Microplastics in the Eurasian Arctic surface water: main sources and drivers of spatiotemporal variability

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Abstract

This work addresses spatial and temporal distribution of floating microplastics (MPs) in the Eurasian part of Arctic Ocean. Studies were carried out in 6 cruises: in August-October 2019, 2020, 2021 and 2022 onboard R/V *Akademik Mstislav Keldysh* and R/V *Akademik Ioffe*. A total of 220 surface water samples and 180 subsurface water samples were collected in the Barents, Kara, Laptev, and East-Siberian seas, comprising by far the most extensive dataset on floating microplastics in the Eurasian Arctic. Floating debris were sampled on the sea surface using a Neuston net with mesh size 330 μm and from subsurface layer (5 m depth) using a pump filtration system with pore size 100 μm. All potential plastic particles were identified on FTIR; both MPs abundance and mass concentration were considered.
It was revealed that MPs pollution on sea surface significantly decreases from the West to East in the Eurasian Arctic, from 19.0 μg/m3 in the Barents Sea to 11.2 μg/m3 in the Kara Sea, 3.6 μg/m3 in the Laptev Sea and 2.0 μg/m3 in the East-Siberian Sea. Less MPs were found in the Great Siberian River plumes than in high saline water. The same tendency was found for subsurface MPs while mass concentration was 10 times lower. The maximum concentration of MPs was found in the Kara Gate Straight (640 μg/m3) in the current flowing from the Barents Sea. This can indicate that the main source of MPs in the Siberian Arctic is located in the Barents Sea.
Variability of surface MPs abundance was found in the Kara Sea for different years, 1000 – 5000 items/km2 on average. Possible influence of several factors affecting MPs fate here was discussed: interannual changes in riverine discharge, shipping activity, ice cover, Barents Sea water inflow, where the last factor turned out to be the most important.

Keywords: Microplastics, Arctic Ocean, Kara Sea, surface water

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