

Fundamental properties of non-volcanic low frequency tremor catalogues

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Since a discovery of non-volcanic low frequency tremor (NVT) in the subduction zone of southwest Japan (Obara, Science, 2002), the NVT has been found in various subduction zones or bottom of faults all over the world, and has been studied by many researchers. In these studies, an envelope cross-correlation technique for NVT detection and making a catalogue of NVT is important to discuss spatial and temporal activity of NVTs (e.g.; Maeda & Obara, JGR, 2009; Ide, Nature, 2010; Nakata et al., Nature Geoscience, 2008; Imanishi et al., GRL, 2011). There are some differences in NVT catalogues in the same region, since each study developed an original program for NVT catalogue. Furthermore, in some cases, even if they use a same program, parameters to detect NVT in the program were changed depending on a scope of the study. Consequently, there are some different features of NVT activity between the catalogues. In this report, we compare three catalogues, made by Japan Meteorological Agency (JMA), National Research Institute for Earth Science and Disaster Prevention (NIED) and Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology (AIST), regarding a resolution of location and a NVT scale-sensitivity property as fundamental properties of the NVT catalogue.

Based on the method to estimate the resolution of location from a standard deviation of relative location (Ide, Nature, 2010), we calculated the resolution of location in each catalogue using several standard deviations of relative location. The estimated epicentral resolutions in three catalogues are almost 2-3km.

The NVT scale-sensitivity was estimated by a ratio of NVT counts in catalogues. For example, the sensitivity of the NIED catalogue for magnitude (M) based on the JMA catalogue was defined as $N_{nied-jma}(M)/N_{jma}(M)$. Here, $N_{jma}(M)$ is total counts of low frequency earthquakes (LFEs) with M listed in the JMA catalogue, and $N_{nied-jma}(M)$ is total counts of NVT in the NIED catalogue which is also listed in the JMA catalogue. To examine the relationship between the scale and the sensitivity in the catalogues, we used magnitude and NVT energy as the scale in the JMA and the other catalogues, respectively. By comparison of the NVT scale-sensitivity properties, it is found that these catalogues have characteristic scales in the sensitivity. Furthermore, the sensitivities of all catalogues decrease for large scale NVT. This is attributed to the increase of lost counts due to complex waveforms of highly active NVT. In our presentation, we show some examples of different features of NVT activities arising from different scale-sensitivity properties.

We conclude that these fundamental properties are useful not only for a comparison of catalogues, but also for an optimization of parameters in the programs of NVT detection.

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Keywords: non-volcanic low frequency tremor, catalogue, position resolution, NVT scale-sensitivity property