

Interactive comment on “Climate indices in historical climate reconstructions: A global state-of-the-art” by David J. Nash et al.

Anonymous Referee #1

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General comments This paper focuses on a very important topic concerning methodological issues related to interpretation of historical documents and compilation of so-called index series of various meteorological elements. In this sense, the paper may help to understand better the methodology to scientists outside the historical climatology community. This contribution provides an overview how index series are compiled and how they are used in climate reconstruction in different parts of the world. The paper is well written with a clear structure. In spite of that, there are several issues requiring clarification or better explanation.

Specific comments In the introductory part, three main categories of information are mentioned that appear in historical documents and inscriptions (lines 32–35) and in the following paragraph authors state that the generation of ordinal-scale indices is a

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common approach for the analysis of the third category – descriptive (or narrative) evidence. However, in the following sections, they mention numerous examples of indexing approach also for the two remaining categories – e.g. sea-ice index (Ogilvie, 1996), phenology-related phenomena from China (section 3.5) or even indices derived from early instrumental measurements (Figure 5 or section 6.2, lines 519–520). I would very recommend to provide somewhere in the introductory part at least some explanation why such type of information (quite often already existing at least on the ordinal scale) is transformed to indices. It would be quite useful to add some simple categorization of indices.

Sections 2–7 provide a detail overview of various index types that different authors compiled at individual continents and ocean according to the meteorological element reconstructed. Too much space is devoted to the scale of index series. At the same time, it is mentioned several times in the text that number of points (or granularity) is dictated above all by the quality and abundance of documentary evidence (e.g. lines 136, 614). In my opinion, more information should be provided on different characteristics of the index series in this part of the text. Those are e.g. the completeness of the index series, their temporal coverage, the way the missing information is handled, meaning of the “zero” category, overlap with the target data for quantitative reconstruction and so on. Authors mention such characteristics only sporadically.

The 3.2 section provides very detailed description of diverse Chinese documentary sources, often not used for index series construction. Moreover, this part is quite long, not directly related to the topic of indices in some cases and it has no corresponding counterpart e.g. for Europe.

Section 8 on methodological approaches used to derive indices appears the most important for those searching for “good practice for future studies” and for advice how to derive indices from their own data. In this sense, however, at least some approaches mentioned here would deserve a short comment or some sort of critics (Section 8.3, end of the first paragraph: Correlation coefficient is a relative measure and the value

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of 0.5 means that compared data sources share only 25% of common variability. Statistical significance of the correlation would be much more relevant).

The same holds for some statements in Section 9. Please check lines 821–829. The whole paragraph is hard to understand and it does not make sense – at least from statistical point of view. It is not clear how “. . . chi-square tests, comparisons with the eigenvectors . . . and the standard error of the estimate” can be used “to derive transfer functions”. For instance, the standard error of the estimate is the result of the transfer function calculation. Thus, it cannot be used to derive it. Similarly: “Such correlations can further be compared and calibrated using instrumental data”. Please re-formulate as correlations (of what?) can be hardly “calibrated”.

In section 9.2 on confidence and uncertainty there is a discrepancy between the title of this section and the text that follows. “Uncertainties in index-based climate reconstructions” are different from uncertainties related to the index series compilation. Both types of uncertainty are very important, however, they have several different reasons and different origin. Unfortunately, the text provides only some examples of the second type of uncertainty (related to the index series compilation). It would be very useful to mention at least some examples of the first one (DobrovolnĀĭ et al., 2010). Ability to quantify uncertainties in the index-based reconstructions (either formally – with some statistics or less formally – by comparison with other reconstructions) makes them fully comparable to natural proxy-based quantitative reconstructions.

It is obvious that this overview cannot refer to all relevant studies. However, I would recommend to mention in the text several other studies especially from Europe. They can be an important example of the indexing approach (Koslowski and Glaser 1999; DobrovolnĀĭ et al., 2015), example of multiproxy reconstructions using temperature (Luterbacher et al. 2004) or precipitation indices (Pauling et al. 2006) or papers important from the methodological point of view (DobrovolnĀĭ et al. 2009, BrĀzdl et al. 2016).

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A suggestion for the Section 10.2, concluding recommendations: Even if the index series are constructed at several-degree scales (7 or more points), indexing always means suppressed variability of index series compared either to target data (instrumental measurements) or to natural proxies (e.g. tree rings). It is advisable to sum-up index series – either in time (from monthly to seasonal or annual) or in space (put together several index series from climatologically homogeneous region). This approach may well approximate index series to natural climate variability.

Minor comments Line 43 – the term "unweighted" index may be misleading here. Line 396 – "... that Henry Lamb was developing ..." Here should be "Hubert Lamb", I guess. Line 626 – "... to define index categories: -/+180% for index values -3/+3, -/+130% for values -2/+2, and +/-65% for values +1/-1." Percent of what? This text is confusing. Please add more explanation. Line 637 – add "decadal" otherwise not clear: "where $\delta T_{DECADAL}$ is the DECADEAL winter temperature index..." Lines 694 – 695 "... the presence of key descriptors is used to distinguish these categories." Not clear, please re-formulate. Line 696 – "Algorithms are then used to weight and combine documentary and instrumental data" Not clear, please re-formulate. Table 3, 5 – There are some empty fields, please add something like "not available" or "not relevant" to avoid misinterpretation. In case of Table 5 please explain "qualitative indication" XXX means the best quality?

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