

Interactive comment on “Characterizing drought by change in precipitation-runoff relationship: a case study of the Loess Plateau, China” by Yuan Zhang et al.

Anonymous Referee #1

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General comments: This work characterizes the drought by linking climate anomaly with the change in precipitation-runoff relationship in China's Loess Plateau, and discusses the policy implications of the study to water resource management in a water-limiting environment. The study is scientifically valid, the methods and data sources are well explained, and the results are clear and well presented, though there are some aspects need to ameliorate. Overall, I would like to support the publication of this manuscript with some comments and suggestions to be addressed.

Section 2.4.1. Parameters estimation: The paper chooses seven commonly functions as the candidate margins distribution for drought duration and severity, there are some

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deficiencies in fitting margin distribution function. For example, "by comparison...", I hope the authors can provide quantitative value to determine distribution functions. "drought and severity are fitted with weibull and gamma ...", the authors need to show relevant statistical indicators.

Section 2.4.2. Only the method of Squared Euclidean Distance(SED) is used to perform the goodness-of-fit of joint distribution function, I recommend the authors can adopt more methods to evaluate the fitted copula, such as root mean square error(RMSE), the Akaike information criterion(AIC)...

The English expression in this MS is sub-standard; it needs to be improved. The authors should further review the whole paper, although I have pointed some in specific suggestions. In addition, some sentences in the paper are very long, without clear phrasing, so that the reader is sometimes left wondering what the main point of the sentence was. The authors need also notice these problems.

Specific suggestions:

Page1.L4, not all readers will know that this re-vegetation is anthropogenic, you need to explicitly state this.

Page1.L5, delete "in the area".

Page3.L11,delete "reflect".

Page3.L20, as the climate is changing over what years are these long-term averages calculated?

Page4. L21, "propose use"?

Page6.L9, states that 7 dry periods are identified yet on Fig 8(a) there are 15 events. This is confusing.

Page6.L19, "In1991–1999($p=0.000$) there was a significant decrease change significantly in the PRR", expression is repeated.

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Page8.L6, "multi_year".

Page8.L10, "Compared to"

Page10.L24, hey you are introducing a new model and a new dataset in the Discussion section. This is very non-standard the structure is all over the place.

Fig 5, Precipitation, and many other hydrological variables, have the dimensions of depth / time, and you need to include the time of integration into you units. So your X-axis should have the units of mm/year. When assessing annual trends of annual (or actual E, potential E or Epan) the units are mm/year/year, as in such a plot the X-axis is years, and the Y-axis of an annual P time-series is mm/year, so the slope (or trend) of $\Delta Y / \Delta X$ has the units of mm/year/year.

Suggested references:

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Vicente-Serrano, S. M., Gouveia, C., Camarero, J. J., Beguería, S., Trigo, R., López-Moreno, J. I., Azorín-Molina, C., Pasho, E., Lorenzo-Lacruz, J., and Revuelto, J.: Response of vegetation to drought time-scales across global land biomes, *Proceedings of the National Academy of Sciences*, 110, 52-57, 2013.

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