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## Riverine transport of microplastics from the Dutch border to the North sea

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Microplastics may affect marine and freshwater ecosystems and human health negatively. Important point sources of microplastics in rivers are locations where microplastics are released into the river, such as waste water treatment plants. Diffuse sources include the fragmentation of macroplastic items and tire and road wear particles that are flushed into the river (Unice et al., 2019). Once in the river, the different types and sizes of microplastics are transported with the flow. How this transport depends on environmental conditions is largely unknown. Due to the effort needed to monitor the microplastic concentration and composition, usually observations are carried out at one location in the water column only and are only repeated a few times. With a model, the spatial and temporal variation of the microplastics concentration can be predicted.

We modeled the transport and fate of microplastics (here defined as particles within 0.05 and 5 mm) in Dutch rivers and streams. We used a depth and width averaged flow model for the Netherlands. At the main upstream boundaries of the model (Lobith in the Rhine and Eijsden in the Meuse) microplastics were released. The concentration of different types of microplastics was based on observations by Urgert (2015). The model included the processes advection, deposition and hetero-aggregation of microplastics with sediment to determine the transport and fate. Overall, the model results suggest that the deposition is small: about 66-90 percent of the released microplastics are transported out of the model towards the sea, meaning that 10-34 percent are either deposited to the river bed or are stored in the water column. Resuspension of deposited microplastics was not included in the model. A sensitivity study for which resuspension was included suggests that it is not an important process in the current 1D simulation, since the flow velocities at accumulation areas rarely exceed the critical flow velocity for resuspension. The simulated annual transport of microplastics is higher than estimates based on observations (van der Wal et al., 2015; Mani et al., 2015), although sources within the Netherlands are not yet included in the model. This needs to be re-evaluated in the future, after sources of microplastics from within The Netherlands have been introduced in the model.

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