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Floods and moisture excesses induced by atmospheric blocking are related at the long-term scale in Europe

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Among weather-related extreme events in Europe, floods are one of the most disastrous and costliest. Atmospheric blocking episodes (i.e., persistent, quasi-stationary, and self-preserved weather systems that propagate very slowly and interrupt the usual westerly flows) are part of the main weather regimes in the Euro-Atlantic and have been associated with notable flood events across Europe. So far, the relationship between blocking and some high-impact extreme weather events has been established, including the modulation of the odds of heavy precipitation. Yet, a long-term continental relationship between blocking and flooding remains unrevealed, and in particular, the way atmospheric blocking translates into floods. For the 1960-2010 period, this study analyses a pancontinental database of maximum discharge, atmospheric and soil variables from ERA5 and ERA5-Land reanalyses, and a gridded binary blocking index derived from ERA20C. Preliminary results indicate mixed positive and negative anomalies in mean precipitation and wet-spell frequencies in response to blocking, depending on the region. Nonetheless, robustly across Europe, the anomalies in wet-spell duration and total precipitation depth are generally positive under blocking conditions. We present the spatial patterns across Europe induced by atmospheric blocking in anomalies of, e.g., streamflow maxima, rainfall maxima, and root zone moisture excess maxima, pointing out that the patterns between streamflow maxima and moisture excess maxima are significantly correlated but not in the case between streamflow maxima and rainfall maxima. Hence, this research suggests that the effect of atmospheric blocking on floods is acting at the level of the interaction between rainfall and soil moisture. The outcomes presented here unveil a continental and long-term impact of atmospheric blocking in relevant variables for flood generation.