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A High Accuracy/Resolution Spectral Element/Fourier-Galerkin Method for the Simulation of Shoaling Non-Linear Internal Waves of Depression Over Realistic Bathymetry THEODORE DIAMANTOPOULOS, SUMEDH JOSHI, Cornell University, GREG THOMSEN, Wandering Wakhs Research, GUSTAVO RIVERA, PETER DIAMESSIS, KRISTOPHER ROWE, Cornell University — Internal solitary waves (ISWs) are ubiquitous oceanic phenomena found on continental slopes/shelves, in submarine canyons, and in the vicinity of distinct features in the oceanic bottom topography. The shoaling of ISWs of depression over the continental shelf can lead to a convective breaking of the wave along with the formation of a recirculating core, which has critical implications on the continental shelf/slope energetics. To successfully simulate the turbulence forming in the interior of a shoaling ISW, a high-order spectral-element-method-Fourier-Galerkin numerical approach for the spatial discretization is adopted. In tandem with an implicit/explicit time-splitting scheme of the incompressible Navier-Stokes equations (INSE), a pressure-Poisson-equation (PPE) accounts for the most computational challenging part of an INSE solver. Consequently, a crucial component for the simulation of shoaling ISWs, is the development of a robust PPE solver. Adopting a domain decomposition technique in combination with a deflated preconditioned conjugate gradient solver, the PPE solve can be leveraged to achieve a high convergence rate with a decrease on the introduced communication overhead compared to other type of solvers. Aspects of performance /scalability of the PPE solver and preliminary three-dimensional results of the INSE solver, as applied to shoaling ISWs, will be demonstrated.

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