Geophysical Research Abstracts
Vol. 14, EGU2012-12822, 2012
EGU General Assembly 2012

How long are submarine landslides coupled to the water column?

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Waves generated from submarine mass failure, come in second only to earthquakes as the most frequent causes of tsunami waves. The gap however between the understanding of earthquake generated waves and the generation of tsunami waves from submarine mass failure (hereafter called submarine landslides) is quite large. A critical component of shortening this gap is to understand the efficiency that submarine landslides have in generating tsunamis. Unlike earthquake-induced tsunamis, where the deformation at the free surface can be derived directly from the deformation of the seafloor, submarine landslides exhibit a complex and nonlinear energy transfer from the moving slide to the water column. Therefore the application of several empirical formulae and equations derived from theory do not lead consistent results. For example inverting the amplitude of the leading wave with such equations can result in a scatter of the wave height up to six orders of magnitude. To derive more robust and reliable estimates of leading-wave characteristics, the coupling between the slide body and the water surface need to be investigated further to shed light on the energy transfer.

We present results from parameters studies, carried out with the hydrocode iSALE. iSALE has proven to be a reliable simulation tool for generation of large waves from subaerial and submarine landslides. In order to shed more light on energy transfer from the slide body to the water column, we focus, in here, on the duration of the energy transfer. In our modeling the slide motion generates a trough with depth, s, which increases after the slide is in motion, $ds/dt > 0$. Decoupling, tau, is then defined when $ds/dt \leq 0$, and the decoupling time, τ_d, as being reached when $ds/dt = 0$. A parameter study relating the decoupling to mass, depth of submergence, and viscosity is conducted as an initial step in elucidating the generation processes of submarine landslide-generated tsunamis.