Geophysical Research Abstracts
Vol. 21, EGU2019-17764-1, 2019
EGU General Assembly 2019

Shading by trees controls the sub-canopy radiation available for snow-melt

Johanna Malle (1,2), Nick Rutter (2), Giulia Mazzotti (1), and Tobias Jonas (1)

(1) WSL Institut for snow and avalanche research SLF, Davos, Switzerland, (2) Northumbria University, Newcastle upon Tyne, UK

Radiative processes are substantially altered by the presence of forest canopies, further affecting snow energetics during wintertime. In-situ measurements of sub-canopy radiation can help improve process-scale understanding of these complex interactions, which are needed to further constrain and improve snow melt models. In this study, a custom-made cable car was used to measure incoming and outgoing, shortwave and longwave radiation below an evergreen forest stand. Hemispherical photographs taken concurrently from the cable-car measured view fractions of shaded snow, sunlit snow and bare ground. With this setup it was possible to quantify diurnal and seasonal radiation patterns together with their potential drivers at high spatiotemporal resolution. Measurements were performed between January and May 2018, along a 48m transect in a discontinuous needle-leaf forest in the Swiss Alps. Analysis of diurnal radiation patterns revealed a strong linear relationship (R=0.94) between outgoing shortwave radiation and sunlit-snow view-fraction, highlighting shading as the main control on the sub-canopy short-wave radiation budget. Measurements of outgoing longwave radiation were strongly controlled by the snow cover extent, with locations of diminished snow cover showing an increase in outgoing longwave radiation of up to 60 W m-2. The sub-canopy radiation budget was shown to be dominated by shortwave radiation when surrounding canopy structure and the position of the sun allowed for direct insolation of the forest floor, but longwave radiation was the dominating component in the absence of direct insolation. Accounting for the effects of shading and fractional snow cover on the sub-canopy radiation budget is a way forward to advance snow melt models suitable for forested environments.