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2011 年東北地方太平洋沖地震から発生した気圧波
Atmospheric pressure waves from the 2011 great off-Tohoku earthquake (Mw=9.0)

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Atmospheric pressure waves were recorded within several hours after the great off-Tohoku earthquake by sensitive micro-barographs not only at several stations on and around the Japanese Islands, but also at 9 International Monitoring System (IMS) stations in the distance range between 1,000 and 6,500 km. Some of the near-field observations have been interpreted as non-dispersive boundary waves propagated along the bottom boundary of the atmosphere (Arai, et al.,2011). In addition to these, characteristic waveforms with two strong pulses can be identified at 3 other Japanese near-field stations, which are supposed to come from two stages separated within several minutes in tectonic vertical deformation on the sea-floor. The far-field observations including those at stations in Alaska, Hawaii, Palau, Australia, Far East Russia, Mongolia, Central Asia, and Greenland, indicate weak dispersive wave trains involving low frequencies between 1.5 and 3.3 mHz (or periods from 11 to 5 min) with a group velocity between 346 and 376 m/s and amplitudes ranging between 0.5 to 3 Pa, depending on their locations. For these reasons, these low-frequency waves may be interpreted as acoustic-gravity waves excited by swelling and depression of the sea surface due to vertical sea-floor deformation, and propagating through the lower to middle atmosphere, as in the cases of the 1964 Alaskan and 2004 Sumatra-Andaman earthquakes. Assuming various source parameters, we calculate synthetic waveforms for several far-field stations by incorporating a realistic, standard thermal structure in the atmosphere up to an altitude of 220 km, and then compare them with the corresponding observations. The comparison provides estimates of possible ranges for the effective source dimension generating these atmospheric pressure waves, average uplift and subsidence of the sea-floor and their time constants.

We expect that the results may become further information independent from seismic, geodetic, and tsunami observations, to the source characteristics of this great earthquake.

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