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Short, pronounced waves generated by the December 2004 tsunami in the shallow Strait of Malacca

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We study how pronounced, short waves emerge and develop in the elevation part of a very long, essentially N-shaped tsunami wave, where the leading part is of depression and the remaining part is of elevation. The short waves develop on the transition between the depression and elevation waves and extend backward in the main wave, more precisely in the elevation part. The short waves are generated when the long tsunami wave moves into a shallow region of variable bottom. As concrete example is chosen the December 2004 tsunami propagating into the Strait of Malacca. Two different solution procedures are adopted: 1) a weakly nonlinear formulation based on an extended version of the Korteweg-de Vries equation (KdV), and 2) a fully nonlinear, fully dispersive method (FNLFD). For the latter, two discretizations are used; a coarse one with Delta x=40 m, and finer one with Delta x=20 m. We note that, in the computational scheme, an antialiasing strategy is implemented in the form of a zeros padding, where the spectra in Fourier space are doubled. This removes the effect of aliasing in products up to cubic order. There is no smoothing or regridding in the computations. Time series of the elevation is exhibited at six positions, namely at 50, 100, 200, 250, 300, 350 km. The short waves appear in a similar fashion in both models, but the wave field is larger with the FNLFD model than with KdV. There are also fundamental differences between the FNLFD and KdV. Global similarities between the models indicate that the local wave induced currents below the wave are basically the same in the two models.