

Transport and degradation of dissolved organic matter and associated freshwater pathways in the Laptev Sea (Siberian Arctic)

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The Siberian shelves are seasonally ice-covered and characterized by large freshwater runoff rates from some of the largest rivers on earth. These rivers also provide a considerable amount of dissolved organic carbon (DOC) to the Arctic Ocean. With an annual load of about 6 Tg DOC a⁻¹ the Lena River contributes nearly 20 percent of the annual DOC discharge to the Arctic Ocean. We present a comprehensive dataset collected during multiple Laptev Sea expeditions carried out in spring, summer and fall (2010-15) in order to explore the processes controlling the dispersal and degradation of DOM during the river water's passage across the shelf. Our investigations are focused on CDOM (Colored Dissolved Organic Matter), which resembles the DOC concentration, interacts with solar radiation and forms a major fraction of the organic matter pool. Our results show an inverse correlation between salinity and CDOM, which emphasizes its terrigenous source. Further, the spectral slope of CDOM absorption indicates that photochemical bleaching is the main process that reduces the CDOM absorption (~ 20%) in freshwater along its transport across the shelf. The distribution of the Lena river water is primarily controlled by winds in summer. During summers with easterly or southerly winds, the plume remains on the central and northern Laptev shelf, and is available for export into the Arctic Basin. The CDOM-rich river water increases the absorption of solar radiation and enhances warming of a shallow surface layer. This emphasizes the importance of CDOM for sea surface temperatures and lateral ice melt on the shelf and adjacent basin. DOC concentrations in freshwater vary seasonally and become larger with increasing discharge. Our data indicate that the CDOM concentrations are highest during the freshet when landfast ice is still present. Subsequent mixing with local sea ice meltwater lowers CDOM to values that are characteristic for the Lena freshwater during the rest of the year.