Snowpack mapping at Syowa Station with UAV photogrammetry

Akihisa Hattori[1], Yuichi Aoyama[1,2] , Koichiro Doi[1,2], Hajime Oishi[3], Jun Nishijima[4] and Hiroshi Ikeda[5], Jun'ichi Okuno[1,2]

[1] *SOKENDAI (The Graduate University for Advanced Studies);*

[2] *National Institute of Polar Research;*

[3] *NEC Networks & System Integration Corporation;*

[4] *Kyushu University;*

[5] *University of Tsukuba*

The Antarctic ice sheet has attracted increasing attention because it is an indicator of the global environmental change and it stores water equivalent to raising sea level by 60m. Gravity Recovery and Climate Experiment (GRACE) mission revealed the ice-sheet mass losses in both polar regions, Greenland and Antarctic. On the other hand, it is also observed the ice sheet in some specific regions grows thicker. In Dronning Maud Land and Enderby Land in East Antarctic, snowfall increase in the last decade, and it is expected to be in positive mass balance.

This local variation of surface mass causes the elastic deformation of the Earth. For example, Aoyama et al., (2016) report that the superconducting gravimeter at Syowa Station captures accumulated snow mass effect. Such displacement due to recent melting or snowfall could be an error source in detecting some long-term and gradual geodetic changes due to Glacial Isostatic Adjustment (GIA).

The purpose of this study is accurate estimation of snow distribution and elastic deformation due to its load by using unmanned aerial vehicle (UAV) with structure from motion (SfM) analysis to correct snow mass effect on the long-term component of crustal movement. We conducted aerial photograph with fixed-wing drone "eBee," which has dual-frequency GNSS receiver, at the Syowa Station in the summer activity of the 59th Japanese Antarctic Research Expedition (JARE59). Besides, we have conducted aerial photograph several times with rotary wing drone "Inspire 2" in the same area during the winter season. We compared some digital elevation models (DEMs) generated with these photos taken at different timings and modeled the snow coverage and depth distribution.

In this presentation, we report the details of observed changes in snow distribution and discuss the elastic deformation caused by them.

References

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