Understanding Heatwaves: a role for Atmospheric Waveguides

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Abstract:

Recent heat extremes in the Northern hemisphere, including the 2003, 2018, and 2019 European heatwaves and the 2010 Russian heatwave, were associated with anomalously high amplitudes of quasi-stationary waves (QSWs), of approximate zonal wavenumber 6-7. QSWs are Rossby waves that have near-zero phase speed, and can thus remain approximately in place for days to weeks; these events are sometimes associated with multiple Rossby waves packets reoccurring in the same region with very similar phase. Atmospheric jets can create atmosphere waveguides,which influence the propagation paths of Rossby waves. Previous work has shown links between waveguides in the zonal mean flow with extreme events and high amplitude Rossby waves. In this talk I will present results from a waveguide detection algorithm I have developed that identifies atmospheric waveguides as a function of both time and longitude. Using this algorithm I connect anomalously high amplitude QSWs in ERA-interimdata to the presence of an upstream atmospheric waveguide in the preceding days. Upstream waveguides are up to twice as likely to be present when there is anomalously high QSW activity in Europe relative to times of anomalously low QSW activity. I will show early results from analysis of model simulations from a subset of CMIP6 models, showing that historical simulations are capable of simulating observed waveguide statistics as a function of longitude. Under SSP585 there is evidence that the frequency of waveguides may increase in the future, with potential implications for heatwave frequency.