

Comparison between tsunami height data obtained by offshore and coastal observatories

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Takayama et al. (1994) reported the first event detected by the Nationwide Ocean Wave information network for Ports and Harbours (NOWPHAS), which is now operated by the Port and Airport Research Institute (PARI), was the 1993 southwest Hokkaido earthquake tsunami. Since then, NOWPHAS has recorded a significant amount of tsunami data. This paper presents a comparison between tsunami height data recorded by offshore NOWPHAS observatories and tidal stations located along the coastlines of nearby harbors.

For this study, we obtained tsunami records from both offshore NOWPHAS observatories and tidal stations from published reports by PARI or Japan Meteorological Agency (JMA). We used a total of 58 sets of observed initial tsunami height and maximum amplitude data of 8 tsunami events that occurred during 1993 - 2007.

Two equations (Eqs. 1 and 2) derived from Green's law were tested. Eq. 1 was derived by Baba et al. (2004) for correcting deep-ocean tsunami amplitudes so that they can be treated in the same way as tsunami amplitude at the coastline for estimating tsunami magnitudes. Eq. 2 was derived from Eq. 1 by assuming that offshore or coastline tsunami observations are affected by total reflection at the coastlines. Baba et al. (2004) implicitly assumed water depth at a coastline was 1 m. However, for this study, water depth at each observatories read from the charts are used so that they are based on the fact.

Eq. 2 was tested by using two other pairs of observation data (data on the 2003 Tokachi-oki earthquake tsunami recorded at Ofunato (Nagai and Ogawa, 2004), and data on the 2004 Tokaido earthquake tsunami recorded at Muroto (Nagai and Satomi, 2005)). These tsunami records were obtained from both offshore GPS buoys and tidal stations located along the coastlines of nearby harbors. Eq. 2 properly corrected both the initial tsunami height and maximum amplitude data recorded by the GPS buoys. This shows that Eq. 2 can be used to correct tsunami observation data recorded by GPS buoys, in order to compare or predict initial tsunami heights or maximum amplitudes recorded at nearby coastline observatories.

