Dense broadband seismic campaign for deep very low frequency earthquakes in Shikoku, Kii and Tokai regions in the Nankai subduction zone

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Very low frequency earthquake (VLFE) is one type of slow earthquakes observed by broadband seismometers at a period range around 20-50 s at the plate interfaces of subduction zones. The signal of deep VLFEs at the down-dip side of seismogenic zone tends to be small compared to that of shallow VLFEs at the up-dip side near the trench. To observe deep VLFEs, we have installed broadband seismometers in the Nankai subduction zone in three different stages.

In the first stage, we deployed three stations in the Shikoku island in 2015 by the earthquake and volcano hazards observation and research program. In the second stage, we deployed two stations in the Shikoku island and one station in the Kyushu island in 2017 as a part of “Science of Slow Earthquakes” project. The seismometers are either CMG-3T (120 s) of the Guralp or the Trillium QA/PA (120 s) of the Nanometrics. The recorders are LF-1100/2100 of the Hakusan. The data is in WIN format and is transferred to Earthquake Research Institute, the University of Tokyo in almost real time. These stations are called “BC series” because their target is the Bungo Channel region where various types of slow earthquakes have been observed. By analyzing these datasets, we have detected and determined centroid moment tensor and its uncertainty for 324 events from 2018 to early 2019.

In the third stage, in this study, we have installed 11 stations and will install 4 more stations from 2019 to 2020 as a part of “Science of Slow Earthquakes” project. The numbers of stations are 7 in the Shikoku, 4 in the Kii and 4 in the Tokai regions. We chose the locations in the Shikoku region near the active area of low frequency tremor but less active area of VLFEs to detect small events. The stations in the Kii and Tokai regions are located near the active area of VLFEs to analyze broadband (10-100 s) spectrum of each event. The seismometers are CMG-3T (120 and 100 s) tested in the Nokogiriyama observatory of Earthquake Research Insititute for one week. The recorder is RT130 of the Reftek. The data is in SEED-STEIM2 format and transferred to newly constructed virtual server on the Sakura VPS service by VPN connection (NXR mobile router and DTI SIM). We will continue monitoring these datasets and determine detailed source parameters of VLFEs to understand the dynamics of interplate slip in the future.

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