Effect of spatial correlations of slip on tsunami intensity inundation parameters

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Abstract

Mega-earthquakes and their respective tsunamis are infrequent and extremely destructive events. Due to the lack of recorded data of tsunami processes, the variability of tsunami intensity parameters is unknown, which motivates us to simulate the physical process of earthquake faulting and tsunami wave propagation. Mai and Beroza (2002) have shown that the magnitude of mega-earthquakes is directly proportional to the average size of slip asperities on the fault. This has been quantified via the calculation of spatial correlations in the wavenumber domain. The spatial heterogeneity of slip in mega-earthquakes, along with bathymetry, controls the intensity of the tsunami processes. Because of this, it is important to quantify the effects of spatial slip correlations have on tsunami intensity parameters, such as runup and wave-height, as well as the between-events variability of said parameters. Preliminary results show that average runup and wave-height do not change with changing spatial correlations. On the contrary, the variability increases considerably with increasing spatial correlations. These findings have great impact on probabilistic tsunami hazard analysis.

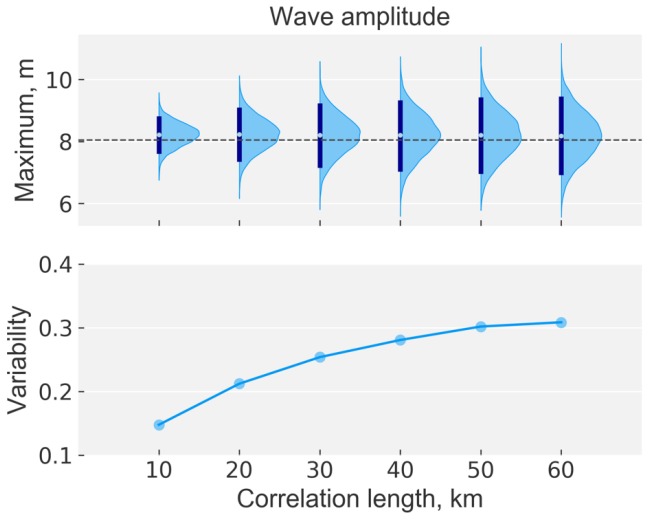

Figure: (top) Probability distribution functions of maximum wave-amplitude (shaded area), the dot corresponds to the mean of the maximum wave amplitude, and the dark blue bar shows the 90th confidence interval. (bottom) The variability corresponds to the 90th confidence interval of the mean.

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Perspectives for Collaboration

We aim to understand the effects of realistic bathymetries and earthquake source complexity have on between-events and within-event variability tsunami intensity parameters, with particular interest of application to probabilistic tsunami hazard assessment (PTHA).

References

1) Mai, M. and G. Beroza, A spatial random field model to characterize complexity in earthquake slip, JGR, 2002.