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Uncertainty in local and regional tsunami earthquake source parameters: Implications for scenario based hazard assessment and forecasting

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Over the last decade tsunami propagation models have been used extensively for both tsunami forecasting, hazard and risk assessment. However, the effect of uncertainty in the earthquake source parameters, such as location and distribution of slip in the earthquake source on the results of the tsunami model has not always been examined in great detail.

We have developed a preliminary combined and continuous Hikurangi-Kermadec subduction zone interface model. The model is defined by a spline surface and is based on a previously published spline model for Hikurangi interface and a more traditional unit source model for the Kermadec interface. The model allows to freely position and vary the earthquake epicenter and to consider non-uniform slip. Using this model we have investigated the effects of variability in non-uniform slip and epicenter location on the distribution of offshore maximum wave heights for local New Zealand targets.

Which scenario out of an ensemble is responsible for the maximum wave height locally is a spatially highly variable function of earthquake location and/or the distribution of slip. We use the Coefficient of Variation (CoV) to quantify the variability of offshore wave heights as a function of source location and distribution of slip. CoV increases significantly with closer proximity to the shore, in bays and in shallow water.

The study has implication for tsunami hazard assessment and forecasting. As an example, our results challenge the concept of hazard assessment using a single worst case scenario in particular for local tsunami.