Vertical ice flow motions obtained from year-round GNSS observations on Shirase Glacier, Antarctica

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The Antarctic ice sheet is a huge heat sink acting as a feedback controller for adjusting global warming, so a loss of its mass would cause a great impact on the global climate change. It is valuable to evaluate an Antarctic ice mass balance, which is a consequence of competition between an ice discharge and a snow accumulation. With an objective of estimating the ice discharge around Lützow-Holmbukta, East Antarctica, we have measured three-dimensional (3D) ice flow motions around a grounding line of Shirase Glacier, which is fastest and largest ice stream in Lützow-Holmbukta.

We first performed one-month GPS measurement near the calving front of Shirase Glacier in 2011/2012 austral summer. The three-dimensional position of this site was determined by the kinematic precise point positioning (kPPP) method at every 30 seconds with a 4-5-cm precision for 25 days. From the 30-s interval position, we estimated the ice flow velocity vector, the basal melting rate of the iceberg, and ocean tidal variations (Aoyama et al. 2016). Subsequently, a year-round GNSS measurement system was installed six kilometers downstream from the grounding line of Shirase Glacier at the end of Jan. 2015. By maintaining this year-round system (changing SD card and battery) every austral summer season, we have already obtained a three-years continuous data from Jan. 30, 2015 to Dec. 30, 2017.
We analyzed the time series of the three-dimensional position of this system with kPPP method. The time series revealed the ice flow motion downstream from the grounding line of Shirase Glacier during 2015-2017. Focusing on the vertical motion, there is no remarkable ocean tidal variation. And the obtained vertical flow motion shows gradually descent, then rise, again descent slope. In order to clarify whether such vertical change is local or wide area, we compared with a TanDEM-X 90m DEM (Rizzoli et al., 2017). In the presentation, we will show properties of the ice flow motion downstream the grounding line of Shirase Glacier.

Keywords: year-round GNSS measurements on Shirase Glacier, Unmanned measurement in site where access is difficult

