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Dynamical properties of the spatial distribution of snow

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Abstract. A simulation exercise has been performed to study the temporal development of snow covered area and the spatial distribution of snow-water equivalent (SWE). Special consideration has been paid to how the properties of the spatial statistical distribution of SWE change as a response to accumulation and ablation events. A distributed rainfall-runoff model at resolution 1 x 1 km^2 has been run with time series of precipitation and temperature fields of the same spatial resolution derived from the atmospheric model HIRLAM. The precipitation fields are disaggregated and the temperature fields are interpolated. Time series of the spatial distribution of snow-water equivalent and snow-covered area for three seasons for a catchment in Norway is generated. The catchment is of size 3085 km^2 and two rectangular sub-areas of 484 km^2 are located within the larger catchment. The results show that the shape of the spatial distribution of SWE for all three areas changes during winter. The distribution is very skewed at the start of the accumulation season but then the skew decreases and, as the ablation season sets in, the spatial distribution again becomes more skewed with a maximum near the end of the ablation season. For one of the sub-areas, a consistently more skewed distribution of SWE is found, related to higher variability in precipitation. This indicates that observed differences in the spatial distribution of snow between alpine and forested areas can result from differences in the spatial variability of precipitation. The results obtained from the simulation exercise are consistent with modelling the spatial distribution of SWE as summations of a gamma distributed variable.

Keywords: Snow, SWE, spatial distribution, simulated hydrometeorological fields

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