Ultraviolet-visible absorption spectra of chromophoric dissolved organic matter (CDOM) in waters throughout the Kolyma River basin, East Siberia

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The Kolyma River in East Siberia is among the six largest Arctic rivers and drains a region underlain by vast deposits of Pleistocene loess known as yedoma, most of which are currently stored in ice-rich permafrost throughout the region. These yedoma deposits are important sources of dissolved organic matter to terrestrial waters that in turn play a significant role in the transport and ultimate mineralization of organic carbon to atmospheric CO_2 and CH_4. In order to determine the concentrations and characteristics of this dissolved organic matter, we measured the ultraviolet-visible absorption spectra (200–800 nm) of chromophoric dissolved organic matter (CDOM) from a broad collection of waters throughout a ~250 km transect of the northern Kolyma River basin. 124 samples were collected during July 2008 and 2009 and include soil pore waters, lakes, streams, rivers, and the Kolyma River mainstem. Absorbance values are highly positively correlated with dissolved organic carbon concentrations, with the highest values in soil pore waters and lowest values in the Kolyma River mainstem. Spectral slopes (at 275–295 nm and 350–400 nm, calculated within log-transformed absorption spectra) are also used to investigate contrasting water types and are found to be useful indicators of the bioavailability of dissolved organic matter. With ongoing and future permafrost degradation, yedoma deposits throughout the East Siberian region will become more hydrologically active and have the potential to be even greater sources of dissolved organic matter to soil pore waters, lakes, streams, rivers, and ultimately to the Arctic Ocean. As such, the ability to easily and comprehensively monitor the quantity and quality of dissolved organic matter across the landscape through methods such as ultraviolet-visible absorption is becoming critical for understanding the global significance of the Arctic carbon cycle.