

Classification and plausibility assessment of historical and future weather and climate anomalies (application for the Wupper River Basin, Germany)

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In the frame of the Horizon 2020 project BINGO (Bringing INnovation to onGOing water management), the effects of climate change scenarios on the water cycle in the Wupper River Basin are being currently investigated. The Wupper catchment area is prone to flash floods in summer, winter floods as well as dry periods. The occurrence of these events has increased in the last decades together with the shifting of the rainy season. BINGO approach focuses on, among others: a) identifying past weather extremes and anomalies due to climate change; and b) gaining deeper knowledge on the effects of soil moisture on water balance and runoff generation processes for reservoir management and enhancement of Wupper Association's flood early warning system.

Historical hydro-meteorological extreme events are assessed based on daily records of long-term precipitation time series (ca. 80 years) as well as precipitation time series from downscaled reanalysis products (i.e. ERA-Interim). The determination of representative indices, e.g., Weather Extremity Index (WEI) or the Standardized Precipitation Index (SPI) serves to compensate for uncertainties in spatial and temporal recording of the parameters of individual processes. The WEI establishes the highest rainfall amount per station and its rarity, the extent of the affected area, and the event duration.

For the evaluation of historical climate signals in the reference period and for the assessment of future scenarios, deviation of the mean monthly observed precipitation from the long-term mean value is determined as a first approach for several stations along the catchment area for individual months and different time scales. As a second approach, different indices such as SPI and SPEI (Standardized Precipitation Evapotranspiration Index) are calculated for different time scales in order to determine whether they were anomalously dry or wet. SPEI is more suitable for climate change analysis than SPI since the former considers not only precipitation but also temperature.