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Embedded grid-modelling of 506 glaciers in the upper Danube basin

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DANUBIA is a Global Change Decision Support System which is able to simulate the water balance and the interaction between surface and atmosphere on a 1 km x 1 km grid, covering 77´000 $km^2$of the upper Danube basin including the partly glaciated Inn river basin. Climate change scenario simulations are performed for periods from a decade up to a hundred year horizon, based on predictions from various sources which are used as model input.

506 individual glaciers exist inside the basin (in 2006), 92 % of which fall below the nominal spatial resolution of the model grid. To get reliable information on the gradual change of thickness and area of a particular glacier, the physically based calculation of the mass change caused by accumulation, ablation and ice movement has to be done on a sub-grid scale. The modelling concept is related to the real resources of ice within the entire basin by using data of the height distribution of glacier areas and the local ice depths, provided by (a) new glacier inventories of Austria and Switzerland, (b) additional ice depth measurements using radio echo sounding and (c) conclusions of analogy. The data base is continuously extended with additional measurements.

The subgrid glacier model was initially tested using the practical and performant modelling framework ESCIMO for local points: the validation studies for well investigated glaciers such as Schneeferner (Germany) or Vernagtferner (Austria) show that modelled local ice thicknesses are very close to the observations. Therefore the model is

suitable to calculate the evolution of mass distribution of most of the types of glaciers which can be found in the upper Danube basin. An Interpretation of the model result in combination with an accurate ice thickness map provides very detailed information about a glacier's shape in a changing climate in the future.