



Quasi-stationary waves and their impact on European weather and extreme events

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Persistent extreme weather events are commonly associated with strong quasi-stationary atmospheric waves (QSW). This link - and the variability of QSWs - are investigated using a new objective quasi-stationary wave climatology.

The QSWs are isolated from the longitudinal envelope of the lowpass filtered (15 day) meridional wind at upper levels. The envelope field, which is a measure of wave amplitude, is calculated by a spatial filtering using a latitude dependent zonal wavenumber range of about 4 to 8 in midlatitudes.

A clear connection between QSWs and European weather and extreme events is confirmed for all seasons, indicating that blocking anti-cyclones are often part of a broader scale wave pattern. Investigation of the QSW climatology in the Northern Hemisphere reveals that wave activity is typically strongest in midlatitudes, particularly at the exit of the Atlantic and Pacific storm tracks with weaker intensities in summer. In general, the structure of individual QSW events tends to follow the climatological pattern, except in winter where the strongest and most persistent QSWs are typically shifted polewards, indicating a distinct evolution of the 'strongest' QSW events. Modes of inter-annual variability are calculated to better understand their importance and connection to European temperatures and to identify relevant QSW patterns. This analysis highlights that European winter temperatures are strongly associated with the meridional location of QSW activity whereas warm European summer temperatures are associated with increases in the overall intensity of midlatitude QSW activity.