How subduction interface roughness influences megathrust earthquakes: insights from analogue models

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The roughness of the subduction interface is thought to influence seismogenic behavior in subduction zones, but a detailed understanding of how such roughness affects the state of stress along the subduction megathrust is still debated. Here, we use seismotectonic analogue models to investigate the effect of subduction interface roughness on seismicity in subduction zones. We compared analogue earthquake source parameters and slip distributions for two roughness endmembers. Models characterized by a very rough interface have lower interface frictional strength and lower interseismic coupling than models with a smooth interface. Overall, ruptures in the rough models have smaller rupture area, duration and mean displacement. Individual slip distributions indicate a segmentation of the subduction interface by the rough geometry. We propose that flexure of the overriding plate is one of the mechanisms that contribute to a heterogeneous strength distribution, responsible for the observed seismic behavior.