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Juen, I., C. Georges, and G. Kaser (2006): Modelling observed and future runoff from a glacierized tropical catchment (Cordillera Blanca, Perú). Global and Planetary Change,

Abstract

Monthly runoff from the 34.3 % glacierized tropical catchment of Llanganuco in the tropical Cordillera Blanca, Peru, is successfully simulated and compared with a measured 44 years time series. In the investigation area, the climate is characterized by all-year round homogenous temperature conditions and a strong variability in air humidity and moisture content of the atmosphere. Thus, contrary to the mid latitudes, the seasonal variation in glacier melt strongly depends on moisture-related variables, rather than on air temperature. The here presented ITGG-2.0-R model aims for this requirements. The lack of moisture-related input data others than precipitation demand for an intermediate calibration step. Net shortwave radiation, the emissivity of the atmosphere and a sublimation/melt ratio are related to precipitation amounts. Runoff is well simulated and correlates with the measured record with $r^2 = 0.76$. Seasonally obtained r^2 are only slightly smaller. On a long-term, the cumulative deviation is minor, and the mean annual cycle of runoff is reproduced rather well ($r^2 = 0.99$). Based on four different IPCC climate change scenarios, future runoff is simulated. All runoff scenarios are modelled for the respective steady-state glacier extent. This leads to a reduction in the glacier size and a decreased amount of glacier melt. On the other hand, direct runoff increases due to larger glacier free areas. Consequently, mean annual runoff remains almost unchanged, but the seasonality intensifies considerably with more runoff during the wet and less runoff during the dry season.