



The application of time-lapse photography for the observation of snow processes in mountainous catchments

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For the forecast of snowmelt flood events in mountainous catchments it is very important to know the spatial distribution and temporal evolution of the snowcover. Topography and vegetation have the most important influence on the spatio-temporal variability of the snowcover. In order to accomplish a continuous observation of the quantity and the status of the snowcover, an extensive measurement network consisting of numerous standalone snow and meteorological sensors and time-lapse photography was established in three catchments in the Black Forest, a typical mid latitude medium elevation mountain range. Catchments with different topographic characteristic and areal extent were specifically chosen for this study. Within the catchments, a stratified sampling design was used to cover a wide range of altitudes and exposures. In order to investigate the influence of a vegetation cover on the snow processes beneath sensors and cameras have been installed under the forest canopy and on adjacent open field sites, respectively.

In the presented study the application of spatially distributed time-lapse cameras for the observation of snow processes and snowcover properties at the catchment scale will be discussed. Image analysis software was applied to extract information about snowdepth, snow albedo and canopy interception from the digital images. A measurement scale with a black/white board was installed in the focus of every camera to allow a determination of the snowdepth at every camera location while the black/white board was used to provide a white balance for the albedo estimation. The albedo provides important information about the status of the snowcover and its temporal evolution is a crucial factor for the snowmelt energy balance. Furthermore the time-lapse images provided a continuous observation of the forest canopy allowing the estimation of the interception efficiency and the temporal evolution of the snow interception for different topographic situations with variable canopy densities. The state of the precipitation as well as information about the snow covered area could also be extracted from the digital images of the used time-lapse cameras. The obtained data was compared with snowdepth and meteorological measurements of existing weather stations and the installed standalone sensors. Study results prove that the application of digital time-lapse photography is an appropriate technique to observe the spatial distribution of key aspects of seasonal snowcovers in a mountainous environment.