Validation of the effect of mantle inelasticity and latitude dependence through the observed tidal parameters

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We showed the effect on tidal parameters of the inelasticity and the latitude dependence compared with theoretical results. By comparison with the theoretical model, Earth tide observations may supply important constraints to understanding of the Earth's interior. Dehant et al. (1999) calculated the latitude dependence of the gravimetric factor, about 0.2% variability for K1. Viscoelasticity causes the frequency dependence of both amplitude and phase shift of tidal parameters. In the main tidal band, it produces an amplitude increase of about 0.12 % (Dehant et al.,1999). In this work, We observed and estimated the Earth tide parameters, gravimetric factors and final residuals, corrected for ocean loading effect using recently developed ocean tide models. Superconducting gravimeter data from Metsahovi, Strasbourg, Sutherland, Canberra and Syowa Station within the G lobal Geodynamics Project (GGP) Network were used. A tidal analysis and local air pressure correction were made using BAYTAP-G (Tamura et al., 1991). For comparison of the ocean loading effects, CSR4.0, GOT99.2b, NAO.99b, FES2004, TPXO7.2, TPXO7_atlas, EOT11a, DTU10 and HAMTIDE global ocean tide models were used, and GOTIC2 (Matsumoto et al., 2001) was used for the ocean loading calculation. For the validation of elastic/inelastic theoretical values, all five stations showed inclination to the inelastic theoretical value for K1, specially at Strasbourg and Canberra over all ocean tide models. Metsahovi and Syowa showed large anomalous in previous ocean model, but showed inclination to theoretical value using recent ocean models.

Syowa Station on polar region is the specially important observatory for validation latitude dependence. We estimated the RMS error to compare each model with tide gauge (4m depth) and bottom-pressure (4527m depth) data around Syowa Station. Fig. 1 shows the RMS for M2 wave, and we can find that DTU10 shows small RMS on both tide gauge and bottom pressure. Meanwhile, TPXO7.2 and TPXO7_atlas shows small RMS in deep ocean area (bottom pressure gauge).

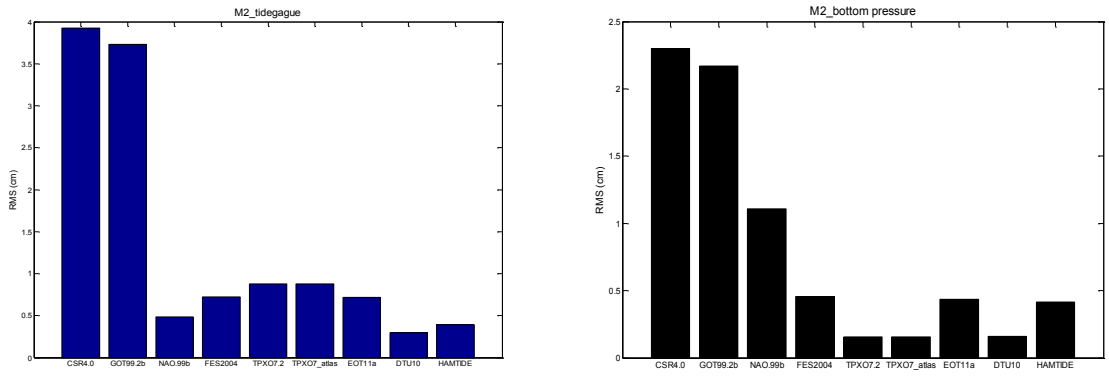

Figure 1. RMS errors of ocean tide models at the tide gauge (69.008°S, 39.570°E, 4m depth) and the bottom-pressure gauge (66.850°S, 37.830°E, 4527m depth).

References

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