Modelling the source of the the Maule Mw 8.8 earthquake and early afterslip using GPS and InSAR data

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The Mw8.8 Maule earthquake occurred in the Concepcion - Constitucion seismic gap that last ruptured in 1835. The deformation associated with this earthquake has been monitored by a continuous GPS network as well as with campaign style GPS measurements, performed in the frame of the Franco Chilean international laboratory "Montessus de Ballore" (see companion abstract by Vigny et al.). In addition, Alos, Envisat and ERS-2 data were used to construct SAR interferograms Amplitude image correlation offsets were also calculated.

This complete data set provides a detailed mapping of the deformation generated by the Maule earthquake. Metric deformation extends from the south of the Arauco peninsula (~S38°) to Navidad (~S34°), up to ~100 km inland. It designs two main asperities of deformation extending from Arauco peninsula to Concepcion (S38° to S36.6°) and from Constitucion to Pichilemu (S35.5° to S34.3°). The Arauco peninsula is uplifted, as well as the coast line up to Constitucion. North of Constitucion the coast subsides, as well as inland areas. Centimetric deformation is also visible more than 500km away from the rupture area, within the South American continent.

This deformation field was inverted to obtain the distribution of co-seismic slip on the subduction interface, using an elastic half space approximation. First results indicate that the earthquake activated the subduction plane from the south of the Arauco peninsula up to Navidad. This corresponds to the area ruptured by the 1835 earthquake and to the area locked during the interseismic period. the average slip is ~10 meters. Two main slip asperities can explain the observations, collocated with the zones of maximum of deformation, with a local maximum of slip of 20m, which is way larger than deduced form the first source distributions deduced from teleseismic seismic data.

Early postseimic deformation deduced from continuous GPS is also inverted to constrain the location of afterslip on the subduction plane. Its relation with the co-seismic asperities is analyzed.