[EJ] Evening Poster | S (Solid Earth Sciences) | S-SS Seismology

[S-SS09]Crustal Deformation

convener:Tadafumi Ochi(Institute of Earthquake and Volcano Geology, Geological Survey of Japan, The National Institute of Advanced Industrial Science and Technology), Mako Ohzono(Institute of Seismology and Volcanology, Graduate School of Science, Hokkaido University)
Sun. May 20, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
Study of crustal deformation plays an extremely important role in the investigation of wide scale earth dynamics those are earthquake and volcanic activity, plate motion and so on. In our session, we discuss the study related to crustal deformation, such as development of observation instrument, observed crustal deformation, analysis method, and simulation study.

[SSS09-P03]Estimation of coseismic slip distribution for the mainshock and foreshock of the 2016 Kumamoto earthquake using PTS

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Detecting aseismic slip within several hours to days is important for understanding a process of earthquake occurrence in a plate interface. Conventional method of GNSS analysis, however, has disadvantage in such phenomena, because of the large uncertainties disturb the detection of the small amount crustal deformation. Thus, we are conducting performance evaluation of “GNSS carrier phase to fault slip” approach (hereafter, PTS (Phase To Slip), Cervelli et al, 2002) to realize crustal deformation monitoring using this method. The PTS method was developed by Cervelli et al. (2002). It directly relates double-differenced carrier phase to slip via the Green’s function, skipping station coordinates. PTS uses Kalman filtering for the unknown parameters estimation.

We already applied the PTS to 2016 Kumamoto earthquakes and investigated the slip history of the single rectangular fault model (Geodetic Society of Japan fall meeting, 2017). In this presentation, we try to expand the PTS approach for the heterogeneous coseismic slip distribution. Targeted event is also 2016 Kumamoto earthquake. We focus on the both of the foreshocks (M_w 6.2 at 12:26 and M_w 6.0 at 15:03, in April 14th) and of mainshock (M_w 7.0 at 16:25, April 16th).

We used every 30s carrier phase data of the 20 GEONET site for the mainshock, and every 1s for the foreshocks. We assumed the two fault planes based on Yarai et al. (2016) for all three events. We adopted the Okada (1992) solution as the Green’s function between fault slip and change of the GNSS carrier phase. We also assumed the white-noise stochastic model with a process noise value 3×10^2 m s$^{-1/2}$ for the fault slip.

As results, we obtained 3.5m average slip (equivalent to M_w 7.0) in the case of mainshock. Estimated slip amount is slightly smaller than that of Yarai et al. (2016). Maximum slip appeared on the northeast side of Futagawa fault. This characteristic is consistent with other previous studies (e.g. Asano et al., 2016).

In the case of two foreshocks, large slip appeared on the central part of the fault plane at the time of the first event. Average slip was about 0.4m (M_w 5.92). Then, southwest side showed large slip at the time of the second event. Average slip reached about 0.6m (M_w 6.05) at that time. Total average slip

reached 1m (M_w 6.19) which is good agreement with Yarai et al. (2016), which estimated 1.1m total slip and M_w 6.23.
Our results may be the first estimation of coseismic slip distribution using PTS. These results suggests that this method is also capable of analyzing M6 event with sufficient accuracy. In contrast, time series of the slip in the assumed fault shows the very unstable condition and the further improvement will be required. We will also discuss about it in the presentation.