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Stress Pattern of the Shanxi Rift System, North China, Inferred from the Inversion of New Focal Mechanisms

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The Shanxi rift system is one of the most outstanding intra-plate transtensional fault zones in the North China block. Earthquake focal mechanisms of the rift system are investigated for the time period 1965 - Apr. 2014. A total of 143 focal mechanisms of ML $\geq$ 3.0 earthquakes were compiled. Among them, 105 solutions are newly determined by combining the P-wave first motions and full waveform inversion, and 38 solutions are from available published data. Stress tensor inversion was then performed based on the new database. The results show that most solutions exhibit normal or strike-slip faulting, and the regional stress field is transtensional and dominated by NNW-SSE extension. This correlates well with results from GPS data, geological field observations and leveling measurements across the faults. Heterogeneity exists in the regional stress field, as indicated by individual stress tensor inversions conducted for five subzones. While the minimum stress axis (σ3) appears to be consistent and stable, the orientations, especially the plunges, of the maximum and intermediate stresses (σ1 and σ2) vary significantly among the different subzones. Based on our results and combining multidisciplinary observations from geological surveys, GPS and cross-fault monitoring, a kinematic model is proposed, in which the Shanxi rift system is situated between two opposite rotating blocks, exhibiting a transtensional stress regime. This model illustrates the present-day stress field and its correlation with the regional tectonics, as well as the current crustal deformation of the Shanxi rift system. Results obtained in this study, may help to understand the geodynamics, neotectonic activity, active seismicity and potential seismic hazard in this region of North China.