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Seasonal prediction of African rainfall using ECHAM4 ensemble simulations - a probabilistic forecast using a MOS predic tion scheme and quantile regression

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Three ensembles of 20th century simulations using the ECHAM4-T42 atmospheric GCM are utilised to investigate the potential predictability of seasonal variations in African rainfall using the CRU (Climate Reseach Unit) observations. Each of the three ensembles consists of 5 simulations over the period 1903-2000 starting from different initial states. The lower boundary conditions of all three ensembles are the global SST and sea ice extent (GISST2.2). The 2nd ensemble additionally has variable concentration of the greenhouse gases CO_2, Methane, N_2O, and CFCs,whereas the 3rd ensemble also includes variations of the solar constant due to natural as well as volcanic changes.

First, a multivariate model output statistic (MOS) system combined with a bootstrap approach is used to assess the potential predictability of African rainfall during different rainy seasons. Forecast skill is assessed using the Brier skill score and the log odds ratio. Second, quantile regression is used to perform a probabilistic precipitation forecast for different African regions. Estimates of precipitation quantiles conditioned on the CCA modes of the MOS system, as well as on SST or simulated precipitation, are calculated.

As suggested by the large agreement between the simulated and observed precipitation anomalies over Africa, the ECHAM4 simulated rainfall provides a skillfull predictor for African precipitaiton in many seasons. In most cases, MOS corrected simulated precipitation provides more skill than SST alone, and skill can be further improved by adding other model variables to the MOS predicition scheme, such as MSLP or streamfunction.