Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SGD22-P08 Room:Convention Hall Time:May 22 18:15-19:30

Absolute gravity changes caused by long-term slow slip events in Ryukyu in May and December 2012

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Long-term slow-slip events (SSEs) have been observed in many plate-boundary zones along the circum-Pacific seismic belt. Previous studies have revealed that high-pressure fluids supplied from the subducted oceanic plate can generate SSEs. SSEs in different areas have different recurrence intervals. In general, the secular stress accumulation rate and the frictional property on a plate boundary controls the interval. Therefore, their differences are considered to cause the differences in the intervals. However, variations in fluid pressure can also change the intervals, because they affect the effective normal stress and the fault strength. Such variations in fluid pressure are predicted by an earthquake-cycle model based on a fault valve behavior of Sibson (1992). So far, variations in fluid pressure associated with SSEs had not been detected by field observations. If a massive fluid pressure change occurred, gravity change could be detected by the corresponding density redistribution in the underground. In the Tokai district in Japan, a long-term SSE had occurred during year from 2000 to around 2006, and gravity changes in 2004-2009 that could be explained by a fluid pressure variation were detected (Tanaka et al., 2010). However, the quality of the data was not good due to the lower temporal resolution of the campaign data and the observation period did not cover the whole cycle of the SSE. Therefore, a clear evidence of fluid-pressure change has still not yet been obtained. Since the end of year 2011, we have conducted a continuous gravity measurement using absolute gravimeters and a superconducting gravimeter in Ishigakijima and Iriomotejima Islands along the Ryukyu Trench where SSEs have occurred twice a year to observe a transient gravity change during the whole cycle of an SSE. In this presentation, we will report an observation result obtained by absolute gravimeters during the recent two slow slip events.

Keywords: slow earthquake, slow slip, fluid, gravity, earthquake cycle, subduction zone