# Reproducibility of MRI.COM-JPN model on seafloor pressure along Nankai Trough: For model-based geodetic signal detection

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Introduction

In the seafloor geodetic observation using ocean bottom pressure-gauge (OBP), it is essential for the transient event including slow slip event (SSE) detection to assess the non-tidal oceanographic fluctuations superimposition to the observed pressure data because their amplitude and time constant are similarly (from days to months). Therefore, oceanographic fluctuations reduction using physical ocean models is one of the promising methods. Still, model reproducibility and reduction effects differ from region to region (Dobashi and Inazu, 2021); thus, evaluating each region's impact is essential. In this study, we compare OBP observations from DONET, located on the southwest margin of Japan, with the high-density resolution ocean model MRI.COM-JPN developed by the Meteorological Research Institute (Sakamoto et al., 2019) to evaluate the model's performance in terms of detecting SSEs.

Data & Method

Spatiotemporal characteristics of oceanographic variability were compared with models using DONET observations. The observed data were pre-processed using Hanawa and Mitsudera (1985) for tides removal, and exponential & linear fitting (Watts and Kontoyianiss, 1990) for instrumental drift estimation and reduction, respectively. Furthermore, the time series was down-sampled to 1-day data aligned with the time resolution of the model. In order to evaluate the performance of the model, we subtracted the oceanographic signals calculated by the model from the observed time series. We also calculated the standard deviation (SD) and power spectral density (PSD) of each time series processed by the subtraction explained above.

Result & Discussion

The SD was calculated based on randomly selected time series from a few days to several hundreds of days in each different time window. The averaged SD reduction ratio with the model application was 5-15% for almost time windows. PSD was well agreed between observation and model in most frequency bands. For example, compared to SOM (Inazu et al., 2012) and ECCO2 (Menemenlis et al., 2008), PSD underestimated and overestimated for oceanographic fluctuations over long periods of dozens of days or more, respectively, and the SD reduction was worse than the MRI model.

Principal component analysis (PCA) can separate the oceanographic fluctuations of DONET OBP data into several principal components with significant spatial characteristics (Otsuka et al., in submitted). When PCA was also applied to the MRI model, it was found to have spatial characteristics similar to observations that varied along the sea depth. It suggested that this model could explain observations well in time and space.

Conclusions

This model helps to reduce the oceanographic contribution from observed OBP data for monitoring the transient tectonic signals. In the presentation, we will also report the evaluation of the model application for transient tectonic signal detection.

 

Keywords: Ocean Bottom Pressure-gauge, Numerical ocean models, Slow slip event, Oceanographic fluctuations, Principal component analysis

 