EMS Annual Meeting Abstracts
Vol. 16, EMS2019-624, 2019

Seasonal variability and forecast biases of local Rossby wave properties and their role for temperature extremes

Georgios Fragkoulidis and Volkmar Wirth

Johannes Gutenberg University, Mainz, Institute for Atmospheric Physics, Physics, Mainz, Germany (gfragkou@uni-mainz.de)

Investigating the dynamics of the large-scale atmospheric flow constitutes an important quest toward a better understanding of weather and climate. Since the upper-tropospheric circulation tends to organize in eastward propagating Rossby wave packets (RWPs), it is important to develop and investigate diagnostics of their local characteristics. Here, we employ a numerical implementation of the analytic signal on the 300 hPa meridional wind in order to diagnose the local RWP amplitude and phase. Based on the latter, we compute the local RWP phase and group velocities. Using ERA5 reanalysis data, we report on the pronounced seasonal variability on the spatial distribution of the derived fields, as well as the distinct differences between the northern and southern hemispheres. At a regional scale, we investigate the role of RWP properties on the occurrence and duration of hot and cold temperature extremes over parts of Europe. Strong RWP amplitudes are found to be associated with increased probability for temperature extreme occurrence, while phase velocity is found to be a critical factor for their duration. Regarding long-lasting and severe heat waves of the past, the spatio-temporal evolution of successive RWPs can also influence the lifetime of the events. Finally, we report on systematic biases in ERA Interim medium-range forecasts of the aforementioned RWP properties and discuss their implications for the predictability of temperature extremes. Overall, this work reports on climatological aspects of new diagnostics on the upper-tropospheric circulation and suggests that a correct representation of the RWP evolution is crucial in predicting the magnitude and persistence of temperature extremes over Europe.