# **Reply to Referee 3**

We would like to thank you for your constructive comments and feedback on this manuscript. We think that the suggested revisions based on the Referee's comments will certainly improve the article. Please find our responses (in blue) to the main points raised (shown in black) below. We ordered the comments to the main sections of the paper in order to supply the same structure to all reviews.

### Introduction:

Figure 1 – adding the country boundaries would be helpful here especially as you use the countries in the analysis later on. In the right hand figure there seems to be a small region inside the high altitude region that isn't labelled. It is also quite hard to see the NUTS boundaries (which are also not labelled – you could consider adding them to the key) it might help to make the maps bigger and the boundaries thicker so they stand out against the elevation.

 $\rightarrow$  We will improve Figure 1 and follow your and Anne van Loons suggestions. We will add a better schematic overview to clarify the different domains covered by EDIIeu and EDIIalps. See our suggested Figure R1.2 below. We would like to avoid adding the label of all NUTS regions, as the maps get very noisy and less clean.



**Figure R1.2.** (a) The  $\text{EDII}_{\text{EU}}$  covering the "Alpine Space" study area for which we updated the original EDII. The Alpine Drought Impact Inventory ( $\text{EDII}_{\text{ALPS}}$ ) covering the different Alpine countries and integrated in the  $\text{EDII}_{\text{EU}}$ . Our study region in its paired subregions for the analysis: (b) the Northern and Southern region divided by grouped NUTS 2 regions, and (c) the pre-Alpine and high-altitude region divided by grouped NUTS 3 regions.

#### Methods:

Did you consider splitting (or aggregating the NUTS regions, perhaps NUTS3) by basin – this could be interesting in Section 3.1 where you look at the spatial differences in impacts, as well as Section 3.4 where you consider the different drought types.

 $\rightarrow$  Yes, we also played with this idea and currently have a Master thesis working on this topic. The preliminary results of this thesis present differences between the basins of Rhine, Danube, Po, and Rhone, which show similar patterns as our results for the Alpine countries in Fig. 2. Due to the additional methodological steps, but more or less similar results, we decided not to include this in the manuscript.

Section 2.2 – further information on the specific sources of impact data for the Alps EDII would be useful. It's not clear for example, whether the Italian and German text reports were from newspapers, government reports etc. and it would be useful to have more information on the Propluvia French data as it is not clear what it is. Please include URLs to the sources where appropriate.

 $\rightarrow$  Yes, we agree with that and will give further information in the revised manuscript. Propluvia is an official government portal that publishes water use restrictions all over France (http://propluvia.developpement-durable.gouv.fr).

Section 2.2 - I suggest that you could put the example impact reports in a table – this would be easier to read and for readers to see the differences between the impact data from the different sources.

 $\rightarrow$  We see your point and will test if it is improving the text or not.

L149 – the choice of the case study years has not been explained – it would be good to introduce these years in the introduction perhaps with appropriate references in the introduction e.g. Lahaa et al. 2017 (<u>https://doi.org/10.5194/hess-21-3001-2017</u>)

 $\rightarrow$  We agree with you that this needs to be clarified. The selection of these years was based on the impact data we compiled. We simply found substantially more reports for these years, wherefore we wanted to specifically focus on them. See also our answer to the related point below (Discussion section).

#### **Results**:

L193 – The percentages here do not match up with those previous sentence – please check these figures

 $\rightarrow$  Thanks for pointing this out. We will correct the mistake in the numbers.

Table 1 – foot note 1 should be moved to the caption for clarity (and could be mentioned in the text). You could consider showing these results in a heat map of all the pairs, highlighting these significant pairs (same for Table 2).

 $\rightarrow$  We agree and will revise the caption of the table. We have a heatmap of all the pairs, but as there are more than 30 NUTS regions this Figure is really large and presents a lot of non-significances. Therefore, we decided to summarize the results in Table 1.

Figure 2a – please add a legend for the grey shading of the NUTS regions and make the country borders clearer

Figure 2b – in the caption please explain that data are shown for each sub-category so it is clear why for example the southern region has two labels for the agriculture impacts and why there are faint grey lines within each impact category block



 $\rightarrow$  We will modify Figure 2 according to your suggestions. See our proposed example (Figure R2):

**Figure R2.** Reported impacts in 13 coloured categories by region (n = total no. of reports per region). (a) Proportion of impact category per country. Darker grey shading relates to a higher count of reports per NUTS 2 region. We labelled NUTS 2 regions with significant differences (see Table 2). (b) Proportion of impact categories (coloured) covering several subtypes (faint lines) for the regions. Subtypes with a proportion  $\geq 10$  % per region are labeled.

Figure 3 - it could be the resolution of the figure in this draft version, but the red text is quite hard to read - it is also not explained what the p value is in the caption.

Figure 3 - I guess that the dotty plot is the 'counts of all reports per country and year' - please add a legend to indicate what size of the circles mean. I also suggest you label this figure 3b and the current figure 3b, to 3c



 $\rightarrow$  We will modify Figure 3 according to your suggestions. See our proposed example (Figure R3):

Figure R3. Reported impact categories between 1975 and 2020. (a) Counts of reports per year, outstanding years marked

with red dotted lines and added label for years with significant different counts. (b) Number of all reports per country and year. (c) Relation between categories (coloured) and their subtypes (faint lines) for outstanding years. Subtypes with a proportion  $\geq 10$  % per region are labeled. Colours correspond to the legend of Fig. 2.

Table 2 – I assume the dashes in the rows for the high altitude and southern regions indicate that there were no significant pairs for these regions, please clarify this in the caption.

 $\rightarrow$  We agree and revise the caption of the table.

Figure 4 - the dates for the seasonal summaries start in March for spring, you could consider doing the same for the time series plots so that the values for the winter are all together.

 $\rightarrow$  Interesting idea. We will test this and evaluate it. If this presents further insights we will add it in the revised manuscript.

Figure 5 – the caption uses the acronyms DSM and DM but in the plot these are labelled as SMD and HD, please make these consistent here (and throughout the paper – sometimes you use the acronym and sometimes not).

 $\rightarrow$  Thanks for pointing that out. We will improve this in the revised version.

Figures 4 & 5 - In the captions for these two figues the sentence "Monthly values are related to frequency of the month with most impacts." isn't very clear - does this mean that for each impact category the monthly data points for each month are from the year with the most impacts in that category? Please clarify this.

 $\rightarrow$  We agree and will clarify the caption of Figures 4 and 5.

#### **Discussion**:

L387-389 – Here you say that 2003, 2015 and 2018 depicted are more comparable picture, but in the following state there was a remarkable difference in 2003. These points seem to contradict each other – unless the comparable picture refers only to the Agriculture and Forestry categories. Please clarify.

 $\rightarrow$  We agree that this part is not clearly written and will rephrase it.

Section 4.3 – it would be interesting to consider the temporal trends and drought occurrence in the context of other known drought events (aside from the case study events used in the paper) for example, comparing the results to papers that consider the timing, propagation and characteristics of drouaht events (e.a. Laaha and Van Loon 2015 (https://doi.org/10.1016/i.ihvdrol.2014.10.059), Bloschl Haslinger & 2017 (https://doi.org/10.1002/2017WR020797) Spinoni such as et al 2015 (https://doi.org/10.1016/j.ejrh.2015.01.001), Sheffield 2009 et al. (https://doi.org/10.1175/2008jcli2722.1) and others)

 $\rightarrow$  We acknowledge the need to better compare our impact data based events with the literature that used meteorologic & hydrologic information in the discussion and suggest writing such a section for the revised manuscript.

## **Conclusion:**

You make an interesting comment in the final line of the paper on the application of the EDII ALPS data, it would be interesting to explore this further in the discussion.

 $\rightarrow$  This was also suggested by Referee 2. We will elaborate further how EDIIalps might be used in practice such as risk assessments or monitoring and early warning..

## **English and Minor points**

 $\rightarrow$  Thanks for pointing us to several minor suggestions improving the clarity and structure of the manuscript. We will address them in the revised version.

 $\rightarrow$  In addition, thanks for your comments to all sentences or paragraphs that were not clear and grammatically correct. We appreciate your detailed suggestions and will improve the phrasing.