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Bias correction of daily precipitation projected by the CORDEX-Africa ensemble for a sparsely gauged region in West Africa with regionalized distribution parameters

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Reliable estimates of future climatic conditions are indispensable for the sustainable planning of agricultural activities in West Africa. Precipitation time series of regional climate models (RCMs) typically exhibit a bias in the distribution of both rainfall intensities and wet day frequencies. Furthermore, the annual and monthly sums of precipitation may remarkably vary from the observations in this region. As West Africa experiences a distinct rainy season, sowing dates are oftentimes planned based on the beginning of this rainfall period. A biased representation of the annual cycle of precipitation in the uncorrected RCMs can therefore lead to crop failure.

The precipitation ensemble, obtained from the Coordinated Downscaling Experiment CORDEX-Africa, was bias-corrected for the study region in West Africa (extending approximately 343,358 km^2) which covers large parts of Burkina Faso, Ghana and Benin. In oder to debias the RCM precipitation simulations, a Quantile-Mapping method was applied to the historical period 1950-2005. For the RCM future projections (2006-2100), the Double-Quantile-Mapping procedure was chosen. This method makes use of the shift in the distribution function of the future precipitation values which allows to incorporate the climate change signal of the RCM projections into the bias correction.

As large areas of the study region are ungauged, the assignment of the information from the nearest station to the ungauged location would lead to sharp changes in the estimated statistics from one location to another. Thus, the distribution parameters needed for the Quantile-Mapping were estimated by Kriging the distribution parameters of the available measurement stations. This way it is possible to obtain reasonable estimates of the expected distribution of precipitation at ungauged locations.

The presentation will illustrate some aspects and trade-offs in the distribution parameter interpolation as well as an analysis of the uncertainties of the future conditions after the bias correction. Also, the effects of the statistical transformation, especially how the climate change signal is affected and how statistics like the average monthly and annual sums of precipitation and the frequency of daily rainfall are changed, are shown.