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Rupture Directivity in the Northern Chilean Subduction Zone

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A systematic analysis of rupture directivity for subduction zone earthquakes in Northern Chile within a time period from 2008 to 2016 is performed. The analysis is based on the seismic broadband recordings of the Integrated Plate Boundary Observatory Chile (IPOC). With its high sampling rate (100 Hz) and a well distributed station selection that covers an aperture of about 180 ° the IPOC is well suited or a thorough directivity analysis.
The directivity is assessed by an empirical Green's function approach. While the elegance of using this approach lies in the low number of assumptions which are necessary for its application, an inevitable condition is the availability of EGFs for an event of interest. Using a cross correlation detector to identify highly similar waveforms between events we find EGFs for over 700 events. Out of these we find clear unilateral direction signatures for 293 events.

The ensemble of directivity solutions displays a strong preference of rupture orientations sub-parallel to the convergence vector of the Nazca plate relative to the South-American plate. The preferred rupture direction is down-dip. We the reason for the dominating rupture direction could be associated with the influence of the material contrast at the subduction interface which, according to the bimaterial effect, should favor the down-dip rupture direction. We speculate that the repeating event like character of the analyzed events could enhance this effect.