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Postseismic deformation associated with the 2010 Yushu, China Ms7.1 earthquake from GPS measurements

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The Yushu Ms7.1 earthquake occurred on 14th April, 2010 in eastern Tibetan Plateau, China. The event ruptured Yushu segment of pre-existing Ganzi-Yushu fault. We establish 15 GPS stations 7-10 days following the earthquake, which comprises an ~360 km long transection across the rupture trace, encompassing one continuously operating, three semi-continuous and eleven survey-mode sites. Most of the sites are observed for more than 250 days to capture the spatiotemporal changes of postseismic deformation. The secular deformation in the study area is derived by a deep-dislocation model. It shows an insignificant contribution to the GPS-measured post-seismic deformation. Analysis to the aftershock-induced deformation shows that aftershocks yield appreciable influence to near-field sites within 60 days after the mainshock, with maximum EW and NS components of horizontal displacements close to 3mm and 7mm, respectively.

A layered lithospheric model is employed to compute surface deformation by poroelastic rebound. The result shows the poroelastic rebound cannot account for the cumulative postseimic deformation. The relaxation of lower crustal and upper mantle is investigated using a Maxell rheological model to infer its contribution to surficial GPS deformation. The resultant deformation is not significant in the early stage of postseismic deformation process.

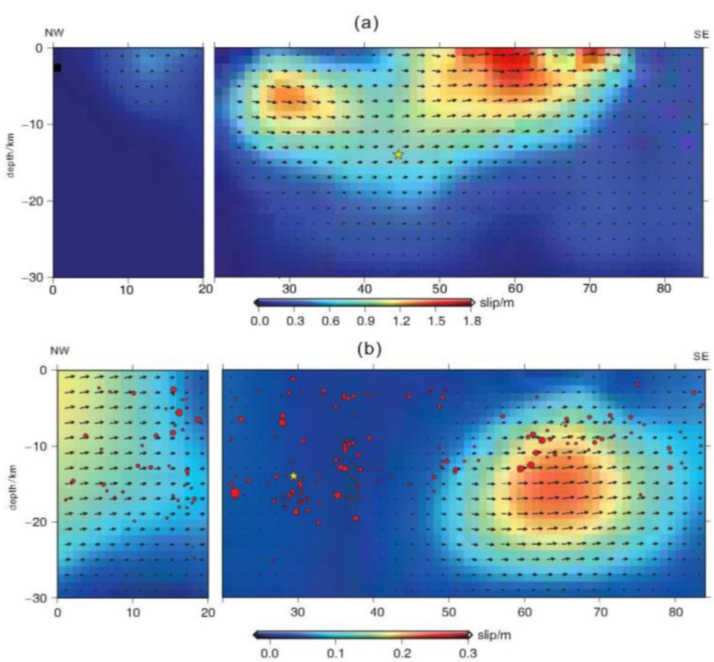

Figure 1: (a) Finite coseismic slip model. Colors and arrows denote the amplitude and the distribution of slip, respectively. (b) Best fitting postseismic model. Colors denote the amplitude of afterslip and red circles denote aftershocks during the first 8 months

Logarithmic function modeling is performed to model time-varying postseismic deformation. The characteristic relaxation decay time is 6.7±1.2 days on average for all the GPS sites. The Steepest

Decrease Method of optimization is employed to test for the temporal changes in the afterslip distribution. The afterslip model indicates that postseismic deformation is consistent with two afterslip patches, with the major one occuring underneath the coseismic ruputure area. The major afterslip patch remains stationary with the time lapse of mainshock. The rapid decay of postseismic deformation and the good fitting of afterslip model suggest that the dominant source in the early stage of postseismic process is most likely ascribed to afterslip.