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Hydrological and sedimentary response of small watersheds in a Low Arctic setting – A case study on Herschel Island, Yukon Territory, Canada

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Coastal ecosystems in the Arctic are being affected by climate change leading to permafrost thaw, to a shifting streamflow regime and to changing fluxes of freshwater and sediment to the Arctic Ocean. The hydrological and sedimentary response of large rivers to climate change have been focus of numerous investigations as they cover 53% of the area draining into the Arctic Ocean (e.g. Holmes et al. 2012). Small catchments are yet widespread and could contribute large amounts of sediment to the nearshore zone. Streamflow and sediment transport is being monitored continuously only at a few sites (Favaro & Lamoureux 2015), which constraints the understanding regarding water quality and nutrient availability. This project is addressing this knowledge gap by investigating streamflow regime and sediment dynamics of two adjacent catchments on Herschel Island in the western Canadian Arctic.

We present an overview of the extensive ecosystem monitoring between 2014 and 2016. Data of vegetation coverage, active layer depth, soil organic carbon and nitrogen collected 2014 and 2015 highlight the great spatial variability of reservoirs in the catchments. The hydrological stations at the outflow of each catchment collect data of water height, temperature and conductivity. Snow water equivalent estimations, retrieved from snow probing along transects in 2016, contribute to an understanding of the hydrological configuration of the catchments, which are characterized by a nival regime. The data analysis further suggests a changing decoupling and coupling of the hydrological regime with snow, depending on the time in the season. Water samples were collected to determine concentrations of dissolved organic carbon and nitrogen as well as suspended particulate sediment. The latter will be linked to turbidity values, which amount up to 132.0 NTU for a drainage area of only 1.4 km2 in the western catchment. Turbidity values in the eastern catchment (1.6 km2) are generally smaller, with a maximum of 77.3 NTU. By comparing both watersheds, sediment sources and controls of its mobilization are going to be investigated. This study will contribute to a baseline for pan-Arctic assessments of sediment flux to the Arctic Ocean.

Holmes, R.M., McClelland, J.W., Peterson, B.J., et al. (2012). Seasonal and annual fluxes of nutrients and organic matter from large rivers to the Arctic Ocean and surrounding seas. Estuaries and Coasts, 35, 369–382, DOI 10.10007/s12237-011-9386-6.

Favaro, E.A., Lamoureux, S.F. (2015). Downstream patterns of suspended sediment transport in a High Arctic river influenced by permafrost disturbance and recent climate change. Geomorphology, 246, 359-369, DOI 10.1016/j.geomorph.2015.06.038.