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Preliminary report of self-potential observation during a water injection experiment at 1800 m depth in Nojima fault

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We report self-potential variations during 2013 water injection experiment at 1800 depth in Nojima fault, which is a surface earthquake fault of the 1995 Hyougoken-nanbu earthquake (Mw6.9). The 2013 water injection test started in 15 September and ended in 29 September. Fresh water was injected into the fault system through the open hole part of the borehole (1800m depth). Average injection rate was 20 litter/min and pressure was 5 MPa. Self-potential variations around the 1800m borehole were very smaller than those in the previous water injection experiments (1997, 2000, 2003, 2004, 2006, and 2008) at 540m depth and self-potential variations did not appear clearly to correspond to the operation of the water injection. The previous water injection experiments have been repeated in the same conditions. The observed variations during the experiments have the following features: 1) self-potential variations appeared to correspond to the operation of water injections; 2) the negative voltage appeared around the water injection borehole, and 3) the magnitude of self-potential variations decreased with increasing distance from the borehole. And the self-potential variations in the previous experiments have become larger every experiment. These features suggest that the observed variations were caused by the streaming potential and the permeability around the open hole part of the borehole (540m depth) has decreased. If the line source model to explain the self-potential variations associated with the water injection is correct, the small self-potential variations observed this experiment may suggest that the permeability of the fault fracture zone at 1800m depth is larger than that around the fault at 540m depth.

Keywords: Nojima fault, 1995 Hyogoken-nanbu earthquake, self-potential, water injection experiment, streaming potential