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Interannual variations in local PM10 concentrations at different sites in Bavaria and their relation to large-scale circulation types

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Variations in local PM10 concentrations are dependend on the one hand on local emission characteristics and on the other hand on local and large-scale meteorological conditions that influence long-range transport, accumulation of emissions and as well the generation of secondary aerosol particles.
In this contribution the relationship between large-scale atmospheric circulation types and monthly indices (mean, exceedances of thresholds, ...) of the local PM10 concentrations at different sites in Bavaria (Germany) are analysed during the period 1979 to 2011.
To this end monthly PM10 indices are estimated from large-scale atmospheric circlation types via two different statistical downscaling approaches. Firstly monthly frequencies of circulation types are entered as predictors into multiple linear regression analyses (stepwise regression) to estimate monthly predictand values (monthly PM10 indices). The second approach utilizes type specific values of the target variable – determined for a calibration period - to estimate predictand values in the validation period.
Both models are applied to multiple calibration and validation samples. The skill of the models is quantified by different skill scores (e.g. reduction of variance, Pearson R) for each of the validation samples.
Each of the two approaches is run using varying circulation classifications. This includes different methodological concepts for circulation classification (e.g. threshold based methods, cluster analysis, . . .), different input variables (e.g. sea level pressure, 500hPa geopotential height, . . .) and different temporal (1-day or multiple day sequences) and spatial domains (synoptic to continental scale).
Via comparison of the model skill determined for the varying approaches (combinations of circulation type classifications and downscaling techniques) those approaches are detected that are best suited for the estimation of monthly PM10 indices. In future steps these approaches may be applied to large-scale climate model data in order to estimate climate related future variations in local PM10 concentrations.