

Detailed Coastline Data around the Syowa Station, Antarctica, and Calculation of the Oceanic Tidal Loading Effects

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In order to improve the estimation of the oceanic tidal loading effects at Syowa Station in Antarctica, we made detailed coastline data around it. Using this data, we calculated oceanic tidal effects at Syowa Station and some of bared areas along Antarctic continental margin by means of GOTIC2 software.

In the calculation of oceanic tidal effects by GOTIC2, four kinds of coastline data can be employed. Around the Syowa Station, the only 2nd order mesh (5'x5' grids) is available so far. However the 2nd order mesh is too coarse to describe the coastline accurately. Consequently there may be a large error in the estimation of oceanic tidal effects. We therefore generated new coastline data which correspond so-called 4th mesh (1.5x2.25sec. grids) from 1/25,000 scale maps around the Syowa Station over 1.5 degrees by 1.5 degrees area.

The 4th mesh data revealed that 12.4% of land-sea boundary were incorrectly treated by the 2nd mesh data. By using the 4th mesh data, the gravity station in Syowa and some GPS points on the bared areas can be correctly located on land areas, while those points were located in the sea by using the 2nd mesh data.

We calculated the oceanic tidal effects for gravity at the Syowa Station by employing NAO.99b ocean tidal model with the 4th mesh data. The obtained amplitudes (microGals) and phases (degrees) are as follows: M2 (2.302, 351.375), S2 (1.585, 1.386), O1 (2.504, 169.139), and K1 (1.953, 172.330) (amplitude, phase), respectively.

The maximum difference of the amplitude compared with the results using the 2nd mesh is 0.47microGal (33%) For the case of an island like Ongul, it is also revealed that the altitude of the calculation point influences the amplitude rather than the distance from the seashore.

On the other hands, the amplitudes of oceanic tidal effects for vertical and horizontal displacements are estimated as 52mm and 15mm, respectively. There are too large to neglect for the precise positioning by VLBI and/or GPS. Moreover relative vertical displacement between Syowa and Skalen, one of the bared areas near Syowa Station, is 8.2mm. It is not able to neglect the oceanic tidal effects even in the GPS relative positioning, if the observation points are near the sea.