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Using high-rate GPS data to measure ground deformations caused by the 2008 Wenchuan Ms8.0 Earthquake

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A strong earthquake of magnitude 8.0 struck Wenchuan county, Sichuan Province, China on May 12, 2008, which lasted more than 100 seconds, and involved a complex rupture process. We have analyzed 1-Hz GPS data observed at 13 stations within 300km away from the epicenter to investigate ground deformation caused by this earthquake. Clearly, 1-Hz GPS data captured rapid co-seismic ground displacements. The amplitudes of dynamic displacements generally are not only dependent with the distance between GPS sites and the epicenter, but also are related with how far the GPS sites are to the coseismic rupture belt. Maximum kinematic displacements, in terms of slip direction, are same as coseismic displacements derived from single-day solution. For most stations, their maximum kinematic displacements are greater than permanent coseismic displacements. At station PIXI, which is 48km away from the epicenter of the main shock, maximum kinematic displacement exceeded 70cm in the north-south direction, and 100cm in the east-west direction. We also processed 30-second sampling GPS data for 6.5 hours and 1-Hz GPS data for 90 minutes preceding the main shock. However, we have not found any significant precursory of ground deformation. Moreover, 1-Hz GPS data recorded in the duration of Ms \geq 6.0 aftershocks of the Wenchuan earthquake are analyzed, and no detectable ground deformation possibly associated with these aftershocks is definitely derived.

Keywords: 2008 Wenchuan earthquake, 1 Hz GPS data, kinematic deformation, preseismic deformation