# Evaluation of seafloor crustal deformation using local ocean bottom pressure array measurements with ocean noise reductions: Application to the Hikurangi margin

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A slow slip event (SSE) is the phenomenon that a rupture progress on a fault slowly, compared with regular earthquakes. In general, the detection of SSE at the shallower part of the subduction zone is difficult using only onshore GNSS data. A sea floor geodesy, especially using ocean bottom pressure recorders, is now being attached with interest by the rest of the world to detect a crustal deformation due to SSEs, because it can continuously detect a pressure change as a vertical crustal deformation. On the other hand, the pressure change at the seafloor generally includes the influence of oceanic variations such as tidal and non-tidal oceanographic components. By taking a difference between two sites in close proximity to each other, both tidal and non-tidal components have conventionally been canceled as the common components appearing at the two sites. However, both correlation distances and depth on a non-tidal component are unknown well, especially within a local ocean bottom pressure array. Here we evaluate correlation distance and depth of non-tidal components appearing on a local ocean bottom pressure array to estimate sea floor crustal deformation more accurately than the conventional method. First, we have compared observed data with predicted data from a barotropic ocean model driven by wind stress to evaluate the performance of the model around the Hikurangi margin. As a result, we have confirmed that our ocean model is applicable to our target area. By taking a difference between the data after reducing the effect of non-tidal components, we have successfully detected crustal displacements from a local array of ocean bottom pressure recorders, which spanned from June 2014 to June 2017 at off the coast of north island in New Zealand.
We have consequently identified the occurrences of two SSEs, which occurred Julian days 265~285 (SSE#1) and 350~370 (SSE#2) in 2014. Comparing these two events, we have found the two spatial patterns of vertical displacements from two events, which are significantly different each other. Also, clear vertical displacements are detected at the shallow portion of the subducting plate interface for each event. Our results suggest that the sequence of shallow SSEs with a duration of ~2-3 weeks frequently occur with a recurrence interval of less than 1 year, especially at the shallow plate interface less than 15 km depth in Hikurangi margin.

Keywords: Ocean Bottom Pressure, Non-tidal oceanic variation, Seafloor crustal deformation