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Application of stochastic fractal surface rupture on non-planar faults in tsunami simulation

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Non-planar faults and surface reached rupture are seldom considered in the source modelling of subduction zone earthquakes. Here we present a new method for accounting for both phenomena in the generation of stochastic slip distribution while still maintaining self similar properties. To do this, we use the composite source model, which involves the placement of numerous circular dislocations on the fault plane. The fault plane is described by an unstructured mesh allowing for a non-planar surface while surface rupture is correctly accounted for by reflecting the slip from circular dislocations that intersect with the fault trace.

In a case study we demonstrate that the inclusion of rupture at the surface alters the ground or seafloor deformation both in terms of the magnitude (between 60%-20% in 5km zone near the fault trace) and the orientation of the deformation vectors (i.e. by up to 5 degrees). Such changes can have a significant effect on tsunami source and subsequent wave.

Additionally, with a prescribed rupture velocity model, complex source time functions can also be calculated for each element on the fault plane. Generally, rise time is assumed to be instantaneous in tsunami simulation.

We will also present preliminary results focused on comparing the tsunami wave height observed along nearby coastlines generated by the different source models (i.e. with/without surface reached rupture and variable source time functions).