MODELING OF THE WATER BALANCE IN THE BERCHTESGADEN NATIONAL PARK

Nationalpark Berchtesgaden

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Introduction

Within the research activities of the Berchtesgaden National Park, great efforts are being made to capture the biological processes and their reaction to a changing climate system. The availability and distribution of water is the basis for the entire ecosystem and future changes of the regional water cycle will have a huge impact on many other processes. The regional water balance is not well understood in many details because of its high complexity and the consequently high variability in space and time. In the framework of two collaborative projects the deterministic **hydrological model WaSiM-ETH will be implemented in the Berchtesgaden National Park to describe the water balance**. The hydrology in this high alpine region is highly affected by the dynamics of the snow cover and the hydrogeological processes. Therefore the projects focus on the two important storage elements of the water balance, **the snow cover and groundwater.**

Methodology

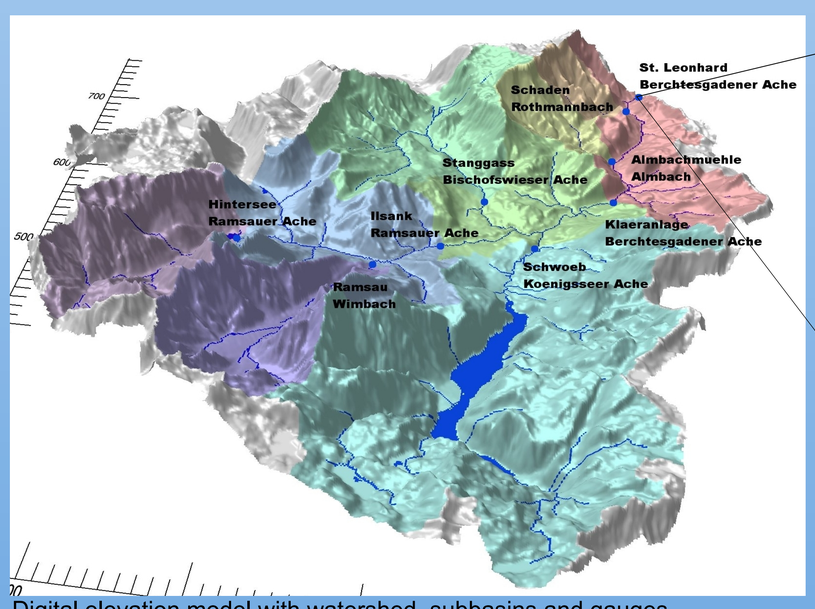
Study area and observation data

The study area covers 432 km². To reproduce the hydrological processes in this complex high alpine terrain, the calculations are performed with a spatial resolution of 50 x 50 m² and a model time step of one hour. With a dense climate station network, comprising 41 stations and data series beginning in 1999, a laser scanned digital elevation model and classifications of soil and land use data, a model environment with high resolution in time and space has been established. Based on the available gauges, the area was divided into 9 subbasins.

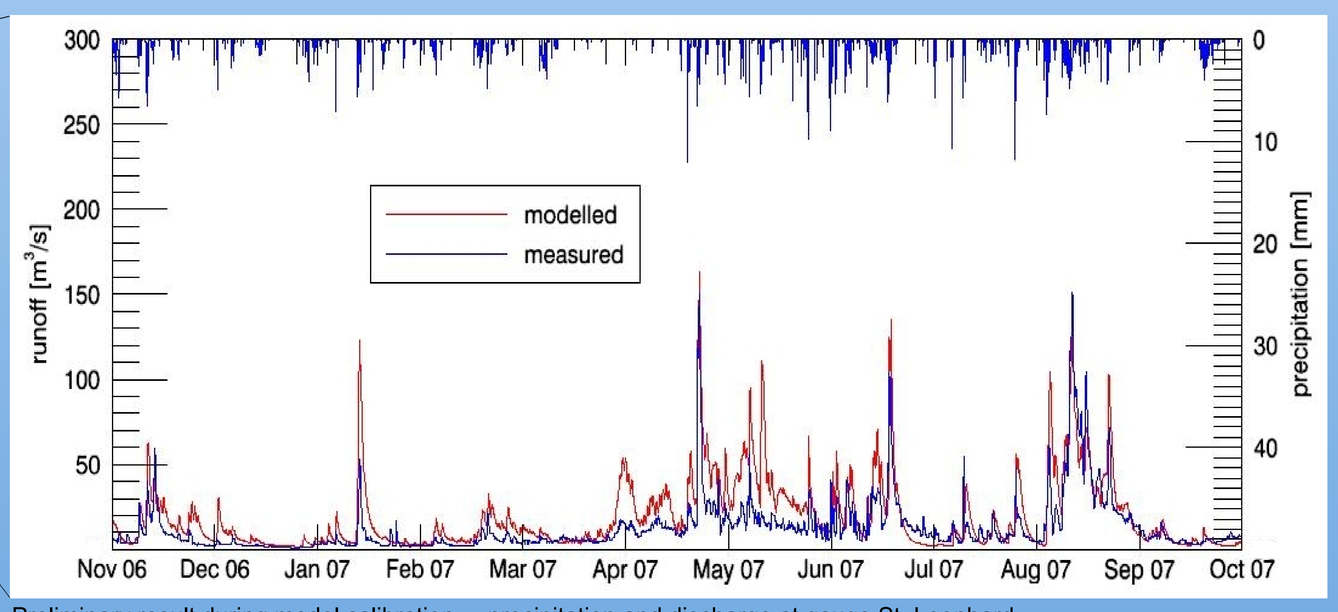
Study area: Berchtesgaden National Park

Hydrological Model

WaSiM-ETH (www.wasim.ch) is a grid-based **Wa**ter Flow and Balance **Si**mulation **M**odel. It is a tool for investigating the spatial and temporal variability of hydrological processes in complex river basins. The model system describes the water fluxes on the surface, in the single soil layers and within the saturated zone.



Digital elevation model with watershed, subbasins and gauges



Preliminary result during model calibration – precipitation and discharge at gauge St. Leonhard

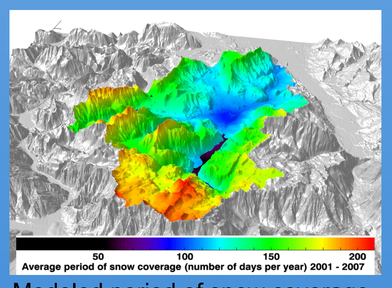
Focus of the projects

Snow dynamics

The integration of the high alpine specific snow model AMUNDSEN is supposed to improve the simulation of the snow cover within the hydrological model.

The new approach simulates snow accumulation and melt by calculating the energy balance of the snow cover and considers lateral snow transport.

The modeled results will be validated with measurements of snow water equivalent whereas the spatial extent of the simulated snow cover will be compared to remote sensing data.



Modeled period of snow coverage (WaSiM - day-degree approach)

Groundwater

Karst aquifers lead either to increased subsurface flow velocities or to subsurface water storage. The aim is to describe karst impact on the water balance of the Berchtesgadener Ache catchment. Model results will be validated with discharge measurements and compared with results of several tracer experiments.

The overall aim is to adapt the groundwater component of the model to high alpine regions.

Karst cave in Berchtesgaden NP with subsurface waterfall

Outlook

The new model system will be validated with station measurements and is supposed to allow a precise numerical analysis of the regional water balance. Further aims are to gain improved process understanding within detailed case studies and to allow an estimation of expected climate change impacts by driving the new model system with climate change scenario data.

References
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