Geophysical Research Abstracts
Vol. 14, EGU2012-9551, 2012
EGU General Assembly 2012

Dissolved Organic Matter Land-Ocean Linkages in the Arctic

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Rivers draining into the Arctic Ocean exhibit high concentrations of terrigenous dissolved organic carbon (DOC), and recent studies indicate that DOC export is changing due to climatic warming and alteration in permafrost condition. The fate of exported DOC in the Arctic Ocean is important for understanding the regional carbon cycle and remains a point of discussion in the literature. As part of the NSF funded Arctic Great Rivers Observatory (Arctic-GRO) project, samples were collected for DOC, chromophoric and fluorescent dissolved organic matter (CDOM & FDOM) and lignin phenols from the Ob', Yenisey, Lena, Kolyma, Mackenzie and Yukon rivers in 2009 – 2010. DOC and lignin concentrations were elevated during the spring freshet and measurements related to DOC composition indicated an increasing contribution from terrestrial vascular plant sources at this time of year (e.g. lignin carbon-normalized yield, CDOM spectral slope, SUVA254, humic-like fluorescence). CDOM absorption was found to correlate strongly with both DOC (r2=0.83) and lignin concentration (r2=0.92) across the major arctic rivers. Lignin composition was also successfully modeled using FDOM measurements decomposed using PARAFAC analysis.

Utilizing these relationships we modeled loads for DOC and lignin export from high-resolution CDOM measurements (daily across the freshet) to derive improved flux estimates, particularly from the dynamic spring discharge maxima period when the majority of DOC and lignin export occurs. The new load estimates for DOC and lignin are higher than previous evaluations, emphasizing that if these are more representative of current arctic riverine export, terrigenous DOC is transiting through the Arctic Ocean at a faster rate than previously thought. It is apparent that higher resolution sampling of arctic rivers is exceptionally valuable with respect to deriving accurate fluxes and we highlight the potential of CDOM in this role for future studies and the applicability of in-situ CDOM sensors.