



Please forward to appropriate candidates

Contact

Dr.-Ing. Markus Noack

Phone

+49 - (0)711 / 685-64774

Fax

+49 - (0)711 / 685-64746

E-mail

markus.noack@iws.uni-stuttgart.de

Date

20.06.2017

TOPIC: Transport behaviour of microplastic particles in rivers

Advisors

Dr.-Ing. Markus Noack, Prof. Dr.-Ing. Silke Wieprecht

Department of Hydraulic Engineering and Water Resources Management

Institute for Modelling Hydraulics and Environmental Systems (IWS)

University of Stuttgart

Keywords

Microplastic (MP), transport behaviour, rivers, experimental work, interactions with sediments

Introduction and background

The presence of microplastic particles (<5mm, MP) in the environment is a problem of growing concern. While research has focused on MP occurrence and impacts in the marine environment, very little is known about their release on land, storage in soils and sediments and transport by run-off and rivers (Nizzetto, 2016). Especially the transport behaviour with involved processes and parameters represents a significant knowledge gap. Therefore, this work focuses on the transport behaviour of MP in rivers as connecting element between source and marine environment. Basically, transport of MP in rivers differs considerably from transport of riverine sediments given the different density, particle shape and ad-/cohesion forces of MP but also given their mixing with riverine sediments. To understand the fate of MP in rivers, it is crucial to conduct experimental research in hydraulic laboratories with controlled boundary conditions to investigate involved processes and parameters. This includes e.g. processes such as sedimentation (settling velocity), interaction with riverine sediments (adhesion) and the resuspension and erosion behaviour that all depend on type, size and shape of the microplastic particles.



Methods to be used

The PhD student will first review both key and recent literature to become familiar with the state-of-research in this scientific field. In addition, the PhD-student needs to get familiar with appropriate measuring techniques to be able to prepare, install, test and use them in the hydraulic laboratory. Based on the literature review, the student will develop an experimental setup (flume) and conduct different series of experiments to identify and examine key processes related to the transport behaviour of MP in rivers. This includes investigations on the settling behaviour of MP in settling columns equipped with cameras for digital image processing to assess settling velocities in relation to particle size, shape and amount of MP in the sediment sample. In addition, experiments with photogrammetric methods to examine the re-suspension and erosion behaviour of MP will be conducted that will be complemented by experiments investigating the interacting forces between MP and riverine sediments. Extensive post-processing, including the use of statistical methods, will be required to develop functional relationships between involved parameters and to compile newly gained knowledge from the laboratory experiments.

Research goals

The main objective of this work is to investigate the transport behaviour of microplastic in rivers based on flume experiments in the hydraulic laboratory. This includes not only sedimentation and erosion processes but also the interactions with riverine sediments. The overall objectives are to investigate the key processes that are involved in MP transport and to derive functional relationships between involved parameters based on experimental research. Hence, this research contributes to a better understanding in the research field 'microplastic in rivers' as it is also demanded by the Federal Environment Agency in Germany (2017).

References (incomplete)

Nizzetto, L., Bussi, G., Futter, M.N., Butterfield, D., Whitehead, P.G., 2016. A theoretical assessment of microplastic transport in river catchments and their retention by soils and river sediments. *Environ. Sci.: Processes Impacts* 18, 1050–1059. doi:10.1039/C6EM00206D

UBA (2017): Conference on Plastics in Freshwater Environments, Umweltbundesamt Dokumentation, 05/2017, ISSN 2199-6571.

Research environment

The doctoral student will conduct the experiments in the hydraulic laboratory at IWS with access to state-of-the-art measuring equipment and support from the laboratory staff. In addition, the student will be embedded in an interdisciplinary working group of post-docs and other doctoral students dealing with different hydromorphological aspects of rivers.

Prerequisites

Background in flow mechanics, statistics and sediment transport is required, at least some idea in experimental work, measurement equipment and techniques.

Contact for questions

Markus Noack, University of Stuttgart, markus.noack@iws.uni-stuttgart.de