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Stress Tensor Inversion of Aftershock Focal Mechanisms of the October 8, 2005 Kashmir earthquake (Mw=7.6)

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The seismic moment tensors of 53 aftershocks are retrieved using near-field 3-component broadband seismograms recorded at the GSN station NIL. The distribution and fault plane solutions of the aftershocks point out some characteristic features like clustering of aftershock activity the west of the Western Himalayan Syntaxis where all the aftershocks show predominantly reverse faulting mechanisms oriented mostly N-S, compatible with the N-S trend of the syntaxis, and NW-SE directions in accordance with the mainshock fault plane solution. However, most of the aftershocks located to the east and beneath the syntaxis show normal faulting mechanisms mostly striking NE-SW along with strike-slip events.

Two prominent groups of P and T axis orientation of the fault plane solutions divide the observed data into two subsets for which we obtain stress tensors. The stress tensor inversion yields two different stress fields indicating shortening in NE-SW and E-W directions. The trends and plunges of the principal stress axes and the stress magnitude ratio that form the best stress tensors are as follows: for NE-SW compression S1=(235, 1), S2=(325, 2), S3=(118, 88), R=0.9; for E-W compression S1=(90, 1), S2=(180, 2), S3=(336, 88), R=0.6. The NE-SW compressive forces are causative for the 2005 Pakistan earthquake and indicate arc radial contraction in Western Himalayas; surprisingly, the focal mechanisms to the east of the syntaxis indicate arc parallel extension – a feature that is observed all along the 2500 km long Himalayan belt. The E-W compression could either indicate reactivation of N-S faults that were active before the onset of NE-SW compression with stress disturbances caused by the mainshock or coexistence of two decoupled stress fields.

The contemporary existence of the E-W and NE-SW horizontal tectonic forces fits the observed NW-SE extension if the amplitude of the E-W force is larger.