Inversion analyses of long-term slow slip events using GNSS and strain data

*Takahiro Tsuyuki[1], Akio Kobayashi[1], Kana Akiyama[2], Reiko Kai[2], Kazuki Miyaoka[2]

1. Meteorological Research Institute, 2. Japan Meteorological Agency

Long-term slow slip events (SSEs) have repeatedly occurred along the Nankai Trough, which are mainly detected and analyzed using GNSS data. Although strain observation data has very high detection level for a few days change like short-term SSE, detection level for longer period than a few months or years is conversely low [Yamamoto et al., 2008] and no clear strain change due to the 2001-2007 long-term SSE in the Tokai region has been found in the JMA's strain observation data. [Yoshikawa, 2003: Yamamoto, 2007]. On the other hand, for the 2013-2016 long-term SSE in the Tokai region, its location and slip moment have been estimated by stacking strain data [Miyaoka & Kimura, 2016: JMA & MRI, 2014-2017] and the estimated slip moment accumulation is similar to that estimated from GNSS data. In addition, a rectangular fault model has been estimated for the long-term SSE since 2018 at Bungo Channel using changes of only strain data observed by AIST in the Shikoku region [JMA, 2018-2020]. In any case, only few components of limited stations show clear change of strain and it is not clear that these changes are caused by the long-term SSEs.
In this study, we tried to estimate slip distribution of long-term SSE by joint inversion of GNSS and strain data using ABIC and compare the result with the analyses using GNSS data. Also, we evaluate the error of observed strain change and verify the possibility that strain data change may be due to long-term SSE. If long-term SSE could be detected by strain observation other than GNSS observation, it can support GNSS analysis and prove the certainty of long-term SSE analysis using strain stacking data. We apply a joint inversion method [Garth et al., 2014] to the inversion analyses using strain and GNSS data. Figure shows an example of inversion analysis of long-term SSE at Bungo Channel. This shows consistency with the result from spatio-temporal inversion using GNSS data [GSI, 2018-2020]. Error of strain observation data is estimated about 10^{-11} strain and we have confirmed that the changes of strain observation data are caused by long-term SSE.

Keywords: Strain observation, GNSS, Long-term SSE, Inversion