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Water balance modeling and climate impact research in the Berchtesgaden National Park

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Keywords

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Summary

Hydrologic processes are underlying specific spatial conditions in high alpine regions. The altitudinal gradient, a complex geologic composition and the alpine climate affect surface runoff, subsurface storage and runoff, snow cover dynamics and discharge routing to the outlet. Within the watershed of the river Berchtesgadener Ache, which comprises the area of Berchtesgaden National Park, the physically based, distributed hydrological model WaSiM is established since 2009 to understand the water balance within the region. The model is set up with a spatial resolution of 50 m and a temporal resolution of 1h. The main focus initially was to examine the influence of alpine karst on the water balance and to improve the modeling of lateral snow transport. Previous tracer experiments and literature about the complex hydrogeological composition, subsurface pathways, spring locations, indicated that groundwater is redistributed within the high alpine valleys in the watershed. Modeling results showed, that the water balance in high alpine subbasins is not closed due to such heterogeneous subsurface storage and transport conditions. For the snow modeling, the reproduction of snow deposition and ablation processes was enhanced using an energy balance algorithm and by accounting for lateral snow redistribution. Based on this work, the focus is now lying on snow processes in forest environments and on climate impact scenario calculations. The model is forced with bias-corrected data from high-resolution regional climate simulations using the RCM WRF (5 km, based on MPI-ESM, IPCC-AR5 scenario RCP4.5) to assess potential impacts of a changing climate on the hydrology of the region. The reliability of the RCM simulations in the complex mountain environment of the catchment is validated by a reanalysis (ERA-INTERIM) driven model run and the dense meteorological station network operated in the National Park.

References

KRALLER, G., WARSCHER, M., KUNSTMANN, H., VOGL, S., MARKE, T., and STRASSER, U.: Water balance estimation in high Alpine terrain by combining distributed modeling and a neural network approach (Berchtesgaden Alps, Germany). Hydrol. Earth Syst. Sci., 16, 1969-1990, doi: 10.5194/hess-16-1969-2012,2012.

MARKE, T., STRASSER, U., KRALLER, G., WARSCHER, M., KUNSTMANN, H., FRANZ, H., VOGEL, M.: The Berchtesgaden National Park (Bavaria, Germany): a platform for interdisciplinary catchment research. Environmental Earth Sciences, doi: 10.1007/s12669-013-317-z, 2013.

WARSCHER, M., STRASSER, U., KRALLER, G., MARKE, T, FRANZ, H., and KUNSTMANN, H.: Performance of complex snow cover descriptions in a distributed hydrological model system: A case study for the high Alpine terrain of the Berchtesgaden Alps. Water Resources Research, 49, 2619-2637, doi: 10.1002/wrcr.20219,2013.

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