Assessing the validity of SWOT-derived river bathymetry under morphological change

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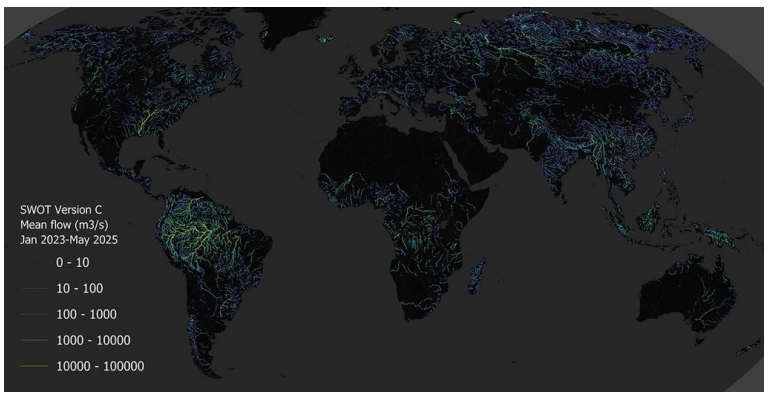
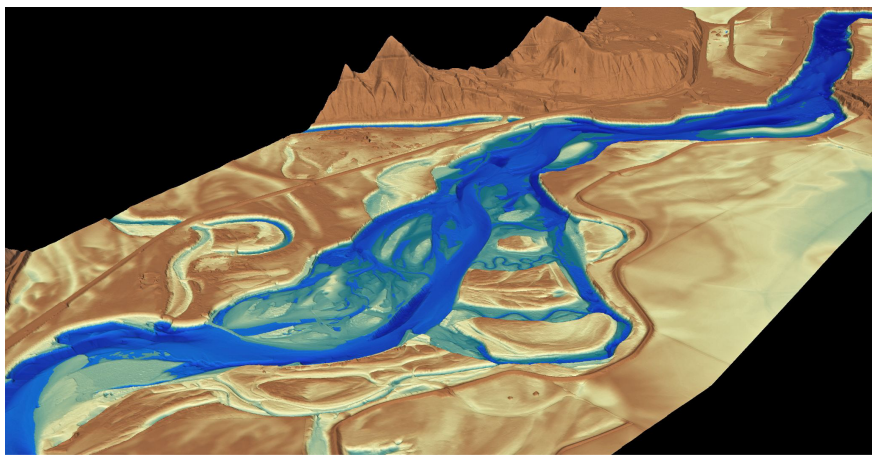
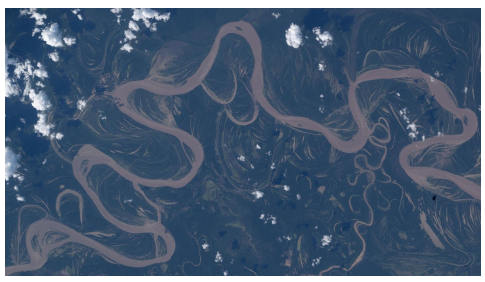
CONTEXT

- Accurate river bathymetry is essential for flood forecasting, but physical surveys remain too expensive and logistically difficult for most global rivers.
- SWOT uses repeated measurements of water elevation, width, and slope to estimate channel geometry and the effective hydraulic parameters needed for river modeling.
- SWOT-derived bathymetry can be applied backward to decades of historical optical and altimetry satellite archives to reconstruct long-term river discharge records.
- Transferring SWOT bathymetry back in time requires testing whether channel geometry has remained stable despite natural channel shifts, erosion, and human engineering.







SCIENTIFIC OBJECTIVES

The main objective is to determine the temporal transferability and error bounds of SWOT-derived bathymetry for reconstructing pre-SWOT river discharge across morphologically dynamic river networks.

THE MISSION

The internship will pursue four complementary missions:

- Characterize the current river geometry inferred from SWOT.
- Detect morphological changes between the pre-SWOT and SWOT periods.
- Distinguish physical changes from observational uncertainty.
- Evaluate the hydraulic transferability of SWOT-derived bathymetry.

REQUIRED PROFILE

Experience or interest in the following areas would be valuable:

- Satellite remote sensing and geospatial data analysis
- River hydraulics or hydrology
- Python programming and scientific computing
- Statistical analysis and uncertainty quantification

REFERENCES

1. Fu, L. L., Morrow, R., Farrar, J. T., & Wang, J. (2024). A breakthrough of radar remote sensing of the ocean: the Surface Water and Ocean Topography (SWOT) Mission. *European Geosciences Union General Assembly 2024 (EGU24)*, 12599.
2. Cerbelaud, A., Wade, J., David, C., Durand, M., de Moraes Frasson, R. P., Pavelsky, T., Oubanas, H. Wide-swath altimetry maps bank shapes and storage changes in global rivers (Nature, 2026).
3. Rezende, I. (2025). *Global River Bathymetry from Surface Water and Ocean Topography (SWOT) and other Satellites* (Doctoral dissertation, AgroParisTech).

THE RESEARCH UNIT: G-EAU

- G-EAU is an interdisciplinary research unit located in the North of Montpellier at the Agropolis campus
- It unites both social and natural scientists interested in the study of water - from hydrogeologists and remote sensing experts to human geographers and sociohydrologists
- Students will be able to integrate themselves into a rich and welcoming environment of scientific diversity. Weekly events include the Friday discovery seminar series (Vendredi Découverte), and the communal coffee social every Tuesday.