Simultaneous estimation of a long-term and short-term slow slip events in the Bungo Channel region with MCMKF-based inversion

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We estimated space-time evolution of slow slip events (SSE) in the Bungo Channel region with the Monte Carlo Mixture Kalman Filter (MCMKF) based Network Inversion Filter [Fukuda et al.,2014]. The Bungo Channel region is well known site where long-term SSEs (duration is about one year) repeatedly occur with the recurrence interval of about 6-7 years. In addition, short-term SSEs (duration is several to ten days) have been reported by analyzing tiltmeter data. In this study, we use GNSS time series of GEONET stations proceeded by GIPSY [Takuya Nishimura, pers. comm.] between Jan. 1, 2009 and Dec. 31,2012 to estimate both long-term SSE and short-term SSEs simultaneously. MCMKF-based inversion has an advantage that the temporal smoothing parameter is temporally variable and chosen to follow the temporal variation of fault slips. In the light of this advantage, we estimated both long-term SSE and short-term SSEs simultaneously.

First we pre-processed GNSS time series; we estimate secular velocities, annual and semi-annual variations, coseismic steps and post-seismic deformation based on the least-square method, and subtract them from the original time series.

We employ the plate configuration by Hirose et al. [2008], and select the area of about 200km long to the east and 280km long to the north as the model region. We subdivide it to 719 subfaults, and represent the slip by a series of 24 depleted basis functions. Finally we performed the MCMKF-based inversion to infer cumulative slips and slip velocities. The estimated cumulative slip distribution is consistent with previous studies [e.g. Yoshioka et al., 2015 for the long-term SSE and Nishimura, 2014 for short-term SSEs].

This study may be the first case where both a long-term SSE and short-term SSEs have been estimated simultaneously from GNSS time series.

キーワード：スロースリップ、豊後水道、GNSS
Keywords: Slow slip, Bungo Channel, GNSS