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Added value of simulating rainfall characteristics over Africa with a regionally coupled atmosphere-ocean model

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High quality climate data at a high spatial and temporal resolution are essential to develop and provide adequate climate services for Africa. Rainfall characteristics such as the number of dry and wet days, extreme rainfall or the length of rainy seasons are derived from regional climate data to create climate service products, e.g. for the agricultural sector. A common method to produce regional climate data is to dynamically downscale global climate change simulations by means of regional climate models (RCMs). These RCMs have to be able to simulate realistically the hydrological cycle in the different African climate zones including the movement of the intertropical convergence zone (ITCZ) over the continent. Deficiencies in the representation of the sea surface temperatures (SSTs) in global ocean models due to a too coarse spatial resolution and missing atmosphere-ocean interactions in RCMs contribute to the rainfall bias over regions affected by the moisture transport from the ocean. The application of a regionally coupled atmosphere-ocean model may reduce the rainfall biases over the African continent.

In our work, we analyze the potential impact of the atmosphere-ocean coupling on the simulation of rainfall characteristics over Africa and identify those regions providing an added value using the regionally coupled atmosphere-ocean model ROM. For this purpose, we downscaled the ERA-Interim dataset and the MPI-ESM-LR historical simulation for present climate and the MPI-ESM-LR RCP8.5 simulation for future climate with ROM. Each simulation was downscaled for a time slice of at least 30 years at a spatial resolution of 25 x 25 km^2 for the whole African continent and the West Atlantic Ocean. In detail, we will show the potential impact of the atmosphere-ocean coupling on droughts and extreme rainfall using different rainfall indices such as consecutive dry days (CDDs), consecutive wet days (CWDs) and very wet days (R95p). Moreover, the effect of the atmosphere-ocean coupling on rainy season parameters will also be analyzed. Finally, a comparison between the bandwidths of the rainfall parameters derived from the uncoupled/coupled projections and the bandwidths of the parameters from the uncoupled CORDEX-CORE Africa ensemble will be shown.