Project title : **Evaluation of the settling velocity and trapping capacity of sediments in lakes in the Great Arctic River deltas**

Our study object, the Mackenzie River is the one of Arctic great rivers by annual discharge and the 18th largest globally. The Mackenzie river catchment is about 1.76 M km² and about 75% of the basin lies within a continuous permafrost zone. Of all the world's northern rivers, the Mackenzie delivers the highest quantity of sediment to the Arctic Ocean. 128 Mt of sediment is supplied by the Mackenzie and Peel Rivers to the Mackenzie Delta annually.

The Mackenzie Delta (13,000 km^2) has a significant effect on flows of water, sediment and nutrients to the Beaufort Sea because the ~45,000 delta lakes and the large delta floodplain have a very large water storage capacity. In this project, we propose the study of lakes in Mackenzie Delta, Arctic Canada, which receive fluvial sediments from the river when spring floodwater levels rise above natural levees. The project aims to understand sediment trapping conditions in Arctic river delta lakes to assess the impact on the overall sediment transport balance. This goal will be achieved by developing a sediment transport model based on the theory of settling basins while incorporating the Gamma distribution law. This model will enable us to assess the efficiency of sediment trapping, sediment settling velocity, and deposition rates, considering the dynamics of sedimentation velocity and sediment re-suspension processes.

On the example of detailed studies of the Big Lake, a no-closure floodplain lake located in the middle part of the delta between the Middle Channel and the East Channel of Mackenzie River, we are going to try to answer the following questions:

i. *What is the sediment trapping capacity of no-closure lakes?*
ii. *How much sediment load is accumulated in lakes each year, and what volume of sediments will be retained in the future?*
iii. *Does the intense release of climate change by Arctic river delta lakes influence sedimentation rates, sediment trapping, and sediment release for fluvial re-transport?*

In this project, we will try to use two original complementary methods (numerical and analytical) based on liquid and solid inputs, fall velocity and the trapping capacity of suspended matter, which will enable us to understand the hydrodynamic functioning of the floodplains of the lakes in the Mackenzie River delta.

The expected results after completion of the project are:

- We will learn how the no-closure lakes in influence the value of sediment transport to the Arctic Ocean during the annual cycle.
- We will determine the impact of extreme phenomena on sedimentation and sediment re-suspension in no-closure lakes;
- We will calculate the load of sediments accumulated and released for transport in the river delta;
- We will learn about the reliability of the adopted settler theory method, particularly in the sediment transport by currents of particles present in the water column and on the bottom; velocity of the fall of particles into the water column, with or without flocculation (particle aggregation); the condition of the deposition of particles on the sedimentary bed; possibilities of erosion of bottom sediments by currents and swells; and the quality of consolidation of multi-layer sediments (via transfer flows between the sediment layers).

A series of field observations and planned research stay in Western Arctic Research Centre in Inuvik were planned to determine the characteristics of the morphometric parameters, suspended solids and sediments present in the no-closure lake of the Mackenzie Delta and evaluate the impact that the settlement velocity of suspended solids and the flow rate have on the sediment trapping capacity of the lakes in the Mackenzie Delta.

This approach will provide new knowledge about current and future sediment transport patterns within river deltas in areas of rapid permafrost thaw. Through this project, we aim to demonstrate the usefulness of deltaic lakes as hydrological recorders of the regime of the Mackenzie River, of changes in flow and sediment transport, and to bridge the gap between hydrological processes and depositional patterns in sedimentology.