Estimation of the coseismic slip history deduced from the “GNSS carrier phase to fault slip” approach

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Detecting aseismic slip within several hours to days is important for understanding a postseismic process in a plate interface. Conventional kinematic GNSS analysis, however, has disadvantage in such slow deformation, because it shows the large noise in the low frequency. Cervelli et al. (2002) developed the new method for such transient crustal deformation. They investigated the aseismic slip history of the fault in Kilauea volcano, directly from the GNSS carrier phase data. In contrast, there are small number of previous researches for the coseismic slip estimation based on their method. Thus, we applied their method (hereafter, PTS (Phase to Slip)) for the estimation of the coseismic slip history for the 2016 Kumamoto earthquake (M_{jma} 7.3) in this study.
The method of PTS used double-differenced carrier phase data as the observation. The observation related to the fault slip directly via the Green’s function. In the PTS, we adopted Kalman filtering approach for the unknown parameters estimation. We adopted the Green’s function solution to the elastic half space problem (Okada, 1992).
We used every 30s carrier phase data in eight GNSS stations (GEONET) in and around the focal area of the 2016 Kumamoto earthquake. For simplification of the inversion, we assumed the geometry of the single rectangular fault model estimated by Kawamoto et al. (2016). Then we assumed the white noise stochastic model with a process noise value 3×10^{2} m $s^{-1/2}$ for the fault slip parameter.
As a result, we obtained the 3.6m coseismic offset within two minutes after the origin time. Obtained result, however, shows a slightly smaller than the result of Kawamoto et al. (2016), which reached 4.2m. Furthermore, our result clearly shows the long-period disturbance reaching approximately 1m. It should be caused by the difficulty of the strict separation between each unknown parameters such as the tropospheric delay and the fault slip. To avoid such problem, the adoption of the optimum process noise value for each unknown parameters is one of the possibilities (e.g. Hirata and Ohta, 2016).
In the presentation, we will describe the more detail characteristics of the PTS not only about coseismic behavior but also the time dependence of the postseismic one.