Geophysical Research Abstracts
Vol. 15, EGU2013-9796, 2013
EGU General Assembly 2013

Monitoring the spatial and temporal variability of snow cover properties using a network of standalone sensors and time lapse cameras

Stefan Pohl, Jakob Garvelmann, and Markus Weiler
University of Freiburg, Institute of Hydrology, Freiburg, Germany (stefan.pohl@hydrology.uni-freiburg.de)

Seasonal snowcovers play a critical role for many hydrologic and climate processes including flood forecasting, water resource managing, and energy exchange between the land surface and the atmosphere. The large spatial variability of the snow cover and the associated meteorological conditions governing its accumulation and ablation make it particularly difficult to monitor and model these snow covers adequately.

This study presents an approach of continuously monitoring the spatial variability of the most important snow cover characteristics and climate factors by using a network of numerous low cost, yet accurate, standalone snow monitoring stations delivering highly distributed data on snow cover and climate conditions. Data collected by the sensors include: snowdepth, air temperature and humidity, total precipitation, global radiation, wind speed, and snow surface temperature. A total of 99 sensors were placed at multiple locations within three study basins to cover a wide range of slope elevations, angles, expositions and vegetation in a stratified sampling design. Additionally, 45 time-lapse cameras provided continuous information on canopy snow interception, the state of precipitation, snowdepth and snow albedo. The study was carried out in the Black Forest region of southern Germany, a mid-elevation, moderate climate and heavily forested mountain region

The results showed that even for a mid-elevation mountain range the differences in snow water equivalent (SWE) introduced by the topography and the land cover were substantial. An analysis revealed that for the spatial distribution of the SWE, elevation and vegetation were the most important factors explaining 77% of the spatial variability. Exposure seemed to be important only for open non-forested locations. The continuous nature of the observations also made it possible to determine that the strength of the elevation SWE relationship increased in accumulation periods while dropping during melt periods. The results of this study are aimed at improving the understanding of the processes governing the spatial distribution of snow and therefore improving the interpolation schemes used in many snowmelt models to distribute point snow observations over a model domain.

The time lapse photographs furthermore provide a more detailed picture of snow interception in the forest canopies. Especially the removal of intercepted snow from the canopy is often a difficult issue in snowmelt models. The analysis of the hourly photographs along with the respective accompanying climate observations can provide a much clearer picture of this process and could lead to improved model routines for canopy snow interception.