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Hillslope-scale hydrological and snow cover dynamics derived from a wireless soil moisture and temperature monitoring network and time-lapse digital photography

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In mountainous catchments, snowmelt may be an important component of the water balance. We apply data from a wireless soil moisture and temperature monitoring network in combination with time-lapse digital photographs from a hillslope in the Schäfertal catchment, Lower Harz Mountains, to investigate interactions between hillslope-scale snow cover, soil moisture and soil temperature. The time series of digital photographs is evaluated using an automatic algorithm that estimates snow height at the position of several snow stakes placed along the hillslope using the green value of the RGB color cube. Inferred snow heights are applied to interpret near-subsurface soil moisture and soil temperature dynamics from the same time period including snow accumulation and melt. The combination of time-lapse digital photography, soil moisture and soil temperature monitoring clearly shows the strong influence of the snow cover on subsurface soil moisture and soil temperature dynamics. The shallow snow cover has a strong insulating effect on near-subsurface soil temperatures keeping the soil unfrozen even at air temperatures reaching down to less than -10 °C. The time-lapse photographs, soil moisture and soil temperature observations also show the different snowmelt behavior of the north- and south-exposed slopes. These observations are important information for future modelling of hillslope and catchment-scale hydrological dynamics.