

### Transient thermal response in ocean-bottom quartz resonator pressure measurement

# Kenji Hirata[1]; Toshitaka Baba[2]

[1] MRI; [2] JAMSTEC

Ocean-bottom pressure gauges are widely used and provide high quality data to detect offshore tsunamis with a peak-to-peak amplitude as small as several millimeters to centimeters [e.g., Gonzalez et al.,1991; Okada, 1995; Ritsema et al.,1995; Hino et al., 2001;Hirata et al.,2003;Baba et al.,2004]. In Japan six cabled observatories with ocean-bottom pressure gauges have been operated [Meteorological Research Institute, 1980; Fujisawa et al., 1986; Kanazawa and Hasegawa, 1997; Monma et al., 1997; Eguchi et al., 1998; Hirata et al.,2002]. All ocean-bottom pressure gauges equipped on the six observatories employ the Hewlett-Packard models 2813B or 2813E based on 'quartz resonator pressure transducer'[Karrer and Leach, 1969].

Offshore ocean-bottom pressures usually follow ocean tidal motion but sometimes deviate from it even when no tsunami occurs (Fig.1). Numerous observations suggest that such deviations highly correlate with sudden temperature changes, probably due to irregular deep ocean currents, around the pressure gauges regardless of static temperature compensation mechanism. We ascribe this deviation to the transient thermal response of the pressure gauges, which produce apparent pressure fluctuations when temperature change quickly so that temperature equilibrium condition of two quartz transducers is not valid. We put forward an empirical method to estimate the transient thermal response correctly. Such rapid temperature change may have to be corrected for a robust tsunami warning based on offshore tsunami observation with pressure gauges.

Figure1 (a) Examples of water pressure deviations from tidal motion observed with an ocean-bottom pressure gauge, PG2, of JAMSTEC cabled observatory off Tokachi, Hokkaido. (Upper) Observed ocean-bottom pressure for three days from 12th to 14th January 2002, (Middle) Temperature, and (Lower) time derivative of temperature. (b) Locations of two pressure gauges PG1 and PG2 of JAMSTEC cabled observatory (solid line) off Tokachi, Hokkaido, Japan [modified from Hirata et al.,2002].

