Modeling dissolved organic matter in northeastern Siberian lakes and rivers using Landsat satellite imagery

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Abstract:

The Kolyma River in northeastern Siberia, one of the six largest rivers draining to the Arctic Ocean, has experienced significant climate warming over the past century and is poised to experience even more dramatic warming over coming decades. The Kolyma River basin is particularly sensitive to climate change, as the region is underlain by vast deposits of carbon-rich Pleistocene loess known as yedoma, most of which are currently stored in icy permafrost. Understanding how this soil carbon is released into rivers and lakes upon permafrost degradation is critical to assessing how regional carbon cycling may impact an already warming climate. Spatially extensive sampling is logistically difficult in this expansive, sparsely populated region with little infrastructure. We present a model that estimates chromophoric dissolved organic matter (CDOM) in streams, rivers and lakes in the vicinity of Cherskiy, Russia in northeastern Siberia using Landsat-5 Thematic Mapper (TM) and Landsat-7 Enhanced Thematic Mapper-plus (ETM+) imagery. Twenty-one field samples were collected in July 2008 and 2009 from lakes and rivers along a ~250 km transect of the northern Kolyma River basin. Reflectance values and band ratios were extracted July 2008 and 2009 scenes from TM and ETM+, then regressed against 21field observations of CDOM, and chlorophyll-a. Preliminary results show that a multiple linear regression of TM4 and TM1:TM3 provide the best approximation of CDOM. Chlorophyll exists in very low concentrations and cannot be estimated from satellite imagery.