Assessing the potential for the Surface Water and Ocean Topography (SWOT) mission for river water and carbon flux estimations

(Gehring, J., Beighley, E. and Stubbins, A., 2023. doi.org/10.3389/feart.2023.1201711)

1. Science Question: SWOT launched in 2023 to observe Earth's surface waters, including improved estimation of river flow. We aimed to understand how SWOT's irregular 21-day return cycle would impact observed river flow for rivers from the equator to the Arctic (Fig. 1), including how the frequency of satellite observations influence estimations of the high flow events that are critical to understand water and carbon flux, plus aspects such as flood risk.

2. Analysis: We created synthetic SWOT time series using SWOT's irregular orbit and measured (gauged) river discharge.

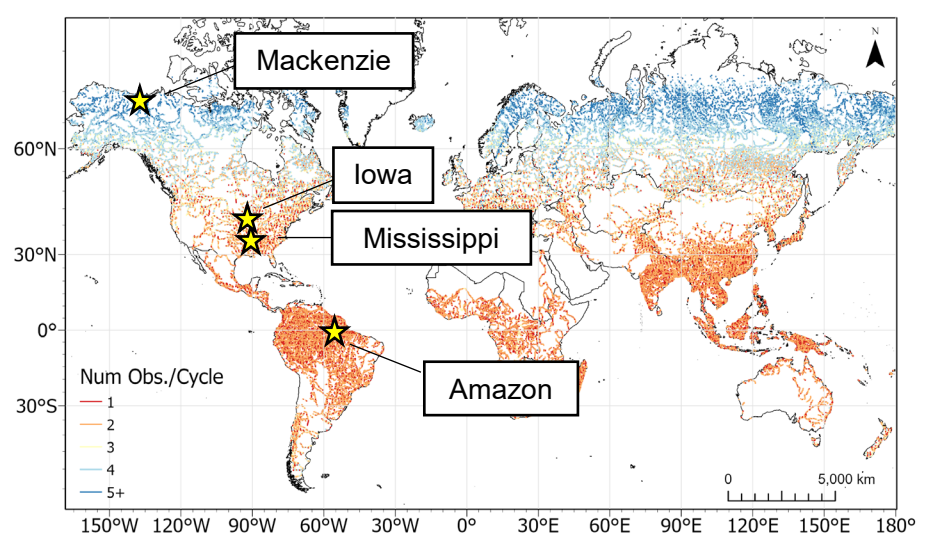

Figure 1. Map of river reaches around the world and the number of times SWOT would observe the reaches per orbit cycle, ranging from the minimum observations (red: once per 21 days) to maximum observations (blue: 5 or more observations per cycle). Rivers evaluated in this study are denoted by the yellow stars.

3. Results

Arctic rivers will be observed most frequently, which is promising for these often under-sampled, and climate sensitive rivers.

Larger rivers, including the Amazon, are less impacted by lower sampling frequency than smaller rivers, such as the Iowa River (Figure 2).

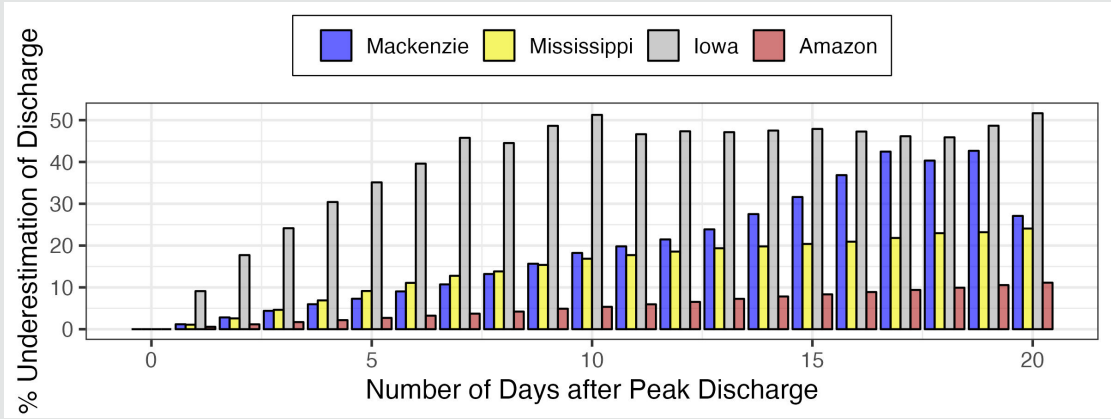

Figure 2. Analysis showing how a delay in SWOT observations (e.g., 1 day from the peak discharge, 2 days from the peak discharge, etc.) due to flyover frequency would impact the perceived hydrology of a river.

4. Significance: Provides insight into how remote sensing tools like SWOT can be used to improve estimations of societally important factors such as total freshwater supply and transport, current and changing carbon flux, and the timing and severity of flooding.

Grant No.: 80NSSC22K0145
CARBON 2020: Remote sensing of river carbon fluxes to the ocean