Geophysical Research Abstracts
Vol. 14, EGU2012-5972, 2012
EGU General Assembly 2012

Carbon isotopes and lipid biomarker investigation of sources, transport and degradation of terrestrial organic matter in the Buor-Khaya Bay, SE Laptev Sea

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Large inputs of both river discharge and coastal erosion matter highly characterises the East Siberian Shelf Seas (ESAS) – the largest continental shelf water in the world. This input is expected to increase with thawing permafrost areas of the Arctic with a potential positive feedback effect to climate warming. To detail the fate of this material our study uses high resolution samples of particulate organic matter (POC) and surface sediment (SOC) from Buor-Khaya Bay, SE Laptev Sea for molecular (lipid biomarkers) and isotopic (stable carbon and radiocarbon isotopes) analysis of transport and degradation patterns. The study area is a hot spot for coastal erosion and also receives a very strong terrestrial signal from the Lena River, which is confirmed by depleted d13C-OC and high HMW/LMW n-alkane ratios. Curiously, the shallow waters (10-40 m) showed a shift in carbon isotopes of +2 to +5 per mille for stable carbon and -300 to -450 for radiocarbon between SOC and POC over the bay, though lipid biomarkers indicate that POC is 5-6 times more degraded than SOC, (via HMW n-alkanoic acid/HMW n-alkanes and n-alkane CPI values).
Thus suggested is that the older yedoma/mineral soil OC from erosion material associate to mineral-rich particles and therefore is ballasted and sink out of the water column quickly. The mineral association may also explain the greater resistance to degradation. In contrast the riverine soil eroded OC is buoyant and stays in the water column where it is readily degraded already before reaching the surface sediment. These two components may represent two pools of OC that are prone to degradation in different ways – and therefore would also contribute to positive feedback by climate warming with different propensities.