WHERE SHOULD WE SAMPLE FOR RIVERINE MICROPLASTICS?

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Abstract

Early sampling campaigns documented the occurrence of riverine microplastic and the associated environmental impacts. Recently, the focus shifted towards providing accurate estimates of riverine plastics, their sources and sinks, and the means to translate observations into actions. The complexity of riverine systems accompanied by sampling limitations and the diversity of microplastic characteristics stand as key barriers. Microplastic distribution within the water column and the underlying mechanisms are still poorly understood. The starting point to tackle these knowledge gaps is to build upon what has been learned from over 100 years of sedimentological studies. Similar to clastic sediments, turbulence might influence the vertical distribution of microplastics in rivers. The Rouse model, originally developed for sediments, has been applied to microplastics (1). A primary parameter within the model is the ratio between material diffusivity and eddy viscosity (i.e., Prandtl-Schmidt number). The parameterization of this ratio in the case of microplastics is yet to be established. The datasets necessary for model validation are still lacking, especially with the limited record of microplastic occurrence within the water column (2). Further, the model is one-dimensional in nature, hence is ideally suited for steady, uniform conditions. More complex flows require the involvement of multi-dimensional models accounting for the three-dimensional nature of the mixing process. In this project, a combination of physical and numerical modeling will be utilized to, i) better understand the turbulent mixing process for microplastics and the associated vertical distribution, ii) establish suitable values for Prandtl-Schmidt number for microplastics of different characteristics, and iii) test and validate the Rouse model for uniform turbulence conditions while exploring the potential and limitations of multi-dimensional numerical modeling for extended flow conditions. These aspects are crucial to guide future sampling campaigns and mitigation measures.
References:

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