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Response of the West African Monsoon System to SST versus anthropogenic external forcing during the 20th century.

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Previous studies highlight robust links between natural modes of variability of global sea surface temperatures (SST) and precipitation over West Africa at different time scales. By contrast, there is still a debate on the influence of anthropogenic greenhouse gases (GHG) and sulfate aerosols emissions upon the West African Monsoon (WAM). In this study, we focus on the relative impact of natural SST modes versus anthtopogenic (GHG and sulfate aerosols) external forcing on the WAM system over the 1900-2000 period. Numerical experiments using the latest version of the Meteo-France ARPEGE Global Climate Model are used to separate the different external forcing signals of the atmospheric response. Three ensemble simulations are performed. The first ensemble is forced by observed SST over the 20th century. The ensemble mean of these simulations is considered as a good estimate of the SST forced variability of the atmospheric signal. A second (third) ensemble characterizes the impact of anthropogenic external forcing on the WAM system, the setup including the additionnal effect of observed GHG (and sulfate aerosols) time evolution. Analysis of variance and optimal filtering methods are applied to the three ensembles to quantify the relative impact of the different external forcing versus the internal variability of the atmospheric signal (chaotic noise) on the WAM system. Preliminary results will be presented suggesting the main role of SST forcing in 20th century rainfall variability and a possible weak impact of anthropogenic forcing upon the recent upward trend in Sahelian precipitation.