EGU21-8103
https://doi.org/10.5194/egusphere-egu21-8103
EGU General Assembly 2021

Cloud effects on surface radiation balance at Helheim and Jakobshavn Glaciers (Greenland) using ground-based observations

Georges Djoumna[1], Sebastian H. Mernild[2], and David Holland[3]
[1]Conseil Scolaire Viamonde, Canada (gdjoumna@gmail.com)
[2]Southern Danish University, The Vice-Chancellor's Office, Odense, Denmark (smernild@gmail.com)
[3]New York University, United States (dmh4@nyu.edu)

The surface radiation budget is an essential component of the total energy exchange between the atmosphere and the Earth's surface. Measurements of radiative fluxes near/on ice surfaces are sparse in the polar regions, including on the Greenland Ice Sheet (GrIS), and the effects of cloud on radiative fluxes are still poorly studied. In this work, we assess the impacts of cloud on radiative fluxes using two metrics: the longwave-equivalent cloudiness, derived from long-wave radiation measurements, and the cloud transmittance factor, obtained from short-wave radiation. The metrics are applied to radiation data from two automatic weather stations located over the bare ground near the ice front of Helheim (HG) and Jakobshavn Isbræ (JI) on the GrIS. Comparisons of meteorological parameters, surface radiation fluxes, and cloud metrics show significant differences between the two sites. The cloud transmittance factor is higher at HG than at JI, and the incoming short-wave radiation in the summer at HG is 50.0 W m−2 larger than at JI. Cloud metrics derived at the two sites reveal a high dependency on the wind direction. The total cloud radiative effect (CREnet) generally increases during melt season at the two stations due to long-wave CRE enhancement by cloud fraction. CREnet decreases from May to June and increases afterward, due to the strengthened short-wave CRE. The annually averaged CREnet were 3.0 ± 7.4 W m-2 and 1.9 ± 15.1 W m−2 at JI and HG. CREnet estimated from AWS indicates that clouds cool the JI and HG during melt season at different rates.