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Micro-block motion and fault activity in North China deduced from GPS measurements

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North China is characterized by active tectonic deformation during Cenozoic time. Historically and contemporarily, 26 M > 7.0 earthquakes occurred in this region. Geologically, this area is composed of Yanshan, North China Plain, Ludong-Huanghai and the Ordos tectonic blocks. We have collected GPS observations from 1999 to 2010, and derived an integrated velocity field. A combined model of block and dislocation is employed to fit the observed GPS velocity field by solving an optimal problem using the simulated annealing algorithm. The main conclusion is as follows: Relative to Eurasia plate, four major micro-blocks show similar rigid motion with close clockwise angular rotation velocities. Zhangjiakou-Penlai fault is undergoing left-lateral slip at a rate of about 1mm/yr, with differential locking depths and slip rates for western and eastern segments. The boundary between the Ordos and Yanshan, has a relatively lager slip rate than eastern part, located between North China and Yanshan. Shanxi fault is characterized by right-lateral motion, with an average velocity of 1mm/yr and a minor extension. Tanlu fault is slipping at a rate of 1mm/yr with high locking ratio. The major faults in North China have high locking ratio, implying strain accumulating and potential risk of future large earthquake.
We also document the far-field co-seismic and post-seismic displacements of the 2011 Great Tohoku earthquake detected by GPS stations in North China. About 2300 km away from the Great Tohoku earthquake, the co-seismic offsets recorded by GPS sites are around 10mm. Post-seismic deformation displays a heterogeneous pattern, implying a complex causative mechanism.