Approaches for utilizing OBS’ s amplitude data for Earthquake Early Warning

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Large-scale ocean-bottom seismic networks, such as S-net (deployed by NIED: National Research Institute for Earth Science and Disaster Resilience) and DONET (deployed by JAMSTEC: Japan Agency for Marine-Earth Science and Technology, operated by NIED) were installed for real-time monitoring in subduction areas in Japan. The Japan Meteorological Agency (JMA) have used DONET data at two stations for Earthquake Early Warning (EEW) since March 2015. In addition, JMA has plans to use S-net data for EEW after checking their data quality. In this presentation, we show characteristics of waveform data at Off-Kushiro OBS and DONET and explain our approaches developed for EEW magnitude estimations by using OBS data.

The JMA magnitude in EEW is basically determined from the maximum amplitude of three-component vector summation of displacement waveform. We found that the difference between the JMA EEW magnitude estimated by using OBS data and the JMA catalogue magnitude (M_{jma}) increases in proportion to input acceleration (PGA). We suppose that the difference is explained by (1) Tilting of OBS housing, (2) Swinging of OBS housing, (3) Amplification of horizontal component at stations near the epicenter. Since tilting and swinging of OBS causes contaminations of gravitational acceleration on waveform record, the DC offset change in acceleration is recorded at each component during earthquake. The integration of such records causes significantly large amplitudes and contributes to the overestimation of the JMA EEW magnitude. The acceleration offset caused by tilting is larger on the horizontal component perpendicular to the cable line than that on the vertical component at in-line cable type OBS stations.

We here propose an alternative magnitude estimation for OBS data by using the maximum amplitude of the vertical component of displacement waveform in order to suppress the effects of tilting and amplification of the horizontal component. The proposed approach also contributes to reducing the difference of amplification factors among sites. For amplifications associated with swinging on the vertical component, we are developing several logics to exclude the anomalous amplified data when estimating the magnitude.

Keywords: Earthquake Early Warning, Ocean Bottom Seismometers, Amplification, Tilting, Swinging

