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Investigating the postseismic deformation of the 2010 Maule Chile megathrust; insights from kinematic inversions

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In the years following great earthquakes, surface deformation around the rupture area occurs at high and variable rates. Rapidly decaying (lasting for days or years) postseismic deformation in the near-field of the rupture may result from fault afterslip caused by the frictional response of the subduction interface to the coseismic stress perturbation. The spatio-temporal evolution of the rapidly decaying deformation has, so far, been difficult to determine based on available observations and present knowledge of the afterslip and related mechanisms.
The 2010 Maule earthquake (Mw8.8) that affected about 500 km of the Nazca-South America plate boundary in south-central Chile was the first great and presumably gap-filling event to be captured by modern space-geodetical monitoring networks. The density of GPS coverage (both campaign and continuous daily solutions) alongside the rupture zone of the Maule event provides an excellent opportunity to probe the postseismic deformation along a daily timescale. Inverting the GPS data from 54 stations to model daily slip on the plate interface reveals how the afterslip distribution jumps around the interface in a somewhat chaotic fashion. Inversion results are validated by aftershock locations, which tend to line up in between patches of high slip on the interface. For certain patches in the slip model we see considerable variability in the slip direction and pulses of acceleration on the afterslip; the cumulative afterslip of the first 430 days released in one seismic event would have a Mw of 8.4.
So far, we have solely inverted for afterslip along the plate interface in modelling the postseismic process. Our ongoing research involves investigating the contribution of other processes such as crustal fault slip, viscoelasticity and poroelasticity to the surface deformation field.