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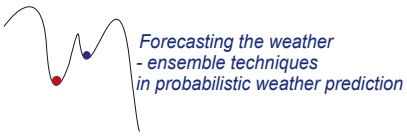

Natural three-dimensional predictor domains for statistical precipitation downscaling

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The question of whether optimized predictor domains and choice of predictors improve the predictive power of statistical precipitation downscaling is addressed. In addition the sources of predictor uncertainty for precipitation downscaling on daily scale are studied, as well as the skills of the potential atmospheric predictors. With this in mind, we pursue a two-fold approach: First, predictors and their corresponding 3D-domains are optimized by a conditional air mass classification. Since no restrictions are made on the shapes of the domains, the method allows for irregular spatial boundaries. Furthermore, in this way the air masses could be optimized to have a wide range of different precipitation distributions. Second, an artificial neural network as a non-parametric statistical downscaling model is applied in order to estimate the sensitivity of individual predictors and their interactions. Inferences on the sources of uncertainty are drawn from model-free sensitivity measures also permitting to capture interaction effects. Using the optimized predictors improves the accuracy of the downscaled time series, in particular in seasons with strong convection. According to a global sensitivity analysis geopotential height, vertical velocity, temperature and specific humidity are the most influencing predictors for precipitation downscaling.