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Climate change scenarios for the assessment of future drinking water availability in the Alps

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The availability of drinking water resources in Alpine catchments is influenced by the complex meteorological features in mountainous terrain. An assessment of the development under changing climatic conditions therefore requires information about expected changes in the main driving variables, precipitation and temperature. Physically based simulations of several Regional Climate Models (RCMs) provide climate change projections. Their model outputs have a coarse spatial resolution, which implies a misrepresentation of alpine topography, and exhibit large deviations from observations. The objective of the presented research was therefore the generation of climate change scenarios for alpine catchments with an adequate representation of temporal and spatial patterns in precipitation and temperature.

Data from three different RCMs – with different driving GCMs – were corrected and downscaled: RegCM3 (driving GCM ECHAM5), PROMES (HadCM3), Aladin (Arpege). Bias corrected data for the entire South East Europe region were generated applying a quantile mapping approach. This correction was based on large scale observation fields with 25km resolution. For the application in impact modeling in alpine terrain, the local distribution of precipitation and temperature was further corrected on the base of observation fields with 1km resolution. The resulting distribution of temperature proved to be adequate, but precipitation still showed considerable underestimation. Therefore, an additional correction was implemented based on water balance simulations. A conceptual water balance model was driven with the corrected RCM data and the resulting long term means of simulated runoff were compared to observations at various runoff gauges. Deficits in the water balance were attributed to errors in the precipitation input. With the objective of minimizing these deficits, elevation-dependent precipitation correction factors were estimated. This final correction resulted in more plausible spatial patterns of precipitation and higher precipitation amounts, yielding more adequate climate data for the assessment of drinking water availability in the Alps.

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