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# Spatial Distribution of Stress along the plate boundary in Hokkaido, northern Japan

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We analyzed earthquake focal mechanism data to infer the spatial distribution of stress and to check the effect of large earthquakes in stress field along the interplate boundary in Hokkaido region, northern Japan. The interplate boundary in this work is inferred as the surface defining the upper seismogenic zone of the double seismogenic zone (or the Benioff-Wadati Zone). To resolve the plate boundary we used earthquake catalog from the Institute of Seismology and Volcanology (ISV), Hokkaido University for the period 1997/1/1 to 2006/12/31 after relocating to compensate location errors due to the heterogeneous P- and S-wave structure beneath Hokkaido. We then projected the data along a number of sections striking east-west with north-south spacing of 0.1 °covering an area between longitudes 140 and 150°E and latitudes 37 and 45°N. Then we fit a surface in each section defining the upper seismogenic zone and finally all of the sections were digitized to get the final data defining the interplate boundary. The plate geometry obtained in this way does not vary significantly from that published earlier but resolve the shallower part of the Pacific slab more precisely. Now to estimate stress states we compiled focal mechanism data from National Research Institute for Earth Science and Disaster Prevention (NIED), Japan for the period 1997 to September 2009. For the period prior to 1997 we compiled already published focal mechanism data from the year 1924. Further, we selected data with high double couple components within a depth range of 10km from the inferred boundary of the subducting Pacific slab. The entire study area is then divided into small squares with dimension 20kmX20km such that one of the sides of the square is parallel to the respective trench axis. For each area focal mechanism data is selected from the catalog and stress tensor inversion is carried out. The inversion of focal mechanism data estimates four parameters (three directions of the principal stresses and a parameter R defining the magnitude of the intermediate principal stress with respect to the maximum and minimum principal stresses). Our result unveils many features showing spatial variation in state of stress. We found a dominant strike slip regime in the deeper part (>60km) of the plate interface across the Kurile trench. Comparatively high angle (>75°) between the maximum horizontal stress and the subducting Pacific slab along with trench parallel seismic slip vectors and small R-values ranging between 0.1 and 0.3 suggest a dominant source of tectonic stress along the trench axis (radial compression) at the deeper part which might be supplied by the arc-arc collision between the Kurile and Japan arcs in this region. Across the Japan trench the scenario is similar to that in the Kurile part but the maximum horizontal stress is parallel to the subducting Pacific slab. A dominant thrust regime is found at the depths between 3 0 and 60km with higher R-values (between 0.8 and 1.0). The maximum principal stress makes small angles (>15°) with the subducting Pacific slab suggesting this part of the interplate boundary is strong and capable of producing large interplate earthquakes. In the shallower part the stress conditions is not consistent in the entire region and is significantly affected by the stress conditions in the deeper part suggesting the weaker rheology.

Keywords: Stress-tensor, Radial Compression, Double Couple Component