Development of Parallel Solvers of 2D–3D One-way Coupling Models for Multi-scale Wave Simulation

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ABSTRACT

We have been developing a one-way coupling system for multi-scale wave simulation between 2D finite element computations based on the pressure-Poisson Boussinesq-type (PPBOUSS) wave model [1] and 3D computations using one of the particle methods with a polygon wall boundary model [2]. In the coupled model, 2D computations based on the PPBOUSS model in the global domain is conducted first, and the velocity profile in the vertical direction is reproduced using the 2D data. 3D computation is conducted in the local domain embedded within in the global domain with interface boundaries that move along the reproduced 3D velocity field in a Lagrangian fashion.

In this study, we develop and incorporate novel modules into existing parallel solvers of both the 2D and 3D computations, the DGSWEM [3] and the LexADV_EMPS [4], respectively, for practical multi-scale wave analysis. We demonstrate the applicability of developed analysis system using a qualitative comparison with wave flume experimental data for tsunami type waves.

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