EGU2020-10677
https://doi.org/10.5194/egusphere-egu2020-10677
EGU General Assembly 2020

Surface lake depths on an Antarctic ice shelf: comparing in-situ measurements with ground and satellite multispectral methods

Ian Willis[1,2], Alison Banwell[1,2], Grant Macdonald[3], Michael Willis[2], and Doug MacAyeal[3]
[1]Scott Polar Research Institute, University of Cambridge, Cambridge, UK (iw102@cam.ac.uk)
[2]CIRES, University of Colorado Boulder, Boulder, CO, USA
[3]Department of Geophysical Sciences, University of Chicago, Chicago, IL, USA

There is growing interest in surface and shallow subsurface water bodies across Antarctic ice shelves as they impact the ice shelf mass balance. Additionally, the filling and draining of lakes has the potential to flex and fracture ice shelves, which may even lead to their catastrophic break up. The study of lakes on ice shelf surfaces typically uses optical satellite imagery to delineate their area and a parameterised physically-based light attenuation theory to calculate their depths. The approach has been developed and validated using various data sets collected on the Greenland Ice Sheet, but so far the approach has not been validated for Antarctic ice shelves. Here we use simultaneous field measurements of lake water depth and surface spectral properties (red, blue, green, panchromatic), to parameterise the light attenuation theory for use during the filling and draining of shallow lakes on the McMurdo Ice Shelf during the 2016/2017 austral summer. We then apply the approach to calculate lake areas, depths and volumes across several water bodies observed in high resolution Worldview imagery, which helps validate the approach to calculating water volumes across a larger part of the ice shelf using Landsat 8 imagery. Results suggest that using parameter values relevant to the Greenland Ice Sheet may bias the calculation of water volumes when applied to Antarctic ice shelves, and we suggest more appropriate values.