©Hohe Tauern National Park; download unter www.biologiezentrum.at

Conference Volume	5th Symposium for Research in Protected Areas 10 to 12 June 2013, Mittersill	pages 413 - 414

Distributed water balance modeling in the Berchtesgaden National Park

G. Kraller[1], M. Warscher[2], U. Strasser[1], H. Kunstmann[2,3], H. Franz[4]

[1] Department of Geography and Regional Science, University of Graz, Austria
[2] Karlsruhe Institute of Technology, Institute for Meteorology and Climate Research (IMK-IFU), Germany
[3] Institute for Geography, Regional Climate and Hydrology, University of Augsburg, Germany
[4] Administration Berchtesgaden Nationalpark, Germany

Keywords

water balance, Alpine, karst, distributed hydrological modeling, snow, National Park

Abstract

The variability of meteorological parameters, a complex hydrogeology and heterogeneous snow cover dynamics affect the water balance in high alpine terrain. Distributed hydrological modeling is facing challenges in those environments and therefore needs to be adapted to the given conditions. We apply the deterministic hydrological model WaSiM-ETH (SCHULLA & JASPER 2007) to analyze the water balance and to focus on snow cover and groundwater modeling in an Alpine catchment.

The test site for our study is situated in the Berchtesgaden National Park (Bavarian Alps, Germany). It is characterized by extreme topography with mountain ranges covering an altitude from 607 to 2713 m.a.s.l.. The mountain ranges in the region consist of soluble limestone with a high number of subsurface pathways (karst) ending up in springs, highly affecting both the soil and groundwater storage. The model setup is based on a spatially dense network of meteorological stations at different elevations, discharge data from nine gauges and furthermore extensive land use and soil data.

To improve the modeling of snow deposition and ablation processes, we have complemented the hydrological model WaSiM-ETH with principles derived from the high-alpine specific snow model AMUNDSEN (STRASSER 2008). The new approach calculates the energy balance of the snow cover considering the terrain-dependent radiation fluxes as well as lateral snow transport processes. Results show that the reproduction of the spatial and temporal dynamics of the snow cover is improved (WARSCHER et al. 2013).

Hydrological modeling is resulting in systematic mismatch of modeled and measured runoff in discharge curves at the outlet points of neighboring high alpine subbasins. Tracer experiments and spring research showed that this can be attributed to the karst aquifer and the heterogeneous soil water transport, which is leading to strongly deviating runoff quantities in those neighboring subbasins (KRALLER et al. 2011). We present an artificial neural network extension that allows to account for subsurface karst water transfer within the hydrological model and increases model performance at subbasin scale (KRALLER et al. 2012).

The model system is forced with scenario data of a regional climate model (RCM: WRF 7 km, GCM: ECHAM5-MPI/OM T63/L32, Scenario A1B, 1970-2000/2020-2050) to assess potential impacts of a changing climate on the regional water balance. Results show a significant, elevation-dependent decreasing trend in snow cover duration. However, the consequent absolute changes in seasonal snowmelt and runoff amounts are projected to remain relatively small.

References

KRALLER, G., STRASSER, U., FRANZ, H. 2011. Effect of Alpine Karst on the hydrology of the basin Berchtesgadener Ache: a comprehensive summary of karst research in the Berchtesgaden Alps. In: Eco.mont: journal of protected mountain area research, 3,1, (2011) 19-28

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

SCHULLA, J. & K. JASPER 2007. Model Description WaSiM-ETH. Technical report, pp. 181, ETH-Zurich, Zurich.

STRASSER, U. 2008. Modelling of the mountain snow cover in the Berchtesgaden National Park, Berchtesgaden National Park research report, Nr. 55, Berchtesgaden. ISSN 621 0172-0023. ISBN 978-3-922325-62-8. EAN-Code 9783922325628.

WARSCHER, M., STRASSER, U., KRALLER, G., MARKE, T., FRANZ, H., KUNSTMANN, H. 2013. Performance of Complex Snow Cover Descriptions in a Distributed Hydrological Model System - A Case Study for the High Alpine Terrain of the Berchtesgaden Alps. In: Water Resources Research (2013). DOI: 10.1002/wrcr.20219 (accepted)

©Hohe Tauern National Park; download unter www.biologiezentrum.at

Contact

G. Kraller
gabriele.kraller@uni-graz.at

U. Strasser
ulrich.strasser@uni-graz.at

Department of Geography and Regional Science
University of Graz
Heinrichstr.26
8010 Graz
Austria
Fax: +43 316 380 9886

M. Warscher
michael.warscher@kit.edu

Karlsruhe Institute of Technology
Institute for Meteorology and Climate Research (IMK-IFU)
Kreuzeckbahnstr. 19
82467 Garmisch-Partenkirchen
Germany
Fax +49 8821 183 243

H. Kunstmann
harald.kunstmann@kit.edu

Karlsruhe Institute of Technology
Institute for Meteorology and Climate Research (IMK-IFU)
Kreuzeckbahnstr. 19
82467 Garmisch-Partenkirchen
Germany
Fax +49 8821 183 243

Institute for Geography, Regional Climate and Hydrology
University of Augsburg
Universitätsstr. 10
86159 Augsburg
Germany

H. Franz
helmut.franz@npv-bgd.bayern.de

Administration Berchtesgaden Nationalpark
Doktorberg 6
83471 Berchtesgaden
Germany

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: Nationalpark Hohe Tauern - Conference Volume

Jahr/Year: 2013

Band/Volume: 5

Autor(en)/Author(s): Kraller Gabriele, Warscher Michael, Strasser Ulrich, Kunstmann Harald, Franz Helmut

Artikel/Article: Distributed water balance modeling in the Berchtesgaden National Park. 413-414