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Broadband characterization of the 2010 Mw 8.8 Maule earthquake combining coherent rupture imaging and kinematic modeling

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Due to the increment in local and regional seismological and geodesy networks, new technics for imaging extended sources have been developed and open up new ways to understand the source dynamic. One of those technics uses the coherent interferometry of the wave radiation emitted during the ruptured propagation at dense arrays; producing imaging of the source emissivity in space and time.

One of the advantages of this approach is that it does not need a-priori information of the source parameters like the rupture velocity and the fault geometry, and even more, it can constrain them for kinematic inversion. Additionally, coherent interferometry provides more information about the complexity of the source process, since it works at frequencies that are generally one or two orders of magnitudes higher than those used for kinematic slip inversion.

The integration of coherent imaging and finite source slip modeling, and their joint interpretation, bring up new perspectives in the study of the rupture processes, in relation to the geometry and the strength of the fault asperities.

We performed a combined coherent rupture imaging and kinematic modeling for the study of the rupture process of the 2010, Mw 8.8 Maule earthquake (Chile). The coherent imaging was carried out with the US and POLENET arrays data for different frequency ranges (0.04-0.1 Hz for US array, and 0.1-0.30 Hz, 0.30-1.0 Hz, 1.0-3.0 Hz for both arrays), for the kinematic inversion we used teleseismic body waves between 30° and 100° with a frequency range of 0.003-0.2 Hz, and the source parameterization led by the previous step. Moreover, we compared the predicted displacement produced by our slip distribution with the local GPS data, and finally, we analyzed the recent 2012 Mw 7.1 Maule earthquake and its role on the 2010 source process.

We interpret the results in terms of their implications on the geometry and mechanical properties of the subduction interface and the dynamical properties of the rupture.