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Interannual drought index variations in Central Europe related to large-scale atmospheric circulation

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This contribution investigates the relationship between large-scale atmospheric circulation and interannual variations of the standardized precipitation index (SPI) in central Europe. To this end occurrence frequencies of circulation types (CT) derived from a variety of circulation type classifications (CTC) applied to daily sea level pressure (SLP) data and mean circulation indices of vorticity (V), zonality (Z) and meridionality (M) have been utilized as predictors within multiple regression models (MRM) for the estimation of gridded 3-month SPI values over central Europe for the period 1950 to 2010. CTC based MRMs used in the analyses comprise variants concerning the basic method for CT classification, the number of CTs, the size and location of the spatial domain used for CTCs and the exclusive use of CT frequencies or the combined use of CT frequencies and mean circulation indices as predictors. Adequate MRM predictor combinations have been identified by applying stepwise multiple regression analyses within a resampling framework. The performance (robustness) of the resulting MRMs has been quantified based on a leave-one out cross-validation procedure applying several skill scores. Furthermore the relative importance of individual predictors has been estimated for each MRM. From these analyses it can be stated that i.) the consideration of vorticity characteristics within CTCs, ii.) a relatively small size of the spatial domain to which CTCs are applied and iii.) the inclusion of mean circulation indices appear to improve model skill. However model skill exhibits distinct variations between seasons and regions. Whereas promising skill can be stated for the western and northwestern parts of the central European domain only unsatisfactorily skill is reached in the more continental regions and particularly during summer. Thus it can be concluded that the here presented approaches feature the potential for the downscaling of central European drought index variations from large-scale circulation at least for some regions. Further improvements of CTC based approaches may be expected from the optimization of CTCs for explaining the SPI e.g. via the inclusion of additional variables into the classification procedure.