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Hydrological system analysis and modelling of the Nam Co basin in Tibet

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Abstract. The Tibetan Plateau and the adjacent high mountain regions of the Himalayas play an important role in the global climate dynamic through its impact on the Asian monsoon system, which in turn is impacting the water resources of this extremely vulnerable region. To provide further knowledge about the changing impact of rainfall patterns, spatial and temporal variability of snow cover contribution, amount of snow and ice melt runoff, evapotranspiration as well as dynamics of wetlands and permafrost water balance studies are required. This is of particular importance in terms of global climate change because of a severe gap in the knowledge of the short, mid and long term implications on the hydrological system.

This study concentrates on the macroscale catchment of the lake Nam Co, located at 4718 m a.s.l. at the foot of the Nyainqentanglha Mountains in central Tibet (30° N, 90° E). The water balance of the Nam Co basin is dominated by semi-arid climate, snow and ice melt runoff and high evaporation rates due to the high radiation input and the low air humidity. The observed temperature rise, glacier retreat, permafrost decay and lake level increase indicate significant system changes and the high sensitivity of the Tibetan Plateau on global warming. The development of a suitable water balance model and its preliminary application was the main objective of this study. The development was done with the Jena Adaptable Modelling System JAMS along with existing scientific process components of the J2000 module library which were partly further developed to reflect the specific conditions of the high elevation Nam Co basin.

The preliminary modelling exercise based on gridded data from a downscaled ECHAM5 data set provided reasonable estimates about the important hydrological water balance components of the Nam Co basin. With the modelling results the observed lake level rise could be reproduced and it could be shown that the runoff from the glaciered areas seems to be the most important component to explain the increasing amount of lake water.

Full Article in PDF (PDF, 6287 KB)

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