Review of Leijonhufvud and Retsö: Documentary evidence of droughts in Sweden between the middle ages and c1800

The revised manuscript is improved compared to the first version. Clearly, the authors have made good efforts to meet several of the critical comments and to follow suggestions given by the two referees. Overall the paper reads better now and the new table at the end of the text provides valuable information summarized in a clear and simple way.

Nevertheless, there are still several problems that need to be addressed before the text is in a sufficiently good state for being accepted for publication. The problems can be divided into four main types: (1) there is still a lack of clarity in the description of how the drought index is constructed and also an associated lack of state-of-the-art discussion of the new index series in context of previous similar work in other regions, (2) there appears to be no connection between the detailed discussion of the evidence for droughts in the documentary data and the new drought index data; in particular the eight sub-periods that are concluded to be particularly struck by summer droughts, and even highlighted in the abstract, are not discussed in connection with the drought index data, (3) it is very difficult to follow and to understand the logic behind the way how the authors discuss their index series in comparision with instrumental data, and (4) the logical order of how some parts of the material is presented to the reader can be improved by some simple rearrangement and clarification of some of the text.

My overall recommendation is a major revision. However, the reason for labeling this as 'major' is mainly that there are so many individual items that need revision. I don't require any new analysis, but rather a quite large number of clarifications and some extended explanation and discussion. Most of the issues that need to be addressed are of rather minor nature. Thus, in terms of working efforts needed, the task of undertaking the revision satisfactorily may be regarded as major rather than minor.

Below I provide a detailed list in order of appearance in the manuscript, where each item is identified by its associated line number. Some items are clearly very minor. Some other items are of higher scientific importance. I don't start each sentence with a 'please', but that is what I mean. I encourage the authors to consider each item in this list. I am convinced that much can be done to help future readers to appreciate the material being presented in a better way. I certainly think this material deserves to be published, but not before another round of revision.

13. Explain here what kind of index that has been developed.

26. Before you can refer to "our drought index" for the first time in the text, you must tell the reader that you have created such an index and briefly explained what it is.

37-51. Insert at least one reference after each essential sentence in the introduction so that it becomes clear that the material presented there is based on knowledge from the scientific literature.

61. It is not acceptable to just say that database will be available somewhere later on. The database should be published in a trusted repository for research data before the manuscript is completed. Complete citation details including a digitical object identifier (DOI) should be provided so that future readers can find the database. Given that the data are from Sweden, a recommendable example of a trusted repository is the one provided by the Swedish National Data Service at https://snd.gu.se/en and https://snd.gu.se/sv

77. The term 'homogenized' only applies to the temperature data from Stockholm, but not for the precipitation data. However, the sentence on line 77-78 gives the reader the impression that all

instrumental data used have been homogenized. Please re-write the text to avoid confusion about this already at the start of this paragraph.

85. It is unclear what you mean when you say that the adjustment factors "will have no effect on correlation coefficients". The statement is possibly wrong. Correlation coefficients between two time series will indeed be affected to some extent if one of the two series is adjusted in a sub-period of the entire time period.

88. The headline 'Method' here is not well chosen. The text that follows until the next headline (which occurs on line 163) does not just describe a certain method, but rather first provides information about the drought index series being derived and then provides information about correlations between this index series and instrumental temperature series and also correlations between instrumental temperature and precipitation data. I suggest to choose a more descriptive headline, which only applies to how the drought index is derived. Such a headline could for example be:

Method for construction of a drought/precipitation index series

90-132. This is the part of the manuscript that describes how the drought index series is derived. It is clearly an imporant and central part of the text. Actually, the authors themselves even state on line 116 that "The most important part of the present analysis is the construction of an index." However, the current version of the text that describes how the index is derived has several problems. Given the importance of this section, more efforts should be made on improving the quality of the text and thereby also the clarity of how the index was constructed. In particular, the following should be addressed:

(a) Add a general discussion of the concept of climate indices as used in historical climatology in studies from other countries, with inclusion of references to key papers in order to give the reader a good view of the state-of-the-art. This should include at least some argumentation for why the current authors have chosen a 7-point index scale from -3 to +3 and not any other scale that in principle could have been chosen alternatively.

(b) The current text on lines 90-132 does not provide clear information that the index scale actually is a 7-point index scale from -3 to +3, or what is meant by each of the seven points on the scale. The only place in the entire manuscript where this is explicitly written is not found until in the very last few sentences in the final discussion (lines 423-426). I was very surprised to see this kind of information only at the end of the paper. It should of course be provided already in the "Method" section so that the reader knows what the index values mean when reading the rest of the paper. I strongly suggest that the authors insert a new table in the "Method" section, which clearly indicates what each of the seven points (-3, -2, -1, 0, +1, +2, +3) on the index scale means, and - this is very important - that provides information about the criteria that have been used in order to determine which point on the scale that is chosen for any given year. This is a main point of weakness of the manuscript in its current form; there is still no information about how the index data is created.

(c) Continuation of the previous point: The text on lines 90-132 does not make it clear whether the index values are based on information from the entire year (i.e. from any part of an individual year) or if they are based only on data from let's say summer, or spring-summer-autumn, or anything else. Please clarify this.

Figure 1. In my opinion, Figure 1, which shows the index data, should not be presented in the "Method" section, but rather in the "Results" section - because it is a result of the application of a method. Thus, I suggest to move Figure 1 and all text that is directly associated with this figure to

immedately below the headline "Results" that appears on line 332 in the current manuscript. Actually, I also suggest that the current Table 3 and everything that is now written on lines 420-429 (i.e. the last part of the final discussion), is also moved to the "Results" section. In my view, both Figure 1 and Table 3 illustrate results of the authors' work and they should thus be presented in the "Results" section.

134. I suppose the text on this line is meant to be a figure caption. If so, it should be moved to below the figure and also made sufficiently complete to be understandable without forcing the reader to read the entire method section.

141-160. The entire text in this part of the manuscript, which is about correlation between in particular the index data and instrumental temperature data, is in my view (just like Figure 1 and Table 3) a part of the result, and not a part of any method. So, I recommend to move this text and place it somewhere below the headline "Results", but after Figure 1. However, the text currently being placed on lined 141-160 has several problems. I simply have great difficulties in following the logic there so it should be re-written and clarified better. I think I do understand what the authors want to say, but the text is not constructed in a very helpful way. Here are examples of problematic issues:

141. State exactly which time period that is used for calculating correlations between instrumental temperature and precipitation data.

142. Why is the slightly negative correlation between JJA temperature and precipitation in Stockholm 'rather surprising'???

146. You could insert the word 'instrumental' before 'precipitation'.

146, and elsewhere. I recommend that you throghout the entire manuscript not write 'precipitation/drought' when you refer to instrumental data that are actually simply 'precipitation' data, but not some kind of combination of data for precipitation and drought.

148. The phrase 'turned out significantly' is not well chosen. If you mean that you find correlations that are statistically significant at a certain chosen level, then this level should be stated and the words should be better chosen to satisfy a reader who reads through a statistician's glasses.

151. The term 'non-existing' is also not well chosen. Do you perhaps mean that the correlation does not reach a certain significance threshold?? If so, which threshold?

153-154. The sentence on these lines is identical to the first part of the sentence on lines 147-149. Delete the sentence on lines 153-154.

156-158. I find the explanation to Table 1 not sufficently clear. Here is my guess of what you mean:

Correlation coefficients calculated between average monthly and seasonal temperatures in Stockholm and (on the first row) with the drought index 1756-1816 and (on the second row) with the corresponding monthly and seasonal precipitation data from Stockholm for the period 1859-2011.

I also suggest that you move and slightly re-phrase the text in the parenthesis (which is better written: daily observations are summed to monthly or seasonal values) to be placed below the table, immediately after your full reference to the precipitation data. Or, this information may instead be given only at the end of the paper, where you provide references to your data sources.

Table 1: The last column labled 'C-Scan' is not explained anywhere. It should be deleted (or be explained).

163-330. This part of the manuscript contains detailed information about what kind of information about droughts (and related things) that is found in the sources. However, it is still entirely unclear, at least to me, how this information has been used to define the index values. Thus, I don't see any clear connection between all the detailed information on lines 163-330 and the method description (currently on lines 90-132). Please, do something that helps me and other readers to understand better how you have derived your index values. This is actually a very important aspect. As I already pointed out above, the authors state on line 116 that "The most important part of the present analysis is the construction of an index." Thus, it is very suprising that I, as a reader, cannot find any connection at all between the detailed description of the content about droughts in the docuementary evdence provided on lines 163-330 and the derived index data. Therefore, I must say that I get the impression that one of the two authors wrote the text on lines 163-330 and the other author wrote the rest of the paper and that there is no connection between these parts. In particular, I find it astonishing that the eight sub-periods of drought in the 17th and 18th centuries are not at all associated with any discussion of their corresponding values on the index scale. Were these eight periods identified entirely without using the index data??? If this was so - then what is the scientific value of the index data in this study??? If I look in Figure 1, I can see that all the eight mentioned drought periods coincide well with time periods when the gaussian filtered data lie above +1 on the index scale. Is this perhaps something the authors have considered? In any case, the lack of clear connection between the detailed discussion on lines 163-330 and the construction of the index, as well as how the eight drought periods were defined, is another main point of criticism to the manuscript in its current form. So, please, help the reader and put the pieces better together.

166. It could be helpful to insert a sentence like the following one, immediately after the sentence on lines 165-166:

Therefore, no attempt has been made here to derive any drought index values before 1500.

271. How did you identify the eight periods? Which criteria were used? It is important to provide clear information about this, given that you have chosen to structure so much of your text on this, inluding the abstract and the content of Table 4.

333. As I suggested above, both Figure 1 and Table 3, with their associated texts, as well as the text that is currently placed on lines 141-161 is about your results and would better be placed here.

334. For clarity, insert 'in Stockholm' after 'summer temperatures'. Also insert 'for Sweden' after 'the drought index'.

334-335. The entire sentence "The correlation from Table 1 of 0.47 is expressed as R^2 in Figure 2" is entirely non-understandable. Either delete it, or re-write in an understandable way.

335-337. Because the sentence on lines 334-335 is non-understandable, also the text on lines 335-337 is non-understandable. Either delete it, or re-write in an understandable way.

339. I suppose this is meant to be a figure caption and should so be placed below the figure. Also, for clarity, insert 'Stockholm' before 'JJA temperature'.

346-348. This sentence is difficult to understand. The logic is unclear. Please explain better what you mean.

348. Because of the difficulty to understand what is written on lines 346-348, it is impossible to understand what you mean with "We believe the main reason for this...". Please explain better what you mean.

349. What do you mean with 'more stringent' here?

354-355. The text here implies that you have computed correlation coefficients between instrumental precipitation data and the index data, but you have not presented any results that show this. So, this text is quite non-understandable here. Please explain better what you mean.

361. I think the text reads better if you replace "are compared to average monthly temperature for the entire period" with "are compared to average corresponding monthly or seasonal temperatures for the entire period"

362. In what sense does none of the dry sub-periods differ "significantly" from the average monthly temperatures...? If you don't mean "significantly" in any statistical sense, then perhaps the word "notably" would suit better. But even so, I personally think a difference by more than 1 degree Celsius between one sub period and the whole period is quite a substantial difference. Please be more careful with how you use the term "significantly", which can be interpreted in different ways depending on the reader's profession.

Table 2. I don't understand what the values given within parentheses on every second row mean or how theywere obtained. This should be explained clearly. If these values represent averages of the index values, then I don't understand how you can get different numbers in June, July, Aug and JJA - because I have got the impression that your index series always has exactly one value in each year, and thus it is impossible to obtain different values for different months within a given sequence of years. Even more confusing: If the values within parentheses are some kind of mean values for the drought index, then how can the value for JJA during 1757-1767 be below 1.00, when the corresponding values for the individual months are above 1.00. Something needs to be clarified and/ or corrected here.

379-380. The way you write the first sentence in the discussion implies that you have tried to calculate correlation coefficients between your drought index series and instrumental drought data (and to instrumental temperature data). However, this gives an incorrect impression because you have not computed any correlations between your index data and any drought data. Please, re-write and explain better what you mean and what you have done.

385. "The main problem" with your precipitation/drought index series is certainly not that "you" only have a short period with overlapping instrumental data of precipitation/drought. But it is true that it is difficult to try and translate your index into let's say seasonal precipitation sums. Please, re-write and explain better what you mean. I would also welcome a more extended discussion of what really is "the main problem" of your drought index - such a discussion could preferably refer to problems and difficulties already discussed in other similar studies.

387-388. Here, again, your text implies that you have calculated correlation coefficients between your index series and instrumental precipitation data - but clearly you have not done that. Or, maybe, you have actually done such caluclations - but you have not reported them in your result section?? Please, re-write and explain better what you mean.

405. What exactly do you mean when you say that "Stockholm temperatures after 1756 have showed to be positively biased"?

406. What is "TRW" and what is "density"?? And what has this to do with your drought index data???

415-429. As explained above, I recommend that this bit is moved to the "Results" section.

431. It would be good to end your discussion by trying to provide an answer to your main question posed in the introduction on lines 26-27, i.e.: "Is it possible to distinguish periods of drought in Sweden through documentary sources from the 15 th till the 18 th century?".

449. I suggest to insert the word 'instrumental' between 'The' and 'datasets'.

691. This table should be labeled Table 4 (not Table 3). The table is certainly very informative. I think it would be excellent if you could extend the table and provide the same kind of information also for all other years in the entire period 1500-1816. That would really make it possible to see and understand how you have derived every single index value in your data series! (But I do understand if you think this will take too much time and my suggestion here is just a suggestion and not a requirement.)

Finally, in the spirit of FAIR data and Open data, the entire index series from 1500-1816 should be provided in the form of data that can be used by others. The simplest way is probably to just present them in a single table in the paper. A better way, however, would be to publish your index data in a trusted repository for research data, so that the data are easily findable and citable. Given that the data are from Sweden, a recommendable example of such a repository is the one provided by the Swedish National Data Service at https://snd.gu.se/en and https://snd.gu.se/sv. Thus, both the database and the index series could be published as separate datasets in (for example) the SND catalogue, each with its own unique address and unique DOI.