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Stress orientations near plate boundaries from single focal mechanism solutions in the World Stress Map data base

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The World Stress Map (WSM) is a global compilation of contemporary stress in the Earth's crust using a wide range of geophysical and geological stress measurement methods including borehole breakouts, hydraulic fractures, overcoring methods, geological indicator and focal mechanism solutions. Near the San Andreas fault the orientation of maximum horizontal stress SH from high quality borehole breakouts is almost perpendicular to the fault strike. This led to the hypothesis that the San Andreas fault is a 'weak' fault. Thus, single focal mechanism solutions from such weak faults are probably inaccurate for deriving the SH orientation.

We proceed a statistical analysis of the data from the WSM release 2004 to develop detection criteria for focal mechanism solutions which are related to presumably weak transform plate boundaries. We conclude that the SH azimuth from focal mechanism solutions is at a greater risk of being inaccurate if the earthquake has a) prevailing strike-slip component, b) occurred within a 100 km corridor around a transform plate boundary, and c) if the azimuth from one of the two possible horizontal slip vectors of the focal mechanism solutions is within 20° of the relative plate motion azimuth. This applies for 605 out of ˜9000 focal mechanism solutions used in the WSM database. We mark these data sets as 'possible plate boundary events', indicating that these events are probably controlled by the fault kinematics and fault geometry and not primarily by the stress field. Case studies at transform plate boundaries reveal that the mean SH azimuth changes significantly deselecting the possible plate boundary events. Along the El Pilar fault in Northern Venezuela the change of mean SH azimuth is -33°. The impact on the San Andreas fault is very small (-2.4°) due to the exceptionally high

amount of stress data available from other sources than focal mechanism solutions. Examples from the southern Pacific Ocean and the central Atlantic Ocean show a change in mean SH azimuth of -22.0° and -33.3° respectively.