

Searching largest displacement zone of the 2014 Orkney earthquake fault with strain data and using Map3Di for scientific drilling.

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The largest event recorded in a South African gold mining region, a M5.5 earthquake took place near Orkney on 5 August 2014. This is one of the rare events as the main- and after-shocks were recorded by 46 geophones at 2-3 km depths, 3 Ishii borehole strain meters at 2.9km depth, and 17 surface strong motion meters at close distances. The upper edge of the planar distribution of aftershock activity dipping almost vertically was only some hundred meters below the sites where the strainmeters were installed at distances larger than a few tens of meters from tunnel. A scientific project is planned to drill into the 2014 Orkney earthquake fault from the localities near the strain meter sites. It is a rare opportunity to recover fault material and fractures, to measure stress, to monitor after drilling at the M5.5 seismic zone. The final purpose of our research is to understand how main rupture stopped and why aftershock have occurred in sequence as observed. For this purpose, we attempted to constrain the largest displacement zone of the 2014 Orkney earthquake fault that account for the observed co-seismic strain with Map3Di to suggest where to drill. We checked polarities of each component of the strainmeters by comparing the observed tidal change with theoretically calculated tide Gotic2 [Sato and Honda (1984)], modifying the polarities of a few components with problems. Identical responses were recorded with the three strainmeters to a M4 earthquake at a few km distance, whereas much larger (up to $1e-5$) and different responses were recorded to the M5.5 earthquake. We calculated strain change of each component of the three strain meters by assuming uniform fault slip over a rectangle area with a same aspect ratio of aftershock area with various areas using map3Di. We found the rectangular area with a uniform fault slip of 0.5 m can explain the observed magnitudes of strain changes. However, we haven't yet evaluated local effects that might cause discrepancies in each component of the three strainmeters. At Japan Geoscience Union Meeting 2016, we are going to make a follow-up report.

Keywords: South Africa, Boundary element method, Drilling project, Strain data, Seismogenic zones