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2D+1D Runup Estimations compared with field data of the three recent Chilean Events; the 2010 Maule, the 2014 Iquique and the 2015 Illapel tsunamis

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In tsunami sciences, it is a desirable goal to forecast the inundation areas quickly after an event. A promising approach is to combine numerical modelling by applying nonlinear shallow water wave equations with one-dimensional (1-D) analytical solution. Here we use synthetic waveforms as input for 1-D analytical runup estimation and compare the results with the measured runup values of the 2010 Mw 8.8 Maule, the 2014 Mw 8.2 Iquique and the 2015 Mw 8.3 Illapel tsunamis. The three earthquakes occurred along the Peru-Chile Trench with the most damaging Maule event on February 27th, 2010 on the southern part between the Nazca and South American plate. After that event, maximum runup values reach 29 m at the city of Constitutiòn. We compute the waveforms of the events using their co-seismic deformations as the initial conditions in the nonlinear shallow water numerical model. We trace profiles orthogonal to the source at the points of runup measurements and extract the synthetic waveform and the slope of the bathymetry. We then use the synthetic waveforms and bathymetric profiles as input for the 1-D long wave runup theory. The comparison reveals that the 2D+1D runup estimations deliver reasonable results compared to measured runup. But in some cases over- and underestimation occurs. Especially underestimation is a critical issue for early warning purposes, and additional fine tuning of the methodology is needed.
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