

## Understanding trench-breaching slip in megathrust earthquakes

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Seafloor GPS measurements and repeated bathymetry and seismic surveys indicate that the fault rupture in the 2011 Tohoku-oki earthquake propagated to the axis of the Japan Trench. Earthquake and tsunami observations are consistent with this scenario. On other occasions, anomalous slip of the shallow part of subduction faults produces so-called tsunami earthquakes. For example, the 1896 Sanriku earthquake which occurred to the north of the 2011 Tohoku-oki earthquake is known to be a tsunami earthquake. In addition, recent ocean drilling in the Nankai Trough yielded evidence for frictional heating on the shallow part of a frontal thrust, suggesting rapid and probably seismic slip. The various observations showing slip to the trench point to the need to better understand the seismogenic behavior of the shallowest part of the subduction megathrust which is usually considered to exhibit a stable-sliding behavior. However, earthquake and tsunami observations and land-based geodetic measurements usually cannot resolve the amount of coseismic slip near or at the trench axis. In order to constrain the near-trench slip and its along-strike variations, new geological and geophysical data from the trench area, laboratory experiments based on these data, and related theoretical studies are being carried out. In this presentation, as an introductory to the session, we review recent results of geophysical, geological, and theoretical studies concerning slip to the trench during the 2011 Tohoku earthquake and propose a research strategy toward understanding the slip behavior of the shallow megathrust in general.

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