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Atmospheric boundary waves excited by the tsunami generation - the great Sumatra-Andaman Islands Earthquake in 2004 -

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The sudden and strong vertical displacements of ocean surface are known to be the source of the long-period acoustic-gravity waves including the boundary waves in the atmosphere. Arai et al. (2011) observed atmospheric pressure changes caused by the tsunami generation of the 2011 Off the Pacific Coast of Tohoku earthquake, and identified them as ”atmospheric boundary waves” on the basis of the waveform characteristics. The sudden and strong vertical displacements of ocean surface caused by the Sumatra-Andaman earthquake in 2004 also had produced long-period acoustic-gravity waves (Mikumo et al. 2008).

We re-explore barograph data observed around the source region of the Sumatra earthquake in 2004. Atmospheric pressure changes caused by the ocean uplift and subsidence were detected at 4 IMS (International Monitoring System for CTBT verification regime) stations. IMS stations provide two kinds of data, one is the band pass filtered (0.02-4Hz) output and the other is the absolute pressure output. Band pass filtered data are archived and used for CTBT’s monitoring purpose. Absolute pressure data are not archived at all IMS stations. If the absolute data is not available, the band pass filtered data have been corrected by deconvolving the filter response and original records have been restored.

Long-period atmospheric pressure disturbance signals which were excited by uplift and subsidence related to the tsunami generation were observed at IS52 (Diego Garcia), IS33 (Madagascar), IS32 (Kenya) and IS35 (Namibia). The pressure signals were identified as atmospheric boundary waves based on their characteristics.

Earth orbiter ”Jason-1” measures ocean surface topography. When the tsunami caused by the earthquake had been propagating through the Indian Ocean, Jason-1 flew over the propagating area. Jason-1 detected the two propagating tsunami wave fronts as the elevated ocean surface topography which indicates two isolated peaks. Detected atmospheric boundary waves also have the same characteristics. Atmospheric boundary waves retain the initial shape of the tsunami, because they are little dispersive. Observed signals suggest the Sumatra-Andaman earthquake had two isolated tsunami source regions.

Keywords: Atmospheric boundary wave, Tsunami source, International Monitoring System