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Impact of AMV on rainfall intensity distribution and timing of theWest African Monsoon in DCPP-C-like simulations

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Previous studies agree on an impact of the Atlantic Multidecadal Variability (AMV) on total seasonal rainfall amounts over the Sahel. However, whether and how AMV affects the distribution of rainfall or the timing of the West African Monsoon is not well known. Here we seek to explore these impacts by analyzing daily rainfall outputs from climate model simulations with an idealized AMV forcing imposed in the North Atlantic, which is representative of the observed one. The setup follows a protocol largely consistent with the one proposed by the Component C of the Decadal Climate Prediction Project (DCPP-C). We start by evaluating model's performance in simulating precipitation, showing that models underestimate it over the Sahel, where the mean intensity is consistently smaller than observations. Conversely, models overestimate precipitation over the Guinea Coast, where too many rainy days are simulated. In addition, most models underestimate the average length of the rainy season over the Sahel, some due to a too late monsoon onset and others due to a too early cessation. In response to a persistent positive AMV pattern, models show an enhancement in total summer rainfall over continental West Africa, including the Sahel. Under a positive AMV phase, the number of wet days and the intensity of daily rainfall events are also enhanced over the Sahel. The former explains most of the changes in seasonal rainfall in the northern fringe, while the latter is more relevant in the southern region, where higher rainfall anomalies occur. This dominance is connected to the changes in the number of days per type of event: the frequency of both moderate and heavy events increases over the Sahel's northern fringe. Conversely, over the southern limit, it is mostly the frequency of heavy events which is enhanced, affecting the mean rainfall intensity there. Extreme rainfall events are also enhanced over the whole Sahel in response to a positive phase of the AMV. Over the Sahel, models with stronger negative biases in rainfall amounts compared to observations show weaker changes in response to AMV, suggesting systematic biases could affect the simulated responses. The monsoon onset over the Sahel shows no clear response to AMV, while the demise tends to be delayed and the overall length of the monsoon season enhanced between 2 and 5 days with the

positive AMV pattern. The effect of AMV on the seasonality of the monsoon is more consistent to the west of 10ºW, with all models showing a statistically significant earlier onset, later demise and enhanced monsoon season with the positive phase of the AMV. Our results suggest a potential for the decadal prediction of changes in the intraseasonal characteristics of rainfall over the Sahel, including the occurrence of extreme events.