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Evaluation of high-resolution climate simulations for West Africa using COSMO-CLM

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The climate change modeling activities within the WASCAL program (West African Science Service Center on Climate Change and Adapted Land Use) concentrate on the provisioning of future climate change scenario data at high spatial and temporal resolution and quality in West Africa. Such information is highly required for impact studies in water resources and agriculture for the development of reliable climate change adaptation and mitigation strategies. In this study, we present a detailed evaluation of high simulation runs based on the regional climate model, COSMO model in CLimate Mode (COSMO-CLM). The model is applied over West Africa in a nested approach with two simulation domains at 0.44° and 0.11° resolution using reanalysis data from ERA-Interim (1979-2013). The models runs are compared to several state-of-the-art observational references (e.g., CRU, CHIRPS) including daily precipitation data provided by national meteorological services in West Africa. Special attention is paid to the reproduction of the dynamics of the West African Monsoon (WMA), its associated precipitation patterns and crucial agro-climatological indices such as the onset of the rainy season. In addition, first outcomes of the regional climate change simulations driven by MPI-ESM-LR are presented for a historical period (1980 to 2010) and two future periods (2020 to 2050, 2070 to 2100). The evaluation of the reanalysis runs shows that COSMO-CLM is able to reproduce the observed major climate characteristics including the West African Monsoon within the range of comparable RCM evaluations studies. However, substantial uncertainties remain, especially in the Sahel zone. The added value of the higher resolution of the nested run is reflected in a smaller bias in extreme precipitation statistics with respect to the reference data.