



Ocean tides observed from a GPS receiver on floating sea ice near Chinese Zhongshan Station, Antarctica

Shengkai Zhang, Jingao Lei, Fei Li, Weifeng Hao, and Chi Xiao

Chinese Antarctic Center of Surveying and Mapping, Wuhan University, China (zskai@whu.edu.cn)

Ocean tides are the rise and fall of sea level caused by the combined effects of the gravitational forces of celestial bodies and the rotation of Earth. In Antarctic seas, ocean tides interfere with satellite and airborne geodetic measurements of ice velocity, elevation and mass change, and are sometimes treated as a noise source. Tides also affect mass balance and dynamics of the entire ice sheet directly or indirectly through interactions with its terminus. Due to limit of coverage in TOPEX/Poseidon (T/P) satellite and sparseness of in-situ tide gauges around Antarctica, the accuracy of global ocean tide models in Antarctic seas is relatively poorer than in low- and mid-latitude regions. To better understand ocean tides in Prydz Bay, east Antarctica, a GPS receiver was deployed on floating sea ice to measure tide-induced ice motion in multiple campaigns. Four online PPP services are used to process the GPS data in the kinematic PPP mode, and U-Tide software is used to separate the major tidal constituents. Comparison between results from different processing methods and with bottom pressure gauge (BPG) measured tides shows that, high-accuracy tidal information can be obtained from GPS observations on floating sea ice, the root-sum-square (RSS) for the eight major constituents (O1, K1, P1, Q1, M2, S2, N2, K2) is below 4 cm. We have also studied the impacts of data span and filter edge effect at daily boundaries on the accuracy of tide estimates, and found that to obtain reliable tide estimates and neglect the filter edge effect, continuous observation longer than 30 days is necessary. Our study suggests that GPS provides an independent method to tidal estimates in Prydz Bay, and can be an alternative to tidal gauges using BPG, which has been costly and hard to maintain in Antarctica.