

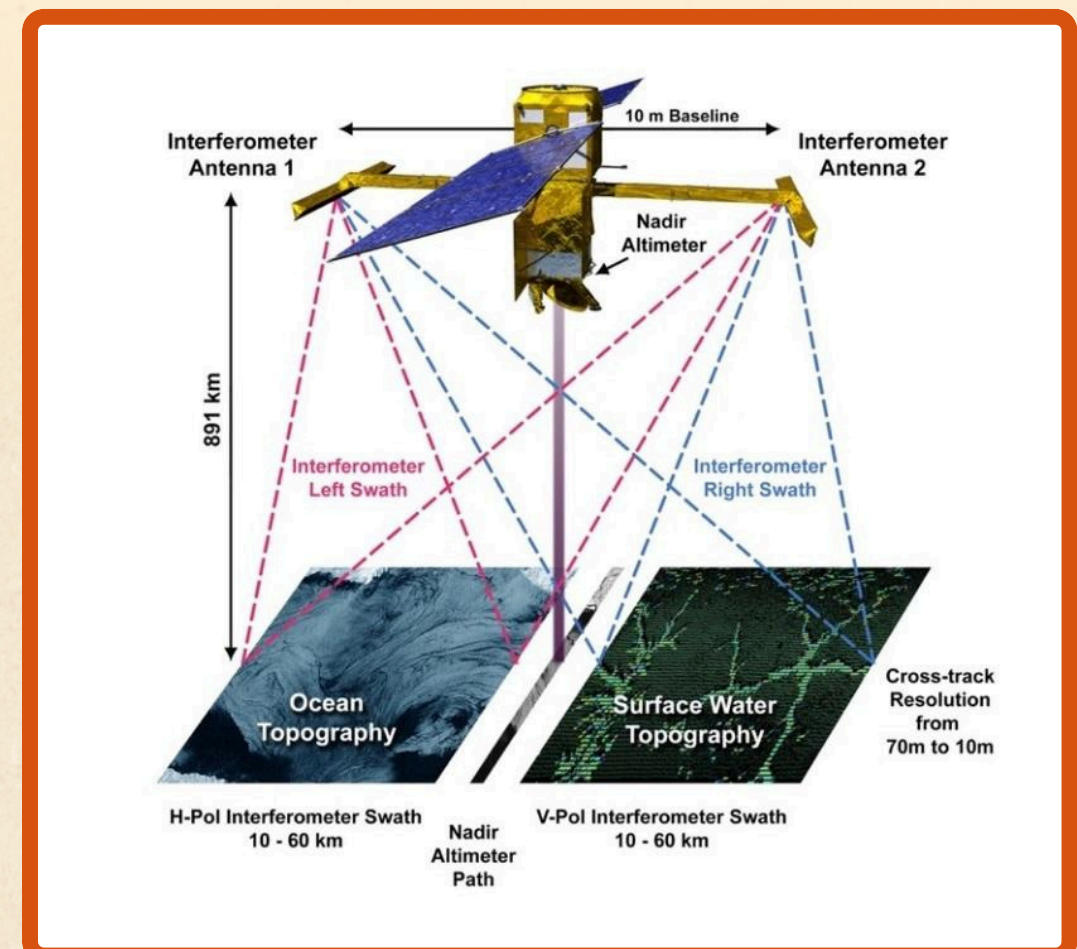
Water Monitoring with SWOT

Surface Water and Ocean Topography

The SWOT mission, launched in 2022, provides the first global survey of Earth's surface water. It measures the elevation, width, and slope of rivers, lakes, and reservoirs. SWOT's water surface elevation products achieve an accuracy of up to 0.18 m for inland waters, greatly improving the monitoring of water bodies. The mission also shows strong potential for flood monitoring by capturing flood dynamics with high spatial and temporal detail, supporting faster response and early warning.

Principal Instruments

- Main payload: a **Ka-band** (35.75 GHz) synthetic aperture radar interferometer (**InSAR**) named KaRIn, which performs 2D topography of Earth's water surfaces.
- Complements: a **Ku/C-band altimeter** (Poseidon-3C) for altimetric measurements in long wavelengths and corrections related to the signal path in the ionosphere. A **radiometer**, to correct altimetric measurements for the water vapor content of the troposphere.
- Swath and revisit: SWOT has a 21-day repeat orbit but its **120-km-wide swath** results in overlapping measurements and an effective average **revisit time of 11 days**.
- Resolution: KaRIn ground resolutions vary from **10 m in the far swath** to **70 m in the near swath**. A resolution of **5 m in the along track** direction is derived by synthetic aperture processing. It operates at lower-resolution over the ocean and at higher-resolution mainly over land.



Applications and Challenges

- Map water surface height of rivers (>100 m wide), lakes, wetlands, reservoirs.
- Estimate discharge via elevation & slope measurements.
- Track seasonal & interannual water storage changes.
- Monitor flood extent & dynamics for risk management.
- Limited spatial resolution: small rivers and floodplains are often missed.
- Detecting water surface slopes is difficult
- Remote and inaccessible regions often lack consistent monitoring.
- Data processing and latency remain barriers for real-time applications.

Examples

Reservoir Monitoring

SWOT simulations were used to estimate water storage in one of India's largest reservoirs. By interpolating across gaps in satellite coverage, researchers showed that SWOT can track reservoir volumes with <8% error. This demonstrates its application for managing water supply and storage in large, complex systems.

River Discharge Monitoring

Synthetic SWOT data on river width and elevation were applied to empirical discharge models of India's Tapi River. Results closely matched ground-based flow measurements (NSE = 0.94). This highlights SWOT's usefulness for monitoring river discharge, supporting flood forecasting and water resource planning in tropical basins.

Application Fit

- First 2D wide-swath radar altimeter (KaRIn).
- Resolves water bodies previously unmonitored.
- Accurate, global, and multi-application data.
- Designed for both science & operational water management.

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