Effect of local snow mass distribution on geodetic observation at Syowa Station with UAV survey

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Syowa Station, located in East Ongul Island, East Antarctica has been conducting various geodetic observations (GNSS, DORIS, VLBI, and superconducting gravimeter observation) for more than 20 years. The continuous data obtained by these geodetic observations are essential to estimate the long-term geodetic variation, such as the glacial isostatic adjustment (GIA) effect caused by the melting of the Antarctic ice sheet since the last glacial maximum. On the other hand, the local snow mass change around the geodetic sites causes the short-term variation (almost annualy). For example, Aoyama et al., (2016) report that the superconducting gravimeter at Syowa Station captures accumulated snow mass effect.

The purpose of this study is to derive the detailed snow mass distribution at Syowa Station from unmanned aerial vehicle (UAV) photographic survey and evaluate the effects of snow mass on those geodetic solutions: elastic deformation, and gravitational force.

We conducted the aerial photographs taken by UAV, "senseFly eBee Plus" and "DJI Inspire 2", around once a month during the 59th Japanese Antarctic Research Expedition (JARE59) activity (2017-2019).The digital elevation models (DEM) and the orthomosaic images were generated from the aerial photographs with the SfM software "Pix4Dmapper." Then, the time-series of snowpack distribution in the survey area was extracted from changes in DEMs. In this presentation, we show the details of observed changes in the snowpack depth distributions, and discuss the comparison between the estimated elastic deformation and gravity effect of local snow accumulation and the geodetic solution derived from each geodetic facility.

In this presentation, we report the details of observed changes in snow depth distribution and discuss the effect on geodetic observations caused by them.

Figure 1.Time series of the estimated gravitaional force of the UAV-derived local snow mass change (orenge line) and gravity changes observed by the superconducting gravemeter OSG#058.