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Detection of quasiresonant amplification of planetary waves and their connection to northern hemisphere summer heat extremes

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Several recent northern hemisphere (NH) summer heat extremes have been linked to anomalous patterns of mid-latitudinal planetary waves , e.g. the European heat wave in 2003, the Russian Heat wave and Pakistani floods in 2010 and the US heat wave in 2011(Lau and Kim 2012, Black et al 2004, Petoukhov et al 2013).
The NH large-scale circulation patterns in those years were characterized by persistent longitudinal planetary-scale high-amplitude waves of relative high wavenumber (6-8). A common mechanism that could lead to the observed high-amplitude planetary waves was proposed by Petukhov et al. (Petukhov et al 2013). Under certain conditions, free synoptic waves can be 'trapped' in a midlatitudinal waveguide while their amplitudes are amplified by a quasiresonant response to thermal and orographic forcing.

We have searched the available reanalysis data for the emergence of waveguides for particular planetary waves and will present preliminary results of this analysis. Using spectral analysis, we quantify the planetary wave field in terms of wavenumber, amplitude, phase and eastward phase-propagation. We will present statistics of these wave quantities for periods with and without waveguides. With those conditions explicitly implemented in code we should be able to detect and point out the periods in time the requirements for amplification were met. By doing so the connection of actual summer month heat extremes to quasiresonance events can be assessed statistically.

Black E., Blackburn M., Hoskins B. and Methven J.; 2004: Factors contributing to the summer 2003 European heatwave 217–23

Lau W. K. M. and Kim K.-M.; 2012: The 2010 Pakistan Flood and Russian Heat Wave: Teleconnection of Hydrometeorological Extremes J. Hydrometeorol. 13 392–403 Online: http://journals.ametsoc.org/doi/abs/10.1175/JHM-D-11-016.1

Petoukhov V., Rahmstorf S., Petri S. and Schellnhuber H .J.;2013: Quasi-resonant amplification of atmospheric planetary waves as a mechanism for recent Northern Hemisphere weather extremes Proc. Natl. Acad. Sci. USA