

## **Seasonal variations of plastic transport in global major rivers**

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Over the past few decades, environmental contamination from plastics has received considerable attention from scientists, policymakers, and the public. Although some models successfully simulated the transport and fate of plastic debris in freshwater systems (Meijer et al., 2021), a complete model of the dynamics of plastics in rivers on a global scale has yet to be elucidated. Previously, two process-based eco-hydrology models, NICE (National Integrated Catchment-based Eco-hydrology) (Nakayama and Watanabe, 2004) and NICE-BGC (BioGeochemical Cycle) (Nakayama, 2017), were applied to evaluate biogeochemical cycling in a range of river basins on scales ranging from local/regional to continental/global. This effort provided insights into the quantification of the role of inland waters on global biogeochemical cycles (Nakayama, 2022), but was limited in its treatment of plastic dynamics. Recently, the authors linked NICE-BGC to a plastic debris model that accounts for both the transport and fate of plastic debris (advection, dispersion, diffusion, settling, dissolution and biochemical degradation by light and temperature), and applied this new model to regional scale (Nakayama and Osako, 2023a) and global major rivers (Nakayama and Osako, 2023b). In this study, the authors evaluated spatio-temporal variations of plastic debris in the world's major rivers (325 rivers) by simulating the amount of plastic that flows from land into rivers and finally into the ocean. The model took into account the connection between hillslope and stream network models. In particular, the model also showed the seasonal and intra-annual variations of plastic fluxes in each continent, and that the flood events have a great impact on plastic mobilization and its high intra-annual variability (Hurley et al., 2018; van Emmerik et al., 2019). These results help to quantify the impacts of plastic waste on terrestrial and aquatic ecosystems, and may aid the development of solutions and measures to reduce plastic input to the ocean.