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Spatial signatures of flooding and blocking are related on the long-term scale

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Process-based explanations of flood controls have increasingly advanced in the last years along with comprehensive datasets availability. However, the relationship on the long-term scale between floods and large-scale atmospheric drivers remains unclear, hindering the understanding of flood-prone periods and the projections of flood change. The translation of atmospheric blocking (i.e., a persistent mid-latitude high-pressure system that blocks westerly flows) into flooding has not been raised for large samples due to the spatiotemporal complexity of the atmospheric and hydrological response. For the 1950-2010 period, this study analyzes summer flood events from a pan-European database, a gridded binary blocking index derived from ERA20C, and hemispheric fields of four meteorological variables from ERA5. By defining a window of days with flooding (dF) related to precipitation surpluses in central Europe, days with blocking (dB) at three different regions namely North Atlantic (NATL), Europe (EU) and Scandinavia (SCAN), and days with simultaneous flooding and blocking (dFxB), our results indicate spatially similar meteorological signatures for dF and dFxB at NATL, but different patterns between dB and dFxB at NATL, suggesting there is a subset of blocking events at NATL controlling the meteorological signature of flood events in central Europe. Patterns for dB and dFxB at SCAN are similar implying that blocking in the SCAN region has the most direct effect on floods in central Europe. Hence, this research could provide new insights into large-scale atmospheric controls and sources of predictability regarding floods.