Geophysical Research Abstracts
Vol. 15, EGU2013-3631, 2013
EGU General Assembly 2013

Towards a robust framework for Probabilistic Tsunami Hazard Assessment (PTHA) for local and regional tsunami in New Zealand

Christof Mueller (1), William Power (1), Stuart Fraser (1,2), and Xiaoming Wang (1)

(1) GNS Science, Lower Hutt, New Zealand, (2) Massey University, Joint Centre for Disaster Research, Wellington New Zealand

Probabilistic Tsunami Hazard Assessment (PTHA) is conceptually closely related to Probabilistic Seismic Hazard Assessment (PSHA). The main difference is that PTHA needs to simulate propagation of tsunami waves through the ocean and cannot rely on attenuation relationships, which makes PTHA computationally more expensive.

The wave propagation process can be assumed to be linear as long as water depth is much larger than the wave amplitude of the tsunami. Beyond this limit a non-linear scheme has to be employed with significantly higher algorithmic run times. PTHA considering far-field tsunami sources typically uses unit source simulations, and relies on the linearity of the process by later scaling and combining the wave fields of individual simulations to represent the intended earthquake magnitude and rupture area. Probabilistic assessments are typically made for locations offshore but close to the coast. Inundation is calculated only for significantly contributing events (de-aggregation).

For local and regional tsunami it has been demonstrated that earthquake rupture complexity has a significant effect on the tsunami amplitude distribution offshore and also on inundation. In this case PTHA has to take variable slip distributions and non-linearity into account. A unit source approach cannot easily be applied. Rupture complexity is seen as an aleatory uncertainty and can be incorporated directly into the rate calculation.

We have developed a framework that manages the large number of simulations required for local PTHA. As an initial case study the effect of rupture complexity on tsunami inundation and the statistics of the distribution of wave heights have been investigated for plate-interface earthquakes in the Hawke's Bay region in New Zealand. Assessing the probability that water levels will be in excess of a certain threshold requires the calculation of empirical cumulative distribution functions (ECDF). We compare our results with traditional estimates for tsunami inundation simulations that do not consider rupture complexity. De-aggregation based on moment magnitude alone might not be appropriate, because the hazard posed by any individual event can be underestimated locally if rupture complexity is ignored.