A Model for the 2020 M7.6 Sand Point, Alaska, Earthquake

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In 2020 and 2021 two M7.8 and M8.2 earthquakes ruptured parts of the Alaska-Aleutian Megathrust, resulting in substantial stress increases on shallow parts of the plate interface. This sequence contains the 2020-10-19 M7.6 Sand Point earthquake. It is thought to be a strike-slip earthquake on a ~50 deg westward dipping fault plane within the downgoing slab, striking roughly north-south. While geodetic and seismic data can constrain a slip model that confirms this, a puzzling observation for this earthquake is rather large tsunami recorded by nearby DART buoys. Neither timing nor amplitude of the tsunami are well predicted by the best fitting strike-slip finite fault model. We evaluate the hypothesis that some megathrust slip occurred during the Sand Point event. We present co-seismic finite fault models based on aftershock relocations, and inversions of teleseismic and high-rate GNSS waveforms, co-seismic GNSS offsets and InSAR line-of-sight displacement fields for purely strike-slip and a combination of strike slip and megathrust slip scenarios. We investigate tsunami model predictions for the nearby 2020 Simeonof event to assess the time constraints of the tsunami model and assess whether megathrust slip can meaningfully be constrained from the observations.