A new snow-vegetation interaction extension for the Water Balance Simulation Model (WaSiM)

Kristian Förster (1,2), Gertraud Meißl (1), Thomas Marke (1), Stefan Pohl (3,1), Jakob Garvelmann (4), Jörg Schulla (5), and Ulrich Strasser (1)

(1) Institute of Geography, University of Innsbruck, Austria (kristian.foerster@uibk.ac.at), (2) alpS - Centre for Climate Change Adaptation, Innsbruck, Austria, (3) Hydrology Department, University of Freiburg, Germany, (4) Institute of Meteorology and Climate Research (IMK-IFU), Karlsruhe Institute of Technology (KIT), Garmisch-Partenkirchen, Germany, (5) Hydrology Software Consulting J. Schulla (HSC), Zurich, Switzerland

The water balance in forested mountainous catchments is strongly influenced by the interaction of snow and vegetation. Especially coniferous forest canopies have a large storage capacity for snow, exceeding the one for rain by one order of magnitude. The snow intercepted by the trees is exposed to increased turbulence. Hence, the sublimation of intercepted snow can amount to a significant fraction of total precipitation and therefore represents an important component of the water balance in forested environments.

The current version of the Water Balance Simulation Model (WaSiM 9.09.01) has been extended to consider snow hydrological processes in forest canopies with:
(i) modified micro-meteorological conditions in the forest canopy,
(ii) snow interception, melt unload, and sublimation of intercepted snow, and
(iii) energy balance snowmelt computation on the ground, considering the modified micro-meteorological conditions.

The study presents a detailed description of the new snow-vegetation extension in WaSiM. Internal state variables of the model have been compared to inside-forest measurements (meteorological variables and snow cover dynamics) from a low-cost sensor network established in the 9.2 km^2 large alpine catchment of the Brixenbach, Tyrol/Austria. Results show the improvements achieved with the extended model version for forested areas in temperate mountain environments subject to seasonal snow cover.