Plastic transport dynamics in experimental estuaries

Unravelling mechanisms between estuarine morphodynamics and plastic transport

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Project description

In this project, you will contribute to conducting physical experiments that simulate entire river estuaries in the www.uu.nl/metronome in the Earth Simulation Laboratory. Estuaries, or river mouths, are the hotspots where plastic waste is transferred from continents to oceans. But estuaries are also sinks for fine sediment and (organic) debris, and may capture much plastics. The question is in what sort of locations, and to what degree, and how this depends on estuary shape and artificially widened areas such as proposed for the Nieuwe Waterweg. The Metronome is a unique setup in the world that was successfully used to create estuaries, tidal basins and deltas. We investigate effects of sea level rise and human influence on these systems, both in the present and in the future. We address fundamental questions about the formation and dynamics of channel networks, also in response to dike constructions or disturbances such as dredging, and about equilibrium/steady state and tipping points for drowning in these systems. We also investigate and visualise effects of the shape and geometry of the estuary in determining the effects of sea-level rise for the Dutch Delta Committee. Key in all these problems is unravelling the processes and dynamics of sediment transport.

You will be working on an interdisciplinary project together with the Faculty of Science to emulate sandy estuaries in the Metronome, which we will pollute with (micro)plastics to study the transport of these plastics and their relationships to estuarine morphodynamics. You will conduct experiments in the Metronome with us to obtain better insights in such plastic and sediment transport. The specific project will be tuned to your skillset and preferences (e.g. practical lab work, quantitative pattern analysis on our large dataset, remote sensing, contributing to open science, but also movie making or vlogging which we can use for public and policymakers). For example, we have conducted experiments in the Metronome with fixed banks, dredging and sea level rise and we are currently studying channel network dynamics under such conditions, where we are testing whether experiments show repeatable patterns or show chaos (in the sense of high sensitivity to initial conditions), which no one has been able to do in the lab so far.

You will collect data with our scanning systems, photography and keep your trained eyeballs peeled for surprises. Following the experiments, you will also help in collecting and collating the experiment data. This will be done in Python, Matlab and/or GIS. Considering this, we're aiming for a job that is well-balanced between lab work and work from home. This subject is closely related to cutting-edge research themes of enthusiastic supervisors, a PhD project, MSc and BSc theses, and, as successfully done in the past, we aim for publication in a journal. Please contact me for further questions.

Job requirements

Knowledge of river and coastal morphology, programming (Matlab/Python) and/or GIS are required. You are willing to work in a well-organised manner in close communication with the supervisor and the technicians, and you are precise in data collection protocols and storage. Unless the university is in total lockdown due to COVID-19, the lab is open for experiments, keeping in mind lab safety regulations. A background in fluvial geomorphology and/or geology/sedimentology and/or civil/environmental engineering (dredging, constraining etc.), and gardening or do-it-yourself could be beneficial.