Presentation Title: Ocean Colour Remote Sensing in Polar Seas:

Speaker: Atsushi Matsuoka

Affiliation: Takuvik Joint International Laboratory (CNRS-Ulaval)

Email address: atsushi.matsuoka@takuvik.ulaval.ca

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Abstract:

Global climate change is affecting a broad spectrum of terrestrial, marine, cryospheric, and atmospheric environments. This is particularly evident at high northern latitudes. Compared to Antarctic sea ice, whose trend is not clear, Arctic sea ice area and thickness has been continuously decreasing over the last four decades due to global warming and ice-albedo feedback. The newly-opened area is now responsible for dissolution of atmospheric CO_2. Depending on nutrient availability and physical conditions (e.g., mixing), primary production of the Arctic Ocean is likely to increase, mainly because of increased light availability associated with the increase in open water area, another sink of CO_2. On land, river discharge has increased in both North American and Siberian sides of the Arctic region since the late 20th century. This increase is likely linked to the recent dramatic decrease in sea ice area and thickness and concomitant atmospheric moisture transport. It is anticipated that a significant amount of organic carbon originating from permafrost thaw will be delivered by river discharge into the Arctic Ocean. The amount of organic carbon sequestrated in the permafrost is enormous (1700 Pg C), accounting for over 50 % of global soil carbon stocks, almost double that contained in the atmosphere (800 Pg C). It is also anticipated that a significant amount of organic carbon originating from permafrost thaw will be delivered by river discharge into the Arctic Ocean. A portion of this organic carbon that was previously sequestered in the permafrost may be actively utilized by heterotrophic bacteria, which may accelerate CO_2 release back to the atmosphere. How organic matter from permafrost-origin impacts the global climate system is not clear.

Satellite remote sensing estimates of organic carbon in Arctic coastal waters, where a significant amount of terrestrial organic matter is transported, have been used to answer part of this important question. In more recent collaborative work, estimates of concentrations of dissolved (DOC) and particulate organic carbon (POC) have been compared with numerical modeling results. Research includes investigation of a recent trend in these fluxes observed in major Arctic river mouths by developing a semi-analytical algorithm with known uncertainty. To examine the influence of river input on coastal marine ecosystems, an objective algorithm has been developed for discriminating different surface water sources using remote sensing data alone. Broader application of this algorithm may lead to the discrimination of water sources in the surface layer in a variety of environments, which may be useful to improving our understanding of physical and biogeochemical processes related to each water source. While Arctic research is central to this study, a similar approach can be applied to other environments at lower latitudes for better

understanding of biogeochemical processes. This presentation is thus relevant to studies investigating organic matter processes in various environments.