

## Summer Sediment Transport Dynamics on the Laptev Sea Shelf (Siberian Arctic)

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The Arctic summer sea-ice cover is continuously decreasing as a result of climate change. Climate models suggest that the Arctic Ocean will even be ice-free in September in about 90 years. Larger open water areas due to reduced sea-ice cover on the vast continental Siberian shelf seas in summer are expected to translate into larger wind fetch and wave heights leading into increased sediment resuspension and coastal erosion. Additionally, models suggest increased loads of suspended and dissolved matter in the Arctic ecosystem associated with an increase in annual Arctic river discharge by 10–20%. A detailed knowledge of the pathways of suspended particulate matter (SPM) and the possible response to climate change is of critical importance to understanding and to forecasting the impact of environmental changes on the land-shelf-ocean interaction.

The Laptev Sea is one of the largest Siberian shelf seas. Its summer shelf hydrography is strongly riverine dominated, with an annual freshwater input of 714 km<sup>3</sup>, mainly from the Lena River. As such, the shelf in summer behaves as an estuarine system that derives its water and material from both terrestrial and oceanic sources. The spatial distribution of the Lena River freshwater plume shows a strong interannual variability, mainly associated with positive and negative phases of atmospheric vorticity over the adjacent Arctic Ocean in summer. It can be assumed that the surface distribution of SPM during the ice-free period is in turn closely connected to the distribution of the freshwater plume.

During the project “Laptev Sea System,” detailed oceanographic (Conductivity Temperature Depth-measurement: CTD), optical (turbidity), and hydrochemical (nutrients, SPM, stable oxygen isotopes) process studies during summer conditions have been carried out continuously from 2007–2010 during the ice-free periods to study the interannual variability of SPM on the Laptev Sea shelf. Additionally, two one-year bottom-mooring stations equipped with acoustic current meters (Acoustic Doppler Current Profilers [ADCPs]), CTDs, and turbidity meters were deployed north of the Lena Delta to study the interannual current and water structure variability within the frontal zone between the river- and shelf-dominated waters. It can be shown that during summers with prevailing westerly winds (summer 2007 and 2009) the

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freshwater of the Lena River, as well as part of the riverine material, is transported eastwards and partly exported to the East Siberian Sea. SPM concentration is elevated near the surface on the eastern inner shelf. In the mid- and outer shelf the surface SPM concentration is negligible. The bottom nepheloid layer was very dominant and resuspension presumably took place. However, during summers with prevailing southerly winds (summer 2008) the freshwater plume stretches up to 76° N, and SPM is transported onto the mid-shelf area within the surface layer, where it sinks down and is transported back onto the inner shelf by bottom currents. We can therefore conclude that there are significant differences in SPM transport and distribution depending on the Arctic cyclonicity. If the trend towards more summers with prevailing westerly winds on the Laptev Sea shelf continues, this might have severe consequences for the sensitive ecosystem on the shelf due to altered nutrient availability and light penetration.

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