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Evaluating the performance of a distributed snow model with varying degrees of complexity and spatio-temporal resolution

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Over the last two decades many empirical and physically based models have been developed to predict the seasonal evolution of the snow cover on the ground. Multimodel frameworks support investigations of the performance of snow models with varying complexity, as well as the uncertainty and availability of forcing data propagating through those models at the point-scale. In this study, the combination of the spatially distributed hydroclimatological model AMUNDSEN and the 1-D factorial snowpack model (FSM) allows us to explore the interaction of snow model complexity and forcing data characteristics in a spatially distributed manner. An ensemble of snowpack simulations, varying in snowpack process representation, spatio-temporal resolution (50m-1km, 1h-3h) and forcing data estimation and regionalization, was generated for the catchment of the Rofenache (98km^2, Ötztal Alps, Austria) for two consecutive winter seasons. The multilevel validation of 2304 model ensemble members using MODIS snow cover maps, airborne laser scans, discharge observations and point-scale snow depth measurements helps (i) to identify the most influential model choices and (ii) to better understand the requirements of snow model complexity for various resolutions and forcing data sets.