Reconstructing 10 years of spatio-temporal aseismic slip history along the San Andreas Fault near Parkfield

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The Parkfield segment of the San Andreas Fault (SAF) sits at the transition between the locked Cholame segment to the South and the SAF creeping segment to the North. This segment hosts regular M_w6 earthquakes followed by postseismic slip with the last one in 2004. Recent studies based on geodetic data have highlighted spatial and temporal variations of aseismic slip rate in addition to postseismic slip. We combine Global Navigation Satellite Systems (GNSS), creepmeter and seismicity data over the 2006-2018 period to detail a comprehensive picture of episodic acceleration and deceleration slip patterns. We produce a catalog of relocated seismicity and repeating earthquakes. We use a variational Bayesian Independent Component Analysis (vbICA) decomposition on GNSS data to separate geodetic deformation due to non-tectonic sources from signals of tectonic origin. We then reconstruct the temporal evolution of fault slip to detect 11 slip transients, revealing the temporal complexity of the slip activity that followed the 2004 M_w6 earthquake. We invert for a 3D fault slip distribution of each transient. Among the 11 transients, 8 are dominantly aseismic while 2 are related to $M_w4.1$ and $M_w4.8$ earthquakes. These slow slip events surround 2 regions that remain locked during the postseismic period. The partial overlap between detected slow slip and coseismic slip of the 2004 M_w6 earthquake potentially highlights fault segments able to host both seismic and aseismic slip.

Mots-Clés : Global Navigation Satellite Systems, Parkfield segment of the San Andreas Fault, Post-seismic deformation, slow slip events, variational bayesian independent component analysis, repeating earthquakes

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