

## **estimation for early warnings using pressure perturbation data**

Deployments of real-time offshore observatory stations could contribute to enhancing early signal detection of hydroacoustic, seismic, and tsunami phases and also to improving accuracies for source analyses of the phases. We investigated pressure gauge data recorded at offshore stations in northeast and southwest Japan to develop an estimation method of providing rapid and reliable magnitude for early warnings. We focused on amplitude in a period band of less than 6 s at moderate to large earthquakes. In the case of stations deployed in deep ocean areas, the amplitude of pressure waveforms in this period band is roughly consistent with the vertical amplitude of water particle velocity. We constructed an empirical equation between the catalog magnitude and the observed maximum amplitude at the stations and estimated the magnitude for each event data. Our results show that the estimated magnitude correlates well with that in the catalog. The two sigma standard deviation is 0.70, which is almost the same value as that estimated from using amplitude data recorded at seismometers. Real-time monitoring of pressure perturbations at offshore stations may be a practical, effective way of estimating magnitude as well as that of seismometer data at suboceanic earthquakes.

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