

## Msc Thesis

**Title:** Verification and validation of CFD to model plastic cleanup systems

**Requirements:** Fluid Mechanics, Numerical Methods, Linux  
Knowledge on CFD, grid generation, Paraview, Python, HPC is a pre

**Duration:** 6-9 months

**Location:** WavEC-Offshore Renewables ([www.wavec.org](http://www.wavec.org)) (Lisbon, Portugal)

**Supervisors:** **Dr. Guilherme Vaz (WavEC)**  
**Dr. Bruno Saint-Rose (TheOceanCleanup)**  
**Ir. Maarten Kerkvliet (MARIN)**

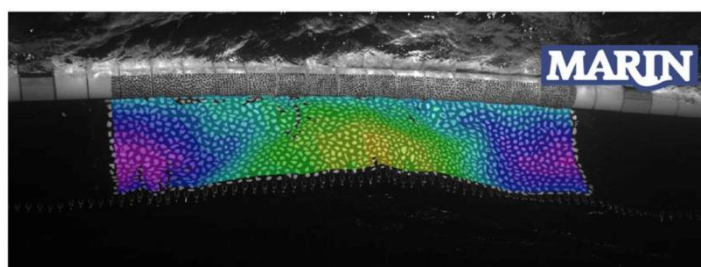
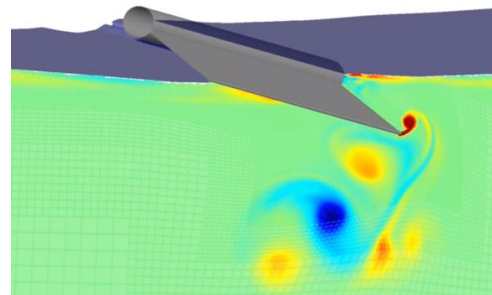
### Description

The Ocean Cleanup (<https://theoceancleanup.com/>) develops technologies to rid the world's oceans from plastic. To remove the plastic from oceanic environments, boom systems are employed to intercept and accumulate the plastics that are floating at the top of the water column. To better understand the mechanism and being able to model the dynamics and capture efficiency of such boom, reliable numerical models are required in order to be used as a design tool. In that context, the open-source CFD software ReFRESKO ([www.refresco.org](http://www.refresco.org)) is employed to model the interaction between the waves and current and the free-floating structure. In 2016 and 2018, two model test campaigns have been carried out which should be used to validate the numerical results. The main objective of the thesis is to validate the use of ReFRESKO in the context of the design of the cleanup systems. The focus of the work will be on two main test cases:

- 2D rigid body motion of a floater tested in June 2016 at 1:5 scale in MARIN's Concept Basin with current / waves / waves and current;
- 3D flexible motion of screen and floater from March 2018 tests at 1:20 scale in MARIN's Offshore basin with current / waves / waves and current.

For both cases, the interception and accumulation of the plastic parts will be handled by the Lagrangian Particle Tracking module, which has been developed jointly by WavEC, MARIN and TheOceanCleanup.

All this involves thorough verification and validation against available experiments. Studies on the influence of grids, time-steps, turbulence models, numerical schemes and other CFD-relevant issues will be also performed. For this work, the candidate will have access to Portuguese and European HPC super-computers. Upon good performance of the candidate the work may be presented in a conference and/or in a Journal, and possibly at the headquarters of TheOceanCleanup in the Netherlands.



### Bibliography

1. Joost Sterenborg , Mark Paalvast , Willem van Schoten , Lourens Boot , Arjen Tjallema , "Model Tests to Assess Wave and Current Loads on Ocean Cleanup's Conceptual Plastic Capturing Barrier", OMAE2017, <https://doi.org/10.1115/OMAE2017-61702>.