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Estimating the Impact of Precipitation and Temperature Variability on the Contribution Potential of Glaciers to Water Availability: A Budget Approach

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Detrimental changes due to shrinking glaciers are universally expected for water availability in river systems under the influence of ongoing global climate change. Using a budget approach, Kaser et al. (2010) estimated the contribution potential of glaciers to water availability in large river basins based on the assumption of a climate-glacier equilibrium.

In the work presented here, we develop this approach further by taking into account temperature and precipitation variability: Based on the seasonal relation between temperature and melt water production in the equilibrium case, a temperature sensitivity of melt water production is derived. Then, observed temperature variability from gridded data sets is employed to estimate glacier melt water production variability in large river basins. Similarly, we take into account observed precipitation variability in order to compare the different impact that precipitation and temperature variability have on the relative importance of glacier melt as an input into the hydrological system. However, we do not consider hydrological processes influencing the actual run-off, and consequently, the validation of the results for selected basins and time periods with existing high quality run-off measurements has to be considered with care.