Inversion of the physical parameters that control the onset of postseismic slip

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Abstract

Whereas the spatial and temporal evolution of postseismic slip over short time scales (i.e., a few hours) has been shown to be complex, we do not know well the mechanisms that control its behaviour. Most studies on the frictional properties of postseismic slip rely on the use of daily data over a long time scale spanning from days to years. Yet, we still do not know if these inferred properties hold for the first few hours that follow a large earthquake. This is largely due to the fact that early postseismic observations are very rare. But, recent progress

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on high-rate GNSS data processing now allows us to resolve accurately surface deformation over a wide range of frequencies, amplitudes and spatial scales. Based on high-rate position time series (30-secs) at 15 stations from 3 minutes to 3 days after the 2015 M8.3 Illapel, Chile, earthquake, we attempt to infer the frictional properties in the early stage of this postseismic deformation. We invert at the same time for the location and the amplitude of the early postseismic slip patches, along with the frictional parameters controlling the temporal behaviour. The slip patches are modelled using the elliptical slip patch method (Vallée et Bouchon,2004 ; Twardzik et al., 2012) allowing us to reduce the number of unknown parameters. The time evolution is modelled using the rate-and-state friction law. The recovered frictional parameters are consistent with a velocity-strengthening behaviour as is commonly inferred at later time periods of the post-seismic cycle. These preliminary results are encouraging, and further refinement will be done to ensure the validity of the method at explaining the early postseismic slip of the Illapel earthquake.