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Carbon dioxide fluxes over the East Siberian Arctic shelf: interannual variability

Irina Pipko (1), Svetlana Pugach (1), Igor Semiletov (1,2), and Leif Anderson (3)

(1) Pacific Oceanological Institute FEB RAS, Vladivostok, Russian Federation (irina@poi.dvo.ru), (2) International Arctic Research Center/University Alaska, Fairbanks, USA, (3) Department of Analytical and Marine Chemistry, Göteborg University, Sweden

We examined the carbonate system dynamics and CO2 fluxes in the East-Siberian Sea (ESS) and adjacent part of the Laptev Sea (LS) based on our multi-year study conducted on the Arctic shelf in Aug.-Sept. 2003-2005, 2008. It is usually assumed that at high latitudes important CO2 absorption from atmosphere occurs during the ice free period when primary production is high and water temperature is low. However our data show that during summer-fall season a significant part of the shallow ESS and LS serves as a strong source of CO2 to the atmosphere. Winter pCO2 values also exhibit a strong water super saturation beneath the fast ice (up to 5,000 μatm). We classified near-shore ecosystem of the ESS as mainly heterotrophic (i.e. net production of inorganic carbon) and the main source of allochthonous OC is a terrestrial labile OC mobilized from the degrading permafrost. Anomalously high pCO2 values (up to 4,000 μatm) are spatially correlated with areas adjusted to the highly eroded ice-complex coast. Riverine waters are additional significant source of carbon in inorganic (including dissolved CO2) and organic (mainly dissolved) forms. The variability of the average CO2 emission during late summer/fall season over the East Siberian Arctic Shelf was ranged between 1 mmol/(m^2day^1) and 10 mmol/(m^2 day^1). It was found that the direction of fluxes changes near the frontal zone between "freshened/source" and "Pacific/sink" waters and this zone's position varies significantly from year to year. It is mainly attributed to the difference in atmospheric circulation patterns driven the Arctic Ocean circulation.