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Three-dimensional crustal deformations and strain field features constrained by dense GPS measurements in Northeastern Tibet

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Abstract: The ongoing collision between the India plate and Eurasia plate brings N-S crustal shortening and thickening of the Tibetan Plateau. Here, using measurements from 40 Continuous Global Positioning System (CGPS) stations of the Crustal Movement Observation Network of China (CMONOC) we determine the latest three-dimensional crustal deformations in the NET region, and based on the Principal component analysis (PCA) technique we calculate and correct the common mode errors (CME). We also use GRACE observations to determine the deformations caused by surface pressure, non-tidal oceanic mass loading and hydrological loading. We find both GPS and GRACE observations show significant seasonal variation, and the observed seasonal vertical variation exhibits a good agreement with GRACE. The annual peak-to-peak amplitudes are between 3 and 40 mm/yr. The corrected vertical crustal deformation indicate that both the crustal uplift and subsidence are anisotropic in NET, and that the maximum uplift rate in the Longmen Shan fault reach 9.5mm/yr. We further use the horizontal velocity to calculate the strain rates throughout the NET. The result indicates that the shear band maintains feature consistent with the strike-slip fault along the Longmen Shan fault and Haiyuan fault. The crustal compression and extension can describe the uplifting and sinking of the crustal in a reasonable way. This study is supported by National 973 Project China (grant No. 2013CB733302) and NSFCs (grant Nos. 41174011, 41429401, 41210006, 41128003, 41021061); Guangxi Key Laboratory of Spatial Information and Geomatics (Grant No.1103108-12); Open Fund of Guangxi Key Laboratory of Spatial Information and Geomatics (Grant Nos. 15-140-07-32 and 14-045-24-17).

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