Geophysical Research Abstracts
Vol. 19, EGU2017-11884-1, 2017
EGU General Assembly 2017

Ground-based and airborne thermal imagery of 2D and 3D forest structure for estimating sub-canopy longwave radiation during snowmelt

Clare Webster (1,2), Matt Westoby (1), Nick Rutter (1), Stuart Dunning (3), and Tobias Jonas (2)

(1) Department of Geography, Northumbria University, Newcastle upon Tyne, UK, (2) WSL Institute for Snow and Avalanche Research SLF, Davos, Switzerland, (3) School of Geography, Politics and Sociology, Newcastle University, Newcastle upon Tyne, UK

The radiation budget at the snow surface is often the main driver of spring snowmelt in forested environments. The shading, absorption and emission of radiation by vegetation cause significant spatial and temporal variation of emitted longwave radiation to the snow surface. This variability is markedly different from adjacent unforested areas and is largely influenced by the canopy temperature. Improvements in estimating the incoming longwave radiation component of the forest energy budget have been developed using direct measurements of canopy surface temperatures, however these methods are impractical for modelling beyond the tree trunk scale. As an alternative method, this study presents ground-based and airborne infrared thermal imagery collected at a discontinuous forest site near Davos in Switzerland during the 2015 and 2016 snowmelt seasons. Repeat imagery demonstrates changes in spatial distributions of forest temperatures that are consistent with canopy warming from direct solar radiation. In shaded areas, average canopy temperature increased with increasing height, reaching air temperature close to the top of the canopy. These vertical profiles reflect the increased exposure to solar radiation at the top of the canopy and increased shading in the lower areas of the canopy. In contrast, sun-lit edges of the canopy were shown to be consistently warmer than air temperature throughout the vertical profile. Improvements in the accuracy of modelling the sub-canopy longwave radiation flux to the snow surface are therefore most important in sun-exposed areas of the canopy during sunny and clear sky periods.