Submitted Abstract

ID IMC22-FSAbstr- 400

First Author	
First Name	Michael (1,2)
Last Name	Haugeneder
Submitting Author	
First Name	Michael
Last Name	Haugeneder
Correspondence	michael.haugeneder@slf.ch
Co-Authors >> E-Mails will be not listed	Lehning, Michael (1,2); Jonas, Tobias (1); Mott, Rebecca (1)
Organisations	1: WSL-Institut für Schnee- und Lawinenforschung SLF, Switzerland 2: School of Architecture, Civil and Environmental Engineering, École Polytechnique Fédérale de Lausanne, Switzerland
Country	Switzerland

Region	Western Europe
Title	Quantifying Heat Exchange Processes Over A Patchy Snow Cover With Data From A Comprehensive Field Campaign.
Keywords	Snow-Atmosphere Interaction, Patchy Snow Cover, Lateral Heat Advection, Snow Melt, Eddy Covariance
Type	List Of Focus Session
Focus Session ID	09

Abstract

Snow-atmosphere interactions drive the mass and energy balance of the snow pack throughout the whole snow season. In late spring, when the snow cover gets patchy, the extreme surface heterogeneity induces complex atmospheric processes as the lateral advection of heat or the development of thin stable internal boundary layers (SIBL) over the leading edge of snow patches. We aim at a better understanding of these near-surface atmospheric processes.

Therefore, we conducted a comprehensive field campaign at an alpine research site. We measured meteorological parameters, snow ablation patterns, and turbulence characteristics using eddy-covariance sensors. Additionally, we applied a novel experimental method. A high resolution thermal infrared camera records a 30Hz sequence of infrared frames. The camera points at vertically deployed thin, synthetic screens. The screens cover a horizontal distance of 6m across the transition from bare ground to snow. The surface temperature of the screens serves as a proxy for local air temperature. The recorded air temperature fields capture the dynamics of turbulent eddies adjacent to the surface depending on different parameters such as wind speed or the snow coverage. A thin SIBL develops above the leading edge of a snow patch possibly protecting the snow surface from warmer air above. However, sometimes the warm air entrains into the SIBL and reaches down to the snow surface adding further energy to the snow pack.

To quantify exchange processes from observed spatio-temporal dynamics, we developed a method to estimate a near-surface 2D wind field from tracking temperature pattern on the screens. Resulting vertical profiles of air temperature, horizontal and vertical wind speeds can be evaluated with a high spatial (0.01m) and temporal (30Hz) resolution.

Combining the screen measurements with data from eddy-covariance sensors enables us to gain an extensive overview of the (sub)meter scale heat exchange processes. For example, we can investigate the influence of laterally advected heat on vertical turbulent sensible heat fluxes within the atmospheric layer adjacent to the surface.

Furthermore, using terrestrial laser scanning and UAV imaginary we can connect small scale heat exchange processes to ablation rates and pattern over a few hectares.

With the data we aim to better understand and quantify small scale energy transfer processes over patchy snow covers and their dependency on the atmospheric conditions. This will ultimately allow to improve parameterizations of these processes in coarser resolution snow melt models.