

Interactive comment on “Projected increases in magnitude and socioeconomic exposure of global droughts in 1.5 °C and 2 °C warmer climates” by Lei Gu et al.

Anonymous Referee #2

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General Comments

In summary, motivated by the 2015 Paris Agreement proposal, this manuscript calculated global 3-month Standardized Precipitation Evapotranspiration Index (SPEI-3) based on 13 CMIP5 GCM simulations under three RCP scenarios (RCP2.6/4.5/8.5) during 1976-2100, quantified changes in global drought duration, severity and occurrence under a bivariate framework, and analyzed the drought exposures of populations and regional GDP under 3 shared socioeconomic pathways (SSPs) in future 1.5 and 2-degree warming worlds. Generally, this well written manuscript is able to portray drought evolution with different warming trajectories and provide information for climate

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adaptation strategies. Here I list several questions below and suggest acceptance of the manuscript after minor revision.

Minor Comments

(1) P7, L19-20. How do you determine the year in which a specific warming target is achieved? I suppose you select the median year of the 30-year period with surface temperature closest to the warming target for each RCP (not for each RCP-GCM combination), so that the reaching year is the same for all 13 GCMs under a prescribed RCP scenario. The authors should clarify this.

(2) Figure 1a. I've noticed that the determined years under both scenarios (RCP2.6 and RCP8.5) are the first year (2020) of the whole period. Is it possible that for some GCM future projections, 1.5-degree warming (or even higher) has already been reached even at the beginning of the simulation period? If so, maybe it could affect the results in this manuscript.

(3) Figure 9, 10, S2 and Discussion Section. There are several countries (e.g. the United States) will experience a decrease in POP and GDP fraction exposing to more frequent severe droughts under the 2-degree warming level compared to 1.5-degree. I will be appreciated if the author could provide possible reasons considering the increasing drought risks in these countries.

(4) P10, L26. Eq. (5) should be Eq. (11)?

(5) As the authors mentioned in Section 2.1 that RCP2.6 is associated with SSP1, I suggest the author use SSP126 instead of RCP2.6 when talking about future drought risks. Same with SSP245 and SSP585.

(6) Relative to huge gaps in drought characteristics for two warming targets, results under three RCP scenarios seems to have few differences (e.g. Figure 6). Maybe the authors could explain the reason in Discussion Section, or explore the possible causes in future studies.

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