

Snow Interception Processes and Prediction in a Windswept Subalpine Environment

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There is a need for reliable models of snow redistribution by forest and wind to estimate snow accumulation in mountain forests. Existing hydrological models utilize snow interception parameterizations which are based on a particular climate and do not contain a comprehensive representation of forest-snow processes. The objective of this research is to evaluate whether existing theories of snow interception are suitable for subalpine forests. This is achieved by investigating in-situ observations of how snowfall is partitioned from the canopy to the ground by unloading and/or drip or back to the atmosphere by sublimation. Snow interception was quantified using a weighed tree lysimeter, the difference between open and forested snow water equivalent (SWE) from station instruments, manual snow surveys and airborne laser scanning (lidar)-derived snow depth. Unloading and melt of intercepted snow was measured using sub-canopy snowfall lysimeters, tipping bucket rain gauges, and time-lapse cameras. Sublimation of intercepted snow was measured using eddy covariance systems located above and below the forest canopy. Examination of these measurements reveal processes that are not currently incorporated or are misrepresented in existing parameterizations. For example, strong winds diminish snow interception efficiency and redistribute snow under the canopy. Air temperature has little influence on initial snow interception but exerts a strong control on subsequent unloading of intercepted snow. The amount of snow intercepted in the canopy during individual storms events also exceeds the limit predicted by existing parameterizations. These results provide insights to develop snow hydrology models that are appropriate for mountain forests.