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Slow earthquake associated with frictional healing of serpentinites

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Slow earthquakes occurred at subduction zone are distinct from regular earthquake in terms of their slip behaviors (e.g., Ide et al. 2007). We consider this difference to relate to localized hydration reactions at the plate interface that influence the frictional properties. The results of laboratory friction experiments indicate that simulated serpentine faults are characterized by a low healing rate and large slip-weakening distance compared with unaltered dry fault patches. These properties are consistent with the characteristics of subduction-related slow earthquakes, which exhibit a small stress drop and a relatively long duration. The results of numerical modeling suggest that slow slip events favor a large slip-weakening distance (e.g., Shibazaki and Iio 2003). These results may explain the slip mechanism of slow earthquake, suggesting that a locally serpentinized plate interface could trigger slow earthquakes assisted by pore pressure build-up, whereas unaltered dry patches that remain strongly coupled are potential sites of regular earthquakes.

Keywords: serpentinite, frictional experiment, frictional healing, slow earthquake