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Slip Vectors and Strain Partitioning Along the Maule 2010 Rupture Zone

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Strain partitioning is observed along various subduction zones where plate convergence is oblique to the trench because slip vectors from thrust earthquakes in the seismogenic zone are rather perpendicular to the trench than parallel to the convergence direction. If no slip partitioning occurs, the slip vectors coincide with the plate convergence direction, whereas for full partitioning the azimuths of the vectors fall along the trench normal direction. Strain partitioning can have an influence on the deformation that remains after a complete cycle and on the seismotectonic segmentation of a margin. On 27 February 2010 the Mw 8.8 Maule earthquake ruptured a seismic gap where significant strain had accumulated since 1835. Before, during and after the earthquake the forearc was densely monitored by seismological and geodetic networks allowing to investigate strain partitioning, its causes and its consequences on the stress regime during the inter-, co- and postseismic phases of a great subduction earthquake.

Here, we examine azimuths from displacements from continuous GPS stations and focal mechanisms along the Maule rupture area as a proxy of stress field indicators. Since the focal mechanisms are related to the principal stress axes and the GPS stations measure the displacement on the surface, they provide independent constraint to quantify the variation in time of the strain partitioning. The azimuthal information from seismicity and GPS is used to characterize the phases of the seismic cycle along the Maule 2010 rupture zone by looking at data from the inter-, co- and postseismic phase. Results show that the mean azimuth direction of the postseismic and coseismic displacement differs approximately 10° with the postseismic displacement directions have a smaller trench parallel component. Larger aftershocks occur mostly offshore or close to the shoreline and show the tendency to point more to the plate convergence direction with increasing distance from the trench. During the postseismic phase, vectors rotate clockwise approaching the plate convergence direction, which may be an indicator of the relocking of the plate interface. Comparing the azimuths of GPS vectors for the interseismic and coseismic phase the data suggests a change in the partitioning behaviour of the incoming plate convergence vector for both, seismic phases and increasing distance to the trench. Similar observations in other subduction zones were previously interpreted as change in the partitioning behaviour. However, rotational effects, internal deformation of the forearc, heterogeneous coupling of the plate interface need to be considered. Furthermore, we compare the results from the Maule 2010 rupture area with the 2005 Nias and the 2011 Tohoku-Oki earthquakes.