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Data quality characterization of deep low-frequency tremor catalogs and frequency-magnitude relation of tremor events

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A nationwide high-frequency seismograph network (Hi-net) deployed by the National Research Institute of Earth Science and Disaster Prevention (NIED) is a key contribution to discovering deep low-frequency tremor associated with subduction in south west Japan (Obara, 2002). The tremor was also found in the Cascadia margin of the North American continent, Taiwan, and the San Andreas Fault. The finding demonstrates that this phenomenon is not regional but universal. Previous studies have focused on developing the methodology to detect and locate tremor events as well as characterizing tremor episodes by migration, segmentation, and periodicity, while the collective (statistical) properties of tremor events are not yet fully understood. Before devoting to in-depth statistical research on tremor events, it is necessary to create tremor catalogs and use them to get better understanding of data quality for each catalog. In this study, we use the NIED tremor catalog as a primary data source and then investigate if the statistical properties of tremor events are similar to those of regular earthquakes. We also create a catalog consisting of events identified as tremors stored in the JMA catalog. This supplement is used for comparison with the NIED catalog. Our approach is based on the Gutenberg-Richter (GR) frequency-magnitude law of tremor events. This law is valid for all earthquakes both regionally and globally. We show that the GR law is also valid for tremor events, suggesting that earthquakes and tremor events are similar physical processes. Reported characteristics will allow us to move toward conducting in-depth statistical studies of tremor events.

Keywords: Seismic instruments and networks, Dynamics: seismotectonics, Statistical analysis, Data management, Earthquake dynamics