



Variability of mean and extreme seasonal precipitation and its impact on the surface water balance in Upper Franconia, Southern Germany: a case study

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Climate change is known to alter precipitation patterns and facilitates the occurrence of extreme hydrological events, both heavy rain and dry spells. However, the variability depends upon the geographical region as well and is subject to strong temporal variation. Both factors aggravate the determination of extreme event statistics resulting in low statistical significance levels and renders simple explanatory mechanisms unreliable or not applicable.

Here, we analyze a unique long-term continuous observational climate data set over approximately 170 years of monthly and 70 years of daily precipitation for a station in Bayreuth, Upper Franconia in Southern Germany, as a representative of a valley station in the Central German mid-range mountain area. While there is no significant trend in the annual precipitation sums, we observed seasonal changes in precipitation sums as well as increase in extreme precipitation sums and number of very heavy precipitation days. We further estimate the surface water balance, defined as the simple balance between incoming precipitation without extreme precipitation events exceeding an infiltration capacity and evapotranspirational losses, and demonstrate, that these changes in timing and intensity of precipitation all contribute to an amplification of water scarcity in this geographic area. The most important reasons are increasing evapotranspiration due to higher temperatures and increase in sunshine hours as well as increase in surface runoff during extreme precipitation events. Therefore climate change is a notable threat for water availability in such areas as Central German upland valleys.