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The hot day frequency of summer 2015 in Central Europe – correspondence with monthly circulation types

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The summer 2015 was characterized by at least three heat waves in Central Europe and a distinct anomaly of hot day frequency (defined by days exceeding the 90th percentile temperature of the period 1950 to 2015 of a Central Europe temperature index inlcuding data from several stations). In order to examine the role of the atmospheric circulation (represented by NCEP-NCAR reanalysis geopotential heights), a circulation type classification based on a cluster analysis conditioned on hot day frequency has been developed for mean values of the months June, July and August 1950 to 2015. In order to optimize the classification, geopotential heights of several levels have been evaluated whereas the 200 hPa level showed highest explained cluster variances. Also four different spatial domains (ranging from the hemispheric to the regional scale) have been tested. However, the smallest one (5-15°E/45-55°N) was the best. Since the hot day frequency was included in the cluster analysis an optimal weight for this variable compared to the circulation data has to be found. Therefore weights beginning at w=0.01 up to 10 have been iteratively increased, while for each weight an ensemble of three random samples has been drawn for clustering, while 25% of the sample have been kept for evaluation, i.e. calculating the explained cluster variance. Thus an optimal weight of w=0.4 has been determined which produced an explained variance of r^2=0.64 for the hot day frequency. A remarkable correspondence between the occurrence of summer months with high hot day frequencies together with two anticyclonic circulation types limited to the second half of the examination period (occurrence only after 1980) has been found and is discussed.