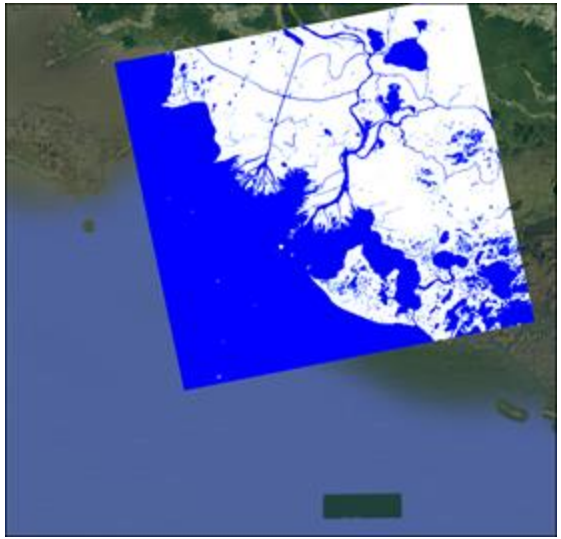
The **DSWx-NI** product is designed to have pixel spacing, projection, grid, file format consistent with **DSWx-S1** and **DSWx-HLS**

	DSWx-NI	**DSWx-S1**	**DSWx-HLS**
Input source	**Radar** NISAR GCOV (L-band)	**Radar** OPERA RTC-S1 (C-band)	**Optical** HLS
MGRS grid extent	~109.7 km x 109.7 km (3660 x 3600 pixels)		
Pixel spacing	30 m		
Projection	UTM coordinate (MGRS)		
File Format	Cloud Optimized Geotiff (COG)		
WTR classes	Open water, Inundated vegetation, Not-water		Open water, Partial Surface Water, Not-water

DSWx product examples

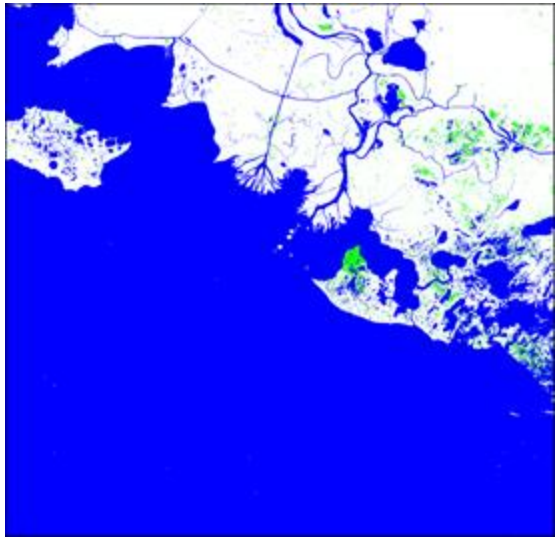
Wax Lake, Louisiana (MGRS : 15RXN)

DSWx-NI (ALOS-2 PALSAR-2)
WTR (Aug 28, 2023)



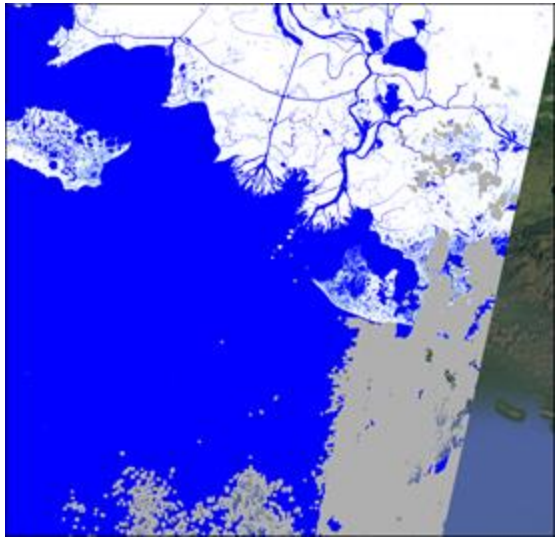
Blue : Open Water
Green : Inundated vegetation
Gray : Layover/shadow
White : Non-water

DSWx-S1
WTR (Nov 04, 2023)



Blue : Open Water
Green : Inundated vegetation
Gray : Layover/shadow
White : Non-water

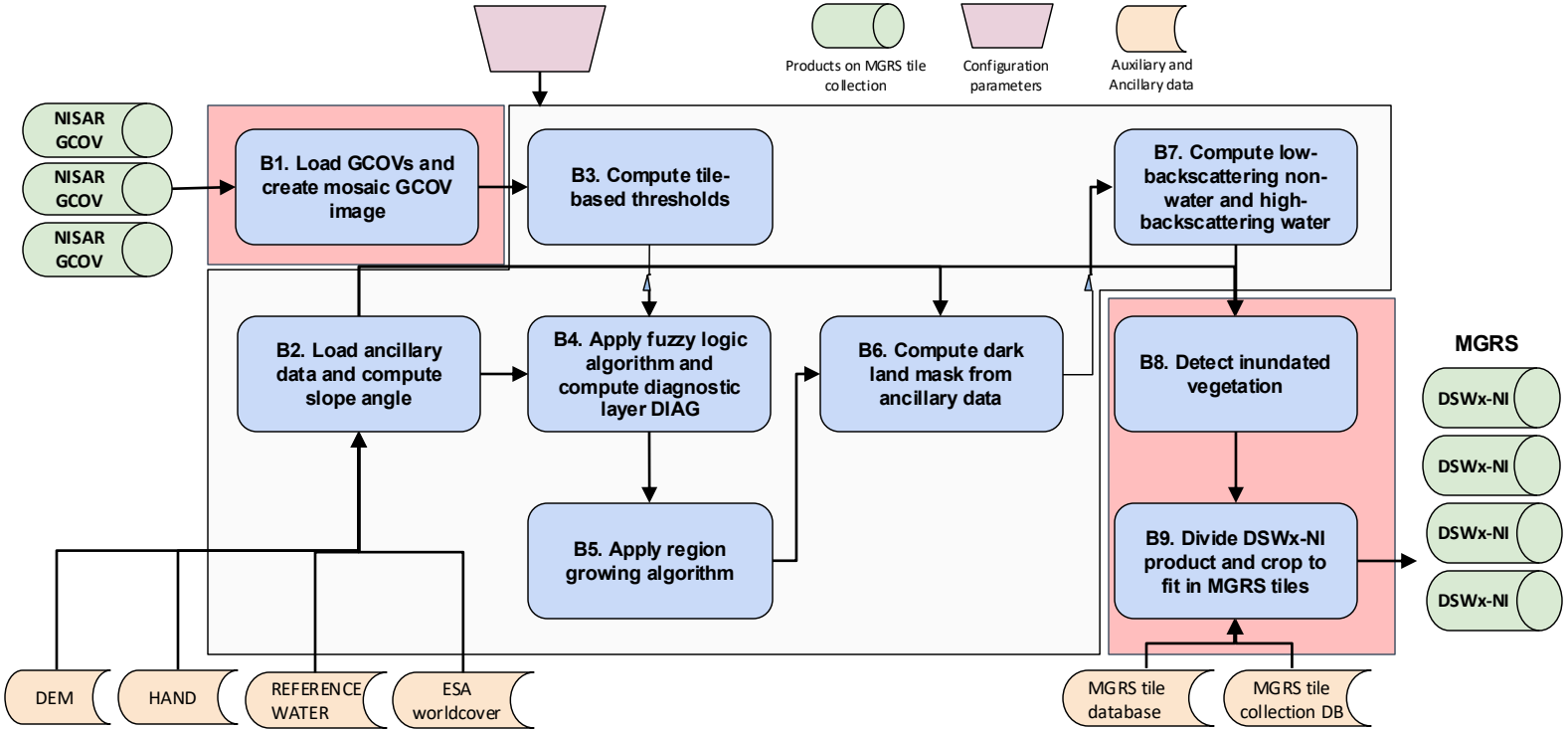
DSWx-HLS
WTR (Aug 31, 2022)



Blue : Open Water
Sky Blue : Partial Surface water
Cyan : HLS Snow/ice (high-confidence water)
Gray : HLS Cloud/Cloud Shadow
White : Non-water

Algorithm Workflow

- Core algorithm to detect the open water is same as DSWx-S1.



DSWx-NI requirement

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Requirements

Open water requirement

- Detectable water features shall be 3 hectares in size or larger and at least **200** m in width.

- The OPERA DSWx-NI shall detect **open water** with a classification accuracy of at least 80% for at least 80% of all validation products considered.

Inundated vegetation requirement

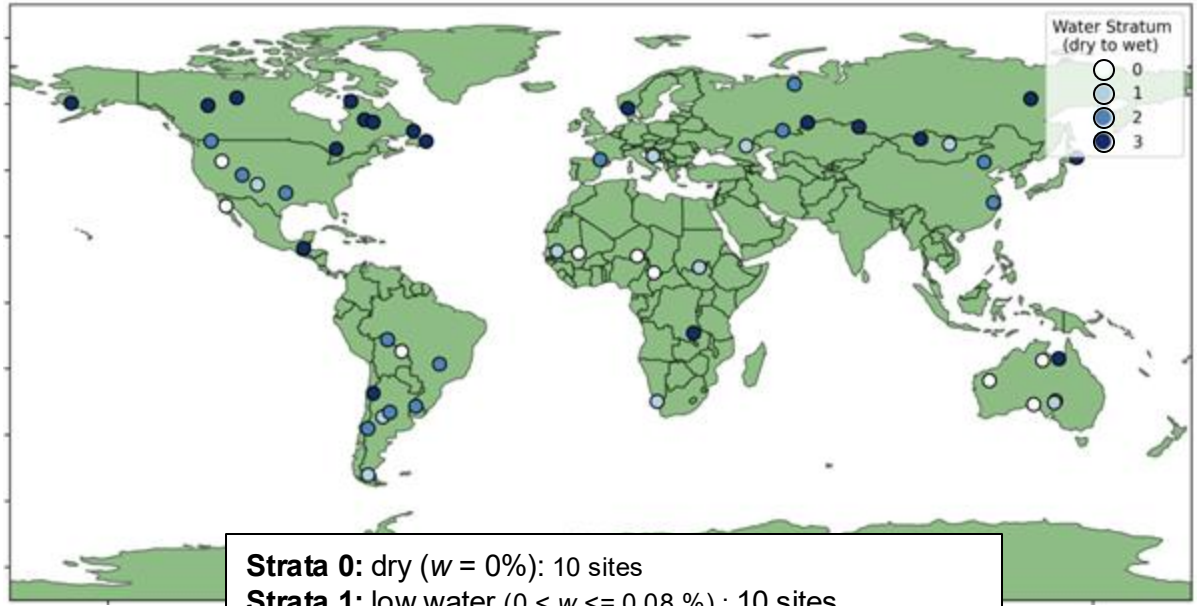
- The OPERA DSWx-NI shall detect **inundated vegetation** in wetlands with a 80% classification accuracy (i.e. at a level that will be established given future algorithm and performance testing).

- The inundated vegetation beyond wetlands is TBD
  - DSWx-S1 (C-band) mainly maps inundated vegetation over the short vegetation.
  - DSWx-NI (L-band) has capability to map inundated vegetations under the tree as well.

Open Water Validation strategy

- Sites represent 4 strata distinguished by amount of water coverage (from driest 0, to wettest 3).
- Nearly coincident NISAR, and Planetscope available at each site.
- Accuracy metrics (precision, recall, kappa, binary accuracy) will be computed and determine pass/fail for each site.

Global validation sites for open water (ex. DSWx-S1)



Strata 0: dry (w = 0%): 10 sites
Strata 1: low water (0 < w <= 0.08 %) : 10 sites
Strata 2: moderate water (0.08% < w <= 2%) : 13 sites
Strata 3: high water (w > 2 %) : 19 sites

Inundated vegetation reference datasets

Several ‘Tiers’

(All with independent, high-resolution image data):

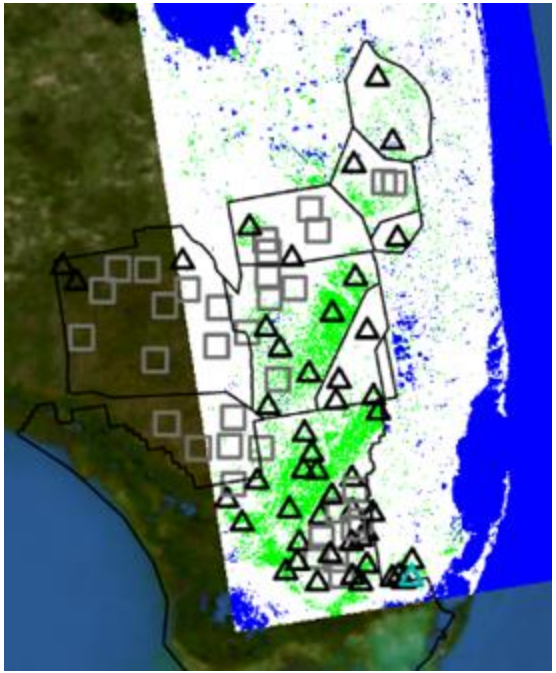
Tier I Stage gage network (150+) with decades of hourly data (FL Everglades).

Tier II Multi-year in-situ data on water feature extent and/or inundation status at transect points (e.g., OR high desert marsh, ND Prairie Pothole, CT coastal marsh, WV forested swamp…).

Tier III UAVSAR/NISAR and other sites where we have ample expert knowledge (e.g., LA, AK, CDA,).

IV calibration example for Everglades, FL

April 29, 2022



Product Usage

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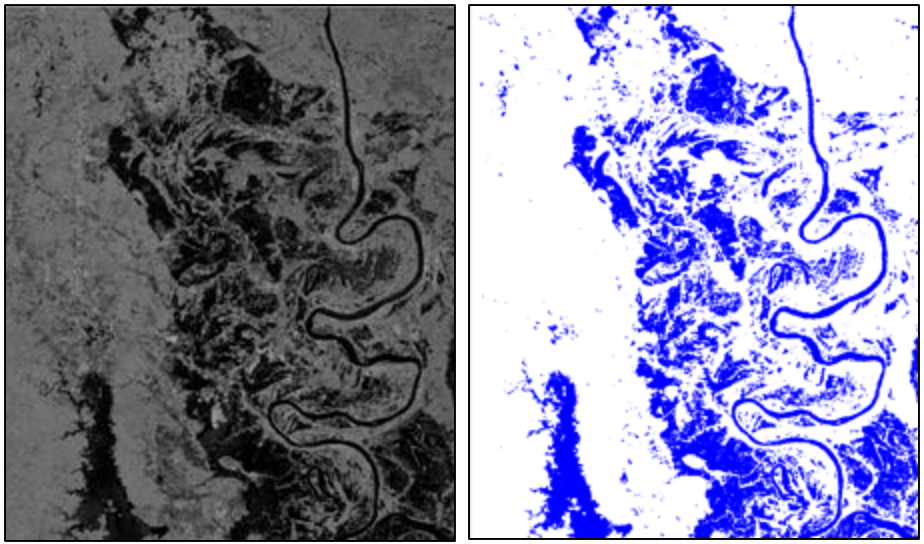
- DSWx-NI maps surface water and inundated vegetation, enabling flood and drought assessment and long-term hydrologic monitoring.

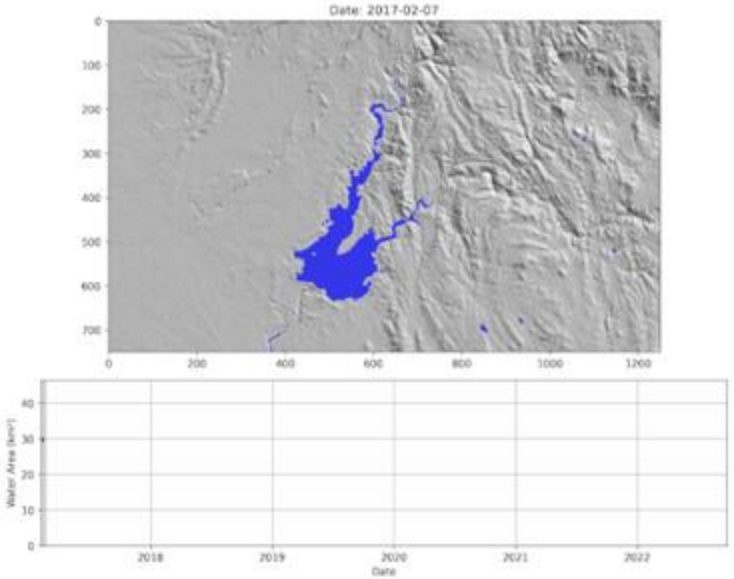
Flood detected from ALOS-1

Laos (2008-08-15)



Water extent changes detected from DSWx-S1

Folsom Lake, CA



Looking Forward

Operational OPERA DSWx-NI products are expected to become available in October 2026

Summary

- The OPERA project will generate DSWx products from NISAR on a near-global scale
- The OPERA team will use NISAR GCOV products as an input and provide users with the highest quality data possible
- We expect OPERA DSWx-NI products to be suitable for a wide range of applications
    - Flood, Drought, Long-term reservoir monitoring.

Next Steps

- OPERA team is currently developing all software required for DSWx-NI production
- Product validation will begin in Feb 2026