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Climatic and anthropogenic drivers of river intermittence in Poland

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Studies on river intermittence are pivotal in water management because water scarcity impacts, apart from the catchment itself, also neighbouring catchments and water reservoirs.

River intermittence was noticed recently in Poland in small and mid-sized catchments. The objective of the study was to answer questions about whether drying showed an increasing tendency, what might be the drivers of the tendency, and how could anthropogenic activity affect the catchment reaction to drought conditions. The total number of zero-flow days and the maximum length of zero-flow events were analysed at the annual and seasonal scale in terms of metrics of intermittence, temporal trend, association with climatic conditions, and the link with anthropogenic pressure. The Standardised Precipitation Evapotranspiration Index (SPEI) was used in identifying the association between intermittence and the climatic drivers such as precipitation and temperature. Statistical methods, namely the circular statistics, the Spearman correlation coefficient, the Mann-Kendall test for monotonic trend, and the Cucconi and the Lepage tests for step trend were applied in the study.

An increasing trend in the total number of zero-flow days and the maximum length of zero-flow events, as well as the negative correlation with the SPEI was detected in two catchments with natural flow regime. The increasing evapotranspiration was identified there as the possible driver of intermittence because the SPEI often showed a decreasing trend in summer months. In the catchment under strong anthropogenic pressure, the zero-flow occurrence resulted from climatological reasons as well as from the operation of the open-cast brown coal mines. The anthropogenic activity enhanced the reaction of the catchment to drought conditions. Some inhomogeneities in discharges were also detected downstream from the location of the dry river bed because of water transfers from the mine. The catchment response to drought conditions was reflected in the pattern of intermittence for natural catchments and for the catchment under strong anthropogenic pressure.

The pattern of intermittence in the form of circular diagram can serve as an indicator of the degree of anthropogenic influence on runoff conditions.

