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A high-resolution, time-variable afterslip model for the 2010 Maule Mw=8.8, Chile megathrust earthquake

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The excellent spatial coverage of continuous GPS stations in the region affected by the Maule Mw=8.8 2010 earthquake, combined with the proximity of the coast to the seismogenic zone, allows us to model megathrust afterslip on the plate interface with unprecedented detail. We invert post-seismic observations from continuous GPS sites to derive a time-variable model of the first 420 days of afterslip. The afterslip pattern appears to be transient and non-stationary, with the cumulative afterslip pattern being formed from afterslip pulses. Frequency analysis of the slip rate for each patch of the interface model shows that the region of the interface with the highest aftershock density also has the most variable slip rate suggesting that afterslip pulses and aftershocks are closely related in time and space. Changes in static stress on the plate interface from the co- and postseismic slip cannot explain the aftershock patterns, suggesting that another process – perhaps fluid related - is controlling aftershocks. We use aftershock data to quantify the seismic coupling distribution during the postseismic phase. Comparison of the postseismic behaviour to interseismic locking reveals that highly locked regions do not necessarily behave as rate-weakening in the postseismic period.