Geophysical Research Abstracts
Vol. 16, EGU2014-12729, 2014
EGU General Assembly 2014

Source time function properties indicate a strain drop independent of earthquake depth and magnitude

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Movement of the tectonic plates leads to strain build-up in the Earth, which can be released during earthquakes when one side of a seismic fault suddenly slips with respect to the other one. The amount of seismic strain release (or "strain drop") is thus a direct measurement of a basic earthquake property, i.e. the ratio of seismic slip over the dimension of the ruptured fault. SCARDEC, a recently developed method, gives access to this information through the systematic determination of earthquakes source time functions (STFs). STFs describe the integrated spatio-temporal history of the earthquake process, and their maximum value can be related to the amount of stress or strain released during the earthquake. Here I analyse all earthquakes with magnitudes greater than 6 occurring in the last 20 years, and thus provide a catalogue of 1700 STFs which sample all the possible seismic depths. Analysis of this new database reveals that the strain drop remains on average the same for all earthquakes, independent of magnitude and depth. In other words, it is shown that, independent of the earthquake depth, magnitude 6 and larger earthquakes keep on average a similar ratio between seismic slip and dimension of the main slip patch. This invariance implies that deep earthquakes are even more similar than previously thought to their shallow counterparts, a puzzling finding as shallow and deep earthquakes should originate from different physical mechanisms. Concretely, the ratio between slip and patch dimension is on the order of 10^{-5}-10^{-4}, with extreme values only 8 times lower or larger at the 95% confidence interval. Besides the implications for mechanisms of deep earthquake generation, this limited variability has practical implications for realistic earthquake scenarios.