Geophysical Research Abstracts,
Vol. 11, EGU2009-11901, 2009
EGU General Assembly 2009

Predicting snowpack stratigraphy in forested environments

K. M. Andreadis and D. P. Lettenmaier

University of Washington, Civil and Environmental Engineering, Seattle, WA, United States (kostas@hydro.washington.edu)

The interaction of forest canopies with snow accumulation and ablation processes is critical to the hydrology of many mid- and high-latitude areas. The layered character of snowpacks increases the complexity of representing these processes and deconvolving the return signal from remote sensors. However, it offers the opportunity to infer the metamorphic signature of the snowpack and to extract additional information by combining multiple frequencies (visible and passive/active microwave). Implementation of this approach requires knowledge of the stratigraphy of snowpack microphysical properties (temperature, density, and grain size), which as a practical matter can only be produced by predictive models. A mass and energy balance model for snow accumulation and ablation processes in forested environments was developed utilizing extensive measurements of snow interception and release in a maritime mountainous site in Oregon. A multiple layer component was added to the model that also takes into account snowpack stratigraphy resulting from snow densification, vapor transport and grain growth. The model, was evaluated using two years of weighing lysimeter data and was able to reproduce the SWE evolution throughout both winters beneath the canopy as well as the nearby clearing. The model was also evaluated using measurements from a BOReal Ecosystem-Atmosphere Study (BOREAS) field site in Canada to test the robustness of the canopy snow interception algorithm in a much different climate. Simulated SWE was relatively close to the observations for the forested sites, with discrepancies evident in some cases. Although the model formulation appeared robust for both types of climates, sensitivity to parameters such as snow roughness length, maximum interception capacity and number of layers suggested the magnitude of improvements of SWE simulations that might be achieved by calibration. Finally, the model's ability to replicate large-scale snowpack layer features and their effect on passive microwave emissivity was evaluated using observations from the Cold Land Processes Experiment (CLPX).