Spatiotemporal variability of surface mass balance along the JARE traverse route for 1992−2018

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Satellite-based observations revealed the recent mass loss of the Antarctic ice sheet, and there is concern about its influence on sea level rise. Although significant mass loss has been reported in the West Antarctica, spatial and temporal variability of surface mass balance (SMB) is poorly understood in the East Antarctica where the ice volume is more than 10 times, due to complexity in snow accumulation in space and time, resulting in relatively large uncertainty to quantify ongoing and future mass loss from the Antarctic ice sheet. Therefore, it is crucial to accurately quantify SMB in East Antarctica. SMB has been measured along the traverse route between coastal area (S16) and the inland Dome Fuji region as a part of the Japanese Antarctic Research Expedition (JARE) since 1992. Net snow accumulation was measured by the stake method at approximately 500 points every 2 km. In this study, we re-evaluate spatial and temporal variability of SMB between S16 and Dome Fuji region during the period of 1992−2018. Uncertainty of the SMB measurements is discussed by the data obtained from stake farms and stake rows along the survey route. Spatiotemporal variability of SMB is discussed with surface slope of the ice sheet as well as wind speed and direction in order to evaluate the influence of surface topography and katabatic wind blowing on the ice sheet surface on snow accumulation.

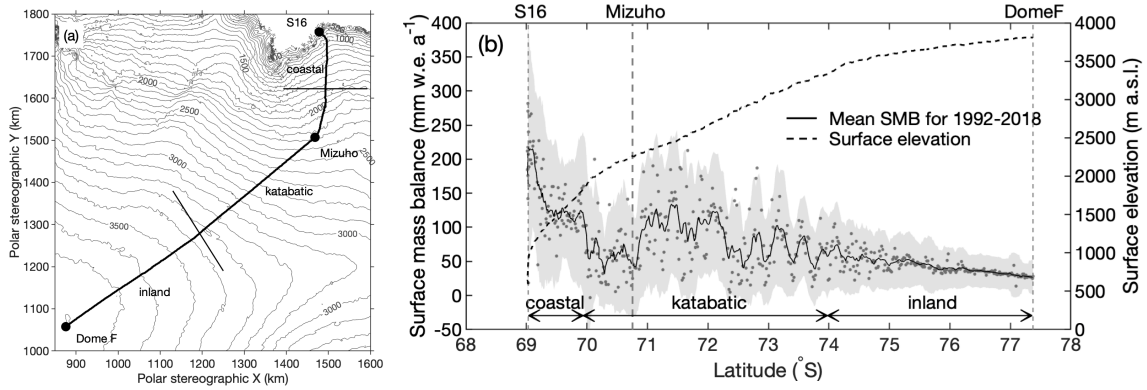

Figure 1. (a) The location of SMB survey points along the traverse route from S16 to Dome Fuji region. The contours indicate surface elevation with intervals of 10 m, based on CryoSat-2 data (Helm et al., 2014). (b) Mean surface mass balance from 1992 to 2018 along the traverse route, with the shaded gray regions denoting the standard deviations. The dashed line indicates surface elevation of ice sheet.

References

Helm, V., A. Humbert and H. Miller, Elevation and elevation change of Greenland and Antarctica derived from CryoSat-2, The Cryosphere, 8, 1539-1559, 2014.