On the sea level variation reduction for the Earth's free oscillation data of Syowa Station, Antarctica

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When detecting signals originating in the solid Earth based on an analysis of gravity time series, the effects of fluid moving near the surface, such as atmosphere, ocean, and ground water, are always nuisances. If auxiliary data are available, a simple correction method may be sufficient to remove those effects. For example, the effects of atmospheric attraction and loading in the tidal frequency band are routinely corrected by applying a simple response method or a transfer function method to a set of gravity and atmospheric pressure data (Tamura et al., 1991; Crossley et al., 1995). Such methods are also applicable to low-frequency seismic records for clearly observing spectral peaks of the Earth's free oscillations buried in the atmospheric background noise (Zurn and Widmer, 1995; Beauduin et al., 1996). On the other hand, this kind of method has not yet been applied for removing effects of the ocean since no auxiliary data are available in most cases. Recently, Nawa et al. (2003) demonstrated that oceanic effects disturbing background spectrum of Syowa SG were successfully reduced by applying a transfer function method (Beauduin et al., 1996) using the sea level variation data from the differential GPS data (Aoki et al., 2000) as the input. Then, we applied the sea level variation reduction to a large earthquake data (1998/11/29 CERAM SEA, Mw=7.7). As a result, spectral feature after the reduction was different from that before reduction especially at frequencies lower than 1.5 mHz although noise level was not changed. For example, SN ratios of free oscillation modes of 0S7 and 0S8 were recovered. Sea level variation data using GPS at Syowa Station are available on only eight-month period in 1998. In the future, we can use continuous ocean-bottom pressure gauge data maintained by Japan Coast Guard, which sampling interval become 30 seconds in January 1999, for the oceanic noise reduction.