

# U.S. Geological Survey Planning for SWOT Data Availability

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U.S. Geological Survey (USGS)

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*SWOT Science Team Meeting, June 2024, Chapel Hill, NC*



# Overview

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Current USGS Surface Water Monitoring

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USGS Plans for Use of SWOT Data

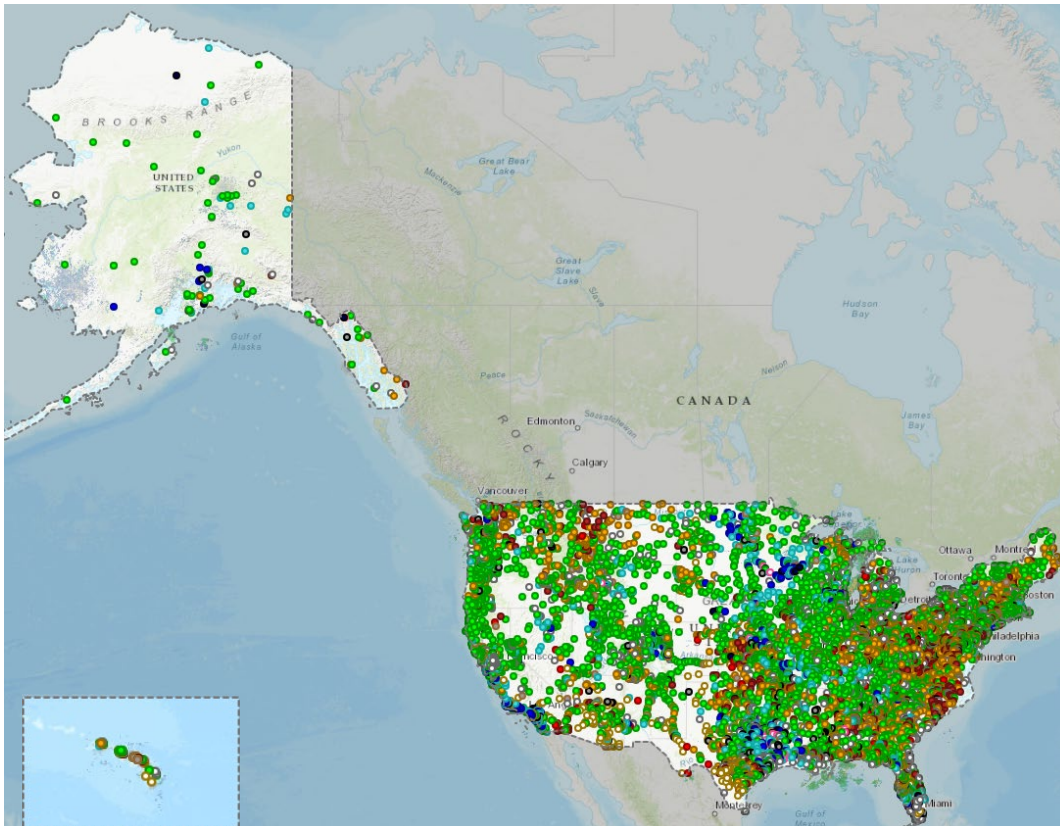
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Long Term Satellite Water Observation

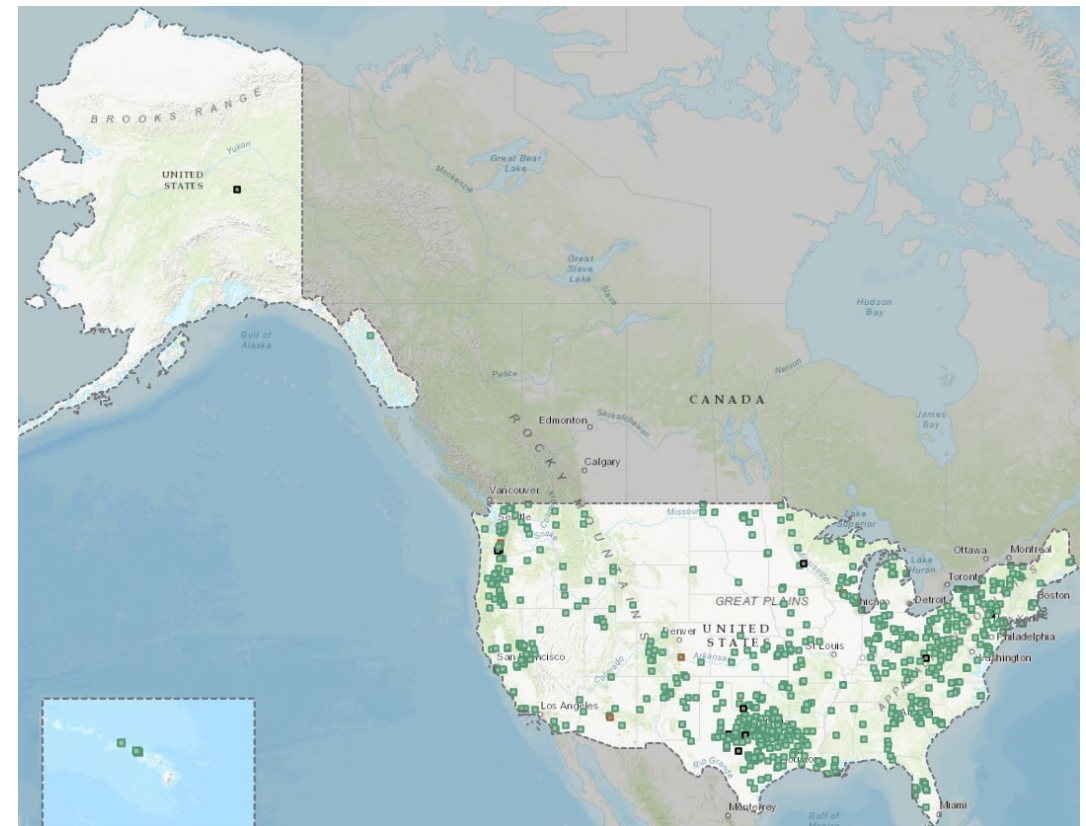
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# USGS National Monitoring Networks

## 8,841 Real-time Streamflow Stations



## 713 Real-time Lake Water Level Stations



# USGS Water Level and Discharge Data

- USGS National Streamgauge Network:
  - ~12,000 Streamgages (~8,800 real time)
- Streamgaging stations are visited every 4-8 weeks for calibration, O&M, and updating
- In 2023, 67% of 2.21 billion requests for USGS water information were for streamflow data
- USGS monitoring stations are run in funding partnerships with ~1,500 public agencies

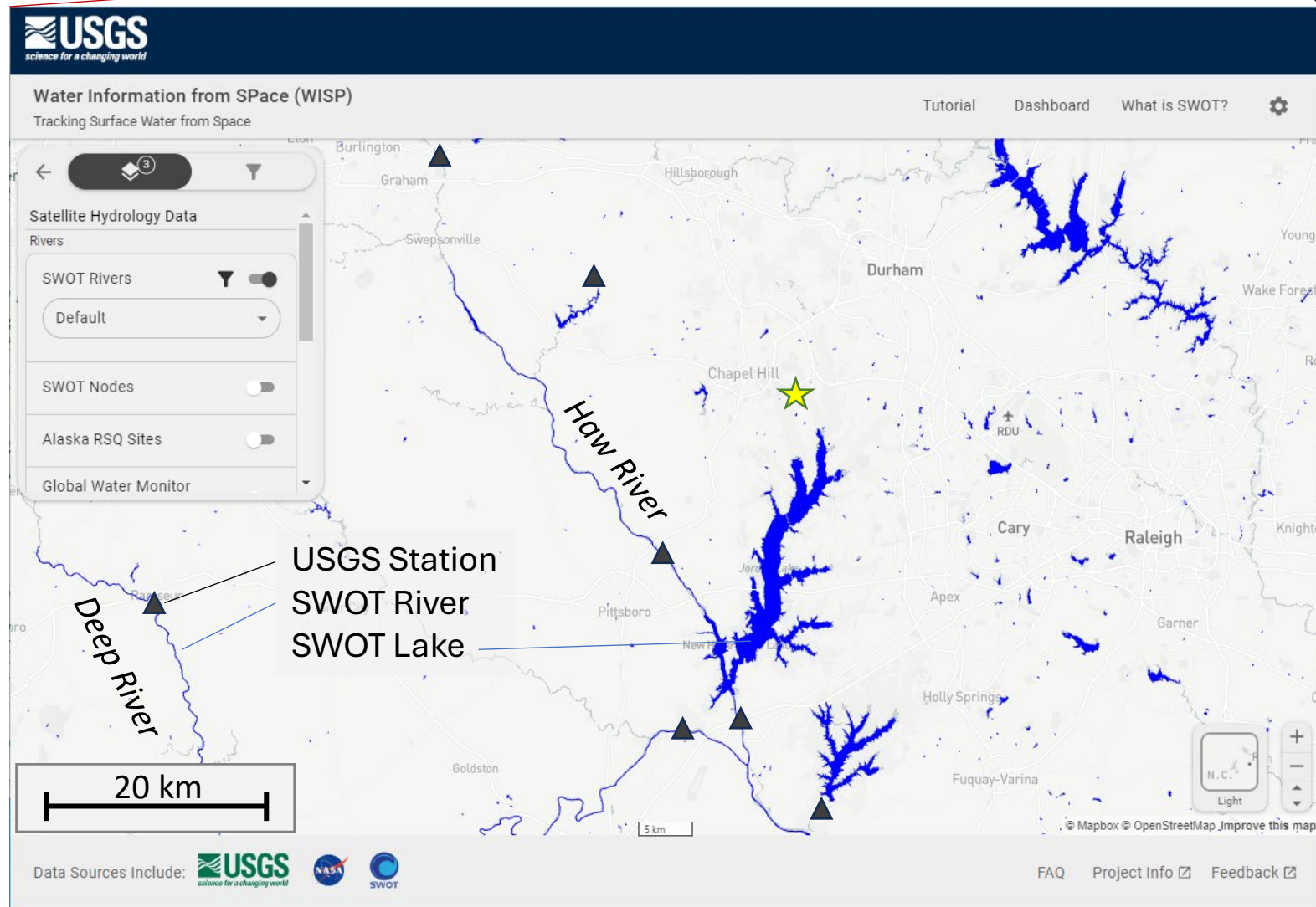


*Heather Best, USGS, at Birch Creek,  
Alaska, station ID 15392000.  
Photo credit: Derek Frohbeiter, USGS*

# Surface Water Monitoring Comparison: USGS in-situ networks and SWOT



- SWOT monitors more lakes and large rivers, for example in the US:
  - 467,528 lakes (USGS ~713 stations)
  - 93,000 river miles (USGS ~12,000 stations, ~8,800 real-time)
- USGS monitors small streams:
  - >80% of USGS stations are on streams too small for SWOT



## Surface Water Monitoring Comparison: USGS in-situ networks and SWOT

**Accuracy** is a key determinant for adoption and use of SWOT data

Data product	Nominal SWOT Accuracy	Nominal USGS Accuracy
Water surface elevation	$\pm 10\text{-}25$ cm	0.3 cm
Water extent	$\pm 15\%$	-
River discharge	????? $\pm 19\text{-}29\%$ for large rivers ( <a href="#">Frasson et al., 2020</a> )	5-15%

# USGS Coastal/Marine Hazards and Resources Program (CMHRP)

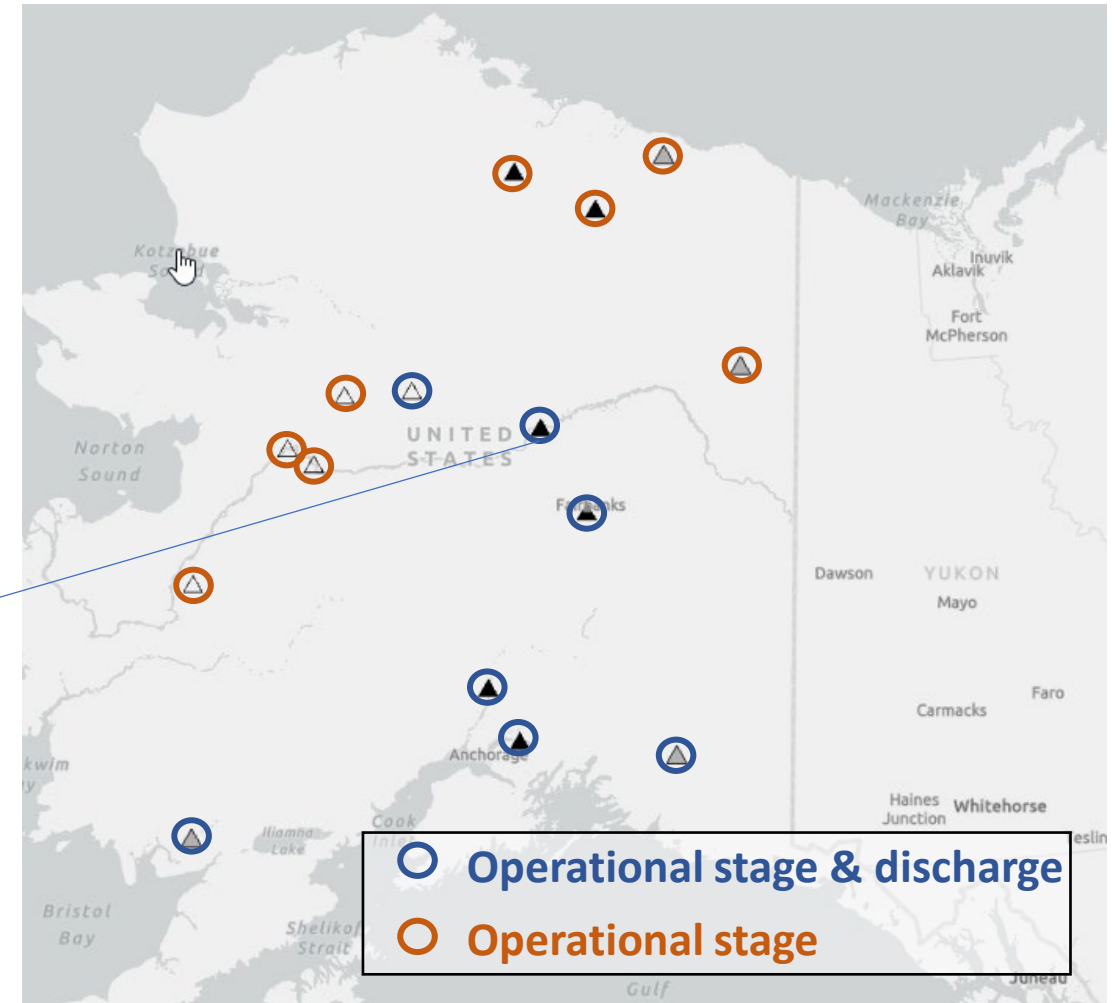
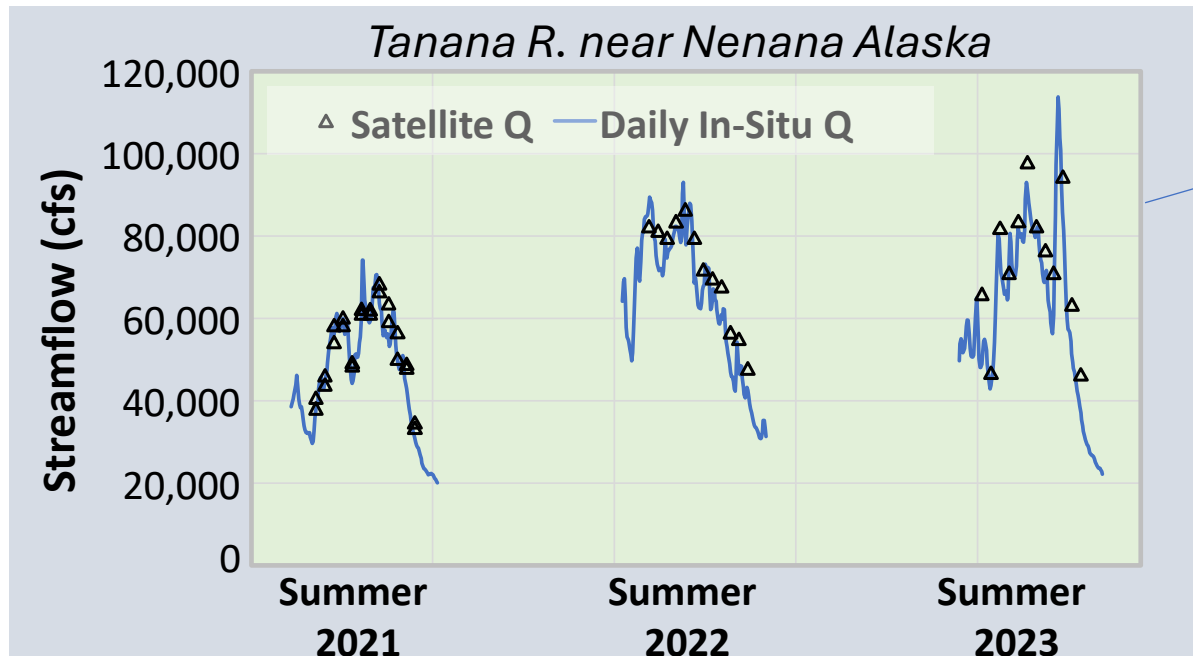
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- **Interested in further discussion with NASA about SWOT capabilities**
- **Pilot testing and Preparation for SWOT Data Availability**
  - Assessment of SWOT products for coastal water level observations in Alaska
  - This is a data poor region and additional coastal water level data are of high value.
- **Potential science applications of interest:**
  - Validation of coastal surge models immediately after hurricanes
  - Salt marsh geomorphology
  - Evaluation of shoreline position and migration derived from SWOT data
  - Potential for obtaining ocean surface winds during extreme events
  - Comparison of ocean circulation features to transport of river plume contaminants after hurricanes
  - Non-storm coastal water levels, especially between the Gulf Stream and the coast
  - Variability of sub mesoscale eddies to compare Gulf Stream circulation to models

# Alaska Satellite Stream Gaging Network

- Providing satellite water level and discharge data to Alaska natural resource agencies since 2021
- Supported by both USGS and NASA
- Preparing USGS and cooperators for SWOT data, which will expand system by ~100X



These data are preliminary or provisional and are subject to revision. They are being provided to meet the need for timely best science. The data have not received final approval by the US Geological Survey (USGS) and are provided on the condition that neither the USGS nor the US Government shall be held liable for any damages resulting from the authorized or unauthorized use of the data.



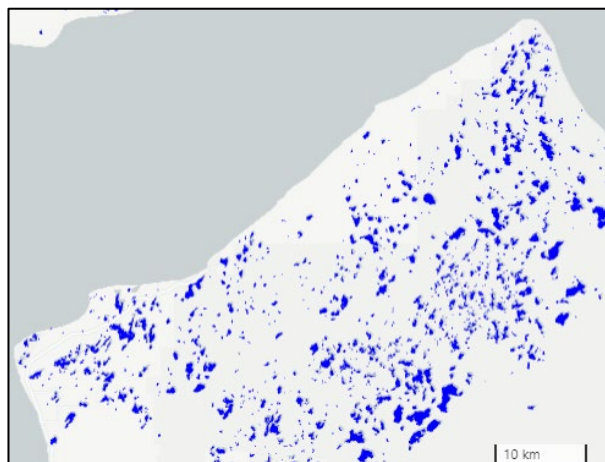
# Planning for Use of SWOT Observations

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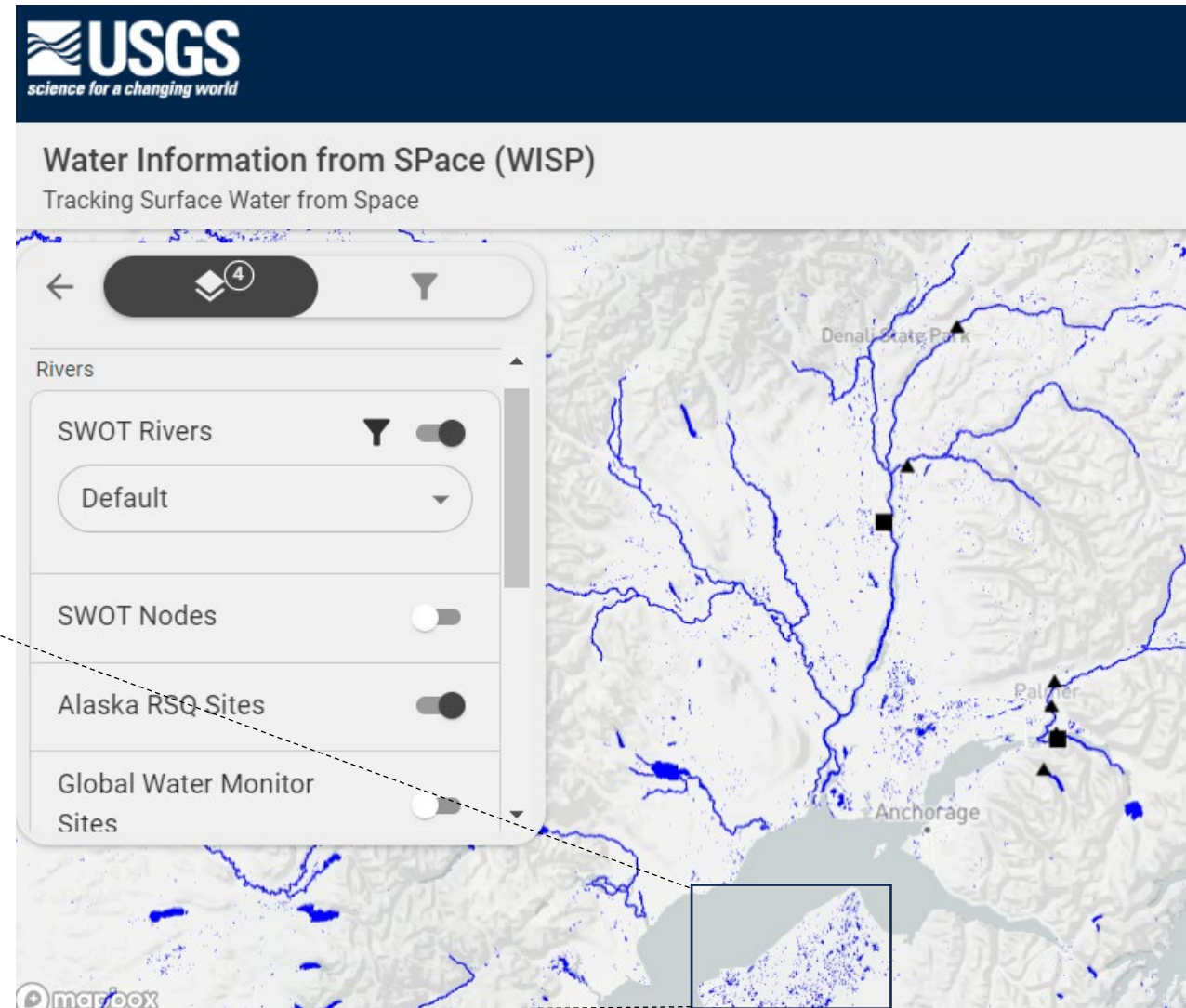
1. We expect that SWOT observations will have increasing accuracy and value with time
2. We are working with partner agencies to discover applications for SWOT data
3. We expect to use SWOT data to address hydrology issues such as:
  - *How much water is stored in rivers and lakes?*
  - *Can we better assess water cycle components and water availability?*
  - *What are reservoir operation rules, in detail, nationally?*
  - *What are flows and seasonal patterns in Alaska rivers and lakes?*
  - *Lake and river ice, where and when does ice occur?*

# USGS satellite monitoring dashboard

- Easy access to satellite water data
- Tool for internal users and the public
- SWOT data ingested from NASA-JPL
- In-situ and USGS satellite-derived discharge data
- Public release later this summer



## Satellite water data near Anchorage AK



# Long-Term Satellite Water Observation Missions:

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**Long-term Reliability** is a key determinant for adoption and use of water data

- SWOT data will need ongoing Calibration and Quality Control/Assurance beyond the 3.5 year planned lifetime
- A SWOT-2 mission should be planned and announced as soon as possible

## USGS Looks to :

- Discover best uses of SWOT data based on ongoing accuracy assessments
- Contribute to accuracy assessment and improvement
- Seek continued close collaboration with NASA
- Participate in federal agency planning, and encourage future SWOT-like missions

# Discussion Welcome

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