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Abstract

The properties and accuracy of the linearized version of the fully dispersive and nonlinear wave model developed in Yates and Benoit (2015) and Raoult et al. (2016) are analyzed for both flat and variable bottom bathymetries. This model considers only a single layer of fluid and uses a basis of orthogonal Chebyshev polynomials to project the vertical structure of the potential. This approach results in an exponential convergence rate with the maximum degree of the Chebyshev polynomial, denoted N_T, while only first- and second-order derivatives in space need to be evaluated.

For the constant water depth case, the linear dispersion relation of the model is derived analytically, and expressions are established for N_T ranging from 2 to 15. The analysis shows a rapid increase in accuracy in the deep water range with increasing N_T. For instance, the relative error in the calculated wave celerity (in comparison with Stokes analytical solution) remains smaller than 2.5% for for deep water cases with kh up to 100 using $N_T \geq 9$ (k and h are the representative wavenumber and water depth, respec-

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