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Parameters of the fluid core resonance estimated from the 10-years data of Esashi SG

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10-years data (from 1992 to 2001) obtained from the superconducting gravimeter at Esashi were analyzed to estimate four parameters of fluid core resonance (FCR), i.e. four of the eigenperiod (T0), the inverse of quality factor (Qi), the real part of the resonance strength (Br), and its imaginary part (Bi). It is well known that the accuracy of ocean tide correction affects on the estimated parameters and the ocean tide effect on diurnal tidal waves in the central Europe is small. Therefore, for comparison, we also analyzed the data from the SG at Membach, Belgium. The data length is about 4.5 years from 1995 to 1999.

The effects of ocean tides (attraction and loading) were estimated using the three global ocean tide models deduced from TOPEX/POSEIDON altimeter data, i.e. three of NAO99Jb (Matsumoto et al.,2000), CSR4.0 (Eans&Bettadpur,1994) and GOT99(Ray,1999). The obtained amplitude and phase of the ocean tide effects at each site are very consistent between the three models, even though these sites are largely separated in their locations on the globe. NAO99b model was used here. The ocean tide correction for minor waves, which the global ocean tide models are not available, was interpolated using the correction values for nearby main waves.

The FCR parameters were estimated by fitting the observed complex tidal admittances to a dumped harmonic oscillator as a model for the resonance. In order to reduce a possible effect of error in the scale factor of gravimeter, we used the admittances normalized with the factor of O1 wave. Estimation error of the FCR parameters was evaluated from the distribution of the solutions which were obtained from 5000 data sets generated by artificially adding Gaussian random noises (with a dispersion of similar magnitude of the RMS error for the observation admittance of each wave) to the observed admittance of respective wave. The analog filter of the Membach SG has been changed from TIDE filter (time constant of about 40 s) to GGP-1 filter (time constant of about 9s) at the beginning of 1998. The analysis results for the Membach data clearly show that ignoring this chnage in the time constant of filters affects on the on the estimated FCR parameters in particular on the eigenperiod. From the Esashi data, we obtained 429.50+/-0.16 sidereal days, 181531 to 864379, -4.96E-4+/-0.017E-4 and -0.10E-4+/-0.02E-4 for T0, Qi, Br and Bi, respectively. These are the value estimated from the tidal factor analyzed using the TIDE data through all observation period.

The eigenperiod obtained here is consistent with the value inferred from the non-hydrostatic inelastic theory (431.37 seidereal days, Dehant et al., 1999) rather than the elastic-hydrostatic one (456.98 seidereal days by the same authors). It is noted that our tidal estimation gives a value very consistent with the parameters obtained from the analysis of nutation data. Many of the previous estimates based on the tidal gravity observation show a systematic difference compared with those from the nutation in particular for the Q-value (i.e. low Q-value). This may be mainly due to inaccurate ocean tide correction in the previous studies. Judged from the Q-value obtained here, it can be said that the strength of coupling at the core-mantle boundary at the durnal tidal band is weak as suggested by the nutation.