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Application of a distributed snow model for the assessment of past snow cover changes in Austria

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Snow depth and snow cover duration in mountain regions are subject to high spatial and temporal variability. Information on this natural variability and climate change induced modifications in snow conditions is a prerequisite for science and stakeholders to understand past and present snow conditions, but also for the interpretation of future snow projections. While instrumental time series of the relevant meteorological and snow cover variables are essential for climate studies, only few long-term climate and snow observation time series are available, and their spatial representativity is strongly limited.
This study applies the hydroclimatological model AMUNDSEN to improve the spatial density of snow information in Austria by continuously simulating daily snow accumulation and ablation at a spatial resolution of 1 x 1 km for all of Austria and the period 1948–2009. The model is driven with homogenized and quality-checked meteorological station observations of daily temperature (minimum and maximum) and precipitation. Model output comprises daily maps of snow water equivalent, snow depth, and freshly fallen snow. Following a thorough validation of the snow model through comparison of simulations to snow observations (point scale) as well as to remotely sensed snow cover patterns, changes in the Austrian snow cover are elaborated and presented in this study. Beside the illustration of changes in the spatial distribution of snow in Austria for the 1 x 1 km raster, temporal trends are elaborated by statistical analyses of mean snow cover change for different elevation ranges providing more detailed insights in the temporal variability and changes in snow cover conditions.