

## ***Interactive comment on “Global meteorological drought and severe drought affected population in 1.5 °C and 2 °C warmer worlds” by Wenbin Liu et al.***

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This article talks about the drought evolution (duration, intensity and frequency) due to the climate change in a 1.5 (2°C) scenarii defined by the COP21. It gives an estimation of the impacted people around the world. To obtain these results, the article uses outputs from eleven CMIP5 GCMs with the RCP4.5 and 8.5, the gridded population from SSP1 scenario and the Palmer drought severity index (PDSI). The transdisciplinary of this article is very interesting and show the human impacts due to the climate change. This paper is divided in 5 parts: an introduction that clearly defines the drought importance on the human society and the 1.5°C (2°C) scenario. The second part describes the data and the method but in this section, some corrections are required (see below). The results are well described and the discussion is interesting but some justifications

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could improve the limits of the method. I suggest publishing this article in ESD with major revision. The different remarks and suggestions are described below.

### Major comment on the methodology

That is the major comment on your article and the bigger correction I demand. First, I find that you don't give enough details to justify the choice to use eleven-CMIP5 models and only 2 RCP scenarios (4.5 and 8.5). Data are available on about 30 models for RCP8.5 (e.g. Famien et al. ESD discussion November 2017) and available for RCP2.6 and 6 but with a reduced number of models. Are more simulations not better? I would like a justification of the models use. Secondly, in your study, all models have the same ponderation but if a model is a reverse signal, this result is not visible, to avoid this problem you can use a classification of model type as in Monerie et al, 2016 (10.1007/s00382-016-3236-y) or in Sgubin et al., 2017 (10.1038/ncomms14375.375). I think that the use of a classification is important to improve your results robustness.

My other remark (the more important correction) is due to your impacted study. You write in the discussion that the uncertainty of the model is important and the use of several models weakens the error. That is true but not sufficient. In some region, I think about West Africa, no models have the correct precipitations pattern. This problem is maybe present in other regions. I think this problem leads to a wrong result for the impact and this part must be corrected. The best solution is to unbiase the outputs of the model with e.g. a quantile/quantile method (univariate or multivariate) and observations. These outputs maybe exist now and can improve your interesting results. Another way is better describe the errors between the models and the current observations to be able to determine a confidence index for all regions. With a correction of the output or with a discussion of the local error from the model, the results will be robust and you can eject the area where the confidence index is not sufficient.

### Some questions/remarks

In the abstract: I suggest adding some numerical results from the results and discus-

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sion part because of now the abstract is too qualitative.

Line 84: maybe add a reference for the longer duration

Line 101: Why do you use only the SSP1 scenario? That is right this is compatible with the 1.5° scenarios (Line 135) but other SSP scenarios are also compatible with your climatic scenario. Have you an idea of the impacts of the different SSP scenarios on your results?

Line 153: Why do you use  $\pm 0.2$  around the 1.5°C and 2°C ?

Line 207: Can you define the used threshold to define the drought duration/intensity?

Line 216: That is better to describe a little more the SSP1 scenario for the evolution of the rural/urban people. Your results explain the different trends but we don't know the evolution of the population.

Line 336: I suggest putting this paragraph before the SSP1 results. I think that is more logical to determine the role of the climate on the population exposure with a current population and after you add the role of the demographic trend.

Technical notes

Line 87: (PDSI) in place of ,PDSI,

Line 236: (more drought-prone) ?

Line 280: a “.” To delete

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