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Impact of dynamical regionalization on precipitation biases and teleconnections over West Africa

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West African societies are highly dependent on the West African Monsoon (WAM). Thus, a correct representation of the WAM in climate models is of paramount importance. In this article, the ability of 8 CMIP5 historical General Circulation Models (GCMs) and 4 CORDEX-Africa Regional Climate Models (RCMs) to characterize the WAM dynamics and variability is assessed for the period July-August-September 1979–2004. Simulations are compared with observations. Uncertainties in RCM performance and lateral boundary conditions are assessed individually. Results show that both GCMs and RCMs have trouble to simulate the northward migration of the Intertropical Convergence Zone in boreal summer. The greatest bias improvements are obtained after regionalization of the most inaccurate GCM simulations. To assess WAM variability, a Maximum Covariance Analysis is performed between Sea Surface Temperature and precipitation anomalies in observations, GCM and RCM simulations. The assessed variability patterns are: El Niño-Southern Oscillation (ENSO); the eastern Mediterranean (MED); and the Atlantic Equatorial Mode (EM). Evidence is given that regionalization of the ENSO–WAM teleconnection does not provide any added value. Unlike GCMs, RCMs are unable to precisely represent the ENSO impact on air subsidence over West Africa. Contrastingly, the simulation of the MED–WAM teleconnection is improved after regionalization. Humidity advection and convergence over the Sahel area are better simulated by RCMs. Finally, no robust conclusions can be determined for the EM–WAM teleconnection, which cannot be isolated for the 1979–2004 period. The novel results in this article will help to select the most appropriate RCM simulations to study WAM teleconnections under current and future climate scenarios.