A comparison of two classification based approaches for downscaling of monthly PM10 concentrations

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Circulation type classifications may be utilised for the downscaling of local climatic and environmental target variables in different methodological settings.

In this contribution we apply and compare two different classification based approaches for downscaling of monthly indices of PM10 concentrations (monthly mean and number of days exceeding a certain threshold) at different stations in Bavaria (Germany) during the period 1979 to 2010.

The first approach uses monthly frequencies of circulation types as predictors in multiple linear regression models (stepwise regression) to estimate monthly predictand values (monthly PM10 indices). The second approach utilizes type specific mean values of the target variable – determined for a calibration period - to estimate predictand values in the validation period.

Both approaches are run using varying circulation classifications. This comprises different methodological concepts for circulation classification (e.g. threshold based methods, leader algorithms, cluster analysis) and as well different temporal (1-day or multiple day sequences) and spatial domains (synoptic to continental scale).

All models are applied to multiple calibration and validation samples and different skill scores (e.g. reduction of variance, Pearson R) are estimated for each of the validation samples in order to quantify model performance.

As main preliminary findings we may state that:

- the regression based downscaling approach in most cases clearly outperforms the approach that uses type specific mean values (reference forecasting),

- best skill is reached in winter (DJF) and spring (MAM),

- comparable model skill is reached for the downscaling of monthly means and extremes indicators (number of days exceeding a certain threshold).