Comparison of Topographic Corrections on Optical Imagery and Snow Albedo Measurements Obtained from a UAV

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Background

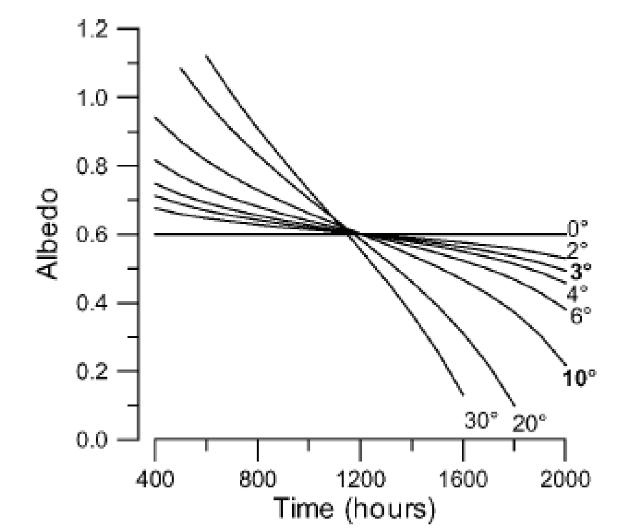


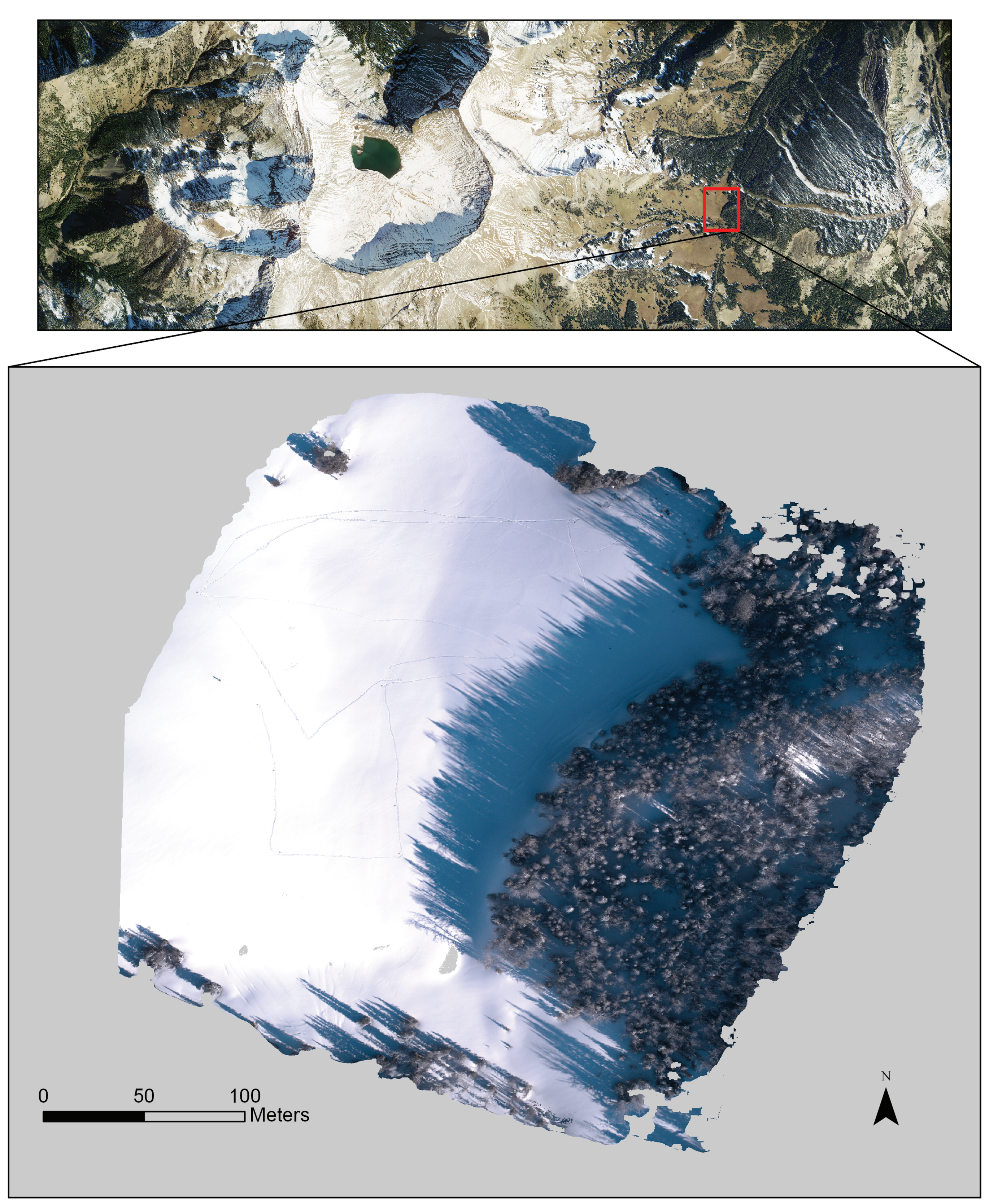
Fig. 2. Apparent albedo resulting from albedo being measured in a horizontal plane over inclined surfaces of different angles. The curves are based on Equation (3) using a true albedo of 0.6, a 90° slope azimuth angle, 22 June, and the position of Storglaciären. Time is local standard time (LST).

Jonsell et al., 2003

- Topography inherently affects albedo measured from radiometers
- UAV-based snow albedo measurements should be corrected for topographic effects if they are to be utilized to validate/calibrate satellite albedo products and models

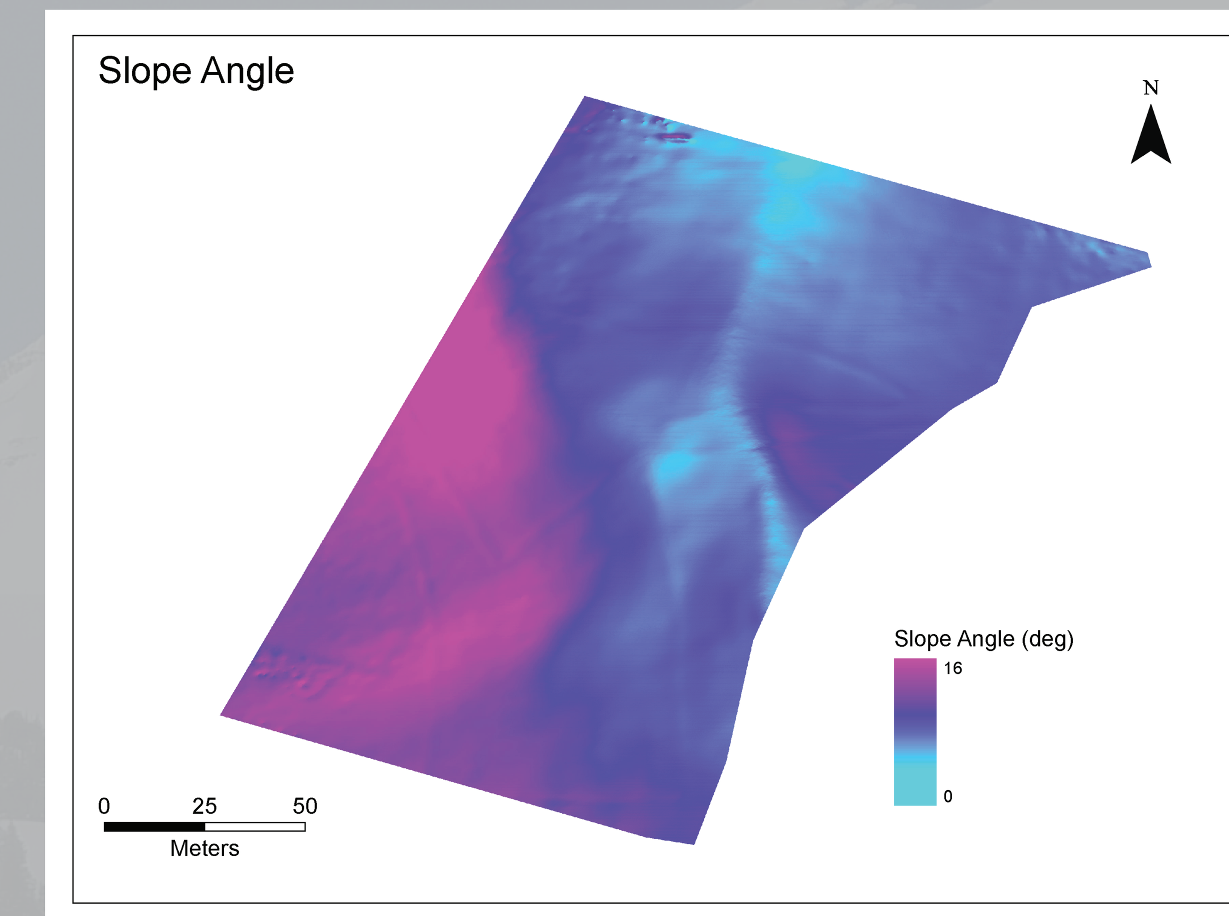
Purpose: To asses the effect of topography on UAV-based snow albedo measurements and compare different topographic correction algorithms

Study Area near Big Sky, MT



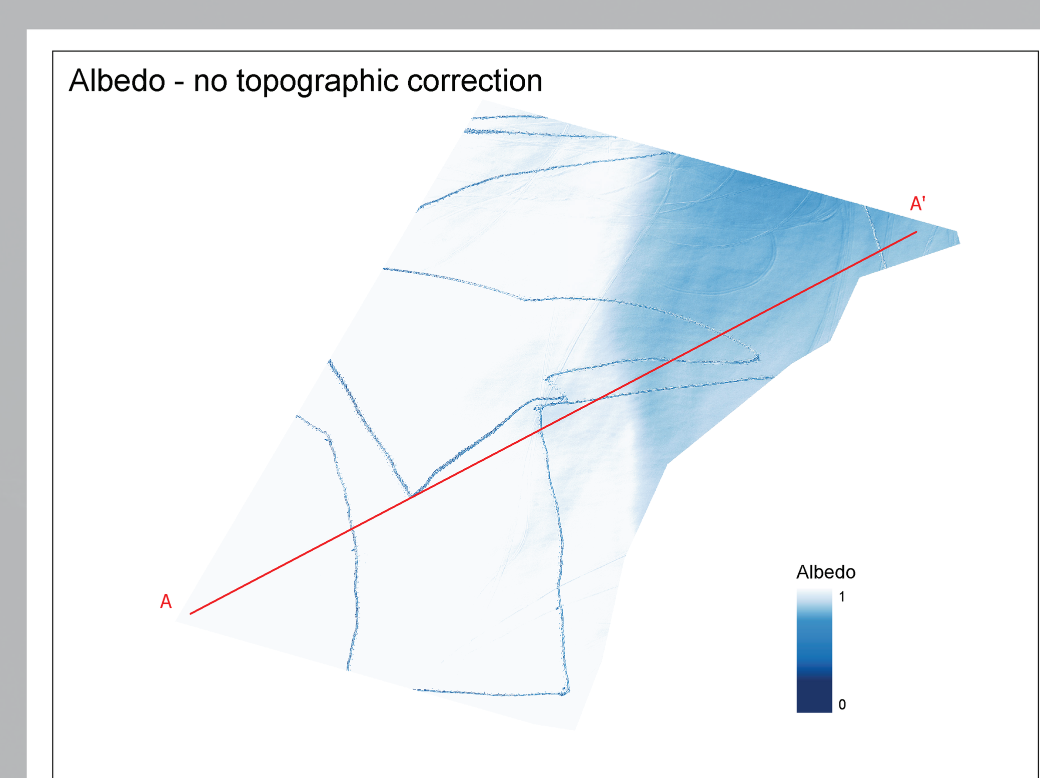
Methods

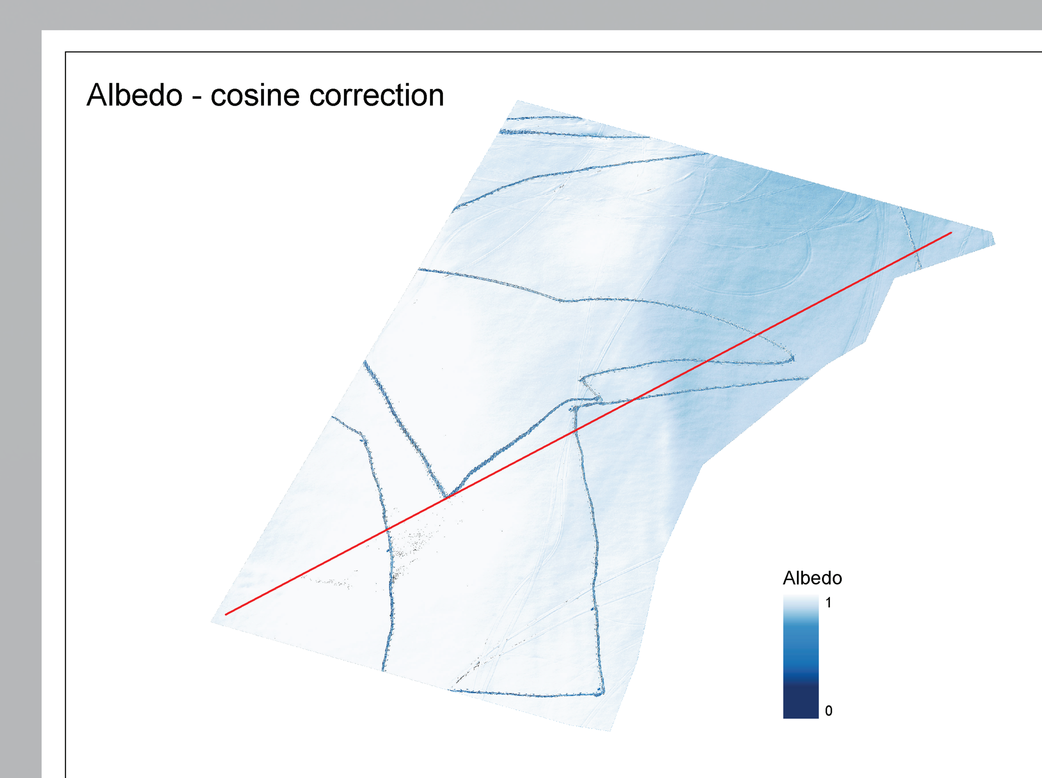
- UAV was flown in lawnmower survey pattern over study area
- Albedo was calculated from ratio of reflected to incoming global broadband shortwave irradiance measured from dual pyranometers
- High resolution albedo was derived using combination of RGB imagery and pyranometer measurements

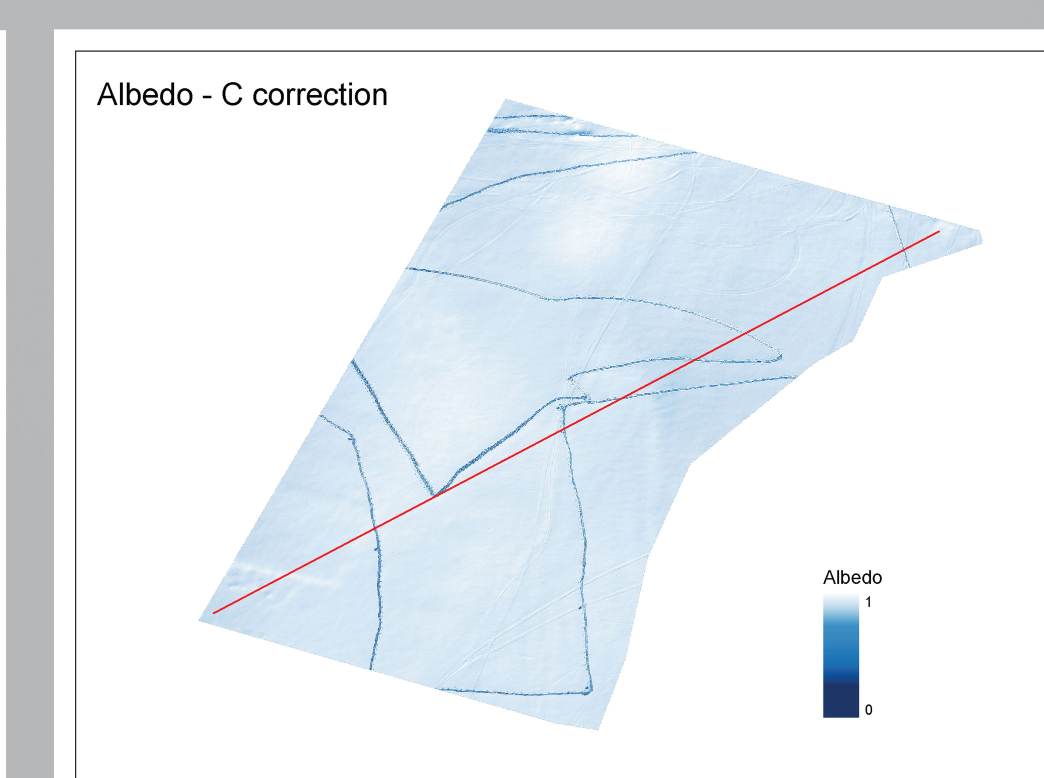


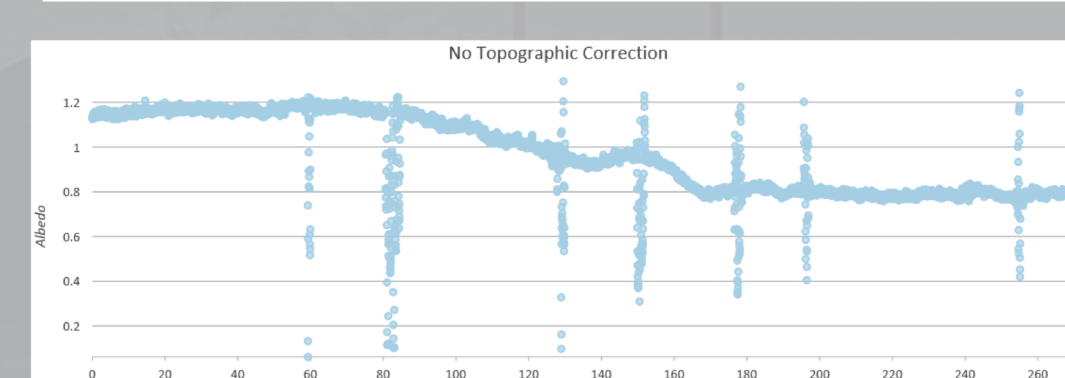
- Structure-from-Motion photogrammetry was used to generate data required for topographic corrections (Agisoft)
- All image preprocessing and corrections were automated with Python
- The 6s radiative transfer model was used to simulate the direct and diffuse proportions of incoming irradiance

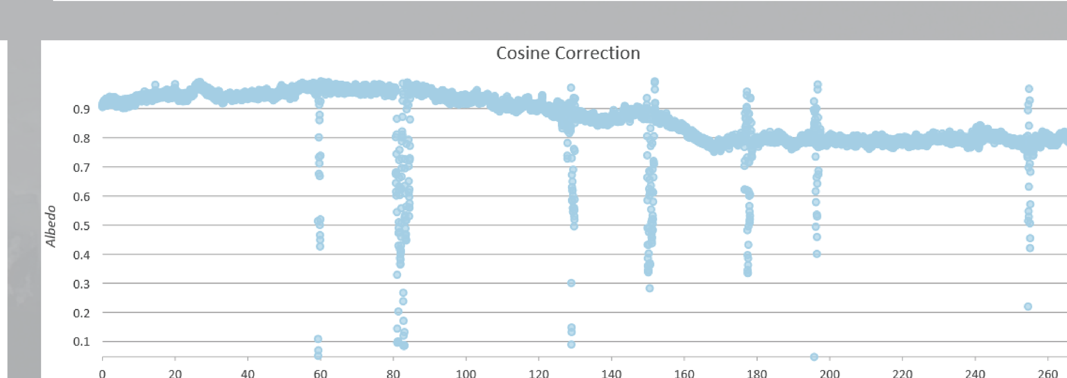
Results

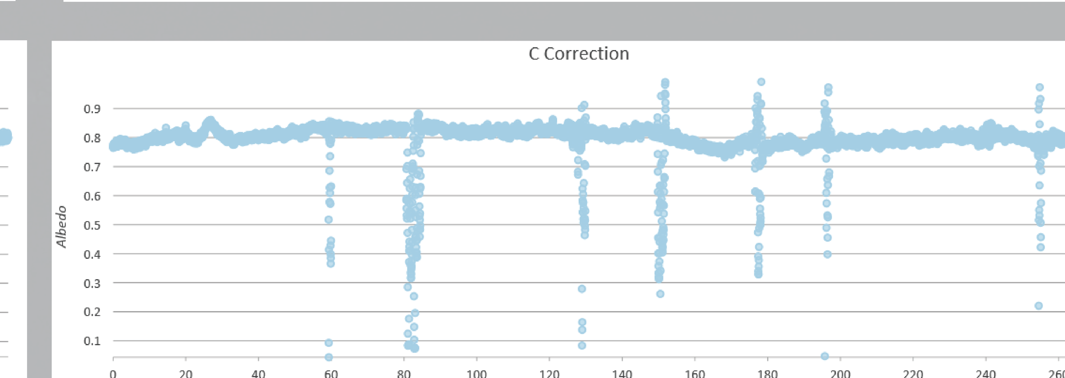












Conclusions and Discussion

- Snow albedo differences across the study site appear to have mainly been due to topography
- The C-correction visibly does a better job at reducing topographic effects than the cosine correction, likely because the C-correction accounts for the diffuse component of incoming irradiance whereas the cosine correction only corrects the direct component
- Further work will be done to validate this correction, especially in the near-infrared portion of the electromagnetic spectrum

Acknowledgments

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Cited literature: Jonsell, U., R. Hock and B. Holmgren. 2003. Spatial and temporal variations in albedo on Storglaciaren, Sweden. Journal of Glaciology. 49(164) 59-68