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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Influence of initial soil moisture in a Regional Climate Model study over West Africa: Part 1: Impact on the climate mean" *by* Brahima Koné et al.

Anonymous Referee #2

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In these two manuscripts Koné et al. initialize a regional climate model with different soil moisture conditions to study the effect of soil moisture on the mean climate and on climate extremes. I believe that these two manuscripts are interesting and potentially of value to the research community, but the authors do not sufficiently justify their analysis design nor do they contextualize their initial conditions relative to observed variability. I would urge the authors to consider providing more context to justify their choices to better help the reader interpret the results.

Choice of study years: How were the years 2003 and 2004 chosen? Perhaps show a time series of precipitation anomalies in your study region to highlight why you chose

2003 and 2004. "Dry" and "wet" are very subjective terms. Or consider showing observed precipitation and soil moisture anomalies during 2003 and 2004.

Choice of soil moisture data: Why initialize soil moisture with ERA 20C, which includes only surface forcings of surface pressure and marine winds only? How well does this dataset compare to satellite-derived observations? ERA 20C isn't really a reanalysis of soil moisture, because the soil moisture doesn't include any observations. If the authors want an observationally-based soil moisture dataset, they could consider a product like GLEAM (Martens et al., 2017; Miralles et al., 2011)

You show the observations for precipitation, perhaps show observations for soil moisture too. You could show ERA20C (which you added) and maybe GLEAM as an independent dataset

Using global wilting points and field capacity: In the dry and wet runs the authors use a uniform wilting point and field capacity everywhere. But we expect that both the permanent wilting point and the water holding capacity of the soil differs by location (see, for example Figure 6 of Leenaars et al., 2018). These two values will be radically different in the Sahara Desert and southern Nigeria, for example. The assumptions made here, that wilting point is 0 or that field capacity is 0.489 is likely unrealistic for many locations, and these extreme initial conditions may be affecting the results. The authors need to more completely justify the use of these initial conditions, as opposed to using the maximum and minimum observed values, for example.

Effect of methods on the analysis: The fact that the wet year (2003) and the dry year (2004) look the same in most graphs when used as the control seems to indicate that they're either quite similar, or that the values for initial soil moisture are incredibly strong, and are overwhelming everything about the dry vs wet year. Are extreme values of soil moisture like this really useful? If so, the authors need to better justify them. I understand that this is a sensitivity analysis, but the authors need to contextualize how relevant this sensitivity analysis is to the conditions of the real world.

Starting at a soil moisture of 0 is quite extreme. Show, for example the local minimum and maximum soil moisture estimated for the region in the target starting month (June) in an observational dataset as comparison. Showing local min/max for each pixel would demonstrate how the initial conditions used compare to what has historically been experienced.

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