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Heatwaves and Predictability - the Role of Rossby Waves and Atmospheric Waveguides

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Heat waves can have a devastating impact on human society and ecosystems, and thus improved understanding and predictability of such events would provide huge benefits. It has been shown previously that many extreme temperature events are associated with quasi-stationary, or recurrent, Rossby waves (hereafter QSWs). We show that these QSWs are often associated with atmospheric waveguides, providing some dynamical understanding of why such weather patterns persist. In the context of this framework, we study the subseasonal-to-seasonal (S2S) predictability of heatwaves, QSWs, and atmospheric waveguides. Operational seasonal forecasts can reproduce the observed climatological statistics of QSWs, and the observed connection between QSWs and extreme temperatures over Europe, although with some biases. To better understand the underlying dynamics of the seasonal forecast models, we explore whether such models are capable of reproducing the observed connection between QSWs and atmospheric waveguides, linked to persistent, and thus high impact, extreme heat events. We examine the S2S predictability of atmospheric waveguides and high amplitude QSW events, to better understand the potential S2S predictability of heatwaves.