From Permafrost to Plume

Tracing Organic Carbon Across the Arctic Land–Ocean Continuum by Satellite Remote Sensing

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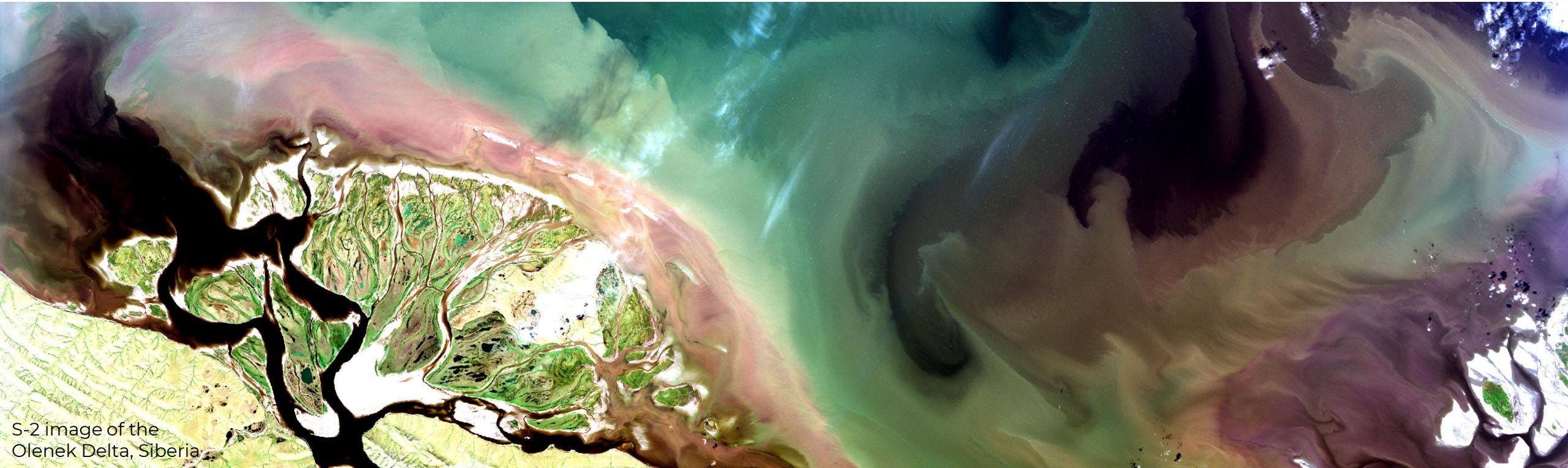


S-2 image of the
Olenek Delta, Siberia

Mobilization

Mudslide at a thaw slump
Qikiqtaruk (Herschel) Island

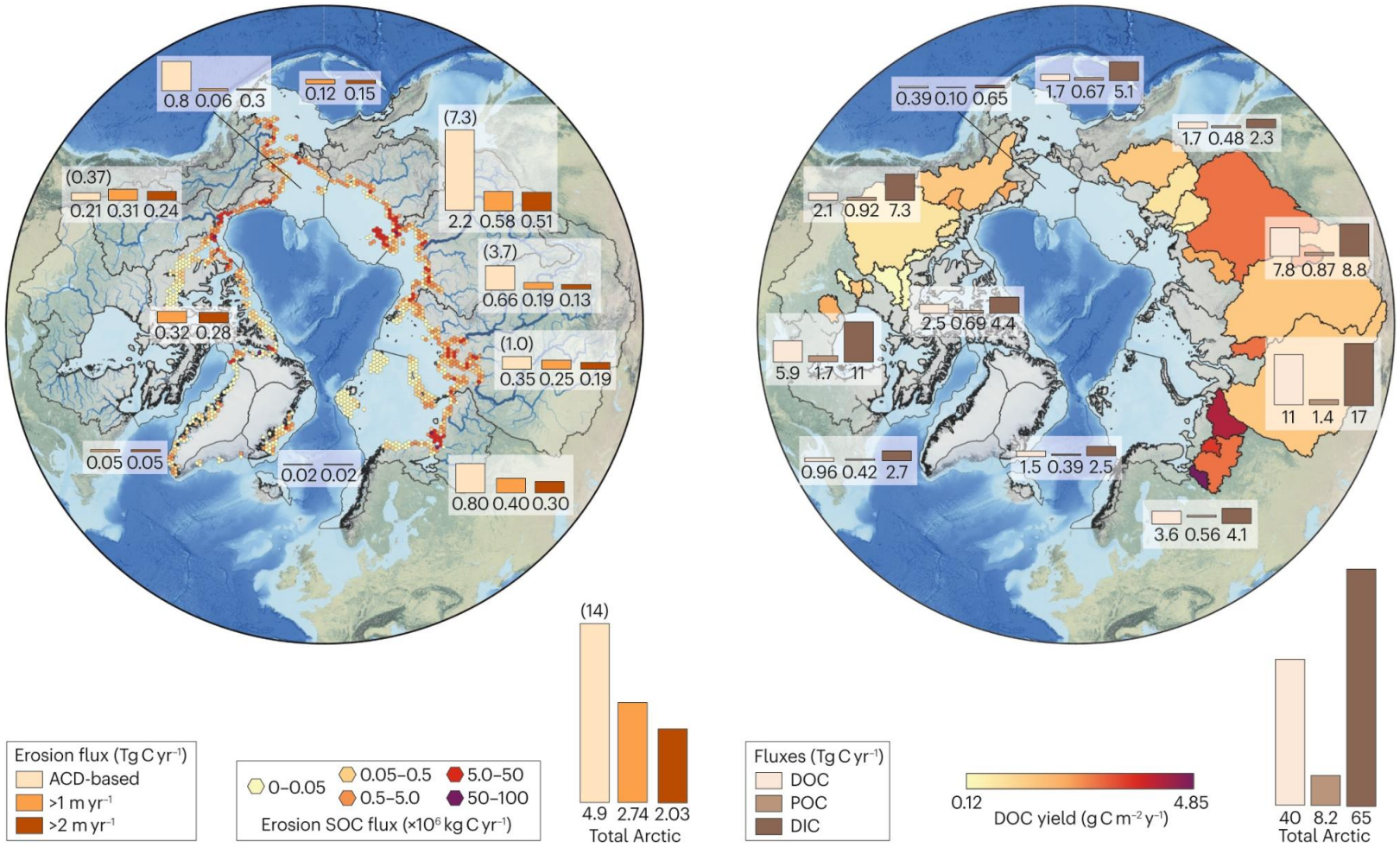
Credit: Boris Radosavljević

Charas mega-slump on the Peel Plateau,
near Fort McPherson, NWT, Canada

Credit: Robert Fraser

Importance

Coastal Erosion



Fluvial fluxes

- The Arctic hosts about 20% of all river and stream surface area on Earth
- Undergoing and vulnerable to rapid change

i) Shifts need to be monitored

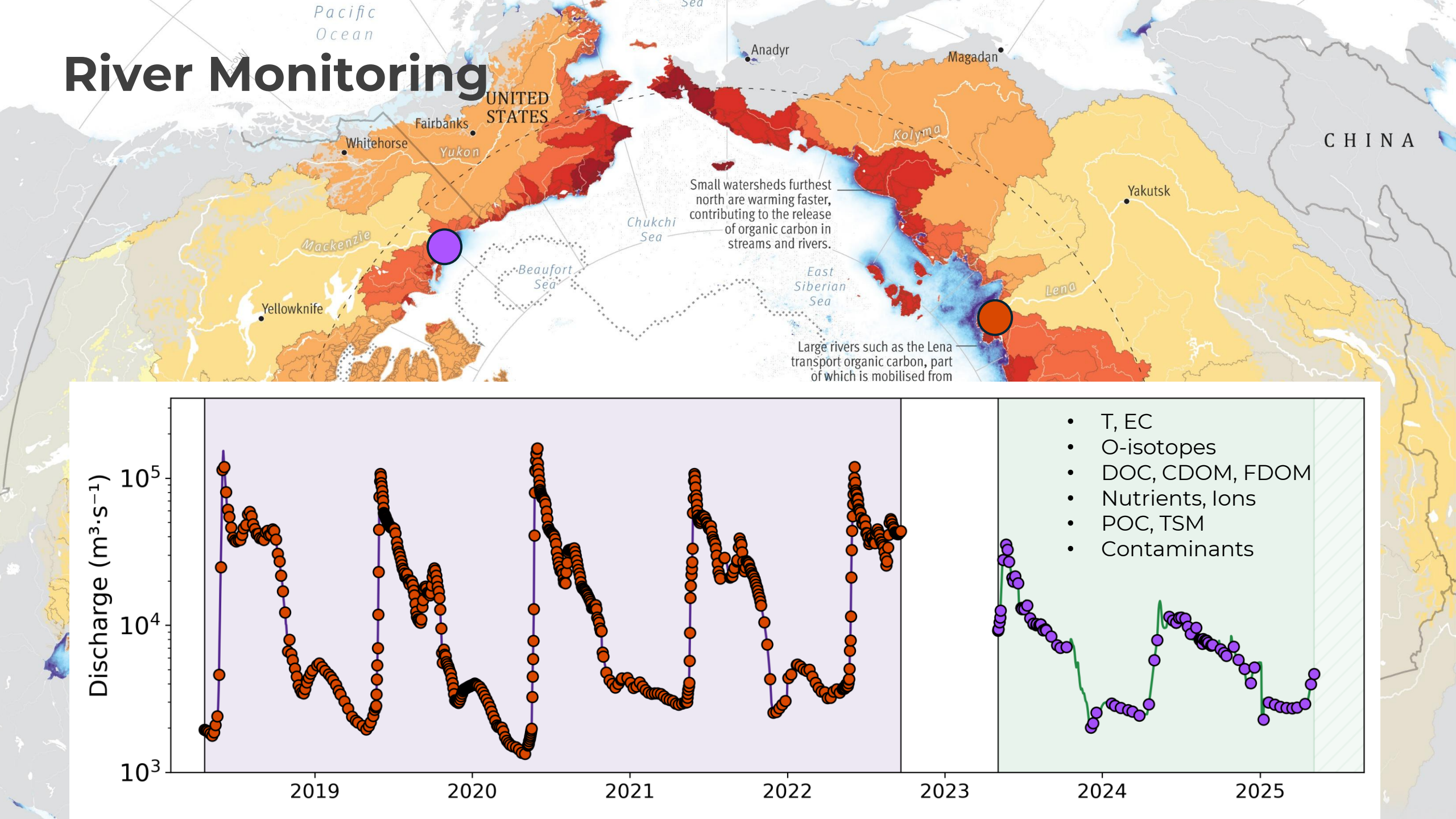
ii) Fate of terrestrial matter needs to be understood

To do this with remote sensing, field data are critical

Vonk et al., 2025 Nat Rev Earth Environ

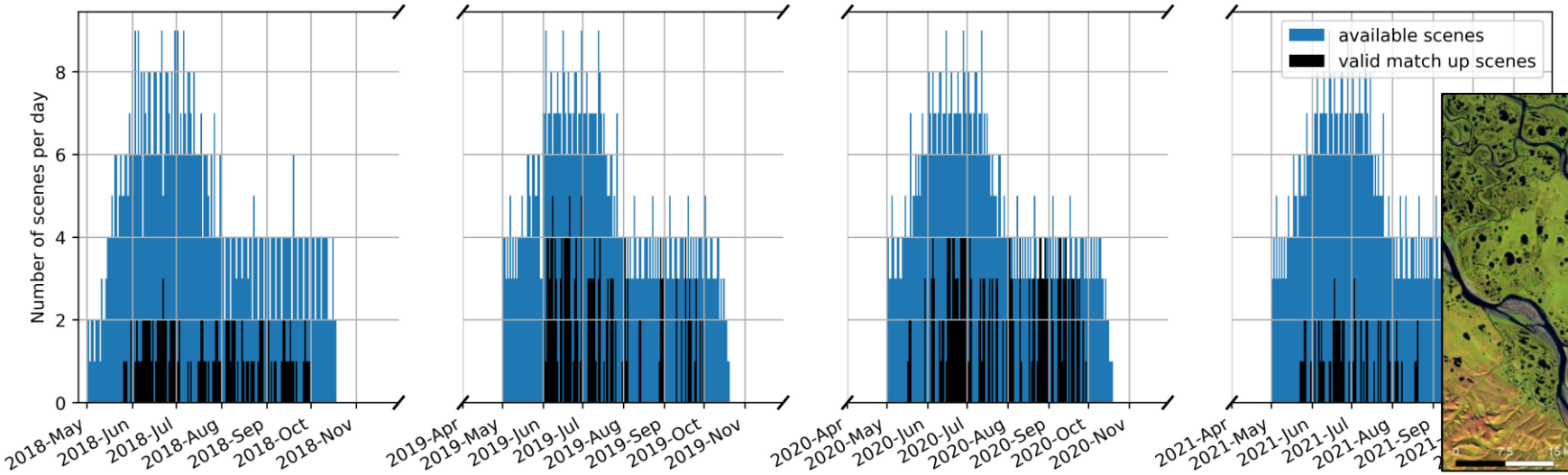
Challenge: Shallow Arctic Coastal Waters

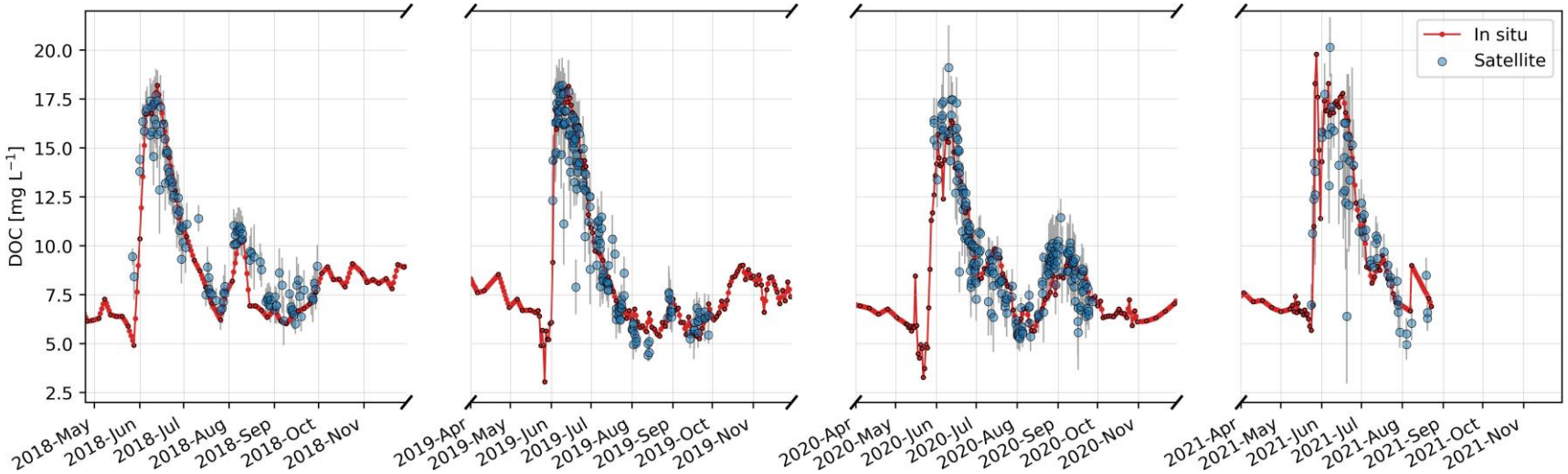
River Monitoring



S-3 to monitor DOC in the Lena River

Jan El Kassar,
Postdoc – FU Berlin

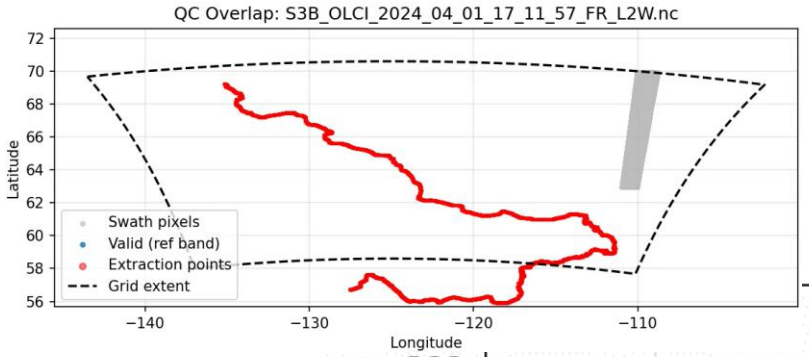


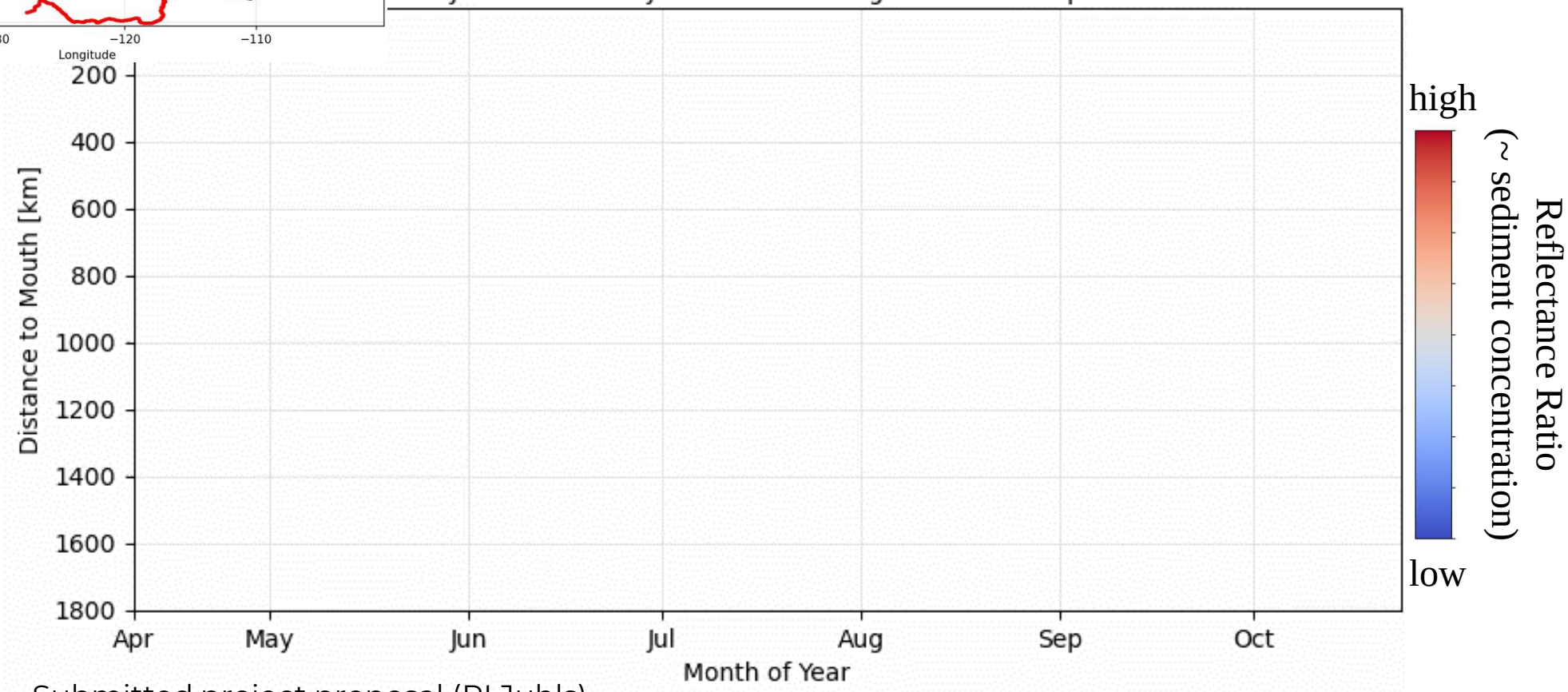


- Sentinel-3 OLCI enables high-frequency monitoring of Arctic River organic carbon load

El Kassar et al., 2023 Frontiers

Observing along-river transport

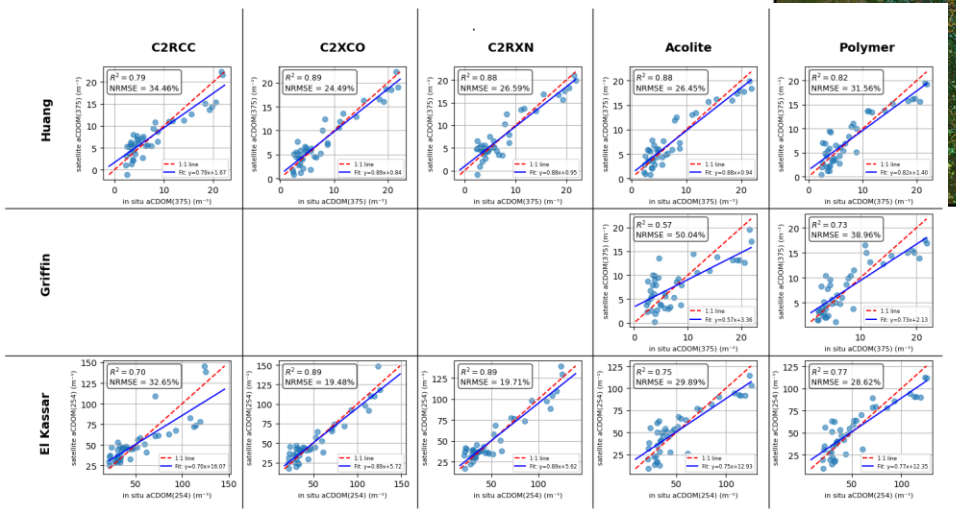


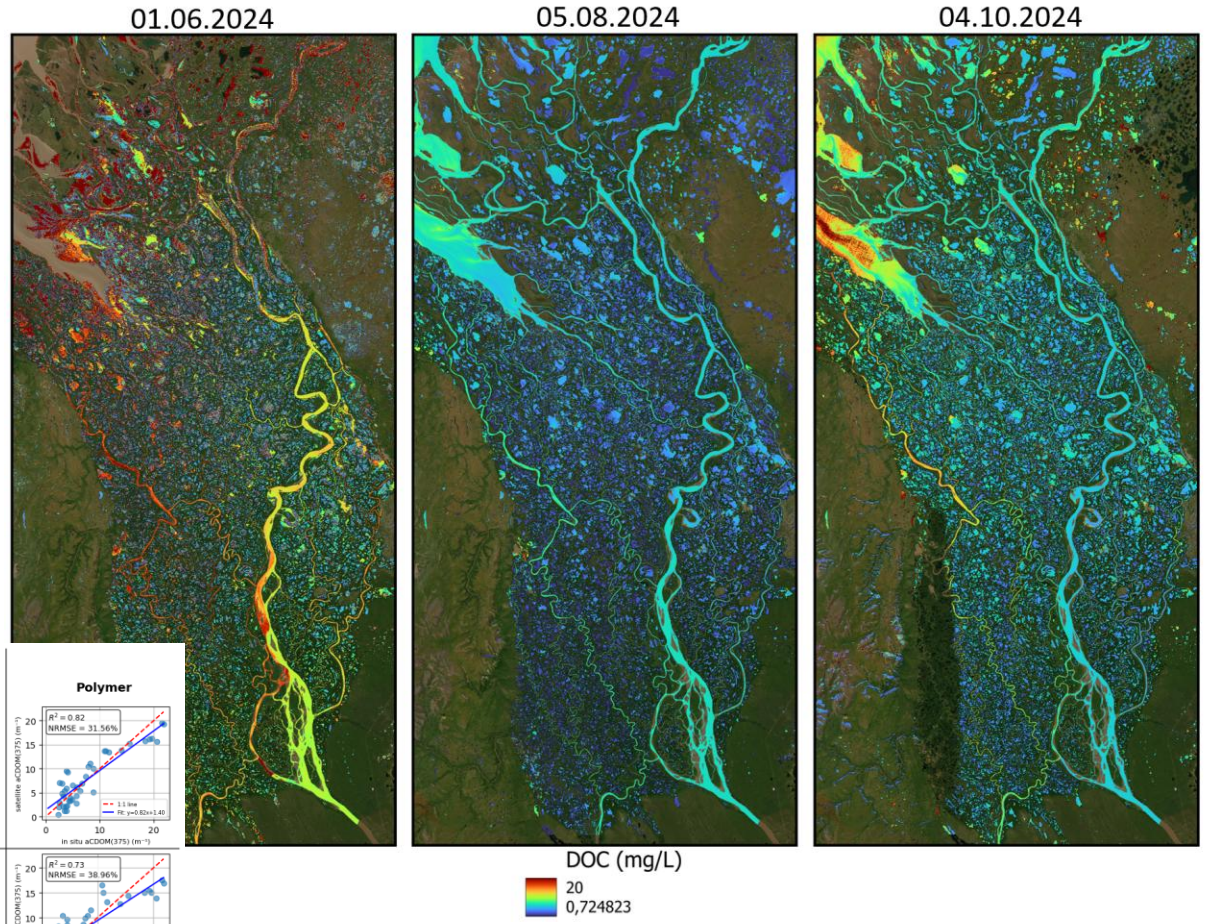


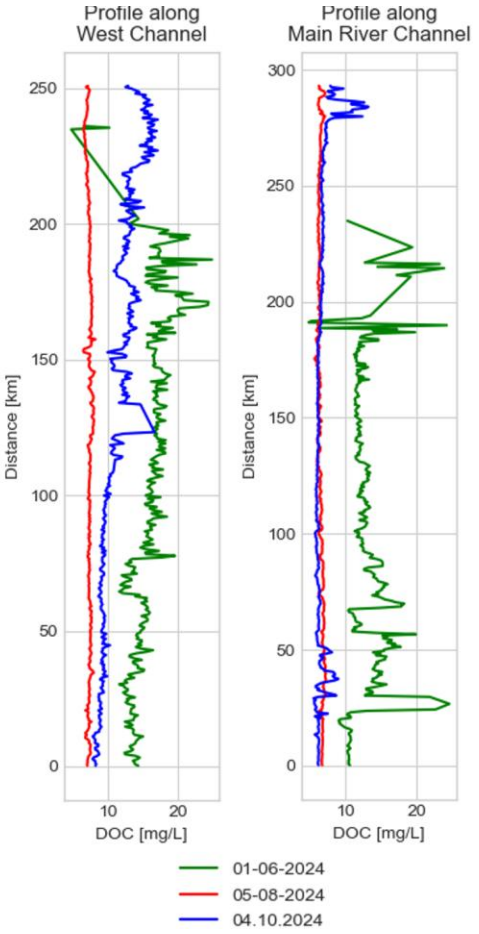
Submitted project proposal (PI Juhls)

Revealing DOC Variability Across an Arctic Delta

Felica Gehde,
MSc student - AWI



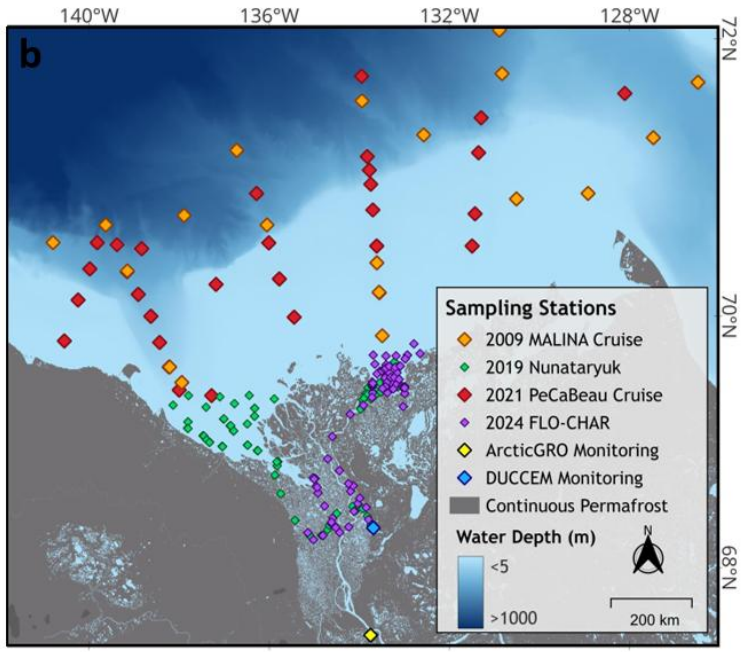


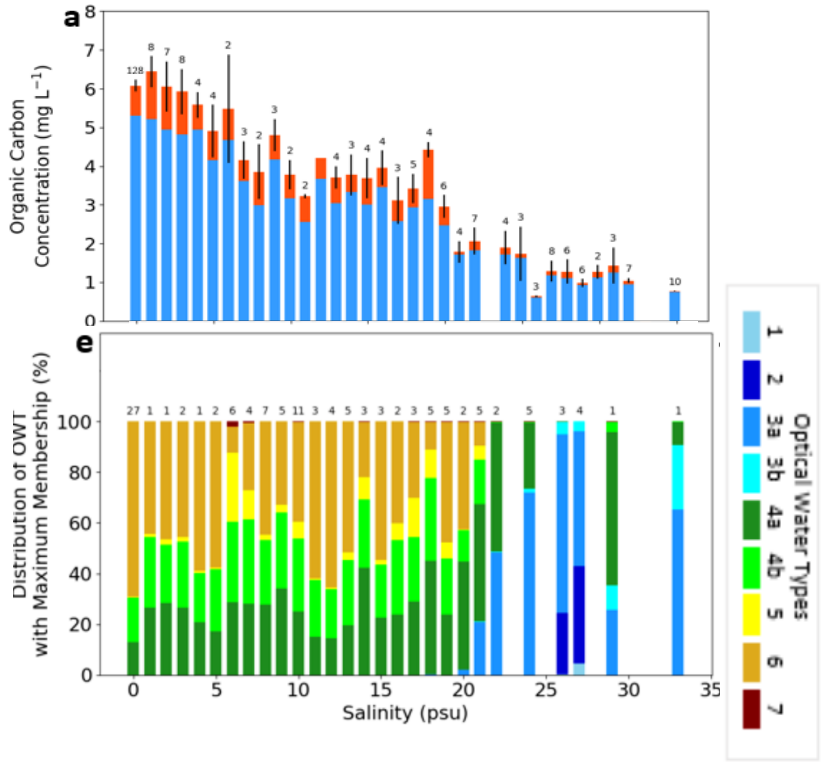


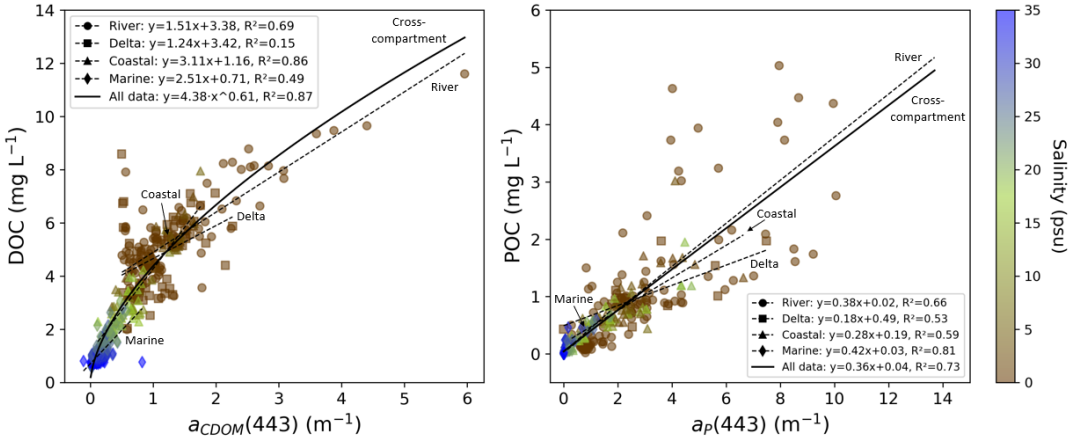
- **Remote sensing reveals high variability** across the delta and across seasons
- CDOM/DOC **band ratio retrievals perform well**

OC Pathways across fluvial-marine transition

Annabeth McCall,
PhD candidate - AWI





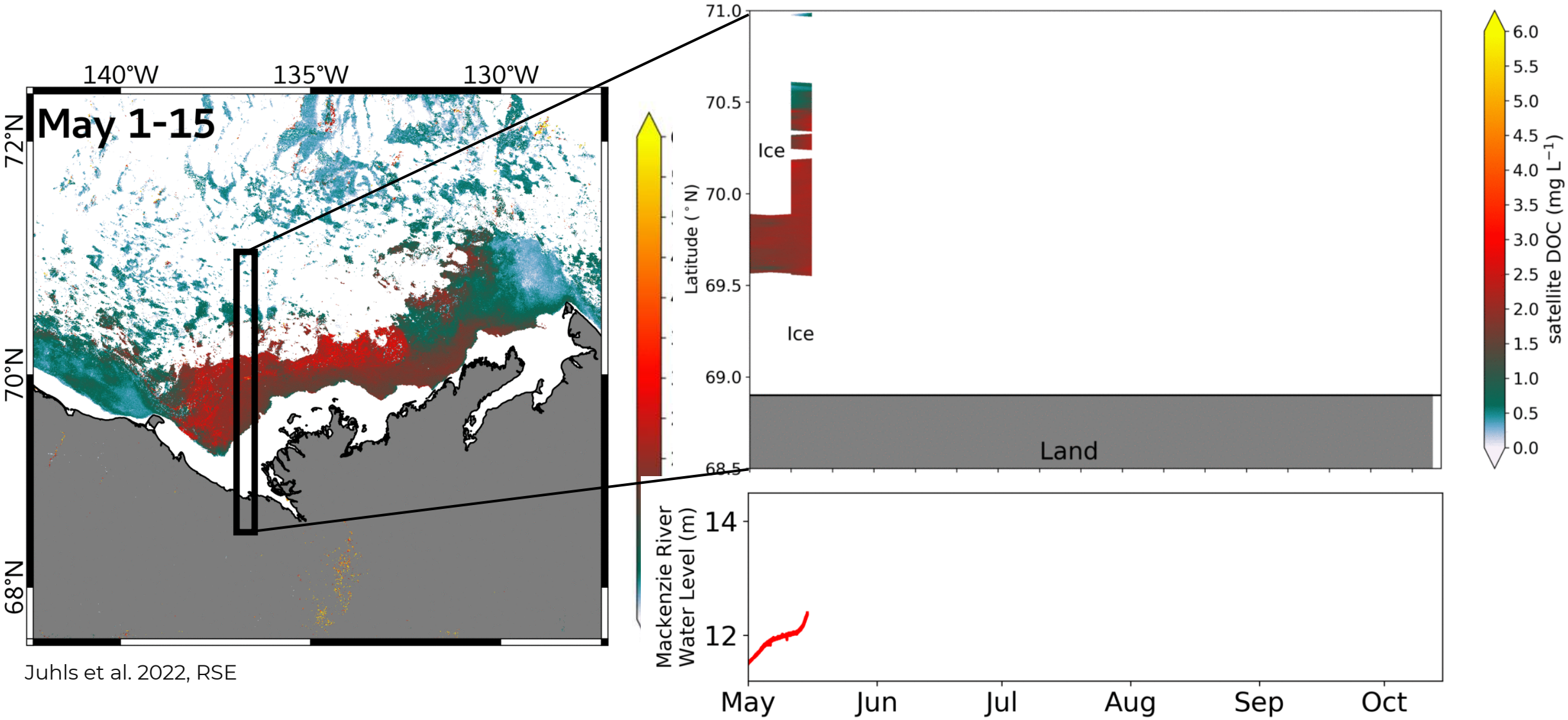


- Improved understanding of **organic carbon pathways and optical water types across the salinity gradient**
- Provide **robust bio-optical relationships** for Ocean Color applications

McCall et al., in prep.

HELMHOLTZ

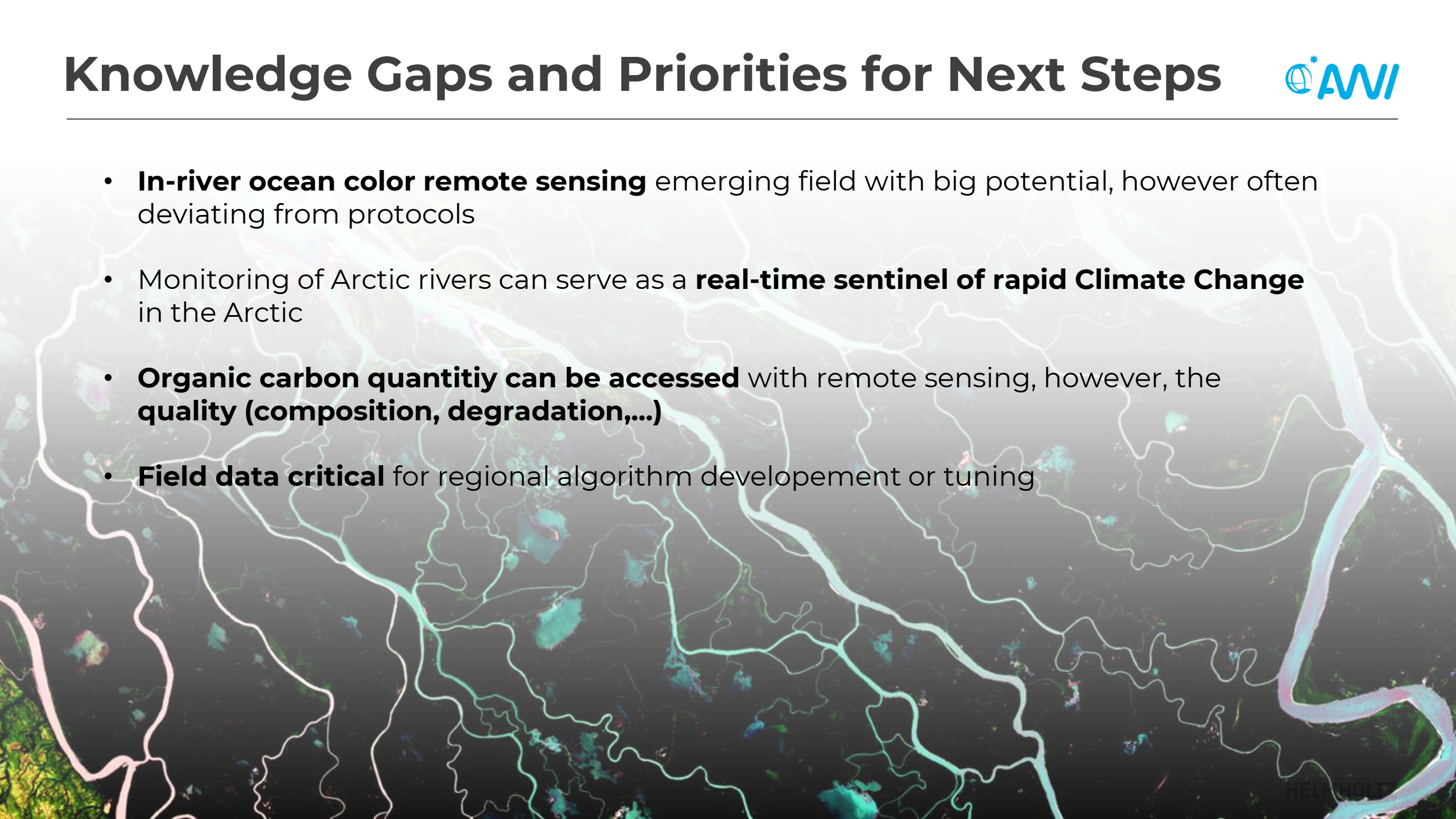
Seasonal Variability of the River Plume



Juhls et al. 2022, RSE

Knowledge Gaps and Priorities for Next Steps

- **In-river ocean color remote sensing** emerging field with big potential, however often deviating from protocols
- Monitoring of Arctic rivers can serve as a **real-time sentinel of rapid Climate Change** in the Arctic
- **Organic carbon quantitiy can be accessed** with remote sensing, however, the **quality (composition, degradation,…)**
- **Field data critical** for regional algorithm developement or tuning



Field Measurements: Expedition 2024