Trench-parallel compressive upper plate stress field in the northern Chile forearc from earthquake source mechanisms

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Subduction zone forearcs deform transiently and permanently due to the frictional coupling with the converging lower plate. Transient stresses are mostly the elastic response to the spatio-temporally variable plate coupling through the seismic cycle. Long-term deformation depends e.g., on the plate convergence geometry, where obliqueness or change in obliqueness play important roles. Here we use the Integrated Plate Boundary Observatory Chile (IPOC) and additional temporal networks to determine source mechanisms for upper plate earthquakes in the northern Chile subduction zone. We find that earthquakes in the South American crust under the sea and under the Coastal Cordillera show a remarkably homogenous north-south, i.e. trench-parallel, compressional stress field. Earthquake fault mechanisms are dominated by east-west striking thrusts. Further inland, where the lower plate becomes uncoupled, the stress field is more varied with direction east-west to southeast-northwest (approx. convergence parallel) dominating. The peculiar stress-regime above the plate-coupling-zone almost perpendicular to plate convergence direction may be explained by a change in subduction obliqueness due to the concave shape of the plate margin.