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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Spatial and Temporal Pattern of Drought Hazard under Different RCP Scenarios for China in the 21st century" *by* Tao Pan et al.

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Dear Editors and Reviewers: Thank you for your letter and for the reviewer's comments concerning our manuscript entitled "Spatial and Temporal Pattern of Drought Hazard under Different RCP Scenarios for China in the 21st century" (ID: NHESS-2018-242). Those comments are all valuable and very helpful for revising and improving our manuscript. We studied comments carefully and made corrections in the manuscript. The response to the reviewer's comments are as follow:

1. Since your research focuses on the SPEI in the future stage, the bias correction method you utilized to correct GCM data should be described in details.

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Authors' response: Thanks for your suggestion. We have supplemented bias correction method to correct GCM data obtained from ISI-MIP in Section 2.2. The statement is "Statistical bias correction methods facilitate the comparison of observed and simulated impacts during the historical reference period and a continuous transition into the future (Rötter et al., 2011). The applied method for correcting simulated data of ISI-MIP is that preserves the absolute changes in monthly temperature, and relative changes in monthly values of precipitation and the other variables (Hempel et al., 2013). For different climate variables, temperature is corrected by additive correction while precipitation, wind speed, relative humidity and solar radiation is corrected by multiplicative correction". Besides, the references were added, too.

References:

Hempel, S., Frieler, K., Warszawski, L., Schewe, J., and Piontek, F.: A trend-preserving bias correction &ndash&59; the ISI-MIP approach, Earth System Dynamics,4,2(2013-07-31), 4, 219-236, 2013.

Rötter, R. P., Carter, T. R., Olesen, J. E., and Porter, J. R.: Crop-climate models need an overhaul, Nature Climate Change, 1, 175-177, 2011.

2. The advantages of SPEI cannot be seen if you only employ one drought index. If you compare SPEI with the other one that does not take temperature into consideration (e.g. SPI), then we can clearly understand the importance of temperature or ET in drought monitoring.

Authors' response: Thanks for your comment. As we stated in the 3rd paragraph of Section 1, we chose SPEI as the drought index to analyze in our study after comparing the characteristics of the three most widely used indexes, SPI, PDSI and SPEI. SPEI combines the multi-scale characteristics of SPI and sensitive to warming characteristics of PDSI, which is so suitable to estimate drought hazard under climate change. But we also think it is really important to compare the results calculated by other drought indexes (e.g. SPI) as reviewer suggested, so we have supplemented the statement

in Section 4. The expression is “This general result is in agreement with those from Huang et al. (2017) and also proves the applicability of SPEI as a drought index in the context of climate change as previous studies. For example, Tan et al (2015) assessed drought hazard in Ningxia province of China indicated by SPI and SPEI, results showed that drying trends revealed by the SPEI were more significant than the SPI, and the trend magnitude was much greater. The differences between this two indexes are mainly attributed to the variation of temperature. It is confirmed that higher atmospheric evaporative demand resulting from temperature rise increased the severity of droughts (Vicenteserrano et al., 2014). Therefore, the SPEI that considers both precipitation and evapotranspiration is more suitable than the SPI for applications examining drought hazard under climate change.” Besides, the references were added, too.

References:

Tan, C., Yang, J., and Li, M.: Temporal-Spatial Variation of Drought Indicated by SPI and SPEI in Ningxia Hui Autonomous Region, China, Atmosphere, 6, 1399-1421, 2015.

Vicenteserrano, S. M., Lopezmoreno, J., Beguería, S., Lorenzolacruz, J., Sanchezlorenzo, A., Garcíaruiz, J. M., Azorinmolina, C., Morántejeda, E., Revuelto, J., and Trigo, R.: Evidence of increasing drought severity caused by temperature rise in southern Europe, Environmental Research Letters, 9, 044001, 2014.

3. The item “ET0” usually refers to reference evapotranspiration. Here in the calculation of SPEI, ETp or PET are recommended

Authors’ response: Thanks for your advice. After checking related literatures, Potential evapotranspiration (PET) is defined as the amount of evaporation that would occur if a sufficient water source was available. Often a value for the potential evapotranspiration is calculated at a nearby climatic station on a reference surface, conventionally short grass. This value is called the reference evapotranspiration (ET0). Since the literature proposed SPEI described as D=P-PET (Vicenteserrano et al., 2010), we have modified the expression to “PET” and make it to be consistent with the original text in Section

2.3. Also, we have supplemented the definition of PET in Section 2.3 to make it clearer to understand.

Reference:

Vicenteserrano, S. M., Beguería, S., and Lópezmoreno, J. I.: A multiscalar drought index sensitive to global warming: the standardized precipitation evapotranspiration index, J. Clim., 23, 1696-1718, 2010.

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