**XI International Conference on Computational Methods in Marine Engineering**

# OpenFOAM-based hybrid CPU/GPU coupled solver on Navier-Stokes equations and shallow water equations

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## ABSTRACT

The aim of this work is to create a fast, robust, accurate and reliable numerical wave tank (NWT) that can simulate the hydrodynamics that take place in the swash zone.

Mintgen and Manhart (2018) created a coupled solver for the Navier-Stokes (NS) equations and the Shallow Water (SW) equations in the OpenFOAM framework designed for river flooding and urban inundation. Its applicability to marine areas was not verified. In addition, the solver could only be run in CPUs.

In this study, a novel hybrid CPU/GPU coupled solver has been developed by merging interFoam, a standard NS solver in OpenFOAM, with a SW solver written using CUDA and running on GPUs. By coupling both numerical approaches, the computational costs are reduced, allowing to increase the zones of interest. Validation of the new solver has been done following O'Donoghue et al. (2010), reproducing the detailed measurements of hydrodynamics with swash generated by bore collapse on a steep beach (Fig. 1). Free surface evolution was analysed by comparing numerical results to measured water depth (Fig. 2).

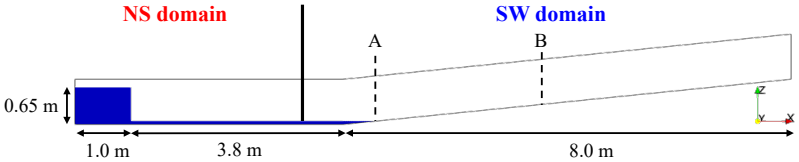


Figure 1: Experimental setup (O'Donoghue et al. (2010))

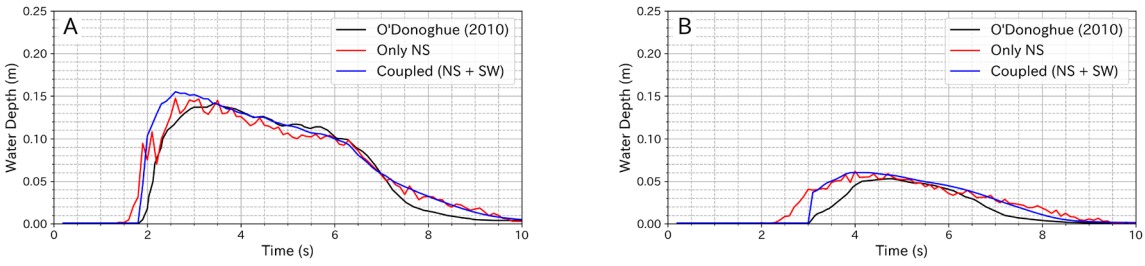


Figure 2: Comparison between the numerical results and the measured water depth

## References

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