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Local diagnostics of Rossby wave packet properties – Seasonal variability, forecast biases and relation to temperature extremes

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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 work on diagnostics of their local characteristics. Here, we employ a numerical implementation of the Hilbert transform on the 300hPa meridional wind field in order to diagnose their amplitude, phase and group velocity locally. Using reanalysis data, the seasonal variability and spatial distribution of the derived fields are presented. In addition, their role for the occurrence and duration of temperature extremes is investigated. Strong RWP amplitudes are found to be associated with increased probability of temperature extreme occurrence in many areas of the Northern Hemisphere, while phase velocity is an important factor for their duration. Finally, we report on systematic biases in ERA-Interim medium-range forecasts of the aforementioned RWP properties and suggest that they contribute to the observed underestimation of temperature extreme duration in many parts of the Northern Hemisphere. Overall, this work demonstrates applications of novel diagnostics on local RWP properties and suggests that a correct representation of their evolution is crucial in predicting the magnitude and persistence of Northern Hemisphere temperature extremes.