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High Resolution Turbidity Modelling in Arctic Nearshore Environments

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The Arctic is directly impacted by climate change. The increase in air temperature drives the thawing of permafrost and an increase in coastal erosion and river discharge. This leads to a greater input of sediment and organic matter into coastal waters, which substantially impacts the ecosystems, the subsistence economy of the local population, and the climate because of the transformation of organic matter into greenhouse gases. Yet, the patterns of sediment dispersal in Arctic nearshore zones and their role in the Carbon cycle are not well known due to difficult accessibility and challenging weather conditions. In this study we present the first multi-sensor turbidtiy- reflectance relationship that was specifically calibrated for Arctic nearshore environments. Field data was collected during summer seasons 2018 and 2019 in the inner shelf waters of the Canadian Beaufort Sea close to Herschel Island Qikiqtaruk. The turbidity-reflectance relationship was calibrated to mid to high spatial resolution sensors which are used in ocean color remote sensing, including Landsat 8, Sentinel 2, and Sentinel 3, using the relative spectral response functions. The results for Landsat 8 and Sentinel 2 are very promising and showcase the possibility to resolve sediment accumulations, sediment pathways and filaments at higher detail than before. Both sensors are able to resolve high turbidity close to the coast with values comparable to our field measurements. Sentinel 3, on the other hand, is too coarse to resolve these features but provides great applicability due to its high temporal resolution. The transferability of these relationships to nearshore environments outside the Canadian Beaufort Sea has to be tested in the future with the potential to map the sediment dispersal in nearshore environments at a circum- Arctic scale.