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Decadal prediction of Sahel rainfall: where does the skill (or lack of) come from?

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Previous works suggest decadal predictions of Sahel rainfall could be skilfull. However, the sources of such skill are still under debate. In addition, previous results are based on short validation periods (i.e. less than 50 years). In this work we propose a framework based on multi-linear regression analysis to study the potential sources of skill for predicting Sahel trends several years ahead. We apply it to extended decadal predictions performed with the MPI-ESM-LR model that span from 1901 to 2010 with one year sampling interval. Our results show that the skill mainly depends on how well we can predict the timing of the global warming (GW), the Atlantic multidecadal oscillation (AMO) and, to a lesser extent, the interpacific decadal oscillation (IPO) signals and on how well the system can simulate the SST and West African rainfall patterns in response to such signals. In the case of the MPI-ESM-LR decadal extended hindcasts, the observed timing is well reproduced only for the GW and AMO signals. However, only the West African rainfall response to the AMO is correctly reproduced. Thus, for most of the lead times the main source of skill in the decadal predictions of West African rainfall is from the AMO. The GW signal degrades skill of the decadal predictions, because the response of West African rainfall to GW is poorly captured. Our results also suggest that there is room for improvement in the decadal initialized hindcasts if the responses of the global SSTs and the West African rainfall to the AMO and GW signals were better reproduced. Furthermore, our approach may be applied to understand and attribute prediction skill for other variables and regions.