

Correction of the Theoretical Oceanic Tidal Loading at Rokko-Takao Station

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The tidal strains observed at Rokko-Takao stations have some discrepancies with the theoretical tides in the amplitudes by a few 10^{-9} and in the phases by 10 degrees or more. These discrepancies are large in the strain components with the large oceanic tidal loading effect. Therefore, the discrepancies might be caused by the inaccuracy of the oceanic tidal model, which were used in the calculation of the theoretical tides. In this study, we calculated the oceanic tidal loading nearby the station by using the ocean level observed at Kobe Marine Observatory, and modified the theoretical tides. This modification of the theoretical tides resulted in the better agreement between the observed and the theoretical tides.

Rokko-Takao station was established by Kyoto University. This station is located in the emergency evacuation road for the Shin-Kobe tunnel. In the station, the extensometer EX2 (N69E) and three strainmeters ST1 (N81W), ST2 (N39E), ST3 (N21W) were installed and observed continuously since 1989. The length of the extensometer EX2 is 12m. We calculated the tidal constants by applying the tidal analysis program BAYTAP-G (Tamura et al., 1991) to the observational strain data during 9 years from 1999 to 2007. The observed tidal strains in major tidal components M_2 and O_1 have some discrepancies with the theoretical tides in the amplitudes by a few 10^{-9} and in the phases by 10 degrees or more. These discrepancies might be caused by (1) the topographic effect around the station, (2) the inaccuracy of the oceanic tidal model used in the calculation of theoretical tides, (3) the inhomogeneous structure in the surrounding crust nearby the station. Mukai and Otsuka (Japan Geoscience Union Meeting 2008) reported that the topographic effect at Rokko-Takao station was too little to cause the discrepancies between the observed and the theoretical tides.

Rokko-Takao station is about 5km from the shoreline of Osaka Bay, and has the large oceanic tidal loading effect. This station is also near to Akashi channel with a width about 4km, which connects between Osaka Bay and Seto Inland Sea and causes the complicated ocean currents. Therefore, the oceanic tidal model of GOTIC2 might not agree with the true sea level changes in Osaka Bay. We calculated the oceanic tidal loading in the range within 0.43 degree of Rokko-Takao station by using the sea level observed at Kobe Marine Observatory, and modified the oceanic tidal loading in the theoretical tides. In this calculation, we assumed that the sea level was uniform in the range within 0.43 degree of the station.

The modification of the theoretical tides resulted in the better agreement between the observed and the theoretical tides in the M_2 component of ST1 and the O_1 component of ST3, in which the oceanic tidal loading was large. Thus, we can conclude that one of the causes of the discrepancies between the observed and the theoretical tides at Rokko-Takao station was the inaccuracy of the oceanic tidal model used in the calculation of the theoretical tides. However, some discrepancies between the observed and the theoretical tides remained. Those discrepancies might be caused by the inhomogeneous structure in the surrounding crust.