

GPSブイによる海洋潮汐観測

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Ocean tidal observation with GPS buoy

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With the objective of measuring the ocean tide around Lützow-Holmbukka, East Antarctica, we have been developing GPS buoys. In 2005, the first GPS buoy was installed on sea surface at Nishi-no-ura, the shore of East Ongul Island, where the ocean bottom pressure has been regularly observed as tide gauge data at Syowa Station. This GPS buoy consisted of a dual frequency GPS receiver and antenna (Lexon-GGD160T & GrAnt; Javad Inc.), the buoy with a float (Zeni-light buoy Co., Ltd.) and two Pb batteries (12V24Ah). Several continuous ocean tidal observations could be conducted for 5 - 7 days without its maintenance. Aiming to perform the continuous ocean tidal observation for a few months, we modified the GPS buoy and examined its performance in 2008. We applied a hybrid power system which was combination of the electric double layer capacitor (30VA, PowerSystems Co., Ltd.) and the Pb battery (12V24Ah) to a second generation of the GPS buoy and we attached 20W solar panel on its float. The dual frequency GPS receiver and antenna (DL-V3 and GPS-702-GG; NovAtel Inc.) were incorporated into the GPS buoy. This GPS buoy was installed on the offing of Benten Jima which is located on about 20 km distance from Syowa Station, at the end of September, 2008. Due to malfunction of the charging to the Pb battery, the power supply of GPS was maintained by the electric charge and discharge to the capacitor. The 30VA capacity of the capacitor and 20W power generation of the solar panel were too short to perform the continuous GPS measurement. Therefore the ocean tidal observation by the GPS was intermittent. Polar day and fine weather in austral summer enabled the comparatively continuous observation. The instantaneous positions of the GPS buoy which were synchronized with the ocean tide were determined from GPS data obtained during Nov. - Dec., 2008 by adopting the kinematic precise point positioning analysis. The ocean tidal analysis was applied to the time series of the instantaneous GPS position data.

We still continue to improve the GPS buoy. We plan to install the several GPS buoys around Lützow-Holmbukka and to conduct the continuous ocean tidal observations in order to study the geoid and the ocean tide in this area.

第46次南極観測隊で2周波のGPS受信機と鉛蓄電池 (12V24Ah 2個) を搭載したGPSブイ (2周波GPSブイ) を潮位観測に使用して以来、海洋潮汐観測を定期的実施している。2008年には、より長期間連続した潮位観測の実施を目指して、20Wの太陽電池パネルと、鉛蓄電池 (12V24Ah 1個) とキャパシタ (ECaSS 30VA 1個) によるハイブリッド電源システムを搭載したGPSブイ (Fig. 1) を昭和基地から約20km西方にある弁天島沖に設置して潮位観測実験を行った。2008年9月から実験を開始したが、太陽電池パネルから鉛蓄電池への充電が順調に行えず、キャパシタのみによる充放電でGPS受信機を駆動することとなった。そのため、白夜で好天が続いた12月になり、比較的連続で潮位観測が行えた。ここで得たデータをGPS Tools (Takasu, 2006) によるキネマティックPPP解析を進めている。本講演では、解析で得られた海洋潮汐について報告する。現在南極で越冬している第51次隊では、極域の夏期間に長期間連続観測が可能になるように、太陽電池パネルを30Wに増強し、さらにキャパシタ3個で構成する電源システムを搭載したGPSブイで観測実験を進めており、GPSブイの更なる改良を行っている。また、昭和基地周辺の海域 (海水域) に複数台設置した、海面高度、海洋潮汐の観測を計画していきたい。

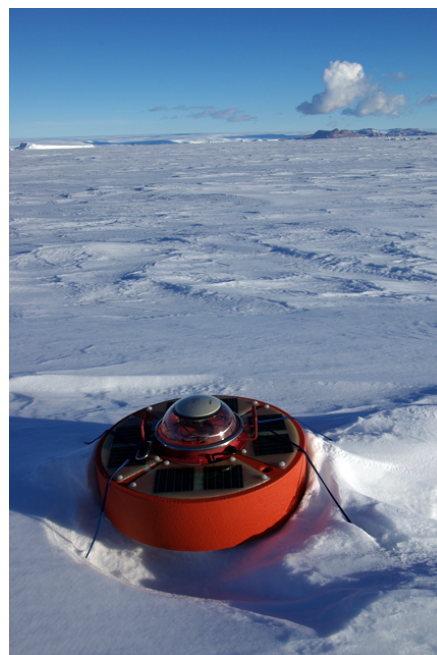


Figure 1. GPS buoy installed near Benten Jima during Sep. - Dec., 2008.