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Fluid distribution in the subducting plate influences interplate slip

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We integrate geodetic and seismological data to explore the mechanisms controlling plate-locking degree, coseismic slip and afterslip distributions at the southern end of the 2010 Maule earthquake (Mw 8.8) rupture zone. We derive from a high-resolution seismic tomography the major lateral variations of the Vp/Vs ratio around the plate interface before the Maule earthquake. This ratio is correlated to changes of the Poisson's ratio which is a proxy for fluids. We demonstrate that the locking degree during the interseismic phase is closely related to the Poisson's ratio variations and thus to lateral variations of fluid content. Locking degree and Poisson's ratio are correlated, as shown by high locked patches in areas of lower Poisson's ratio suggesting that high accumulation of seismic energy relates to areas with low fluid content. In turn, areas with low locking degree and high afterslip rates correlate with enhanced Poisson's ratio, showing the influence of fluids. The inhomogeneous fluid content along strike is due to the Mocha fracture zone that is subducted in the southern part of the Maule rupture plane. Here dehydration due to methamorphic reactions provide substantial fluid volumes that migrate along the fractures into the subduction interface whereas further north of the fracture zone much less fluid is available causing a high locking degree and high co-seismic slip. Our findings suggest that the variation of fluid content and thus changes of effective stress at the plate interface have a direct control in the interplate dynamics.