

## ***Interactive comment on “Developing drought impact functions for drought risk management” by Sophie Bachmair et al.***

### **Anonymous Referee #2**

Received and published: 2 August 2017

This study tests the potential for developing empirical drought impact functions based on drought indicators as predictors, and text based reports as variables for drought damage using South East England as a case study. The study shows that text-based reports can provide valuable information for drought risk management and that various methodological approaches can be applied to develop drought impact functions.

By showcasing and evaluating methodologies for setting up drought impact functions the study provides a valuable addition to the “drought impact debate”. Apart from that the study reads well. I would therefore support the manuscript for publication but with substantial revisions taking into account the following general and technical comments/suggestions:

General comments:

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1. The study currently only looks at counts of impacts and not the actual height of impact. I wonder whether the authors checked the relation between the count and actual height of impacts, whether this relation is positive or negative. Could the authors elaborate further on this and on the question what would happen with the impact functions if height of impact is taken into account?

2. The authors fit “damage functions” based on a ‘leave-on-out’ principle. To me it isn’t a surprise that with such an approach high correlations/good results are being found. I’d suggest the authors to do some extra sensitivity testing on this issue: e.g. leaving out more variables in the fitting. Could the authors elaborate more on how stable this relation is then? Up to what level (# of points left out) are still reasonable results achieved?

3. From reading the methods it does not become clear to me how exactly you coupled a gridded product (SPI/SPEI) to counted impacts over the basin in SSE. And this you use an equal time-period to establish the fits for the different accumulation times? Please elaborate further on this.

4. Some parts in the methods section are repetitive, for example the paragraphs on P.6. Please take a look and move repetitive sections of text.

Minor comments:

1. P1.L24: “lowest prediction uncertainty”: How about the uncertainty when modelling full counts? But using only binary outputs?

2. P1.L25: “Reasonable limits”: what limits?

3. P2.L29: “water use... fish kills”: As an additional reference, use Logar et al. Costs of drought

4. P3.L2: “vegetation stress”: Could you give some more examples here?

5. P3.L5: “rainfall”: I’d put this broader: particularly other hydrological variables cause

C2

- droughts, e.g. runoff. Especially in an area with relatively high irrigated agriculture
6. P3.L28: "Predictive power": elaborate further on what you mean with this.
  7. P4.L1: "SSE": the abbreviation for South-East England is not consistent, see also L5.
  8. P5.L4: "drought impact occurrence during each month": Is this a valid assumption? And did you do some (sensitivity) testing to back-up this assumption?
  9. P5.L10: "All impact reports are counted": Does it matter in terms of actual height of impact to define and sum these sub-types? 7 sub-types together may have a lower impact than 1 sub-type impact elsewhere.
  10. P7.L6: "0.7": Was this value based on literature or randomly chosen?
  11. P7.L12-L17: I wonder whether you can do a proper regression for different sectors (and sometimes adding them up) while leaving out years without a drought. In doing so you miss part of the impact mechanism, i.e. droughts without an impact. And shouldn't it be more transparent to use the same n-months of drought for all impact categories?
  12. P7.L29: "SPI-6...": Could you elaborate a bit further on whether taking these variables make sense from a physical point of view? And how about double-counting of drought mechanisms? Please also clarify where M and Y stands for, so far not explained in the text yet.
  13. P8.L10: "Positive impacts": Do you mean here, an impact measured?
  14. P8.L10: "Four instances": is it possible to highlight these with a different color. From looking at the figure I count more than 4.
  15. P8.L11: "yet negative indicator values": I can image that this can be explained by demand/supply mechanisms. Did you check for which impact indicators this holds?
  16. P8.L15: "The RF model better captures": How can we see this from the figure?

### C3

17. P8.L16: "SPEI-24 but less negative": Did you also compare the performance of indicators when using only SPI-6 or SPI-24?
18. P8.L28: "two data-points": Could you point this out in the figures. Not completely clear to which points you refer here.
19. P9.L1-L4: Specify where we can find these results, e.g. in figures or tables
20. P9.L13: "including impact information from the preceding month": How did you do this exactly? And are there many one-month impacts or are most months characterized by multi-month impacts?
21. P10.L20: "Streamflow": I don't exactly understand where the term streamflow comes from here. Please elaborate.
22. P11.L21: "to predict impact occurrence for yet unexperienced drought scenarios". I wonder whether this methods can be used for extrapolation or prediction of impacts for unexperienced drought scenarios, especially in case these drought scenarios become more extreme. By using SPI/SPEI values the drought range was more or less fixed from -3 up to +3 (SPI/SPEI values), representing the variability from a long-term mean state. I wonder how you would deal with e.g. the increased severity of droughts. What if the value behind a -3 would become a -2 or -4 when taking a different/longer time-series into account, e.g. due to the effects of climate change? Would it be an option to add a trend to impacts in order to account for this issue?
23. P11.L29: "damage functions": Damage functions are often used for a specific grid, i.e. a pixel flooded, resulting in a certain degree of (monetary) damage. I'm not totally sure whether it is appropriate to call this damage functions when being applied on the scale of a basin or when including only counts as measure of severity. How would you interpret "maximum damage" here, or "vulnerability"?
24. P21.Fig5: Could you elaborate further on how to interpret these figures given the leave-on-out cross validation that was performed? From looking at this figure I under-

### C4

stand that the hurdle approach underestimates impacts. Could you discuss/elaborate more whether it would be more important for a policy maker to under- or overestimate impacts, from example from a political or safety point of view?

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2017-187>, 2017.