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Terrestrial CDOM in lakes of Yamal Peninsula: Connection to lake and lake catchment properties

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Abstract

© 2018 by the authors. In this study, we analyze interactions in lake and lake catchment systems of a continuous permafrost area. We assessed colored dissolved organic matter (CDOM) absorption at 440 nm (a(440)CDOM) and absorption slope (S300-500) in lakes using field sampling and optical remote sensing data for an area of 350 km2in Central Yamal, Siberia. Applying a CDOM algorithm (ratio of green and red band reflectance) for two high spatial resolution multispectral GeoEye-1 andWorldview-2 satellite images, we were able to extrapolate the a(λ)CDOMdata from 18 lakes sampled in the field to 356 lakes in the study area (model R2= 0.79). Values of a(440)CDOMin 356 lakes varied from 0.48 to 8.35 m-1with a median of 1.43 m-1. This a(λ)CDOMdataset was used to relate lake CDOM to 17 lake and lake catchment parameters derived from optical and radar remote sensing data and from digital elevation model analysis in order to establish the parameters controlling CDOM in lakes on the Yamal Peninsula. Regression tree model and boosted regression tree analysis showed that the activity of cryogenic processes (thermocirques) in the lake shores and lake water level were the two most important controls, explaining 48.4% and 28.4% of lake CDOM, respectively (R2= 0.61). Activation of thermocirques led to a large input of terrestrial organic matter and sediments from catchments and thawed permafrost to lakes (n = 15, mean a(440)CDOM= 5.3 m-1). Large lakes on the floodplain with a connection to Mordy-Yakha River received more CDOM (n = 7, mean a(440)CDOM= 3.8 m-1) compared to lakes located on higher terraces.

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Keywords

CDOM, Lake catchments, Lakes, Permafrost, Remote sensing data, Yamal

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