



Surface Water & Ocean Topography (SWOT) Applications

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*SWOT Science Team Meeting
June 21, 2024*





Introductions!



**Cassandra
Nickles**



**Angelica
Rodriguez**



**Matthew
Bonnema**



**Santiago
Peña Luque**



**Nicolas
Picot**



Activities over the Past Year

- Early Adopter Workshop! December 2024
 - Report
 - Submitted to AGU Advances
- With Pre-validated data release March 6th, we've been reaching out to our Early Adopters!
 - Individual support
 - Quarterly telecons
 - Office Hours
- Western Water Applications Office (WWAO) presentation to water resources managers



EA Workshop

- 7-8 December 2023
- Pasadena, CA & virtual (Caltech or JPL)
- Focus on use of SWOT
 - Early Adopter updates
 - Some early impressions of SWOT Beta Products
 - Modeling activities that may benefit from SWOT
 - Training on use of and access to SWOT data
 - PO.DAAC
 - Hydroweb.next
 - AVISO



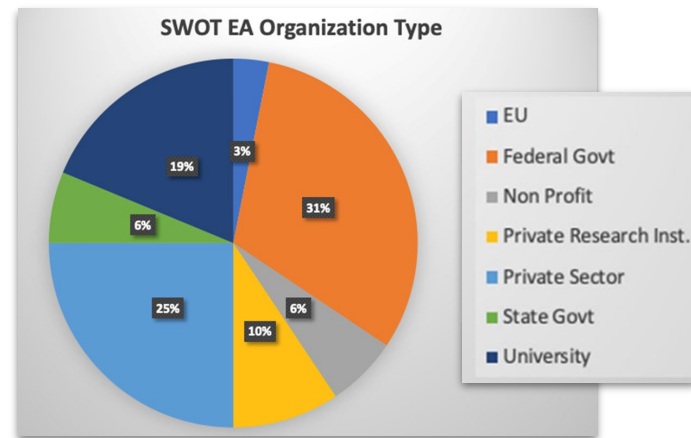
SWOT Early Adopters Program

- SWOT Applications Program since 2012
- 40 SWOT Early Adopters
- U.S. and International leadership – NASA/CNES
- Building toward early SWOT applications success stories!
- Few ongoing projects over Africa, but **promising contacts with OIEAU team (refer to Monday presentation and slide later on)**

<https://swot.jpl.nasa.gov/applications>



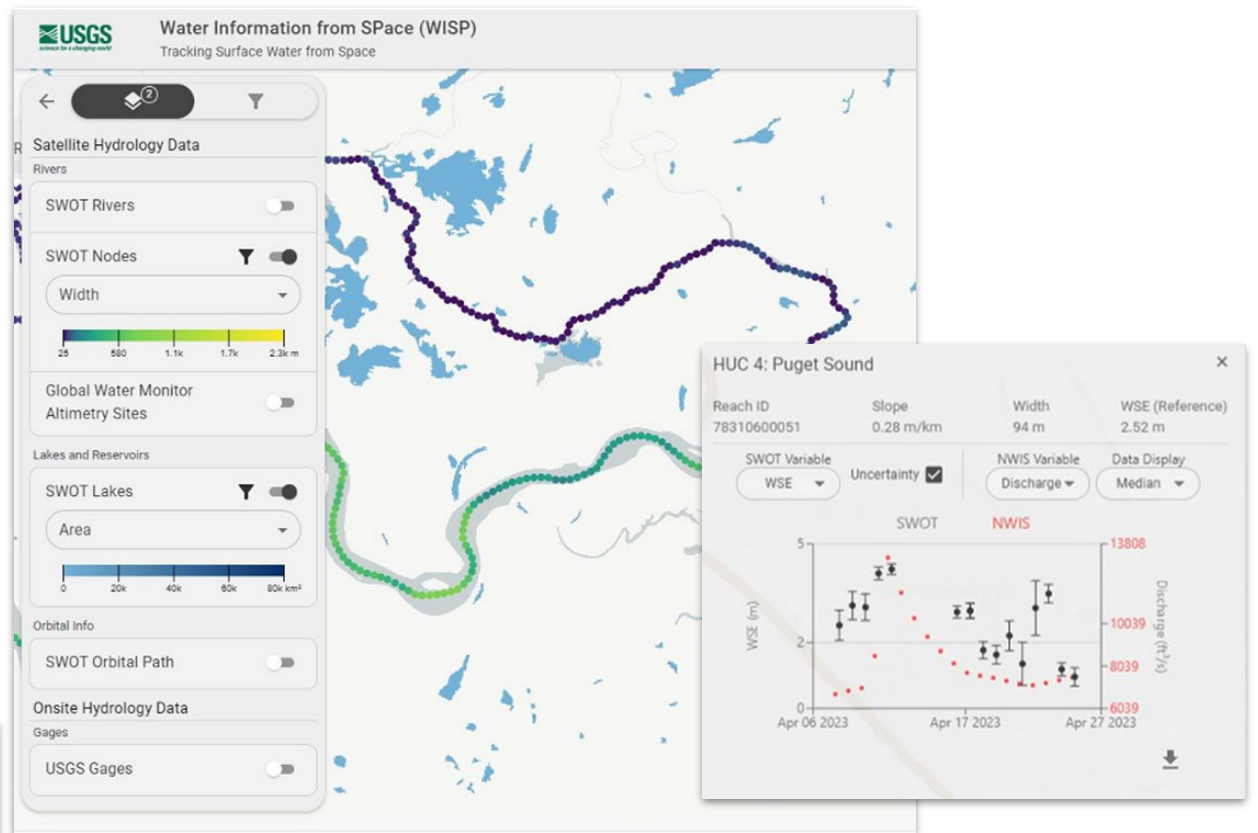
Figure 2. Forty SWOT Early Adopter teams span the globe with a wide range of operational and applied science project topics. Visit swot.jpl.nasa.gov/applications/early-adopters/ for information about all SWOT EA projects.





Water Information from SPace (WISP) Dashboard

- SWOT River data time series alongside USGS gauge data
- Uses Hydrocron tool developed by PO.DAAC
- Not yet publicly available, but in the works!



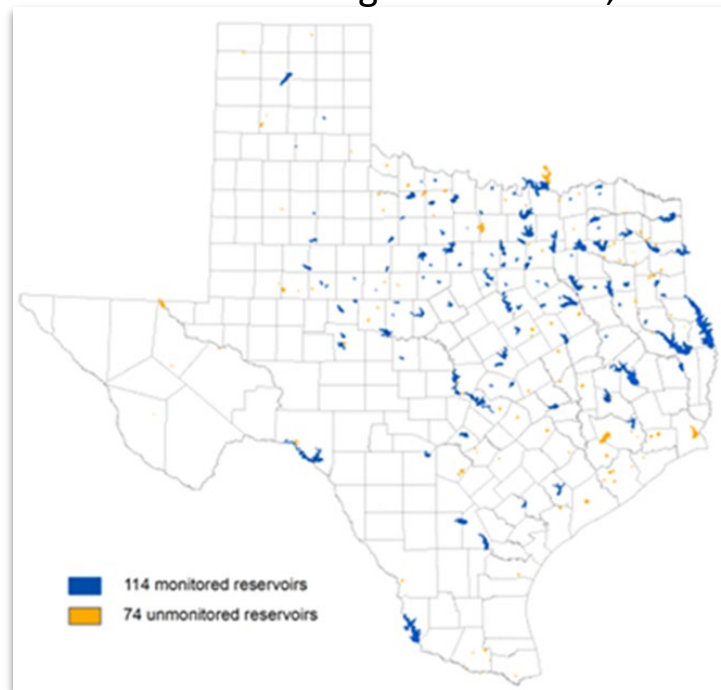
This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information."



Texas Water Development Board (TWDB), Austin, TX

- Estimation of Volumetric Evaporative Water Loss from Unmonitored Reservoirs in Texas
- SWOT provides surface area for reservoirs and TWDB plans to compute “statewide” evaporation losses (evaporation - precipitation)
- Leads: Nelun Fernando & John Zhu

Major Texas reservoirs (capacity is greater than 5,000 acre-feet); ~200.





IIT - Bombay

Work in Progress:

- Lake Data Inventory
- Floods on Indian Rivers through Discharge Estimation
- Extending historical gauge network over Indian river reaches
- Hydrologic model calibration over the Indian Basin
- Sentinel-1 based Inland water dynamics Mapping System (SIMS) Toolkit

Leads: Indu Jaya & Manu Soman

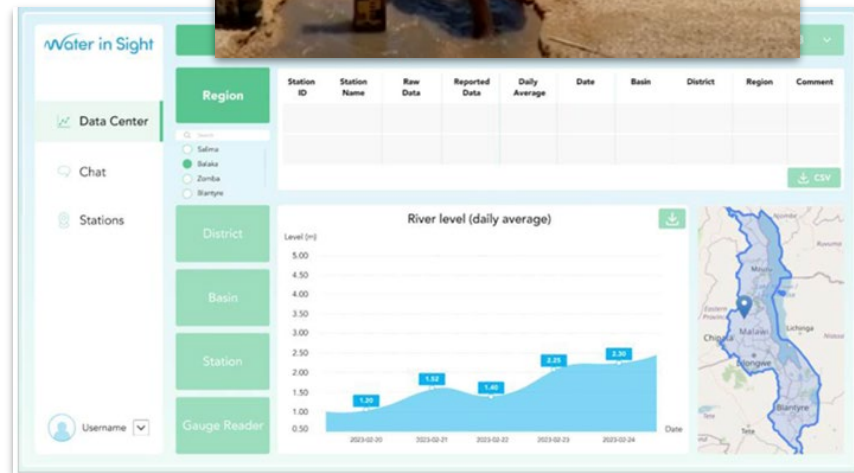


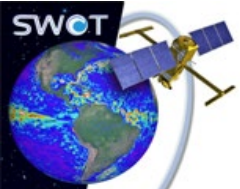


Water in Sight

Swedish startup

- Developed SMS & WhatsApp for hydro gauge readers in Least Developed Countries (LDC)
- SWOT EA project area– Africa (Malawi, Mozambique, Sierra Leone)
- Smartphone observations of river & rainfall levels sent to database for govt operational agencies, compare to SWOT
- Flood thresholds & equipment inventory



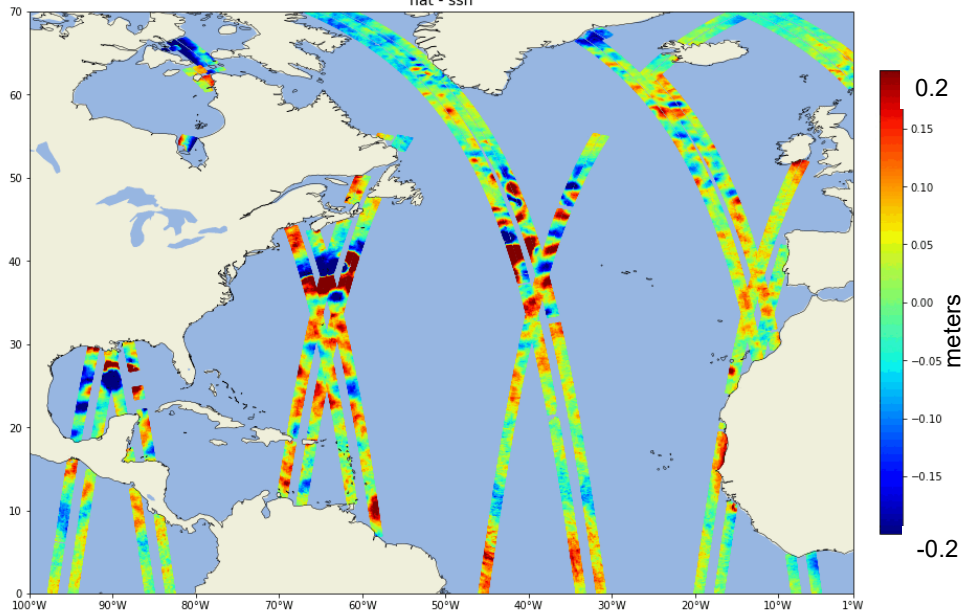


SWOT Ocean Early Adopters

Satellite and GDR: all all

nat - ssh

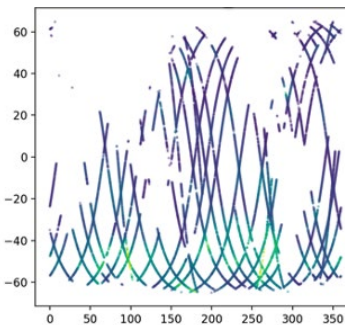
Target Date: 2023-09-10
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- SWOT Ocean swath data and nadir data already integrated!

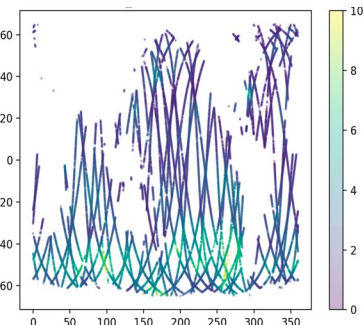
24 hrs Altimeter Data

11,962 obs



24 hrs Altimeter Data with SWOT

19,303 obs



- Ocean weather forecasts to reduce fuel and emissions for maritime shipping
- Adding SWOT gives 50-100% more observations





SWOT Tideflats Early Adopters

- One of the SCO (Space Climate Observatory) projects, using Sentinel-2 and SWOT data
- <https://www.spaceclimateobservatory.org/eo4intertopo>
- Promising capacity of SWOT mission to observe the intertidal topography



Topics



Sustainable Development Goals



Summary

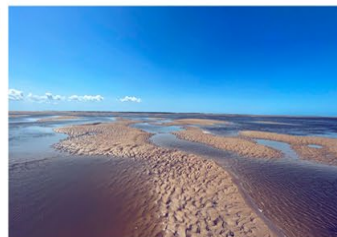
- Overview
- Application site(s)
- Data
- Results - final product(s)
- References
- Our partners
- Contact

EO4Intertopo

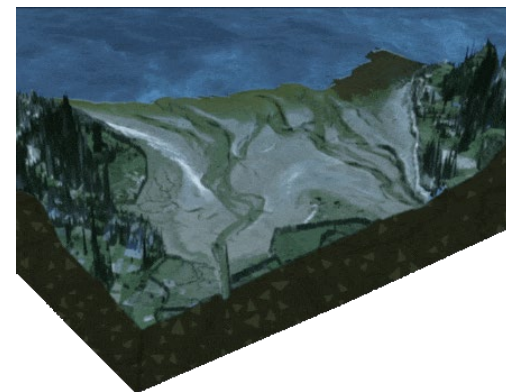
Intertidal zones, located at the interface between land and sea, play a vital role as natural buffer zones to protect coastal regions. Using optical and radar satellite imagery, EO4Intertopo aims to map the morphological evolution of Normandy's intertidal zones and contribute to the effective management and conservation of these critical ecosystems.

Observation of changes in the topography of coastal intertidal zones from space in the context of climate change

[fr]



La baie des Veys en Normandie à marée basse. © CNRS/Edward Salameh

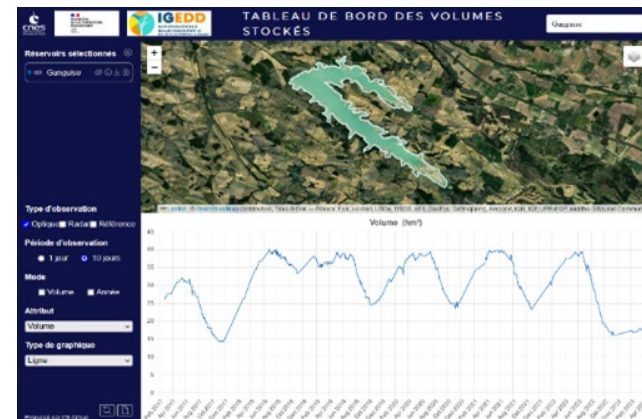




SWOT on Reservoir Absolute Storage

- Stockwater project, using Sentinel-1 SAR DEM & soon SWOT data
- <https://www.spaceclimateobservatory.org/en/stock-water>
- Assessment over 110 reservoirs en Tunisia, Burkina, Brazil, India, Europe

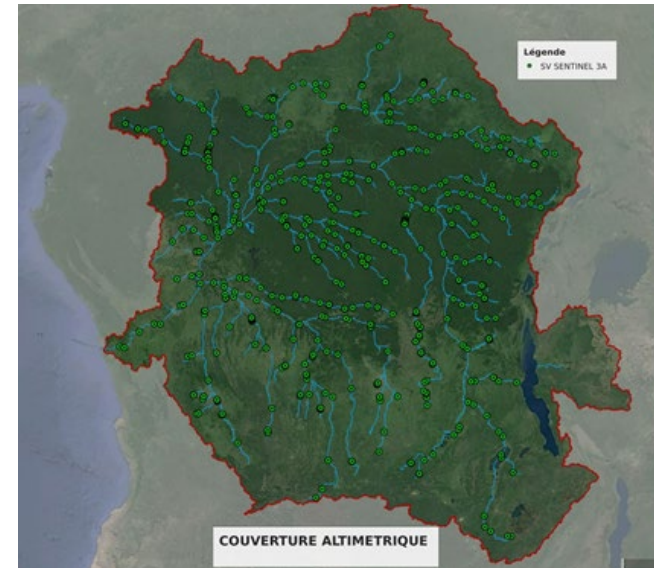
- France platform - 350 reservoirs
- <https://www.france-suivi-sa-des-retenues.org/>
- Operational services for French Government (9000 water bodies) going



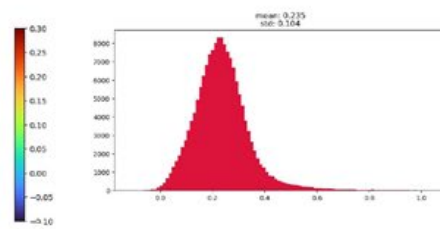
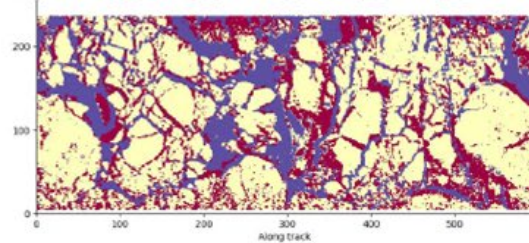
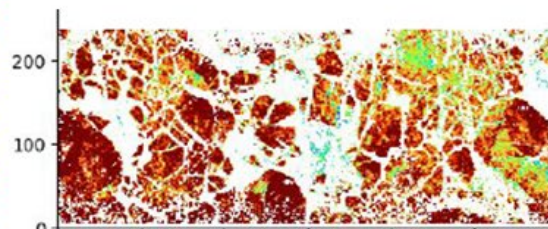
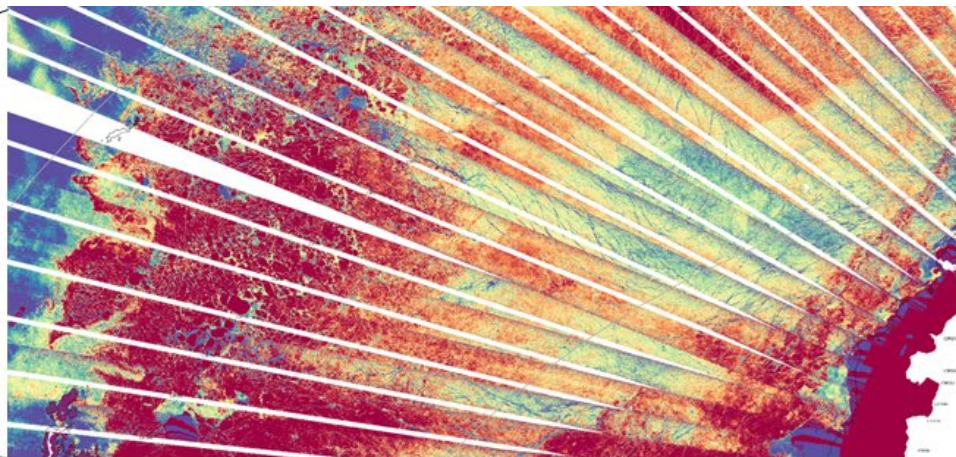
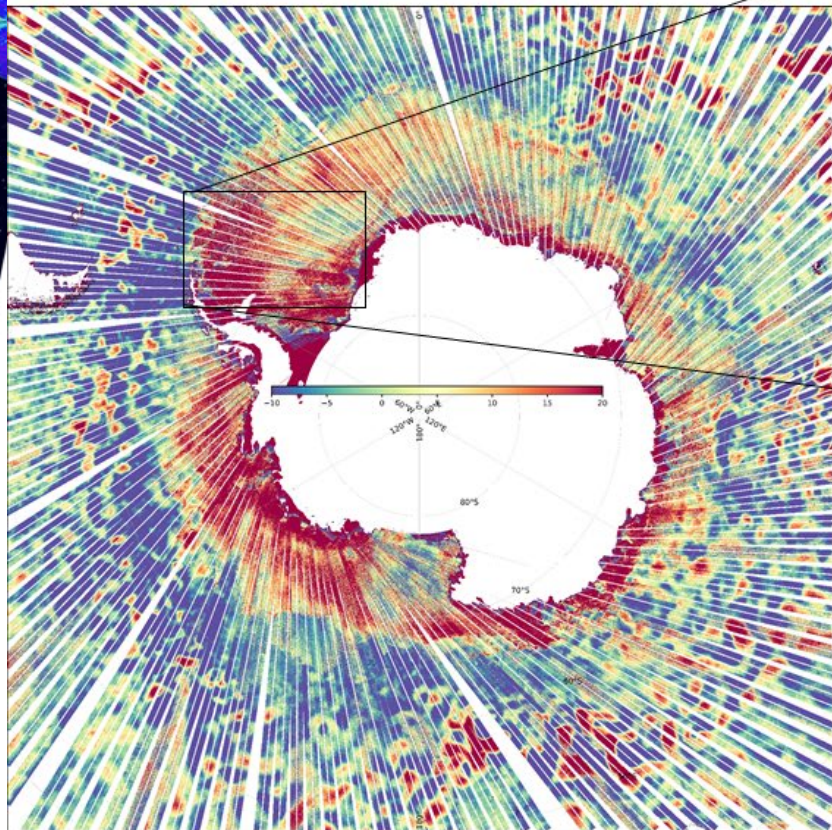


SWOT and Discharge Monitoring over Africa

- With OIEAU and AFD collaboration, a new project will be launched to compute river discharge over several basins
 - Congo, Niger, Senegal, Mozambique
- Based on a combination of nadir altimetry data, SWOT and large scale hydrological modelling (MGB).



SWOT and Sea Ice



SWOT provides new insight over this fragile area.
Ongoing work to compute SWOT Sea Ice FreeBoard



What's Next?

- **SWOT Community & Early Adopters**
 - Dissemination of open science products/tools to broader science and applications users
 - YouTube Videos to spread the word & information
- **Early Adopters Continuation**
 - Quarterly telecons
 - Annual workshop in the fall
 - Individual project support for EA's
- **Office Hours for SWOT Community**
 - Collaborate with PO.DAAC
- **SWOT Applications Working Group (SAWG)**
 - Soliciting participation from the next ST iteration
 - Coordination with other SWOT working groups (Coastal, Data inversion and assimilation, Open science, etc.)



You're Invited!

SWOT Applications Working Group (SAWG)

Purpose

- **Build connections** and awareness among ST members that are participating in **applications -relevant SWOT investigations**
- **Spread expert knowledge** on how data should be used and communicated (**videos!**)
 - **Best practices** for quality flags and filtering the data, etc.
 - **Open science**
- Working group to move beyond understanding the data and toward using it for **societal benefit**
- **Achieve high visibility, high impact applications**

What does this look like **practically** ?

- **Quarterly virtual gatherings** to communicate what we're already doing in application spheres and brainstorming ways to synergize & spread the word
- **Email will be sent out to sign up**

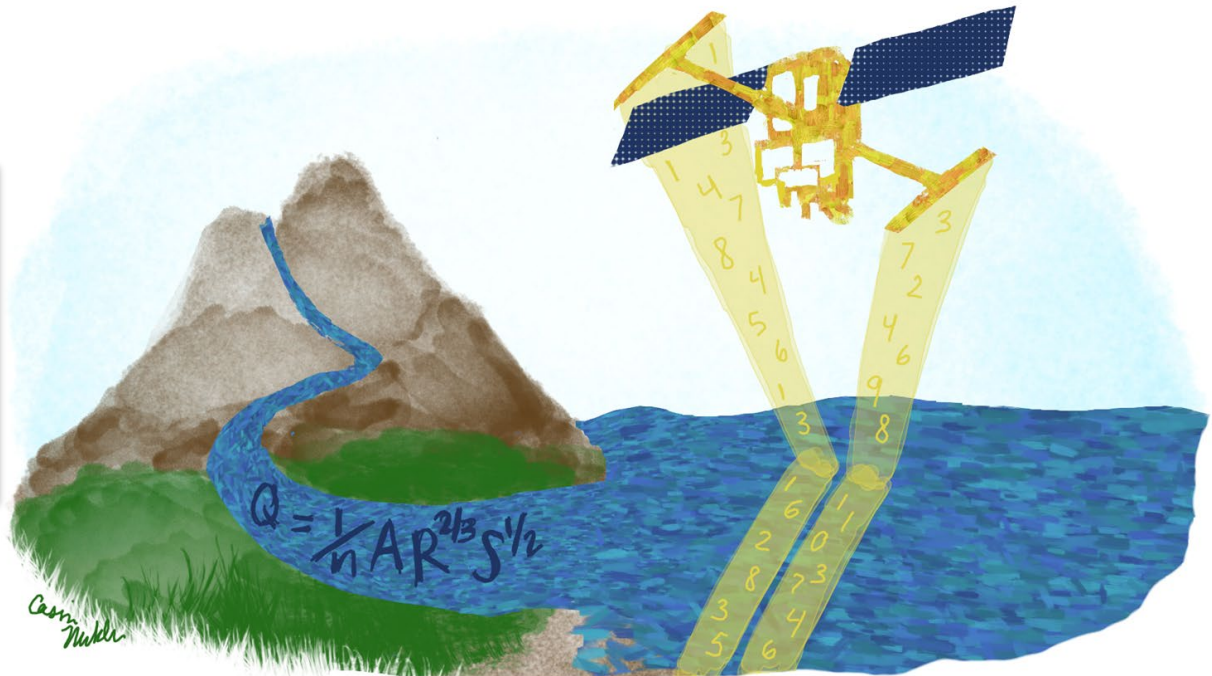


Thank you! Questions?

<https://swot.jpl.nasa.gov/applications>
<https://swot.cnes.fr/en/search/site/SWOT>



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Extra Slides



Resources, Tips, & Tutorials!

PO.DAAC Cookbook: SWOT Chapter

The screenshot shows a web browser displaying the tutorial page at podaac.github.io/tutorials/quarto_text/SWOT.html. The page has a left-hand navigation menu with the following items: SWOT (selected), Search via GUI, Programmatically via Command Line, Spatial Coverage, Tips for SWOT HR, Spatial Search, Access & Visualization, SWOT Hydrology, SWOT Oceanography, GIS Workflows, StoryMap, Shapefile Exploration, Transform Data, Hydrology Time Series, and NetCDF to Geotiff. The main content area is titled "SWOT" and "SWOT Data Tutorials". Below this is a section titled "SWOT Background" which contains the following text: "The Surface Water and Ocean Topography (SWOT) mission aims to provide valuable data and information about the world's oceans and its terrestrial surface water such as lakes, rivers, and wetlands. SWOT is jointly developed by NASA and Centre National D'Etudes Spatiales (CNES), with contributions from the Canadian Space Agency (CSA) and United Kingdom Space Agency (UKSA). The satellite launched on December 16, 2022. PO.DAAC is the NASA archive for the SWOT mission, and has made data available via the NASA Earthdata Cloud (hosted in AWS) with direct download capabilities available. PO.DAAC hosts a variety of [SWOT data products](#), whose product description documents can be found in the chart listing each dataset. More information can be found on [PO.DAAC's SWOT webpage](#)." At the bottom of the page, there is a section titled "SWOT Data Resources & Tutorials".



https://podaac.github.io/tutorials/quarto_text/SWOT.html



GitHub Collaboration Space

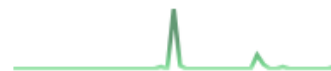


SWOT Community

This is a code space for the global SWOT mission community. We share experience, code, research and much more. Our mission is to increase the value of SWOT.

SWOT-OpenToolkit Public

Community codes for processing SWOT data. This is a community code repo, does not include the algorithms that belong to the project.



● Python ☆ 29 📄 Apache-2.0 🍴 7 🕒 0 📁 1 Updated 2 weeks ago

CNES-AVISO Public

● Jupyter Notebook ☆ 7 📄 BSD-3-Clause 🍴 1 🕒 0 📁 0 Updated 3 weeks ago



<https://github.com/SWOT-community>

Tools for accessing SWOT data- Cheatsheet



Ocean



Hydro



Coast



Learn/Information

- PO.DAAC Dataset Mission Page and Landing Pages <https://podaac.jpl.nasa.gov/SWOT?sections=data>
- PO.DAAC Cookbook - SWOT Chapter https://podaac.github.io/tutorials/quarto_text/SWOT.html



Find Data - Map GUI interface

- Search & Access in *Earthdata Search* <https://search.earthdata.nasa.gov/search?q=SWOT%20HR&long=0.0703125>



Access - Command line/automated scripts

- Subscriber/Downloader https://podaac.github.io/tutorials/quarto_text/SWOT.html



Access & Subset - GUI

- HiTIDE <https://hitide.podaac.earthdatacloud.nasa.gov/>



Access - Cloud native, Big data, ML

- in-cloud access available: [example for LR ocean](#), [example for HR hydro](#)



Access & Explore - In development or planning phase:

- [Hydrocron](#) Timeseries API
- [SWODLR](#) On-demand Raster - *in development (Beta, Spring 2024)*
- GIS-friendly, e.g. web services (e.g. WFS) - *in development (Beta, mid-2024)*
- QGIS and ArcGIS - local: download and open - *works now*
- Exploratory Analysis in [SOTO by Worldview](#) - *early 2025*

