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DOC – CDOM relationship in Arctic coastal waters (Laptev Sea) and its implication for Ocean Color Algorithms.

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Thermal degradation of permafrost and enhanced coastal erosion due to increased air temperatures and a longer open-water period remobilize organic carbon in the arctic coastal areas. Near-coastal waters in the Laptev Sea show extremely high concentrations of dissolved organic carbon (DOC) most of which derives from the huge discharge of the Lena River.
We strongly lack knowledge about organic carbon budgets and how they are modified during arctic warming potentially resulting in environmental changes and positive feedback mechanisms.
The colored fraction of dissolved organic matter (CDOM) is the dominant optical component reducing the penetration of light into the water. Numerous studies showed a strong correlation between CDOM absorption and DOC. The absorption of CDOM in surface waters can be estimated by Ocean Color Remote Sensing and thus CDOM can be used to quantify and monitor fluxes of DOC. However, a robust and highly accurate model is required to retrieve DOC concentration from CDOM absorption. Existing models lead to an underestimation of DOC concentrations in extremely CDOM-rich coastal waters. In situ measurements especially in coastal waters are required to improve model representation of CDOM absorption versus DOC. Here, we show an extensive multiyear dataset (2010 – 2017) of in situ DOC and CDOM measurements in arctic coastal waters which is used to develop and improve the model. Results show that the relationship between CDOM absorption coefficient and DOC is strongly wavelength dependent. Whereas DOC and CDOM absorption are strongly linearly correlated at 254nm, the relationship is distinctly non-linear at 443nm.
The spectral slope coefficient in the UV domain can also improve our understanding of organic matter sources and processes that alter it, leading to variations in the relationship between DOC and CDOM. Ultimately, our in situ data cover an extremely wide range of DOC concentrations – very high concentrations in river and near coastal waters and low concentrations in offshore oceanic waters. This wide range allows the development of a robust relationship for CDOM versus DOC. This improved understanding of DOC and CDOM changes in coastal waters of the Laptev Sea can be used to improve the derivation of DOC with Ocean Color Remote Sensing.