

This is an interesting work where the authors have explored drought exposure and impacts data from two datasets, viz, EM-DAT and DISM and have linked these to drought characteristics. They also access how well do drought impacts link to the choice of drought indicator, threshold and timescale. The finding that SPEI relates to reported drought impacts more than SPI is particularly interesting. However, the paper in its current form needs improvement on several fronts to be considered for publication in this journal to match the journal standards. The findings have a potential to be published in this journal but only after major revisions. The authors could have given more thought on how they could have done a better job with their figures to demonstrate their findings. The current 3-D plots make it difficult to interpret those figures. The writing is a bit vague at many places. The introduction section, particularly, is not appropriately utilised to set the scene for the present study and is filled with basic information on droughts which is already well known. The introduction section needs to be thoroughly revised to tailor it to the purpose of the work carried out and to match the standards of the journal. The authors also do not highlight clearly what the new dataset around which they have centred this work. My detailed comments are as follows:

We thank Reviewer 4 for the detailed and constructive assessment of our manuscript.

We agree on several of the points that the Reviewer raises. In the revised manuscript, we will restructure the Introduction to focus less on general drought background and more on the specific motivation for this data product, the gaps in existing drought impact datasets, and the contribution of our workflow. We will also give more space to the dataset throughout the manuscript, since ESSD is a data journal, by explicitly describing its contents, variables, spatial and temporal coverage, file structure, and intended use cases.

In addition, we will replace most of the current 3D figures with clearer 2D figures, including heatmaps and scatter plots. We detail below how we plan to address the other specific points raised by the reviewer.

Section 1: A large part of the Introduction section is basic background to droughts which is already well-known knowledge. repeating all those is a redundant use of the introduction. the authors should revise the intro to streamline it to what their overarching aim is, what gaps motivated it and the advantage of doing so. the current introduction is poorly written, lacking structure and central messages of the paragraphs. the authors fail to articulate what are the gaps in these existing studies that motivate the current work.

In the revised manuscript, we will reduce the general background on droughts and focus instead on the specific motivation for the study: the need for an event level drought disaster dataset that links reported drought events with gridded meteorological drought characteristics, population exposure, GDP exposure, and reported impacts.

We will also clarify that many existing drought datasets focus primarily on meteorological drought indicators, whereas disaster databases provide reported impacts but often lack spatially and temporally explicit physical drought information. The revised Introduction will therefore be organized around the need to connect these two types of information in a reproducible global data product.

L 68-70: India is a big region. please specify the regions India that were affected by the drought.

In the revised manuscript, we will either specify the affected regions of India for this example or remove the example if it does not directly support the central motivation of the study. Since we will shorten the general drought background in the Introduction, we may also replace this example with a more focused discussion of the need for event based drought impact datasets.

L119: the words ‘resulting dataset’ is a bit vague. Here and throughout the paper, I found it difficult to understand what exactly is the dataset that the authors have come up with. Please dedicate a few sentences wherever appropriate to state this clearly.

In the revised manuscript, we will define the resulting dataset more explicitly and add additional sections describing it in detail. We will clarify that the dataset contains harmonized event-level drought disaster records linking EM-DAT/GDIS drought events with SPI/SPEI derived drought characteristics, population exposure, GDP exposure, and reported impacts.

We will also add a dedicated data description section that lists the main fields included in the dataset, such as event identifier, country, event window, drought index, timescale, threshold, mean detected area, mean detected severity, population exposure, GDP exposure, weighted exposure, and EM-DAT reported impact variables.

L 210: but SPI is known to not do a good job for some climate types, such as arid regions.

We agree. In the revised manuscript, we will add a short discussion of the limitations of SPI (and SPEI), especially in regions where precipitation alone may not fully represent drought stress.

Section 3.3: please cite literatures that have used the methods described in this section.

We have already discussed the use of drought objects to some extent in the Introduction. However, we agree that the methodological context should be strengthened. In the revised manuscript, we will add references to studies that have used connected component clustering, spatial drought tracking, or drought event extraction from gridded drought indices. We will also clarify that our clustering step is used as a transparent raster object extraction procedure, rather than being presented as a new clustering method.

L 267-268: but the drought may extend beyond a year. this is also the reason why I am not sure if it makes sense to have a 'target year' as you describe in line 265

We agree that this needs clarification. In the revised manuscript, we will move away from the phrase “target year” and instead use the “reported event window”. Where EM-DAT provides start and end dates, we will use the corresponding event window to extract monthly drought clusters. This allows events to extend across multiple years where reported by EM-DAT.

We will clarify the difference between analyses based on a single GDIS year and those based on the full EM-DAT reported event window. The main revised analysis will use the EM-DAT event window where available.

L 272-273: what is the reference for this? The widely accepted formula for risk is risk=hazard x exposure x vulnerability.

This formulation is standard in many fields, notably in actuarial science. However, we agree with the reviewer that in a climate context it may be unfamiliar to readers and may appear as odds with the hazard-exposure-vulnerability perspective. In the revised manuscript, we will avoid presenting the metric as a complete risk measure. Instead, we will describe it as a weighted exposure metric that combines the amount of exposed population or GDP with the detected duration and severity of drought conditions within the event window.

Figure 3 caption: what do the 'different clusters' mean, please specify

We will revise the Figure 3 caption to clearly explain what the different clusters represent. We will state that the clusters are spatially contiguous areas where SPI or SPEI values fall below the selected drought threshold for the selected month and timescale. We will also clarify the meaning of GDIS polygons, representative locations, and any search areas shown in the figure.

L 292: you mentioned 'connecting drought events to impacts data' in your previous heading too. Would recommend better organisation of the subsections.

In the revised manuscript, we will rename and reorganize the subsection headings to avoid repetition.

L 323-303: reason is not discussed

This pattern is derived directly from the compiled GDIS/EM-DAT records and associated exposure calculations, and the available data do not allow us to determine the underlying reason for it. In the revised manuscript, we will therefore avoid speculative interpretation. We will revise this part of the Results section to describe the pattern as an observed feature of the dataset, rather than implying a causal explanation.

L 310-311: but did you not in Figure 1 show Australia as reported to have higher number of drought events? Doesn't this mean you have information on events for Australia?

Figure 1 shows reported drought events from GDIS, including Australia/Oceania. However, in the later continental analysis, Australia/Oceania was excluded because of the small number of impact data available for robust continental comparison. In other words, the difference is between the number of events and the number of impact entries. In the revised manuscript, we will state this clearly and consistently, and we will explain what we mean by "small sample size," including the number of events involved.

L 311-312: vague. meaning is not clear.

'Asia generally shows the highest population exposure across all drought time scales, except at lower thresholds, where Europe shows the highest exposure.'

The statement was intended to describe the pattern observed in the exposure results, rather than to provide a causal explanation. In the revised manuscript, we will clarify the exact exposure metric, drought index, threshold definition, and configuration to which the statement refers.

Figure 5-12: i think it might have helped to have the same range of the axes in all the figures so that they could be better visually compared

We agree with the reviewer's point, and we initially explored using comparable axis ranges across panels. However, because of the large variability among continents and configurations, using identical axis ranges caused substantial loss of visual detail; in some cases, the patterns for certain continents became highly compressed and difficult to interpret. For this reason, the original figures used panel specific ranges.

In the revised manuscript, we will address this issue by replacing most of the 3D figures with clearer 2D heatmaps and scatter plots. We will also shorten the Results section and focus the comparisons more explicitly across indices, thresholds, and timescales.

L 375-378: difficult to understand what the authors are trying to say.

'The extent of the reduction in weighted exposure relative to absolute exposure provides insights into the nature of drought conditions. The largest reductions are observed in Asia, suggesting that droughts in this region may be less severe or less frequent within a given year than in other continents.'

Our intention was to explain that the reduction from raw exposure to weighted exposure reflects the role of detected duration and severity. A large reduction means that many people or assets are located within the detected drought affected area, but the drought signal is not present for the full event window, is relatively weak in severity, or both. In the revised manuscript, we will rewrite this sentence using the terms detected duration and severity, rather than "frequency," to avoid confusion.

L 406-408: it might be worthwhile adding a sentence here on concluding what advantage the weighing of exposure is offering in giving a new/different/similar perspective on understanding the links between exposure and drought characteristics. this would give a good closure to this section.

In the revised manuscript, we will state that weighted exposure provides an alternative to raw exposure by accounting for the detected duration and severity of drought conditions within the event window. This helps distinguish between events where population or GDP is briefly exposed to weak drought conditions and events where exposure occurs under longer lasting or more severe drought conditions.

L 469: s not S in shorter timescale

In the revised manuscript, we will correct this typographical error.

L 481: 'small sample size' : vague. please elaborate on what you mean by 'sample'

In the revised manuscript, we will provide the number of events for any continent or region that is excluded from a comparison because of limited event counts. We will also clarify that, in addition to the small number of harmonized events, some events have missing impact information, which further limits the robustness of continent level comparisons. Where this affects the analysis, we will report the available sample size used for the corresponding figure or statistic.

L 538: add a sentence on what this means

‘There are no cases where the ratio of total damage to GDP exceeds one’

In the original manuscript, we intended to indicate that the ratio of reported total damage to GDP exposure did not exceed one, meaning that reported total damage was never larger than the corresponding GDP exposure value in relative terms. However, we recognize that this ratio based explanation may not be the clearest way to present the relationship between reported damage and GDP exposure. In the revised manuscript, we will remove this explanation and instead discuss the relationship using correlation analysis between GDP exposure and reported total damage.

L 539-540: here and everywhere else where you mention correlation, I think it might be good to quote the average value of the correlation

In the revised manuscript, we will discuss the correlation results more explicitly. In addition, the correlation coefficient and corresponding p value will be reported directly in the figure panels, so that readers can assess both the strength and statistical significance of the relationships between drought characteristics, exposure, and reported impacts.

L 545-546: here and even in the previous section, when you conclude that SPEI corresponds to impacts more than SPI, I think it will benefit the paper a lot if you include a figure that clearly shows this, as this does seem like an important conclusion stemming from this work.

‘Across all timescales, SPEI consistently corresponds to higher total economic damages from drought events than SPI.’

We agree with the reviewer that the comparison between SPEI and SPI is an interesting result. However, in response to comments from other reviewers, we will shorten the Results section and reduce some of the extended interpretation. We will therefore remove the extended SPI versus SPEI impact comparison from the revised manuscript and focus instead on the dataset structure, variables, sensitivity information, and limitations.

Section 6: since this is a data paper, it would be useful to include a sentence here on what new dataset you have produced in this study. I felt that clarity on this aspect was a bit lacking in the paper.

We agree. As previously stated, we plan to reduce the analysis of the data to provide more space for the dataset description - as also requested by other Reviewers. We will additionally clarify in the conclusions that the dataset provides harmonized event level drought disaster records linking GDIS/EM-DAT events with SPI/SPEI drought characteristics, population exposure, GDP exposure, weighted exposure, and reported impact variables.

L 589: when you say ‘scale’, please be specific. I think you mean timescale here.

In the revised manuscript, we will revise “scale” to “timescale” wherever that is the intended meaning.

L 593-594: if this is a key conclusion, I would urge you to put a result figure corresponding to this in the main manuscript rather than in the SI. You don't need to put all the figures, but maybe one that clearly shows this point.

‘No consistent relationship between drought characteristics (such as severity or area) and drought timescale emerges for either SPI or SPEI.’

This conclusion was based on our interpretation of the full set of SPI and SPEI sensitivity figures. However, we agree with the reviewer that any key conclusion retained in the revised manuscript should be supported clearly in the main text. Since we will shorten the Results section and reduce the extended interpretation of the sensitivity analysis, we will remove this statement from the revised manuscript. The revised manuscript will focus more clearly on the dataset structure, variables, sensitivity information, and limitations.