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Subject Area	Energie- und Umwelttechnik
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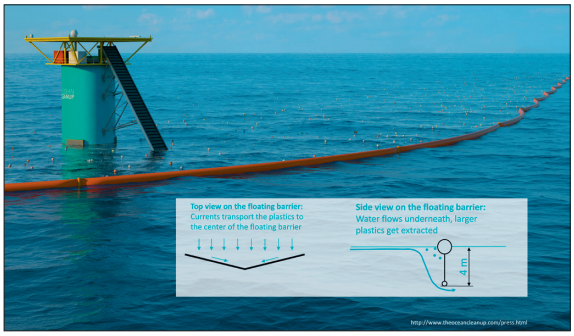
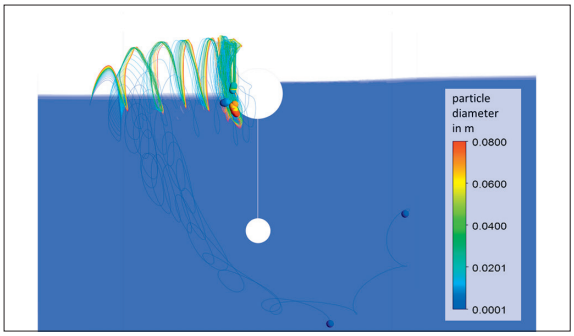
Capture efficiency analysis including wind and wave influence



The concept: a large floating barrier moored to the seafloor extracts the plastics from the water that moves through



Trajectories of particles with a density of 960 kg/m^3 injected at a water depth of 1 m

Typical plastic debris swimming in the oceans and its likelihood of being caught

Introduction: Some of the approximately 300 million tons of plastics that are produced every year enter the oceans. As plastics do not decompose, they remain in the ecosystem and damage sea life. Animals mistake the plastics for food or can become entangled in larger plastic debris. There is a concept called "theoceancleanup", which plans to moor a floating barrier in the garbage patch in order to remove these plastics from the oceans. Ocean currents transport them into this barrier, where they are concentrated and removed. In the past few years, a study was conducted that showed that the concept is feasible and less expensive than other cleanup concepts.

Objective: In the feasibility study, a simple one-phase steady-state simulation was conducted to investigate the particle size that can be caught with the floating barrier design chosen. The main task of this thesis is to investigate the influence of waves on the capture efficiency.

Result: As a first step, a steady simulation with a similar setup to the one in the feasibility study was conducted. These two steady simulations were compared. The comparison showed huge particle trajectory differences. Finally, it was found out that the simulation conducted in the feasibility study was based on faulty Reynolds number calculations. Therefore, the particle diameters that are critical to be caught were proved to be about 50 times smaller than those calculated in the feasibility study. In order to analyse the wave influence, a transient free-surface simulation was conducted. The waves were generated with a tool included in ANSYS Fluent; the particles were defined in the discrete phase model. Although convergence could not be proved in the wave-included simulation, it is assumed that the capture efficiency is significantly lower than that calculated in the steady stimulation.The simulated spherical particles were compared with real particle shapes with reference to their rising speed. It can be said that the probability of removing a large number of the particles dangerous for animals from the oceans with the chosen boom geometry is intact. However, thin debris, such as plastic bags, is very unlikely to be caught. It is recommended to investigate the influence of different environmental conditions (wave height, inlet velocity, particle density) and different boom designs in a converging simulation. Experiments might be more time-efficient to investigate certain requirements, such as a more accurate capture efficiency calculation.