

Interactive comment on “Non-linear intensification of Sahel rainfall as a dynamic response to future warming” by Jacob Schewe and Anders Levermann

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General comments

In this paper, future projections of Sahel rainfall are analysed. The authors show evidence for the possibility of an abrupt intensification of rainfall under future climate change, proposing a mechanism based on the non-linear response of precipitation to tropical Atlantic warming. The addressed scientific question is fully relevant to the scope of ESD.

The paper is written in a clear and concise manner. Wording is precise and the organisation of the manuscript facilitate the comprehension of background, motivation,

C1

method, results and conclusions. Title and abstract effectively drive the reader into the focus of the paper. Motivation and objective are clearly stated, data and method are appropriate to address the scientific questions. Data used are open access and the method is straightforward and clearly described, making easy the reproduction of the study. Results are robust and correctly interpreted, supporting substantial conclusions, which are precisely outlined. Essential existing literature is cited to introduce the background on the subject, to motivate the study and indicate the originality of the contribution, as well as to put results and conclusions in the context of the current knowledge on the subject.

These results represent a noticeable contribution to the debate on future projections of the Sahel rainfall, though some aspects should be improved (see specific comments below).

Specific comments

Page 2, line 19: Add Park et al. 2015, on the northern-hemispheric differential warming impact on the projected Sahel rainfall (<http://www.nature.com/articles/ncomms6985>).

Page 2, lines 19-21: Other than the magnitude of the big drought, it would be interesting also to analyse the model ability in reproducing the decadal variability in the historical period.

Page 2, lines 31-33: What does “particularly pronounced” exactly mean? Please detail the method to select precipitation and moisture transport boxes in Figure 4.

Page 3, lines 1-3: This is the main issue in the paper. You state that “a substantial part of today’s Sahel moisture is sourced from the Mediterranean”, and this has been shown to be one of the key areas in future GW scenarios (Park et al. 2016). Then you state that the flux from the Mediterranean is negligible compared to the tropical Atlantic. This should be substantiated. A comparison between tropical Atlantic and Mediterranean moisture sources should be shown, as well as a comparison between

C2

the effects on precipitation of the SST warming in both the basins.

Figure 2: Is the magnitude of drought computed as drought minus no-drought? So models reproducing drought should give negative values. I think it would be better to change the sign, also for coherence with the changes by the end of the 21st century. Moreover, in the text you state that Wet7 models are “better than average in reproducing drought magnitude”, therefore I suggest to add the multimodel mean to the plot, to show this.

Figure 6: How do you obtain precip-SST plots? Do they refer to 21st century only? Please clarify this.

Figure 7: It would be very useful to add the SST time series to precipitation.

Figure 8: I think showing again MIROC-ESM-CHEM is redundant, better to show the multimodel mean, alongside the conceptual scheme.

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