Detection ability of Crustal deformation by Slow Slip Events along the Nankai Trough subduction zone

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1. Introduction

Japan Meteorological Agency (JMA) is monitoring data of the strain-meters in the Tokai region installed by the JMA, Shizuoka Prefecture and National Institute of Advanced Industrial Science and Technology (AIST) to detect a crustal deformation induced by a slow slip event along the Nankai Trough subduction zone. On the other hand, JMA cannot monitor the crustal deformation precisely in the western part of the Nankai Trough subduction zone in real time because of few observation stations in the area except for those installed by AIST. National Research Institute for Earth Science and Disaster Resilience (NIED) installed a high sensitive acceleration-meter with a high sensitive seismograph in a Hi-net station throughout Japan. The acceleration-meter can detect small tilt changes induced by slow slips in Nankai Trough subduction zone. Therefore we expect an improved detection ability of crustal variations by an integrated analysis of the high sensitive acceleration-meter data (tilt data) and the strain data. In this study, we investigated the detection ability of the crustal deformation induced by the slow slip applying the Geodetic Data Stacking method (GDS: Miyaoka & Yokota, 2012 and Miyaoka et al., 2017) to tilt data and strain data.

2. Method

Since the tilt and strain data are affected by ambient noise with responses to solid and oceanic tide, atmospheric pressure, geomagnetic field, and precipitation, we firstly correct these responses. Next, we stacked data to enhance signal to noise ratio in order to detect very small crustal deformations caused by slow slip events. In the procedure of data stacking, we calculate a polarity of the deformation by an assumed small slip on the Philippine Sea (PHS) Plate boundary, and stack them with reversing a polarity of the data with negative calculated change. In this research, we assume a 15km x 15km small fault at each grid point of 0.15 degree intervals for latitude and longtitude on the PHS plate and construct an stacked data at each grid point, which would indicate a distinct positive change if a slow slip occur on the corresponding fault. Then we calculated a smallest moment magnitude at all grid points which exceed the three times of noise magnitude.

3. Result

The detectability of crustal deformation due to slow slips on the PHS plate improved especially around the Kii peninsula and the Shikoku region with adding the tilt data of NIED to the stacked data comparing with that using only strain data. In the presentation, we will show a detection ability of the slow slips on the PHS plate in the Nankai Trough subduction zone as well as a spatial resolution of the monitoring with the GDS method.

Keywords: Slow Slip Event, Geodetic Data Stacking method, Strain-meter data, Tilt-meter data

