Modelling the fate of sinking microplastics in an urban fjord in western Norway

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Abstract

It is a well established fact that the ocean floor acts as a major sink for microplastics; however, the details of sinking behaviour and fate of these microplastics is quite uncertain. Byfjorden in Bergen, Norway, is a semi enclosed basin in an urban area with typical and relatively well known sources of microplastics such as sewage, traffic and industrial pollution, lending itself well to modelling.
In this study, we investigate the transport and dispersion of microplastic debris that come from tires due to road traffic over two bridges in Byfjorden. A Lagrangian particle tracking framework, OpenDrift, has been used to model the uncertainty in events. The particle trajectories are computed based on horizontal velocity fields from a general ocean circulation model and a vertical velocity component given by a sinking rate. The sinking rate is obtained from a modified Stokes law and, hence, depends on the size of the particle.
We use Monte Carlo methods to correlate release locations in the vicinity of the bridges with the locality where the particles settle at the seabed; Especially, the horizontal velocity experienced by individual particles depends on release time, e.g., when in the tidal cycle the particle is released. This aim is to discover potential aggregation zones and corresponding gradients along the bottom of the fjord. Results could be relevant in understanding the mechanisms behind particle transport in the fjord and aid in designing sampling campaigns.

Keywords: Sinking rates, Modelling, Lagrangian particle tracking, Monte Carlo methods

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