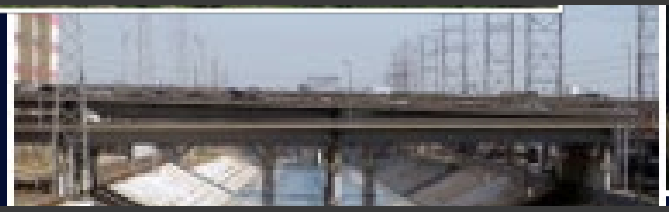
SWOT River Discharge

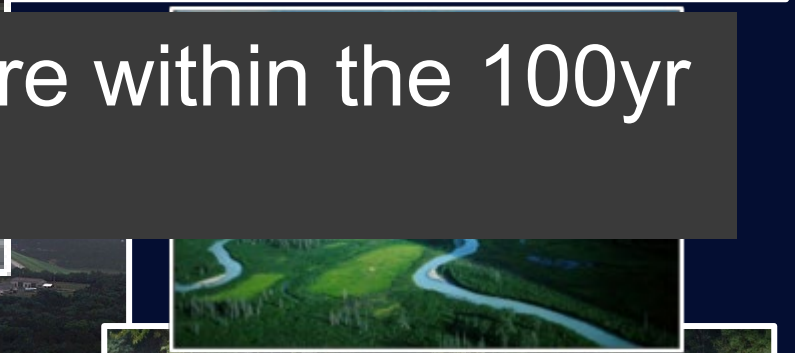
The First Glimpses

Colin Gleason,
Hind Oubanas,
Paul Bates …
… and **many, many others**

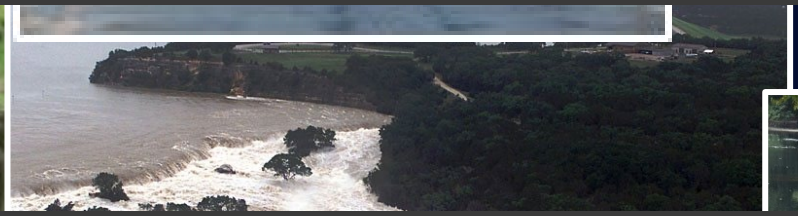
Humans use rivers

44% of humans live within <3km of a river
(Kummu et al 2011)

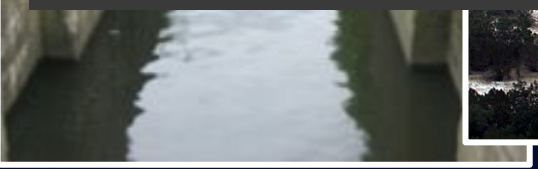




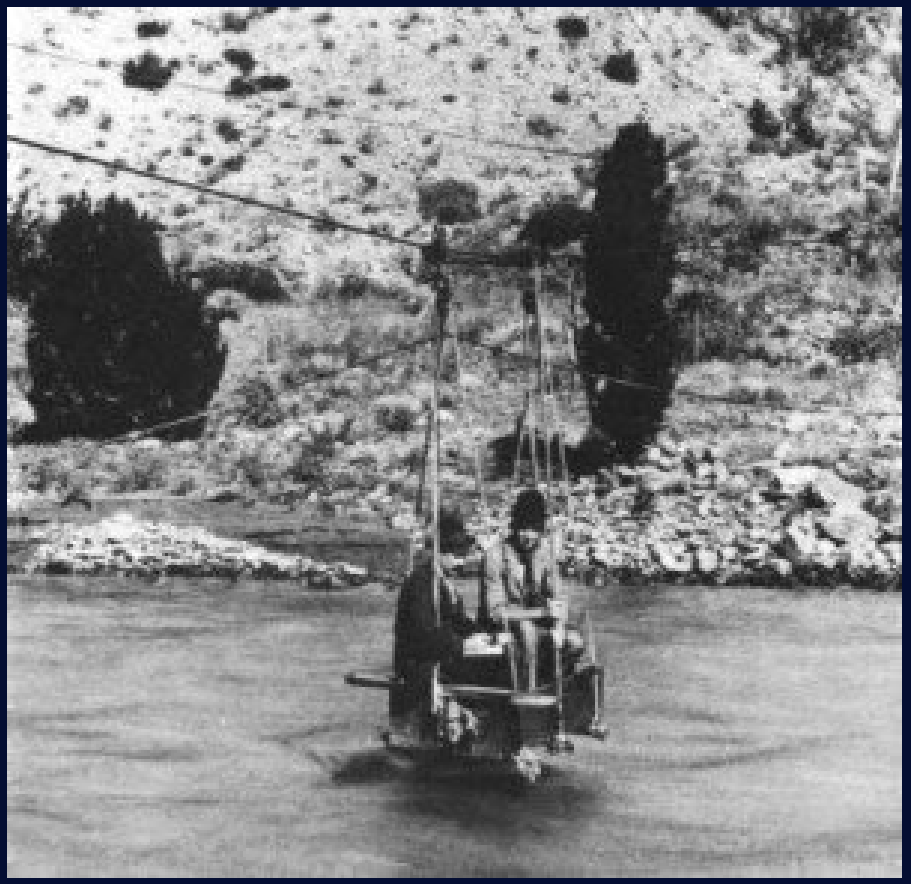
1/6th of global urban areas are within the 100yr floodplain (Andreadis et al., 2023)



25% of national borders are a river (Smith, 2020)



We've been measuring river flow rate for thousands of years



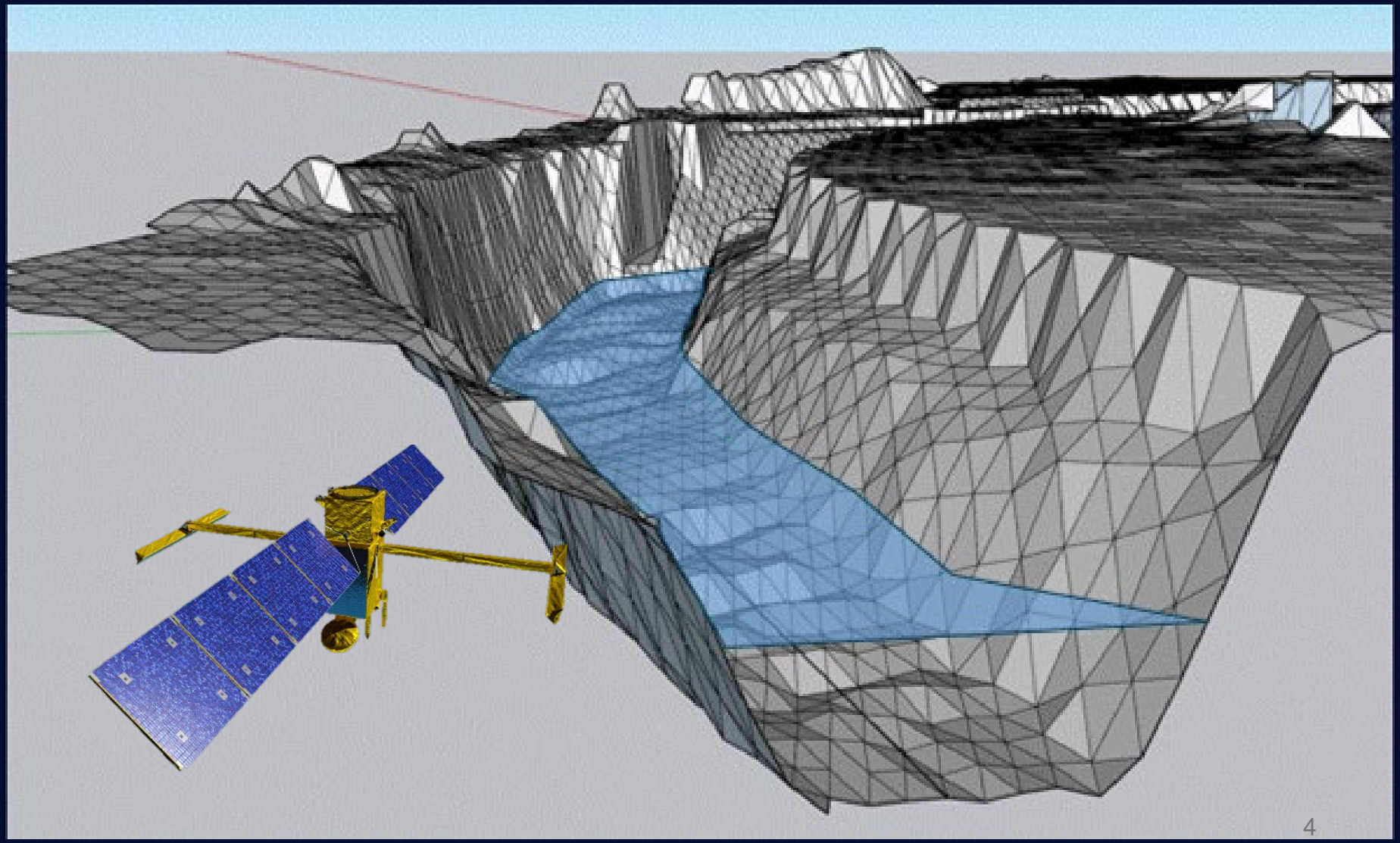
USGS Manual Cable Car ~80-100 ybp

Egyptian Nilometer ~2,000 ybp

SWOT fieldwork with ADCP 0 ybp

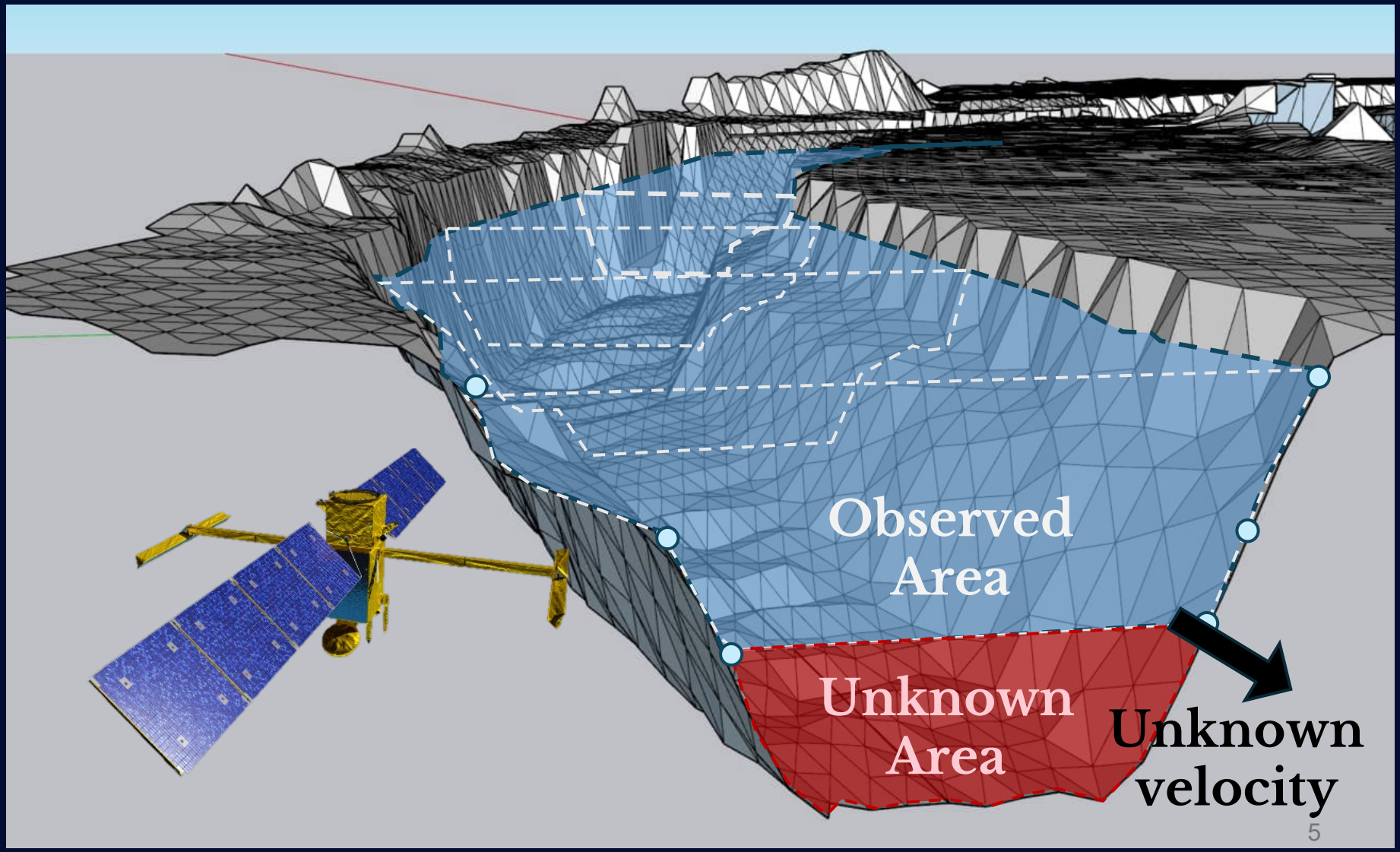
SWOT Discharge: Rivers change as flow changes

SWOT sees the surface

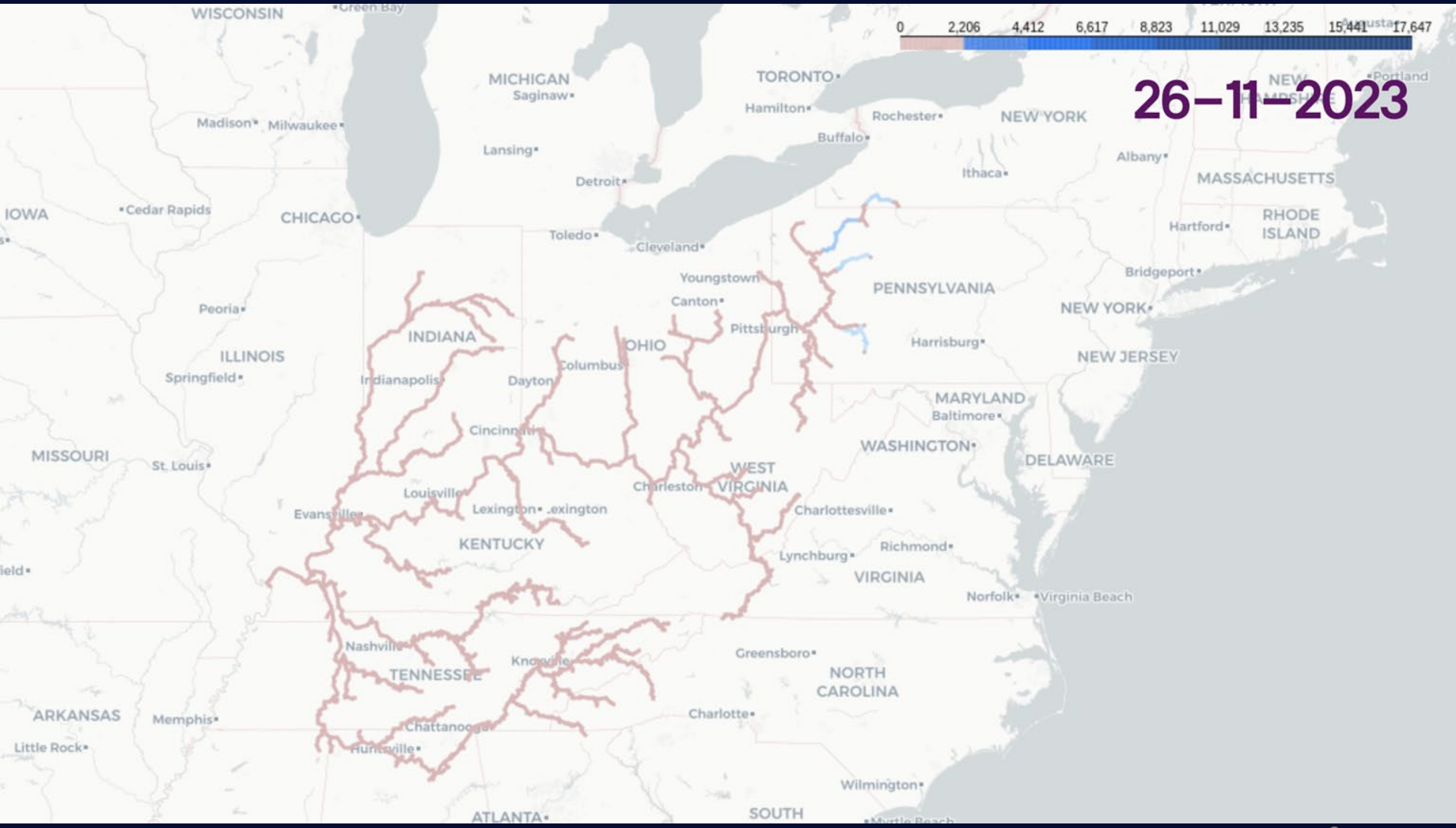


Solve underconstrained (ill-posed) inverse problem

Unknown depth(area) and velocity

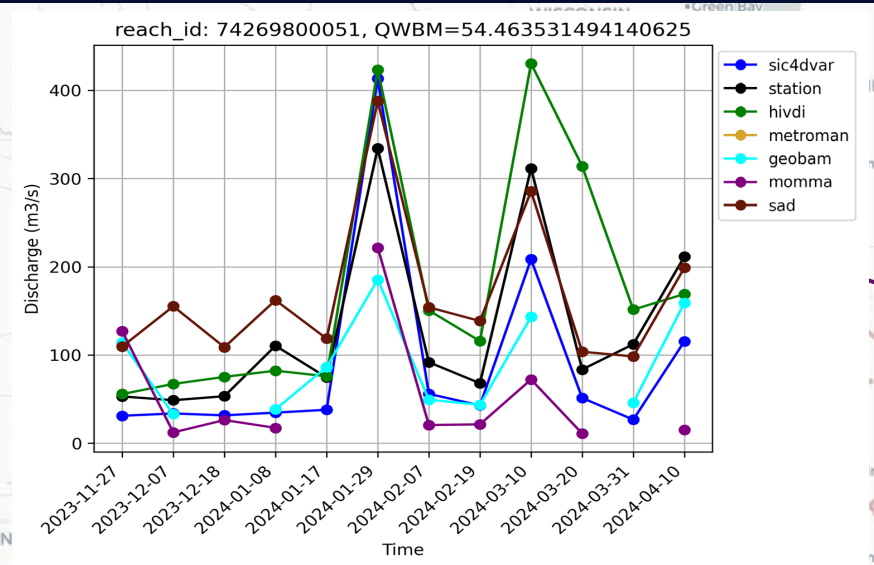


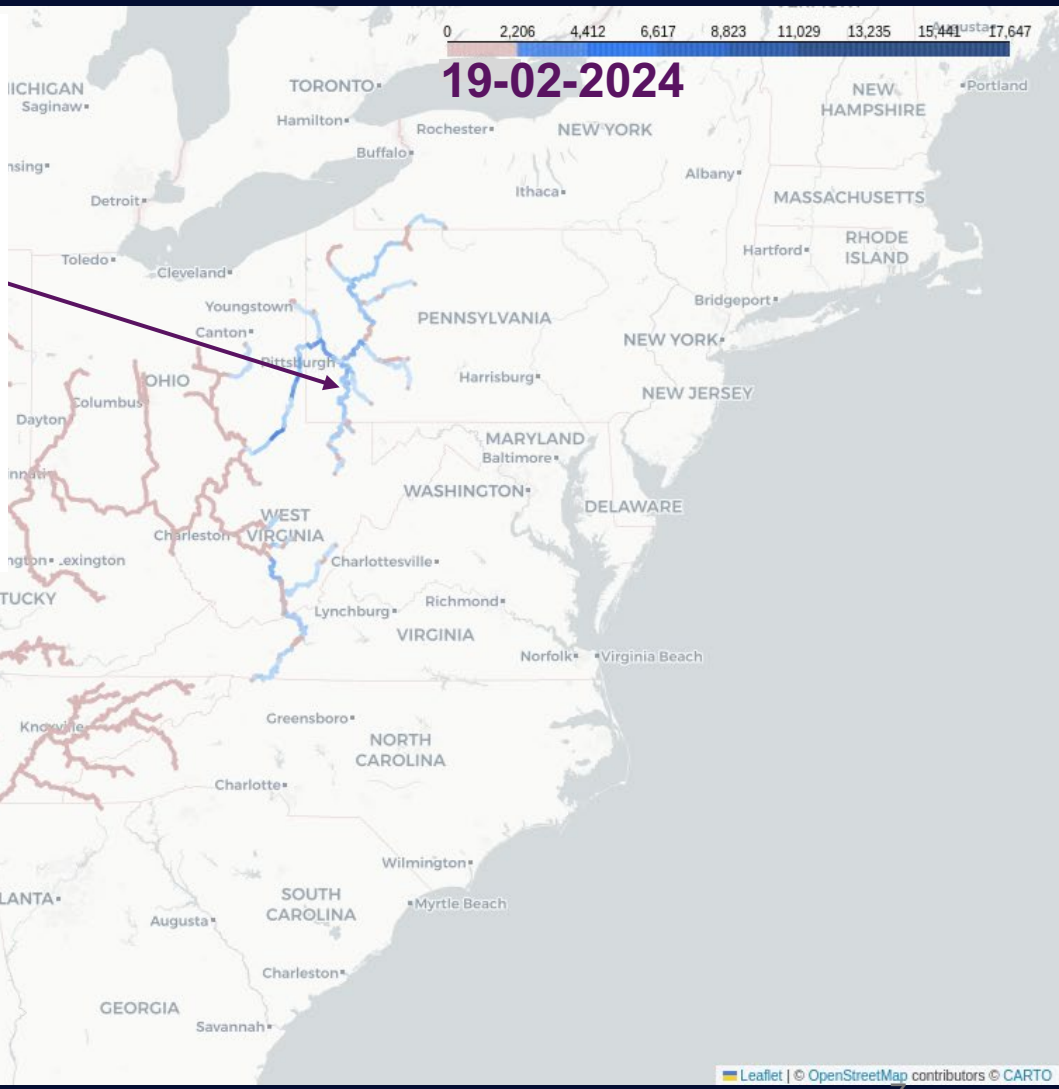
Revealing discharge variability in space and time **from SWOT ONLY**



Following 20+ years and collaboration of >100 people

Results are promising
in smaller rivers





Results are promising
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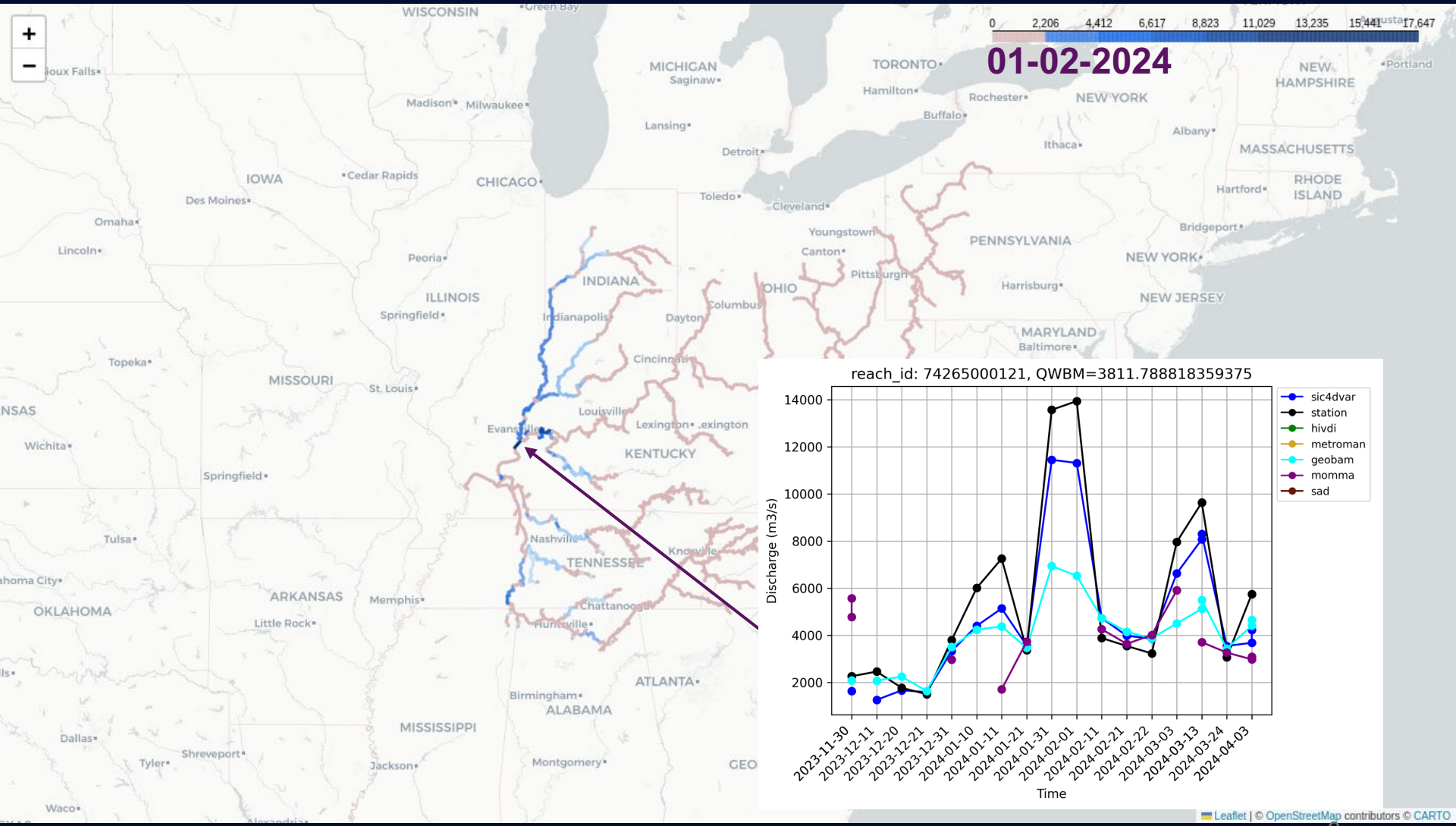
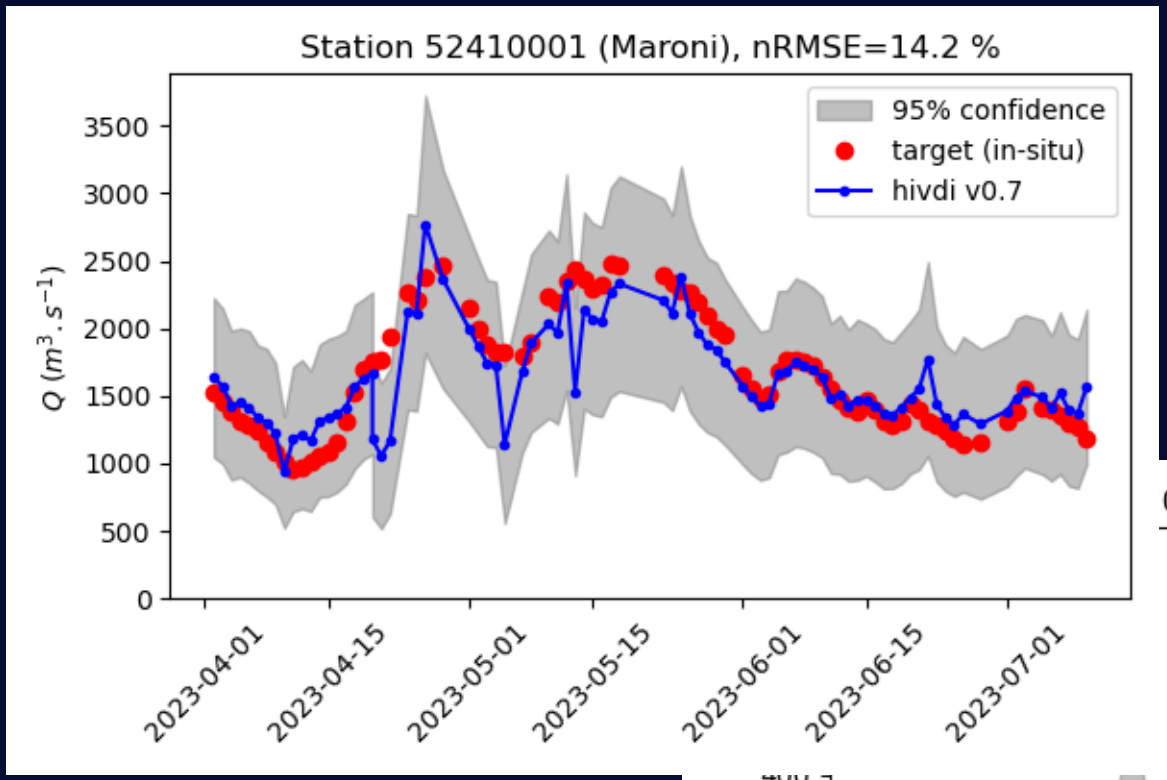
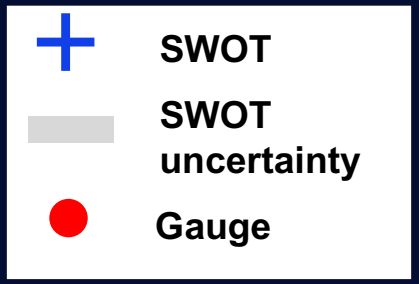
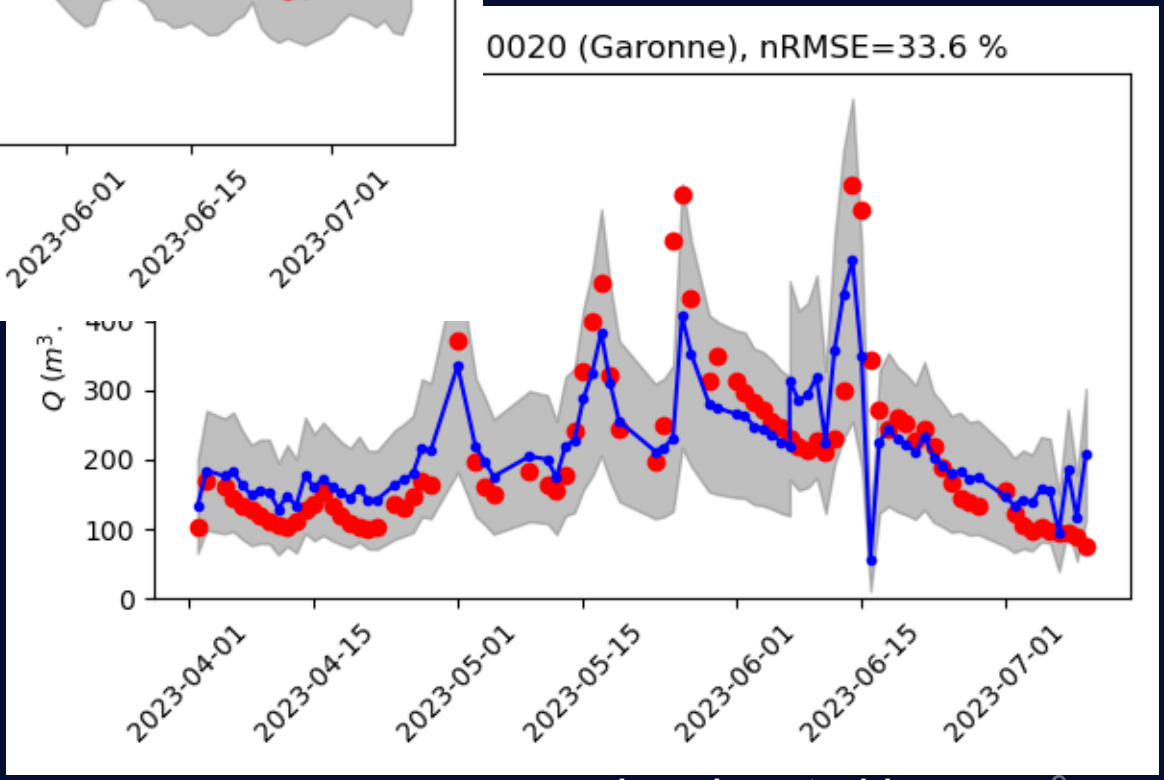


SWOT Discharge during the CALVAL Orbit





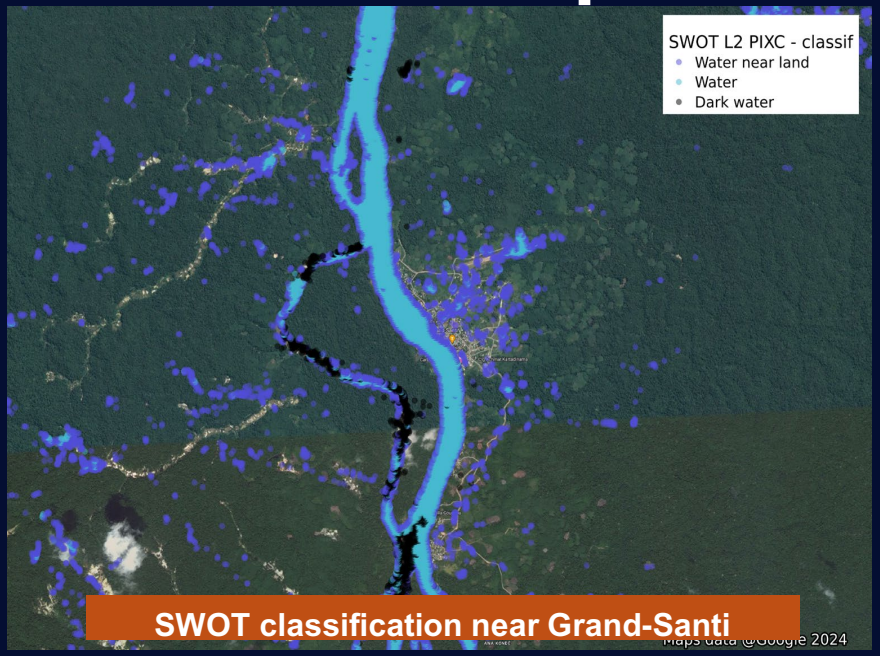


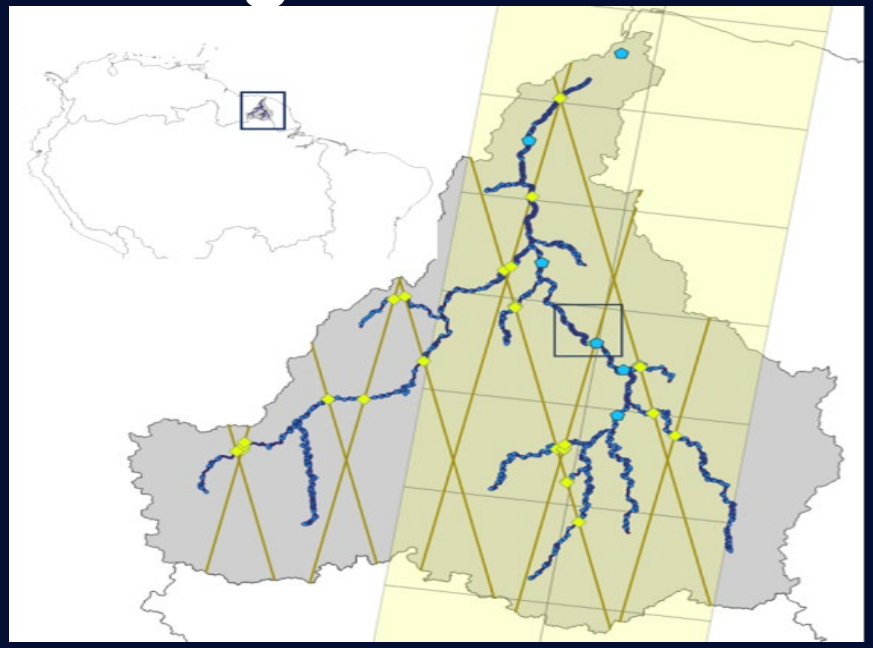
SWOT had a special orbit for its first 90 days

Discharge was computed daily for select rivers!

Larnier et al in prep

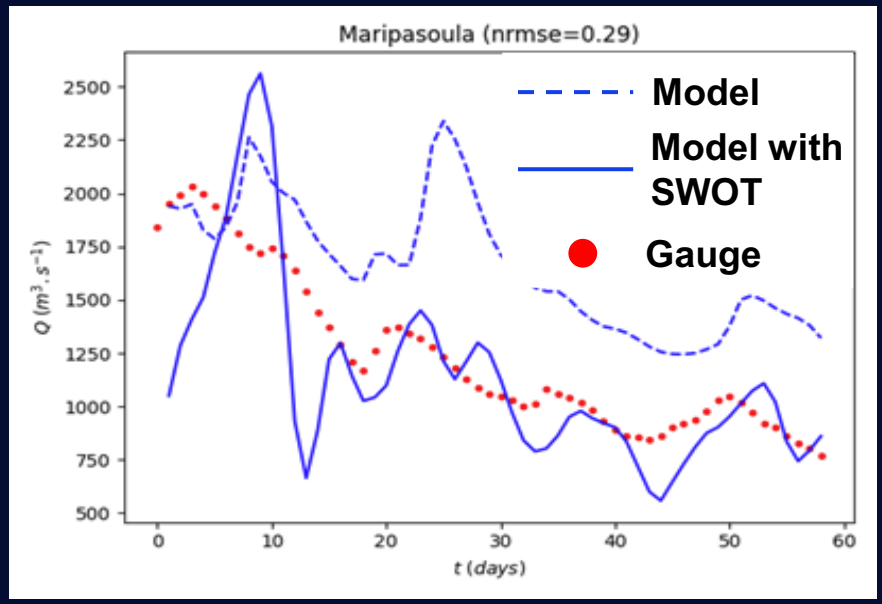
SWOT can improve discharge from models





SWOT can be *assimilated* into models (hydrologic +hydraulic)

Can push SWOT information to all rivers, not just those observed by SWOT



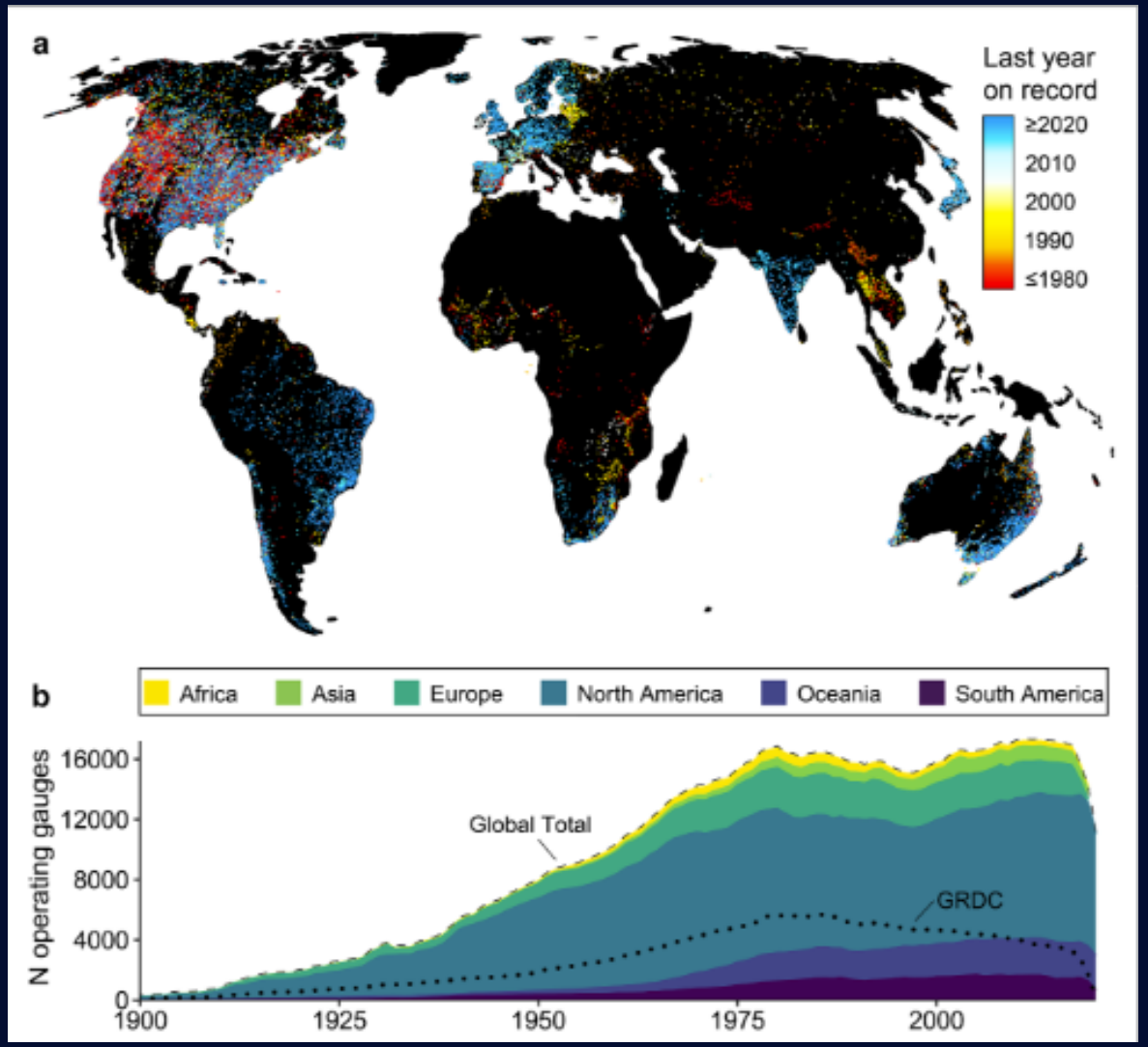
Larnier et al in prep

What does SWOT discharge do for hydrology?

The first ever global discharge data

Different from, but complementary to, gauge data

… with the potential to be revolutionary



Riggs et al., 2023

What does SWOT discharge do for hydrology?

- Measuring for the first time in a comprehensive and consistent way:
  - Continental runoff to the Ocean
  - Volume of terrestrial water storage
  - River fluxes in time and space over multi-annual cycles
  - The spatial footprint of floods and droughts
  - River form and process
- Used in models to better predict floods, water resources, sediment, habitat, and biogeochemical cycles
- Combined with other data to truly map the global river network in unprecedented detail