Searching significant displacement zone of Orkney earthquake fault by forward and inversion analysis with strain data observed at very close distance

*Tatunari Yasutomi[1], Hiroshi Ogasawara[2], Akimasa Ishida[2], Hiroyuki Ogasawara[2], Raymond Durrheim[3], Alex Milev[4], Makoto OKUBO[5], Teruhiro Yamaguchi[6], James Mori[1]

1. Kyouto university, 2. Ritsumeikan university, 3. Univ.Witwaterarand,South Africa, 4. CSIR,South Africa, 5. Kouchi university, 6. Hokkaidou university

The largest event recorded in a South African gold mining region, a M5.5 earthquake took place near Orkney, South Africa on 5 August 2014. This is one of the rare events as the main- and after-shocks were recorded by 46 geophones and 3 Ishii borehole strain meters at 2 - 3 km depths with epicentral distances, delta < several km, and 17 surface strong motion meters with delta < 20 km. The upper edge of the planar aftershock activity dipping almost vertically was only some hundred meters below the sites where the strainmeters were installed. As the M5.5 seismic rupture is located within a range drillable from gold mine workings at depth, ICDP approved a project to drill into the seismogenic zones. Moyer et al. (2016 SCEC) inverted surface strong motion data, suggesting significant fault slip even at the mining horizon, while there was no seismic rupture mapped or there were three strainmeters installed. So, the three strainmeters can contribute to constrain the configuration of the seismic rupture. As population of the aftershocks varies in space significantly, we expect a possibility to discuss a relationship the fault slip and the aftershocks.
These strainmeters were apart each other about 150 m only. However, their strain changes had different polarities while the other M4 strain changes with a similar hypocentral distance was the same. So, this information can constrain the location and configuration of the M5.5 fault critically.
First, we conducted a forward analysis by assuming a point source with the mechanism same as macroscopic one of the M5.5 faultingat a distance of a few km. However, no difference in polarity in strain change was seen, suggesting that the effect of a finite size of the source with an edge much nearer than the point source had to be taken into account. We are attempting to invert the slip distribution on a source with a finite size together with surface strong motion data. We will report on the results at the meeting.

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