

Clim. Past Discuss., referee comment RC1
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Comment on cp-2021-57

Anonymous Referee #1

Referee comment on "Unlocking weather observations from the Societas Meteorologica Palatina (1781–1792)" by Duncan Pappert et al., Clim. Past Discuss.,
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Overview

The manuscript introduces a new database of early instrumental weather measurements from a major historical observation network, the Societas Meteorologica Palatina (SMP). It explains the methods and publications of the SMP as well as the methods used to compile the SMP's measurements into the new database and to analyze, homogenize, and correct SMP data. Finally, it demonstrates the usefulness of SMP measurements for climate reconstruction and history.

The database will undoubtedly be of importance to historical climatologists, and this manuscript could be useful to users of the database and to historical climatologists in general. However, as explained below, the article would be much more useful and impactful if the structure were revised for clarity. In particular, the authors should distinguish discussions and analysis of the original SMP observations from discussions and applications of the new database. Finally, the manuscript should address specific questions and concerns at the end of this review.

Structure

The current structure of the manuscript is somewhat complicated and unintuitive, so I have summarized it here:

Section 1 (Introduction) provides historical background to the SMP and emphasizes its importance as one of the largest and best early instrumental networks.

Section 2 (Data and Method) is divided into:

-Section 2.1 (Source material description) describes the location and dates of the network, its instruments, and its publications.

-Section 2.2 (Compilation of measurements) explains that the information could be more useful to modern researchers if converted into a different format.

-Section 2.3 (Data processing) describes how the original SMP measurements were taken and the formulas used to convert those into modern figures (e.g., Réaumur into degrees C).

-Section 2.4 (Data format) describes how the data were entered into Station Exchange Format.

-Section 2.5 (Quality control) explains how outliers in the original SMP publications (including typos and mismeasurements) were identified.

-Section 2.6 (Homogenization) explains the processes for identifying and correcting inhomogeneities in the SMP measurements and where those inhomogeneities were found.

-Section 2.7 (Generation of daily and monthly series) describes the process for producing those series, but not the series themselves.

Section 3 (Inventory) contains:

-Section 3.1 (Summary) explains (1) other information in the SMP publications left out of the database; (2) refers back to section 2.2 regarding the new format for presenting information (the "inventory"); (3) uses the inventory to create figures displaying the number stations of recording what kind of information and when; (4) discusses issues with data depth and resolution in the SMP observations.

-Section 3.2 (Discussion) includes various observations about the strengths and weaknesses of the network and the information it produced.

Section 4 (Examples) contains:

-Section 4.1 (Storms during the winter 1783/84) compares the processed SMP data with the synoptic pressure reconstruction in Kington 1988. It concludes, "This brief example demonstrates the reliability of the processed pressure data as well as its usefulness when paired with documentary sources" (lines 426-427).

-Section 4.2 (1785: the coldest March) compares the "SMP observations" to a reanalysis and finds "reasonable agreement."

5 (Conclusions) reviews the findings about the quality and coverage of the SMP measurement and the potential value of the new database for climate and historical research.

First, this structure can be confusing for the reader and makes it difficult to find and remember important content. Some topics are divided across multiple sections, while in other cases information has to be repeated. For example, sections 2.1 and 3.1 substantially overlap, and it's not clear why some information went in one section instead of the other. The fact that the original society reports contained much non-meteorological information and that this information was left out of the database seem like items that should have been discussed in "methods and data". On the other hand, much of the "methods and data" section consists of analysis or induction that I would normally expect in a "results" section (which is altogether missing from the article). These issues of clarity are problematic in an article such as this one, which is meant to serve as a guide to users.

Second, the structure does not allow the author to systematically address the project's context within, and contributions to, each field of research relevant to this study. These fields include:

- The history of meteorology and climatology;
- The study of early weather instruments and their measurements;
- Data rescue of early instrumental measurements;
- The creation of useful historical climatology databases; and
- High-resolution historical climate reconstruction.

I wouldn't expect detailed discussion of each of these. However, simply keeping them in

mind and addressing each specifically in the introduction and conclusion would help frame the article and ensure it does not neglect important context or applications.

Third, the current structure blurs discussion and analysis of the methods and publications of the original SMP observation network and the usefulness of its measurements, on the one hand, with discussion and analysis of the methods and organization of the new database and its usefulness for climate reconstruction, on the other. Each of these is an interesting subject in its own right. As a researcher in historical climatology and potential user of the database, I would like to know (1) about the SMP, its background, and its activities; (2) about the new database and how it works; (3) what the database can tell us about the SMP, its coverage, and the quality of its observations; and (4) whether and how the database can help improve climate reconstructions. While that information is present in various places in the manuscript, it is currently all mixed together in ways that make it very hard to get at a good distinct explanation of each of these topics.

As referee, I would not want to dictate the structure of the article. There are various ways the authors could revise or amend the current structure to address the three major issues outlined above. However, I suggest the following possible changes:

-The introduction could address the project's context within, and contributions to, the relevant research fields, as described above. The background and history of the SMP would fit better in the section on sources and methods.

-The section on sources and methods could separate (1) the structure, methods, and publications of the SMP from (2) the structure of the database, its methods of compiling SMP data, the methods used to analyze the SMP network with the database, methods of correcting and homogenizing SMP measurements as they are put into the database, and how the database could be compared to other data or studies to examine its value for reconstruction.

-There could be a "results" section presenting (1) the results of the analyses of SMP data for coverage, resolution, and consistency (currently in section 3.1); (2) results of analyses of tests for homogeneity and breakpoints (currently in section 2); (3) results of comparisons with other data or reconstructions (currently in section 4).

-A "discussion" section could include much of the discussion in section 3.2 and the conclusion.

-The conclusion could recap the article and address the project's contribution to the relevant fields of study presented in the introduction.

Other questions and issues

Is the database compatible with those of other early instrumental data rescue projects such as ACRE? Are the results being incorporated into ACRE or another such project?

Have any of the original instruments from the SMP (or other examples of the same manufacture) survived? If so, have they been analyzed for any particular errors or biases, particularly those that would require non-linear corrections at high or low temperatures (in addition to the data processing already discussed in section 2.3)?

The case study in section 4.1 compares information in the new database with the reconstructions of Kington 1988. However, as described in the introduction (line 55-56), Kington 1988's reconstruction is also based on SMP measurements. Therefore, the comparison does not justify the conclusion that "This brief example demonstrates the reliability of the processed pressure data as well as its usefulness when paired with documentary sources" (lines 426-427). For tests of reliability, the processed SMP data should be compared with other early instrumental series or high-resolution reconstructions based on reliable phenological observations. In fact, if there were differences between Kington 1988 and the new database, then that would actually underline the importance of the correction and homogenization applied to the SMP data. Instead, this example seems to illustrate relative ease of producing and visualizing data with the new database (as opposed to the laborious hand-drawn maps of Kington).

Similarly, in section 4.2, can the authors confirm that the EKF400v2 reanalysis (line 431) did not itself use SMP measurements?

The manuscript is generally well written but contains occasional minor issues of English usage (for example, in line 30 "spurn" should be "spur").