Title: Arctic deltas as sponges: How do river deltaic plains now filter and trap sediment and carbon?

According to the "Arctic Report Card 2023" report published by the NOAA, the Arctic continues to warm twice as fast as the rest of the globe. Arctic warming. The flow of water in Arctic rivers and stream networks is dramatically affected by climate warming, with critical implications for coastal ecosystems, and has far-reaching, long-term consequences beyond the region. This project emphasizes the need to understand the functioning of 'large-river deltaic estuary' systems affected by hydroclimatic development. We are going to show the signatures of loads and fluxes of sediments and carbon transported to the Arctic Ocean of one of the largest Polar rivers - Mackenzie. Of all the world's Northern rivers, it delivers the largest amount of sediment to the Arctic Ocean. The Mackenzie Delta has a significant impact on the flow of water, sediment and nutrients into the Beaufort Sea because the delta's approximately 45,000 delta lakes and large floodplain have a very high water storage capacity.

The research questions that want to be answered with this project about the main objectives are:

1. What is the best possible combination of satellite products to perform multiprocess analyses of hydrological connectivity within the large-river deltaic estuary?
2. How do hydrological connectivity influence sediment and organic matter pathways and linkages in Polar large-river deltaic estuary systems, and how are these processes related to channel bank degradation driven by climatically induced erosion?
3. What is the possible impact of permafrost thawing processes on the water and sediment connectivity between the most significant rivers, lakes and their coastal systems?

This project comprises field-based measurements and surveys of satellite data availability over a 'large-river deltaic estuary', and the use of remote sensing technologies and numerical hydraulic modelling. For the first time, we will implement Wetland Interferometric Synthetic Aperture Radar (Wetland InSAR) technology for high-resolution imaging of hydrological connectivity and freshwater transport on the coastal ecosystems of a large Arctic delta. Additionally, numerical modelling will be used based on the Adaptive Hydraulics model (AdH), and the Particle Tracking Model (PTM) uses the Lagrangian (particle-based) approach will help understand the role of deltaic-floodplain lakes in sediment trapping. All for help identifying the past and future signatures of loads and fluxes of sediments and carbon transported to the Arctic Ocean via large-river deltaic estuaries.