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Towards Model-Adaptivity: Localized non-hydrostatic wave modeling

Joern Behrens
Universität Hamburg, Dept. Mathematik, Hamburg, Germany (joern.behrens@uni-hamburg.de)

Long wave modeling is often performed with linear or non-linear shallow water wave theory, implemented in corresponding hydrostatic computer models. However, for more realistic features, in particular wave dispersion, non-hydrostatic approaches implemented by Boussinesq-type equations or by hydrostatic correction methods to the shallow water equations are used. Here we use a Runge-Kutta discontinuous Galerkin (RKDG) implementation of a non-hydrostatic projection method [1].

The computation of the non-hydrostatic correction requires solving an elliptic problem, which leads to solving a global linear system of equations and is computationally expensive. Therefore, an adaptive local restriction of the non-hydrostatic region is proposed. It can be shown that the dispersive wave properties can be maintained with much less computational effort, compared to a global projection method. However, proper criteria for selecting the non-hydrostatic region need to be found. Additionally, boundary conditions at the interface between hydrostatic and non-hydrostatic regions needs to be treated adequately.

References

[1] A. Jeschke, S. Vater, and J. Behrens (2017): A Discontinuous Galerkin Method for Non-hydrostatic Shallow Water Flows. In: *Finite Volumes for Complex Applications VIII - Hyperbolic, Elliptic and Parabolic Problems*, Eds. C. Cancès and P. Omnes) . FVCA 2017. Springer Proceedings in Mathematics & Statistics, vol 200. Springer, Cham. DOI:10.1007/978-3-319-57394-6_27.