

Changes in quantity and variability of runoff from Alpine basins with climatic fluctuation and glacier decline

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Abstract Impacts of climatic fluctuation on amount and year-to-year variability of runoff were assessed for four sub-basins with between ~1.8 and ~70% glacier cover within the upper Rhône catchment, Switzerland, during a period of sustained glacier recession. Runoff in the most highly-glacierised sub-basin mimicked annual mean summer air temperature through two warming cycles. In the least glacier-covered basin, the pattern of runoff variation was inverse, reflecting changes in total annual precipitation. Coefficients of variation were used to characterise runoff variability, which increased with level of discharge in only the most highly glacierised sub-basin. Overall, variability of runoff was negatively related to percentage glacierisation despite variability increasing slightly in basins with between 40 and 70% ice cover. Variability was enhanced in the more glacierised, but reduced in the less-glacierised basins during the warmer drier 1980s through 2000s, by comparison with the cooler wetter 1960s through 1970s.

Key words climatic fluctuation; coefficient of variation; glacier recession; glacierised basin; meltwater discharge; percentage glacierisation; runoff
