Investigating permafrost coastal erosion and the resulting nutrient input in the western Canadian Arctic

Jaroslav Obu, Hugues Lantuit, Michael Fritz, Birgit Heim, Lutz Schirrmeister

Alfred Wegener Institute for Polar and Marine Research Potsdam

Background

Rapid environmental changes in the Arctic, including permafrost thaw and coastal erosion, are expected to have great impacts on the global climate system, on the ecosystem and on local communities. The magnitude at which these processes occur and their impacts is still not completely understood. This project focuses on the study of coastal erosion rates and the resulting organic carbon and nutrient release to the nearshore zone on Herschel Island and Yukon Coastal Plain in northwest Canada. The main aim is to explore means of coastal erosion, sediment transport to the sea and estimation of the amount of available organic carbon and nutrients.

Surface properties survey

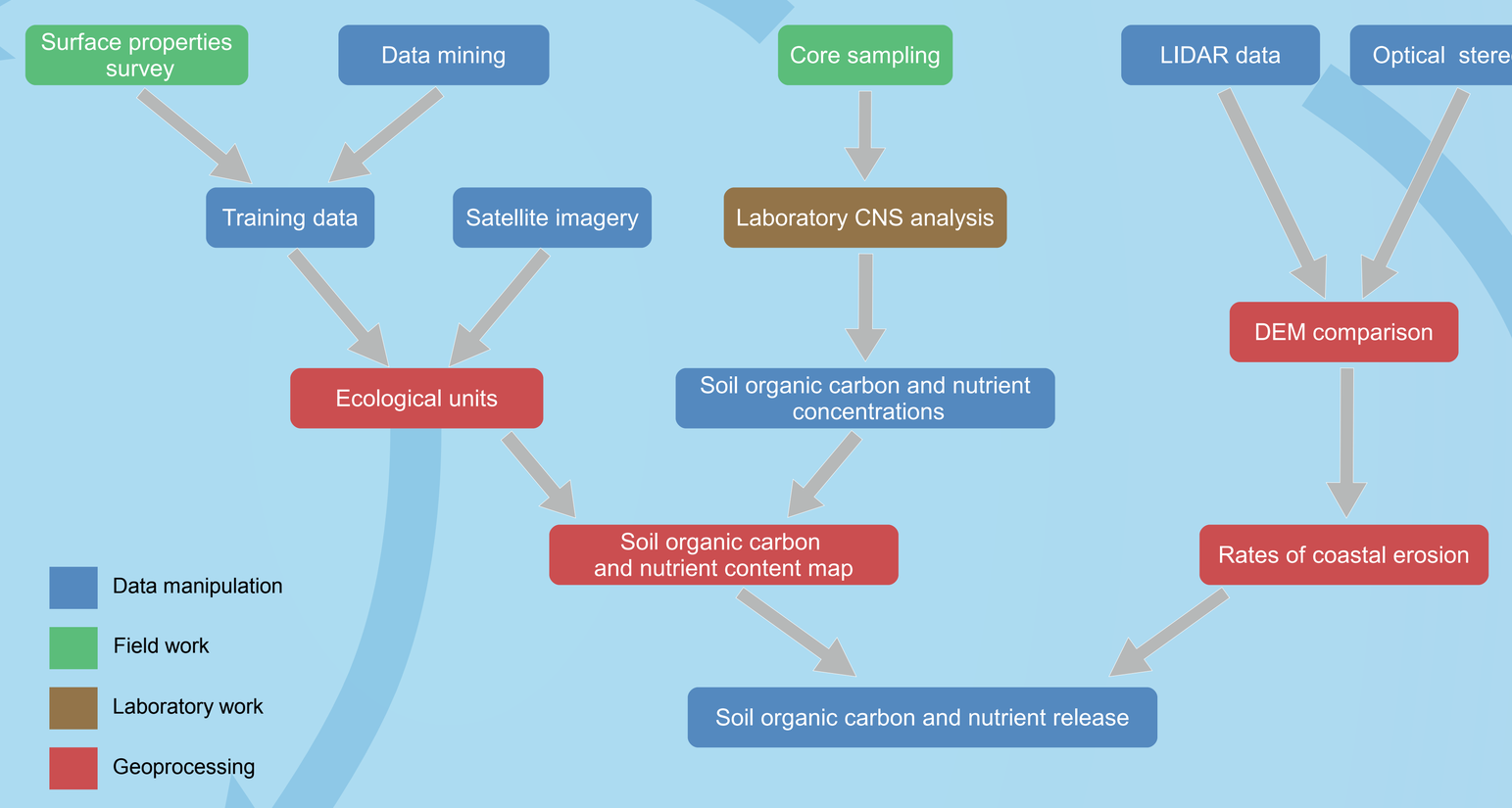
Study area

Study area of PhD project is Yukon Coast with Herschel Island. Both consist of unconsolidated sediments, massive ice and are thus very exposed to coastal erosion. Herschel Island is ice-thrusted moraine and terrain is moderately sloping with mostly steep coastal bluffs. Yukon Coastal Plain is flat and gently sloping with steep coasts, retrogressive thaw slumps, spits and barrier islands. Area has polar tundra climate with harsh winters and summer mean temperatures above 0°C.

Permafrost Coring

- A pit was dug in active layer and permafrost was drilled with SIPRE corer up to 2 meters
- Cores were sampled for 5 cm samples each 10 cm
- They are being analysed for soil organic carbon and total nitrogen

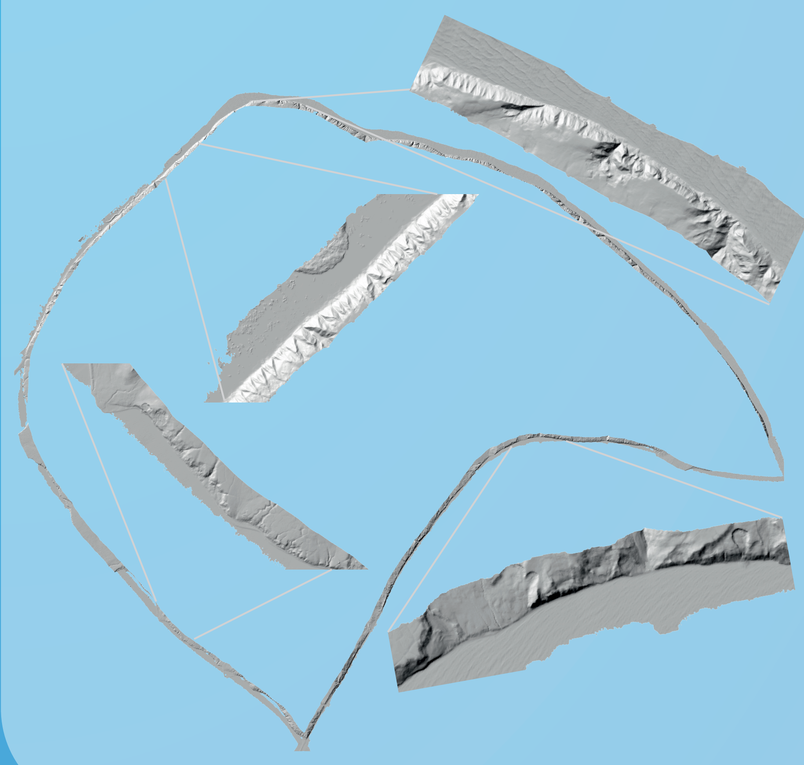
Project flow chart



Ecological units and core locations for organic carbon and nutrient quantification

Ecological classification was produced from RapidEye multispectral satellite imagery and slope layer with maximal-likehood supervised classification. Training areas for 8 predefined ecological units were delineated during the expedition to Herschel Island in 2013. 13 cores were drilled, at least one in each unit, to produce soil organic carbon and nutrient content map.

LIDAR Digital elevation model



One meter resolution DEM was obtained from LIDAR scanning of Yukon Coast and Herschel Island in 2012. DEM from year 2013 will be used to reveal changes in landscape. Emphasises will be on coastal erosion and different means of material transportation to sea.

Photos: M. Fritz, 2013

jaroslav.obu@awi.de