

Goldschmidt Medal Abstract

Effects of the declining sea-ice on the Arctic ocean ecosystem: How life matters

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Recent field studies and ocean models indicate that the rapid sea-ice decline in the Arctic could already be changing the distribution and productivity of key species, with consequences for local to regional biogeochemical processes. But because of missing baselines, uncertainties are substantial as to the change in light and nutrient availability, stratification, primary productivity and particle export. Missing links are the role of melt ponds, microscale to macroscale mixing processes especially at the marginal ice zones, and shifts in the key primary producers, including sea-ice algae. This presentation discusses recent scientific and technological advances and further needs in accelerating observation of Arctic Ocean ecosystems change from surface to bottom, with a focus on the link between sea ice-cover and the deep-sea floor via the biological pump. It addresses recent results from long-term ecological time series of the Arctic seafloor, and how to establish indicators for Arctic ecosystem change. Our results suggest that environmental changes in the past two decades, foremost sea ice thinning and retreat, have led to a substantial increase in phytodetritus sedimentation to the seafloor, especially at the lower margin and adjacent basins. This is reflected in increased benthic microbial activities, leading to higher carbon remineralization rates, especially deeper than 3000 m. Also first assessments of faunal abundances at the seafloor fit the prediction of higher productivity and particle deposition rates upon sea ice retreat. The presentation also discusses future needs in Arctic process studies and long term observation, for a better understanding of the feedback mechanisms between physics, biology and biogeochemical processes.