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MUSICALS - (MUltiscale Snow/ICemelt Discharge Simulation into ALpine ReservoirS): Validation of a method to estimate ice volume and ice thickness distribution in the Ötztal Alps, Tyrol, Austria

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The spatial and temporal variability of snow cover and glacier distribution has a significant impact on streamflow in Alpine headwatersheds. Regional effects of global climate change like changes in precipitation regimes, reduced snow cover duration and ongoing glacier retreat severely affect melt water contribution to total runoff. In Alpine regions, where stream flow is often used for energy production by means of hydropower plants, the assessment of snow and ice water resources under current and potential future climate conditions are of particular importance in order to optimize the operation of Alpine reservoirs.
The aim of the project MUSICALS is to simulate the contribution of snow and ice melt to river discharge in Alpine catchments (Ötztal Alps, Austria) as well as to perform short-, middle- and longterm forecasts based on weather predictions and climate scenarios. To achieve these goals, profound knowledge on present-day land surface conditions is required to initialize the applied snow model AMUNDSEN (e.g. data on glacier distributions and glacier thickness). Moreover, techniques have to be developed that allow the conditions at the land surface to react on changing climate conditions.
Data on glacier distribution and glacier retreat is readily available for Austria as a result of glacier inventories carried out in the years 1969, 1997 and 2006. However, little is known about the total ice volume and ice-thickness distributions for Austrian glaciers. Here, todays knowledge is restricted to a small number of glaciers in Austria, as existing methods to measure these parameters (e.g. Ground Penetrating Radar) are expensive and time consuming. The approach presented in our poster contribution estimates spatial distributions of glacier thickness and total ice volume based on glacier mass turnover and principles of ice-flow mechanics. Overall, 16 glaciers in the study region of the Ötztal Alps were used to validate this method. Modelled ice thickness of each glacier for 1997 is compared to thickness data from GPR measurements. Moreover the volume differences derived from glacier inventories, are compared with the modelled volume difference of the same time period.