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The dynamics of synchronized weather extremes: Planetary wave-resonance and circumglobal teleconnections

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Periods of consecutive hot days have become longer in recent boreal summers, suggesting that dynamical factors are playing a role in driving heat waves. Indeed several persistent heat waves severely affected societies, agricultural production and ecosystems in the northern hemisphere mid-latitudes recently. Several of them were linked to quasi-stationary atmospheric wave-patterns in the upper troposphere which might cause concurrent heat waves in far-away regions, constituting circumglobal teleconnection patterns. Quasi-resonant amplification (QRA) was proposed as a dynamical mechanism causing such high-amplitude waves. Here we discuss the spatial confinement of these teleconnection patterns and identify the central US, western Europe and Ukraine/Russia as regions specifically at risk to experience severe heat during QRA. Further, we provide insights on how the observed increase of a persistent circumglobal wave 7 teleconnection relates to recently observed changes in large scale zonal- and meridional near surface temperature gradients. In addition the future development of such events is examined by employing the projections of state-of-the-art (CMIP5) climate models. Here we find that such high amplitude events are likely to increase by $\sim$50% over the next century under business-as-usual carbon emissions, with considerable variation among climate models.