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The diversity of intermediate-depth and deep earthquakes revealed by global analysis of rupture duration and radiated seismic energy

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We study the rupture duration and radiated seismic energy of more than 1000 deep and intermediate-depth earthquakes (depth>50km and M>5.5). The average source time function is obtained by stacking broadband P-wave pulses recorded globally and is used to measure the rupture durations, by comparing alternative versions of the same waveform. The radiated energy is obtained by integration the velocity spectrum observed at each station after correction for radiation pattern and propagation effects.
The rupture durations show, beyond the scatter of the data, the depth reduction of scaled source duration can be explained by incremental shear velocity with depth. Furthermore, the duration to moment scaling shows that self-similarity not valid for deep seismicity, suggesting a difference in the behavior of small and large earthquakes. The existence of a different scaling law is further corroborated by the analysis of scaled energy, which is not constant as function of moment.
The radiated energy and rupture durations are combined to derive stress drop, apparent stress, radiation efficiency and other source parameters. These results indicate a systematic difference between shallow earthquakes and deep and intermediate-depth earthquakes.
Along strike variation of the derived source parameters are seen in various subduction zones, suggesting a significant diversity of deep and intermediate depth earthquake behavior. Comparison of our measures with independent geophysical properties of slabs as plate age, thermal parameter and convergence rate is done, in order to unravel any possible relation between the subduction zone style and its associated seismicity.