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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Numerical modeling of rogue waves in coastal waters" *by* A. Sergeeva et al.

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In the paper "Numerical modeling of rogue waves in costal waters" by A. Sergeeva et al. the authors present numerical simulations, reconstructing the evolution of rogue wave time-series using the nonlinear Schrödinger model for variable bathymetry / finite depth. Furthermore, the lifetimes as well as the propagation distances of the considered extreme wave events are analyzed and the possibility of rogue wave occurrence in shallow waters are discussed with respect to the dimensionless depth variable kh. The results are of high and significant relevence in the field of nonlinear wave propagation, rogue waves, costal and offshore engineering as well as similar related areas of research.

It is well-known that rogue waves emerge in deep-waters, while the main mechanism, which describes their focusing in an unidirectional wave field is the Benjamin-Feir in-

stability. The simplest evolution equation describing this instability, taking into account dispersive and weak-nonlinear effects is the nonlinear Schrödinger equation. It was first derived by Zakharov (1986) for the case of deep-water and later extended to the case of finite depth using the method of multiple scales, see Hasimoto and Ono (1972). Recent numerical studies mentioned in the paper as well as several laboratory experiments confirmed the validity of the NLS to describe strong localizations, related to exact NLS solutions, which the amplitude of the carrier by remarkable factors of three and higher. Therefore, the choice of the NLS to describe the propagation of wavepackets over variable bathymetry is justified. I also agree with the authors that a single measurement of an extreme event at one specific position is useless and numerical simulations, which reconstruct the dynamics in space and time are crucial in order to understand the behavior of such waves in realistic environmental conditions and especially in costal zones.

I only have few comments, I would like to address and which should be discussed in the revised version. First, there is only one point of disagreement here. Waves in shallow-waters are defined for the condition $kh \sim < 2$. However, even for $0.8 < kh < 1.363$, waves are still considered to propagate in finite depth. It would be more informative to show the spectra of the rogue wave measurements, since the validity of the NLS-choice depends on the narrowness of the spectrum. This brings us to the Benjamin-Feir index, as mentioned in the manuscript a variable which depends on the bandwidth of the corresponding spectrum. There are several possibilities to define the spectral bandwidth (half the width of the half energy, using the Goda-peakdness-parameter etc.). The chosen method should be mentioned in the manuscript. The authors present the variable bathymetry, related to the exact locations. This is of important relevance for the modeling of course, but it is also crucial to know, if the considered waves were effectively propagating in the direction of the presented uneven bathymetries. This information is missing in the current version. Furthermore, there are more accurate weakly nonlinear evolution equations, describing the nonlinear wave motion in finite depth, see Slunyaev (2005). The numerical and analytical difficulties dealing with these

extended models should be explicitly discussed in the text. Finally, a short discussion on wave breaking, not taken into account in the NLS model, and the accuracy of the results should be added.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 5779, 2013.