

Response to comment of Referee #1

Please find in Black the reviewer's comments and in Blue our responses.

Comment: "Dear authors, many thanks for your highly interesting submission to HESS/NHESS. I'm always glad to see some added value/application off the EDII. Overall the manuscripts reads very well and is embedded in the current state of literature. Nevertheless, I do have some major points of critique I would like to discuss:"

Reply: Dear Veit Blauhut, we thank you for reading our manuscript and for your suggestions on how to improve it. Below, we provide answers to your comments and explain how we will update the manuscript to address your points of critique.

Comment: "Data: One of your first take home messages is "We encourage drought impact information to continue to be collected and given importance in future drought impact studies". I'm sorry to say, but this is nothing novel. All publications with or on EDII data claim this...which brings me to my major point of critique."

Reply: We will change the message "We encourage drought impact information to continue to be collected and given importance in future drought impact studies" since as mentioned, it is not a novel statement and replace it with "drought impact information has already been proved to be useful in drought impact studies (Blauhut et al., 2015, 2016; Stagge et al., 2015; Bachmair et al., 2015, 2016) and it also proves to be useful here when assessing links between different drought indicators and impacts in Spain."

Comment: "the version of EDII data you applied is quite outdated (I guess you downloaded the online version at EDC). Besides well known reporting biases in space and time, you missed recent major drought event(e.g. 2017/18). Therefore your data is likely lacking representativity (?).You should invest some time to update the Spanish case (you might contact ruth.stephan@hydrology.uni-freiburg.de or me for assistance and an actual offline version of the EDII). Furthermore, I'm afraid you did not do an EDII-data quality check of the Spanish case? Since 2015 we did learn quite a lot of how to use the data (more below)."

Reply: We carefully consider your point that the version of the EDII data we used is somewhat outdated. However, we would like to note that although the more up-to-date version includes the recent major drought event in 2017-2018, it is not publicly available. In addition, we find that conducting a quality control of a new data set is out of the scope of a revision. While impact entries have been added to some regions of the data base, however, Spain has not been amongst them and correct classification, duplications and typos have not been checked for Spain (communication with Ruth Stephan). For these reasons, we believe the use of the original data base is more appropriate here. We did a comparison of the common period and both data sets are very similar.

However, we will make sure to emphasise that the version of the EDII data used is somewhat outdated and that it misses a recent drought event and the potential consequences this has on our results. In the revised manuscript we will mention that our

results are limited by the availability of the data. In the discussion section, we will include a paragraph emphasising the limitations of the study due to this and that instead, we encourage future studies to use impact data that is more updated in time and that includes as many major drought events as possible, by collecting further impact data.

Comment: “From the methodological site, I appreciate your work using RF. Nevertheless I do have remarks to consider. Furthermore, some ideas to upgrade (?) your paper and to move from “showing a method which has been done already for the case of Spain” towards a little bit more.”

Reply: We agree that the aim and what our study did was to similarly reproduce a method that showed success in some regions to another region. We did this because we thought that such a study could be useful in a region where droughts cause severe impacts. We now follow your suggestions to upgrade our paper.

Comment: “The EDII data is a collection of impact reports which were attributed to 1 of >100 impact types. These impact types are categories to 1 of 15 impact categories. Accordingly, these impact categories pool sometimes very different drought types together! E.g. agriculture (1.2 – Reduced productivity of permanent crop cultivation; 1.7. Regional shortage of feed/water for livestock, 1.8 others). These impacts occur at very different stages and/or types of drought. Furthermore, “others” can be anything related to drought. Forestry for example might be “impacts on mushroom harvest” but also reduced tree growth/ dieback of trees. Again, very different effects needed to cause these impacts.

The method to “simply use the impacts categories (as Stagge et. all and Blauhut et al. did) is not as easy and requires “a dive into the data” to maybe re-categorise impact types or not to use all impact types within a single category. Anyway, I cannot at all recommend to use all impact categories together. Yes, Bachmair et al. did it, BUT you will get a way better signal if you do it category separated. You will probably not be able to use all, only the ones with good data, and monthly data, but this will make way more sense this way. Also, you should consider the “logic” of impact occurrence with regard to their nature (time of occurrence and duration). E.g. agricultural impacts can only seldom have a beginning and end by month. Normally, harvest is “weighted” ones a year. There is not “drought impacts on grain occurred from May to July). Its only quantified ones! Of cause, impacts on meadows might occur three times a year (at least in Germany). In contrast, impacts on hydropower production can of cause have a clear timestamp on it (low flow from may – September). Hence – this is another reason why you cannot merge the impact categories.”

Reply: We are aware that aggregating all impact types to a single category was not an optimal choice, however, the impact data we were using was of a small size, in comparison to these other studies mentioned. We have plotted sector-specific drought impact occurrences in Figure 1 below. Each sub-region shows 3 or less types of impact categories, except for the S region that shows 7. For this reason we think that a sector-specific analysis is not appropriate here, since there are not enough data points to investigate categories separately. In the revised manuscript we will discuss which impact dominates in each region and the “logic” of impact occurrence with regard to their nature” as mentioned. We will also replace Figure 1 in the original manuscript with Figure 1 below and explain why a sector-specific analysis is not conducted.

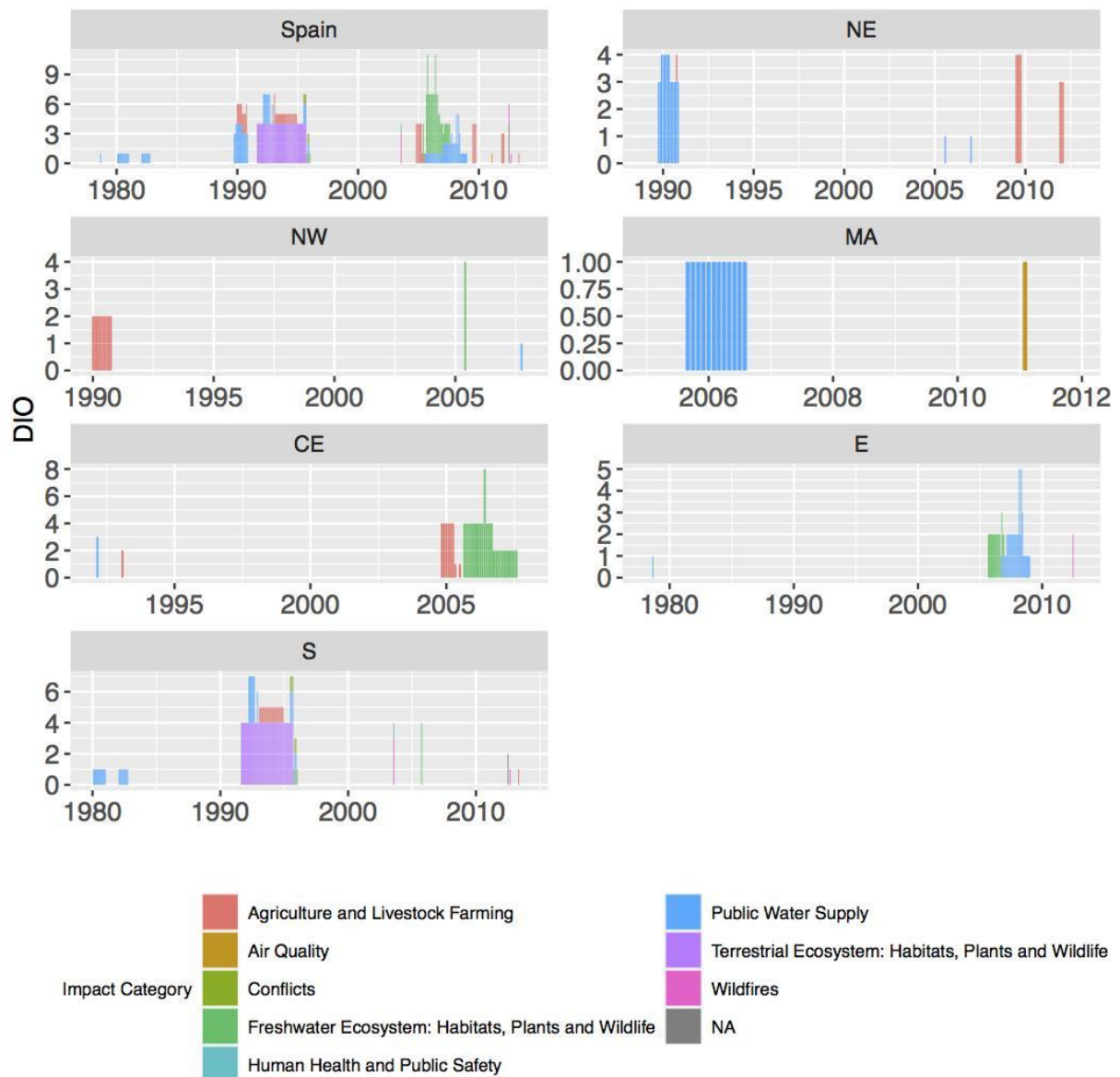


Figure 1. Sector-specific drought impact occurrences (DIOs) total for Spain and for each NUTS-1 region.

Comment: “Using total numbers of impact reports is ambiguous- but possible. Nevertheless, the strong bias over time (1976- 2020) has to be considered somehow. Reporting culture and media has changed dramatically since. à you might consider also testing on binary signals, rather than totals.”

Reply: We acknowledge this and in the revised manuscript, we will make a point that the reporting of drought impacts has changed over time and that this is not considered in the counting of impacts. We will mention that for instance, the overall increase of impact occurrences over time could be a result of this.

In terms of testing on binary signals, we did this in the RF analysis, by including a regression and a classification model. The classification model classifies impact occurrences into the two categories: “impact” or “no impact”.

Comment: “Since you are using RF, I would like to consider some more factors which could increase your model performance. Blauhut et al (2016) included vulnerability factors as determinants (vulnerability factors) to explain LIO beyond the hazard. Including such increased model performance for most cases!”

Reply: We will add vulnerability factors as impact predictors in the RF models. We will then compare the performance of the models with our previous results. As vulnerability factors, we will include yearly data for each NUTS-1 region of: GDP per capita, population density, public water supply, unemployment rate, employment by economic activity for agriculture, forestry and fishing, and industry (except construction). Also, the area of: artificial surfaces, agricultural areas, arable land, non-irrigated arable land, permanently irrigated land, Forest, Wetlands and Water bodies. The data will be obtained from the Instituto Nacional de Estadística, Eurostat and the Corine land cover data set. These factors have been reviewed and tested as drought vulnerability factors by Stefano et al., 2015 and Blauhut et al (2016). All of these factors have data available for NUTS-1 regions and have various time steps. Other factors that do not have various time steps cannot be used in the RF analysis, hence why we are limited with our choices.

Comment: “With regard to model quality I please you to also present the Area under ROC curve characteristics, as Stagge, Sutanto and Blauhut did. A cross-correlation is not expedient.”

Reply: We agree and will now also present the area under the ROC curve.

Comment: “Furthermore, you could use your novel, self-investigated data to test your model?”

Reply: We believe that the impact data used in this study is sufficient to test our models here. However, we will emphasise in the discussion the limitations of the impact data set used and will suggest that future studies invest in creating novel drought impact data sets.

Comment: “By now your work is only a copy of... if you would separate the impact types as Blauhut et al 2015/6 and apply your indices, and forecasting... this would become a more beneficial contribution. Furthermore, you could consider to include catchment specific characteristics (vulnerability factors) such as is the catchment managed (yes/no), how many reservoirsa lot of opportunities to consider and I would be happy to discuss about.”

Reply: Hopefully after making the changes according to the both reviews, especially by including vulnerability factors, the study will be more than a similar reproduction of a method that showed success in some regions to another region.

Comment: “Some minor comments on text and figures can be found in the PDF.”

Reply: We will apply all of the minor modifications suggested in the revised manuscript.

Comment: “To wrap up, I highly appreciate your work! But you should take the chance to give it a bigger meaning for the community. Thus, the first step would be to investigate more

impacts and then 2nd you should consider to re-categorise the impact reports, only use specific impact types (e.g. with high counts of reports) or maybe use different prediction models in comparison (e.g. zero inflated models?). Anyway, a big added value to the community would be a comparison of such.

Please feel free to contact me for an open discussion or assistance.”

Reply: We very much thank you for your review and also highly appreciate it. As already said, we believe that by making the modifications discussed above, our work will have a bigger meaning for the community. We have considered all of your comments very carefully.

References:

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