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Simulation of snow and ice melt discharge into the Gepatsch reservoir (Kaunertal/Austrian Alps)

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We present an enhanced method to simulate snow and ice melt discharge into an Alpine reservoir (Gepatsch reservoir, Ötztal Alps, Tyrol/Austria) by combining a process based snow model with sophisticated data assimilation techniques.
Within the frame of the alpS project MUSICALS (MUltiscale Snow/ICemelt Discharge Simulation into ALpine ReservoirS), snow cover distribution is analysed based on a set of high-resolution surface elevation datasets acquired from airborne laserscan (ALS) flights over the entire catchments (approx. 580 km^2, 23% glacierized) contributing directly or by diversion to discharge into the Gepatsch reservoir.
The resulting maps of spatially distributed snow water equivalent (SWE) are compared to SWE maps produced by the snow model AMUNDSEN, a distributed physically based energy balance model specifically designed for high mountain regions. AMUNDSEN distinguishes between different types of snow and ice (new snow, old snow, firn and glacier ice) and accounts for their distinct properties. The initial ice thickness distribution is modeled based on digital elevation models and glacier outlines from the Austrian glacier inventory. This is required to account for changing runoff generated from glacier melt under conditions of glacier retreat.
Discharge generation from calculated meltwater production and precipitation is simulated in AMUNDSEN using a linear reservoir model with five parallel reservoir cascades considering the distinct storage properties of snow, firn, ice, unglacierized areas and soil. Calibration of the recession coefficients is done separately for each subcatchment.
MUSICALS aims to model discharge generated by spatially differentiated snow and ice melt more realistically and to develop a robust simulation tool that is able to calculate short-, middle- and long-term forecasts of reservoir inflow based on weather predictions and climate scenarios.