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Estimating the spatial variability of SWE

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A major cause of severe flooding in Norway is the combination of intense snowmelt and precipitation. In order to be able to forecast these flooding events, we need a reliable forecast of precipitation and temperature, and a good estimate of the snow reservoir and its coverage in the catchment at the time of forecast. The dynamics of runoff due to snow melt is very dependent on the evolution of snow free areas, which, again is closely linked to the spatial distribution of snow water equivalent (SWE). The mean and the variance of the spatial field of accumulated SWE are estimated by considering accumulated SWE as a sum of correlated, gamma distributed variables. The sum consists of a number of unit events of snowfall, of which each are gamma distributed with shape parameter ν_0 and scale parameterα_0. The covariance between units is assumed to be proportional to the variance of the units. The spatial distribution of SWE is then modelled as a sum (number of events) of uncorrelated gamma distributed variables, where the new set of parameters are dependent on ν_0 and α_0, the number of events and covariance. The variance of the spatial field of SWE after additional snow fall- or melting events can be estimated by considering the covariance matrix of partly uncorrelated and correlated variables, and new sets of parameters can be determined for representing the spatial distribution of SWE as a sum of uncorrelated gamma distributed variables. Spatial mean and variance from snow course data sampled weekly, or every second week at the same location throughout an entire snow season have been used to verify the method. Close agreements are found between estimated and observed spatial mean and variance of SWE.