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The influence of complex fault geometry and slip of large subduction earthquakes on tsunami generation

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The scope of this study is to investigate the influence that some details of the seismic source process, namely slip distribution and geometry complexity, have on tsunami generation. In particular, we examine to what extent a tsunami generated by a Mw 9 earthquake is sensitive to rupture complexity or if a simple fault model, i.e. a constant slip on a planar fault, is sufficient for hazard studies.

To study this problem, we first need to solve how to distribute a composite source model on a curved fault plane. To do this we compute a geodesic distance matrix, which is an improvement on a classical Dijkstra's algorithm on a complex 2D surface in a 3D space. This distance matrix is then used in a composite source model in order to generate hetereogeneous slip distributions with k-2 spectra.

The subduction zones that generated the 2011 Mw9 Tohoku and 2013 Mw 8 Santa Cruz Islands earthquakes are taken as case studies. Simple rectanglar faults and complex 2D fault surfaces based on Slab 1.0 with both uniform slip and k-2 slip are used as source generation for tsunamis. Preliminary results will focus on comparing the tsunami wave height observed along nearby coastlines generated by the different source models.