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MODEL ADAPTIVITY – COMBINING HYDROSTATIC AND NON-HYDROSTATIC SHALLOW WATER MODELING

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In coastal hydrodynamic modeling a shallow water approximation of the governing equations is frequently used. While this approximation serves many purposes, such as modeling for wave propagation, simple flow simulations, or tsunami early warning, it does not allow for wave dispersion or non-hydrostatic effects in variable bathymetries.

One efficient way to include non-hydrostatic effects into the equations and by that allow for wave dispersion is a projection method that has been described for example in [3]. This method is equivalent to a Boussinesq-type model as shown in our previous work [1].

The price for the added accuracy and physical capability is the solution of a large linear system of equations, of the order of the number of unknowns. This system is derived from an elliptic partial differential equations derived from the projection. With global communication involved, this system solve is a bottleneck in the computation of the non-hydrostatic projection method.

In this work we present a possibility to adaptively apply the projection method. Originally proposed in [2], this idea is now explored in more detail. In particular, we apply the projection method only to a small number of grid nodes in the domain, by that saving substantially in the computational complexity of solving the linear system. We also investigate a number of criteria, obtainable from the hydrostatic (shallow water) solution to control the area of applying the non-hydrostatic projection.

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