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International studies in the East-Siberian Arctic Shelf during the last eleven years (1999-2010): An overview

Valentine Sergienko^{1*}, Natalia Shakhova², Igor Semiletov²

¹Far Eastern Branch Russ. Academy of Sci., ²International Arctic Research Center

The Arctic Ocean is surrounded by permafrost, which is being degraded at an increasing rate under conditions of warming which are most pronounced in Siberia and Alaska. A major constraint on our ability to understand linkages between the Arctic Ocean and the global climate system is the scarcity of observational data in the Siberian Arctic marginal seas where major fresh water input and terrestrial CNP fluxes exist. The East-Siberian Sea Arctic Shelf (ESAS) has never been investigated by modern techniques despite the progress that has been made in new technologies useful for measuring ocean characteristics of interest. In this multi-year international project which joins scientists from 3 nations (Russia-USA-Sweden), and in cooperation with scientists from other countries (UK, Netherlands), we focus on the ESAS which is a poorly explored area located west from the U.S.-Russia boundary. In this report we overview the main field activities and present some results obtained during the last eleven years (1999-2010).

Siberian freshwater discharge to the Arctic Ocean is expected to increase with increasing temperatures, potentially resulting in greater river export of old terrigenous organic carbon to the ocean. Our working hypothesis was that rivers integrate the variability in the components of the hydrometeorological regime, including soil conditions, permafrost seasonal thaw, and thermokarst development. All these variables determine atmospheric and ground water supply into the rivers and chemical weathering in their watershed. We found that 1) carbon dioxide and methane fluxes are significant (and non-accounted) components of the carbon cycling in the Arctic Ocean; 2) transport of eroded terrestrial material plays a major role in the accumulation of carbon in the ESAS; 3) the seabed is a major CH₄ source over the ESAS; 4) eroded carbon is biodegradable; 5) oxidation of eroded carbon onshore and offshore is a strong source of carbon dioxide. Thus, studying carbon cycling in the East Siberian Arctic shelf seas has a high scientific priority for quantification of the regional carbon budget and evaluation of the role of the Arctic in the global carbon cycling. These studies in the coastal zone are of a special importance, because there the characteristics of carbon exchange with atmosphere are not yet known and a redistribution of carbon between terrestrial and marine environments occurs. Initial scientific plan for the next decade will be presented.

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