

Detection of supershear rupture in 2013 Craig, Alaska, earthquake

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Seismic ruptures are akin to unzipping a zipper—a gap in the crust starts in one location and travels along the fault in a particular direction. When a strained fault ruptures in an earthquake, seismic waves also spread out from the epicenter. In some cases, the waves' passage can trigger the initiation of a new rupture ahead of the initial expanding rupture in locked portions of the fault. If the triggered rupture grows successfully, the overall rupture front can then outpace the passage of the shear waves, secondary seismic waves that travel slowly after the earthquake begins and are responsible for the bulk of violent shaking. These earthquakes display what is known as supershear rupture, and only seven such earthquakes have previously been recorded.

Based on new observations, Yue et al. describe the occurrence of supershear rupture in a magnitude 7.5 [earthquake](#) that hit near Craig, Alaska, in January 2013. The observations mark the first time supershear rupture has ever been detected on an offshore boundary between two plates.

By inverting and modeling observed seismic waves, the authors describe the earthquake's rupture mechanism. They find that from the earthquake's epicenter the supershear rupture front moves northward at 5.5 to 6 kilometers per second (3.4 to 3.7 miles per second) down a length of the fault system roughly 100 kilometers (62 miles) long. This supershear rupture moves faster than the motion of secondary seismic waves and nearly as quickly as the primary waves, pressure waves that travel quickly from an epicenter when an earthquake starts. The

earthquake also shows additional rupture to the south, but that was caused by regular subshear rupture.

Aside from having an unusual mechanism, supershear rupture affects the potential damage caused by an earthquake. Supershear rupture increases the amount of ground shaking in the propagation direction. According to the authors, the clearest detectable sign of a supershear earthquake is the detection of secondary seismic waves that are produced by the rupture front that arrive before the secondary waves that are produced at the initiation point of the earthquake.

More information: Supershear Rupture of the 5 January 2013 Craig, Alaska (Mw7.5) Earthquake *Journal of Geophysical Research-Solid Earth*, DOI: [10.1002/2013JB010594](https://doi.org/10.1002/2013JB010594) , 2013
[onlinelibrary.wiley.com/doi/10 ... 013JB010594/abstract](https://onlinelibrary.wiley.com/doi/10.1002/2013JB010594/abstract)

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