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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Exploration of diffusion kernel density estimation in agricultural drought risk analysis: a case study in Shandong, China" *by* C. Wen et al.

Anonymous Referee #2

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Review of study "Exploration of diffusion kernel density estimation in agricultural drought risk analysis: a case study in Shandong, China"

The aim of this study is to estimate the joint return period of agricultural drought duration and intensity for a case study area in China using kernel density estimation. The focus is on estimating drought risk for corn during different growth stages and comparing two different kernel density estimation methods. Overall, the topic is highly relevant for agricultural drought risk management. The paper is well structured and I appreciate the authors' effort to describe all methodological steps in detail. Despite supporting the general idea of the paper I have a few major concerns regarding the aim of the study,

the presentation of corresponding results, and methodological choices. I recommend to present further result and put more weight on discussing relevant findings.

Selection of results: I appreciate the efforts to compare the obtained bivariate PDFs of drought duration and intensity by Gaussian kernel density estimation (GKDE) and diffusion kernel density estimation (DKDE). The way the results are presented, however, does not allow to properly assess the differences in results of both methods. Currently, only the differences in bivariate PDFs (KGDE vs. DKDE) of drought duration and intensity based on SPI are shown for ONE station (54 714; in Fig. 5/7/8 station 57 414 is named, which I don't find in table 1). Why for this station? I also find it difficult to follow the results since in my view the figures are not clearly labeled (e.g. Fig 9: Is this KGDE or DKDE based? Fig. 7: which station is shown? Fig 11: I assume the figure is based on DKDE but you should have this info in the caption). The paper would be much stronger if it was shown how the results differ for several, if not all, stations. I recommend to think about ways how to summarize this information; currently only Table 3 displays a station-wise comparison for the univariate p-value of K-S test statistics for univariate PDF of drought intensity estimated by DKDE and GKDE. Your final aim is to present how the joint return period of agricultural drought duration and intensity differs for both kernel density estimation methods (if I am not mistaken). However, the map showing drought risk in Fig. 11 only makes reference to one method and only for one selected drought duration-intensity scenario.

Aim of study: Please elaborate a bit how the final information could be used to improve agricultural drought risk management, e.g. the maps about the return period estimates? How different would the maps look like using KGDE? The paper is methods focused, yet some discussion on the added value for risk management using DKDE over GKDE would be useful.

Methodological choices: In my view the assumption of setting a truncation level of SPI=0 to determine drought duration and intensity is critical. I would appreciate to see results using different truncation levels. How would results change? Also, I find

it critical to calculate SPI only over each growing stage rather than also taking into account longer accumulation periods, e.g. SPI accounting for 3 months (if I correctly understood). Would not the soil moisture content determined by rainfall of the past x months be critical for drought response during the specific growing stage? A weakness is also the use of SPI as single indicator. Drought is a multifaceted problem and other indicators such as SPEI or soil moisture are often used for agricultural drought assessment. On page 6761 you state that "The occurrence frequency and severity of drought risk per growth phase from multiple perspectives are conducted", which, to me, implies using multiple indicators.

Specific comments:

Abstract: I encourage the authors to go into more detail. The sentence that "The results show that DKDE is relatively more accurate without boundary-leakage" should be somehow placed into context. Since NHESS readership may be broad there should be more explanations what this indicates.

"Combined with the GIS technique" –> Referring to which?

"The estimation provides a different way to study the occurrence frequency and severity of drought risk from multiple perspectives." –> as in major comment, from multiple perspectives could be misinterpreted (multiple drought indicators)

Introduction: 6758, L 25 onwards: There are many more indicators. Reference to a few studies that evaluated different drought indicators for agricultural drought would be useful to cite.

Methods: I appreciate the authors' efforts to be very clear in the methods. However, some methods (detrending; SPI calculation; threshold method to determine duration and intensity) are very standard and referencing a few papers and a short explanation would be sufficient.

Results/Discussion/Conclusion: Currently there is a strong focus on the methods de-

scription (which in my view could be shortened) but the discussion of the meaning of the results, methodological choices, and the added value for risk management is a bit weak. Also, further references how your research fits into findings of similar studies would be useful.

Figures/Tables:

Generally: Please critically check all figure captions, it is not always clear what is presented.

The info from Table1/Figure1 is mostly redundant. Consider deleting Table 1 and to put additional information into Figure 1. Figure 1: "Insured Areas", which is also mentioned in the paper –> please explain further Table 2: not necessary Figure 2: rather background information (which source?); consider deleting and rather adding more figures on the comparison of results of different stations Figure 4: not necessary; see comment on methods (well known); consider deleting and rather adding more figures on the comparison of results of different stations Figure 7: Which station? What is the drought duration unit, years? Fig 11: The color coding thresholds/range seems a bit arbitrary (should be consistent for all maps); wouldn't inverse color coding be more intuitive (higher return period, lower risk, less red)? Fig. 10/11: How do you explain a value of 6 in Fig 10 (darkest red polygon) and much lower values in Fig 11 for the same polygon?

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 6757, 2015.