EGU22-2583
https://doi.org/10.5194/egusphere-egu22-2583
EGU General Assembly 2022
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Changes in the actual catchment evapotranspiration in the Western Carpathians in Slovakia

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Actual catchment evapotranspiration, which includes all forms of evaporation and transpiration through plants, plays an important role in the water, energy, and carbon cycles. This contribution aims to explore trends in the actual catchment evapotranspiration based on the analysis of the components of the long-term hydrological balance of selected river basins in the Western Carpathians and detect changes attributable to changing landuse and climate conditions. We have used high-quality gridded data sets of precipitation and air temperatures from the CarpathClim project for the water balance. Temporal changes in the catchments' average air temperature, precipitation, runoff, and their differences (considered as an index of the actual evapotranspiration) have been estimated for 49 years of data and compared between two non-overlapping sub-periods (25 and 24 years). Given that both inputs into the equation of the long-term hydrological balance contain uncertainties, we also used proxy evapotranspiration data modelled according to the Budyko-Tomlain method for comparison. Changes in land use were evaluated from the CORINE project. This allowed us to consider the impact of the rising air temperature and, in part, the local physiographic factors, on the changes in runoff and actual catchment evapotranspiration as the main drivers of changes in the hydrological balance. In particular, the increase in air temperature was found to be statistically significant across the transect. The main conclusion related to water resources management is that the hydrological balance has changed towards an increase in actual catchment evapotranspiration and a decrease in runoff. An increase in the catchment precipitation was present in the trends but was not statistically significant. The Budyko-Tomlain actual evapotranspiration proxy series confirmed the tendencies in the actual catchment evapotranspiration with significant trends. However, local factors of runoff generation, especially catchment storage, can exhibit an influence at higher elevations (approx. above 800 m a.s.l.), thereby partially disguising the expected general tendencies at a given altitude. These factors can both lessen or intensify the changes in runoff and actual catchment evapotranspiration in catchments at similar altitudes. On the other hand, in lower elevations where runoff generation is less intensive, the influence of the climatic factors is decisive. The research was supported by the Slovak Research and Development Agency under Contract Nos. APVV-18-0347 and APVV-20-0374, and the VEGA Agency Grant No. 1/0632/19. The support is gratefully acknowledged.