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An extended application for strongly nonlinear two-layer model[1]

SHENGQIAN CHEN, ROBERTO CAMASSA, University of North Carolina at Chapel Hill, Mathematics, WOOYOUNG CHOI, New Jersey Institute of Technology, Mathematics, ROXANA TIRON, University College Dublin, School of Mathematical Sciences — Strongly nonlinear internal wave models that have been developed in recent years have mostly been derived under long-wave, shallow-water assumptions. This talk will focus on assessing the applicability of these models in setups that go beyond their derivation hypotheses by comparisons with direct numerical simulations of near two-layer Euler-fluids' motion emanating from experimentally realizable initial conditions. By placing numerical filters that effectively truncate high Fourier modes, the ill-posedness associated with the model equations is resolved, allowing numerical time evolution studies to proceed. As wave profiles change dynamically, the numerical filters are designed adaptively. Compared with full Euler solutions, model evolutions show good agreement from small to moderate amplitude waves. Even for large amplitudes, when Kelvin-Helmholtz instability can occur, the primary waves are still captured in both amplitude and phase, demonstrating how an accurate filter implementation is capable of enhancing the models' predictive validity. Comparisons with two-layer Korteweg-de Vries (KdV) equation for the same initial conditions will also be presented, and advantages and shortcomings of the different models will be discussed.

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