WATER BALANCE OF THE VERNAGTFERNER HIGH ALPINE BASIN

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Long-term monitoring of the Vernagtfferner (approx. 9 km²) annual glacier mass balance since 1964, along with measurements of precipitation and other climatological variables and discharge since 1974 at the gauging station “Pegelstation Vernagtbach”, are the basis of the data analysis presented here. In this Austrian high alpine basin with an area of 11.4 km² extending from 2640 m to a maximum elevation of 3630 m the mean annual precipitation amounts to about 1560 mm (20 % of which falls as rain and 80 % as snow), evaporation is estimated at 170 mm, mean discharge amounts to 1800 mm, a value that can only be maintained by a mean negative glacier mass balance of -400 mm with respect to the total basin area over the 29 years of record. While the Vernagtfferner winter balances have remained more or less stable at a value of 1000 mm over the past 40 years, the summer balances show an obvious trend from values of -1000 mm in balanced years when measurements began, towards strongly negative values in the 1990s, culminating in the year 2002/03 with a record summer balance of -3000 mm, and a record basin runoff of 3300 mm. Using daily mean air temperature and daily precipitation sums as input, a conceptual runoff model can simulate daily discharge (R² about 0.90) and glacier mass balance (R² about 0.78) satisfactorily, suggesting a fraction of 30% of precipitation falling as rain and 70 % as snow. The highly transient runoff conditions necessitate the continuation of the monitoring efforts on a long-term basis, so that models predicting possible trends in water yield from high alpine basins under conditions of climate change can be validated.