# An attempt to detect small crustal deformation caused by ETS in southwest Japan, using GNSS data

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In the Nankai subduction zone, Slow Slip Events (SSEs) coincident with non-volcanic deep low-frequency tremors which is called Episodic Tremor and Slip (ETS), have repeatedly been detected by using tilt from the NIED Hi-net and GNSS form the GEONET. In this study, we applied the stacking method of GNSS daily increments proposed by Frank (2016) to GNSS and tremor data in southwest Japan, and attempted to detect small crustal deformation accompanied by tremor activities, which is difficult to identify for each SSE.

As GNSS time series, we use the daily coordinates of 111 GEONET stations estimated with the Precise Point Positioning strategy by GIPSY software between Apr. 1, 2004 and Mar. 31, 2015. Firstly, we remove the offset by eliminating displacement increments for 6 days before and after major earthquakes and antenna changes as preprocessing. Secondly, we estimate annual and semiannual components, and post-seismic deformation of the 2011 off the Pacific coast of Tohoku Earthquake in GNSS time series and subtract them from the preprocessed time series. Thirdly, we calculate daily displacement increments of the corrected GNSS time series. Fourthly, we separate the displacement increments into the loading group and the release group based on the daily sum of tremor energy (Annoura et al., 2016; Kano et al., 2017). Finally, we cumulatively sum up the daily displacement increments of the release group, which we consider to be cumulative crustal displacement due to the tectonic stress release, and we estimate release velocity by a least square method. We also estimate loading velocity by the same procedure.

Our result shows the release velocity at some stations is oriented in the opposite direction of the plate convergence during tremor activities. It suggests that our analysis partly succeed in detecting small crustal deformation associated with tectonic stress release. However, the release velocity shows large scatter and we can’ t see its coherent distribution unlike the case of Frank (2016) in Cascadia. We consider the effect of stress loading in the locked zones updip of the ETS zone is so large that the release velocity is canceled out. Therefore, the signal of tectonic stress release might be too small to detect in southwest Japan. Our results may suggest the different characteristics of the subduction zones between southwest Japan and Cascadia.

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