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Climate of the Past Discussions

Interactive comment on "Extreme climate, not extreme weather: the summer of 1816 in Geneva, Switzerland" *by* R. Auchmann et al.

R. Auchmann et al.

renate.auchmann@giub.unibe.ch

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We thank reviewer 1 for constructive comments/suggestions on the manuscript and especially graphics. We respond to the particular points in the following. Reviewer comments shown in quotation marks:

Anonymous Referee 1. Received and published: 16 December 2011

"Basically, I think this is a very good case study research paper on a detailed Geneva, Switzerland record for 1816, which emphasizes the importance of subdaily data analyses. Geneva is well-situated for this 1816 study. The methods and results, including the statistics, are well-described and pretty sound, and the paper is well-cited with appropriate references. Therefore, I recommend publication but suggest some minor

revisions, mostly in the graphics/visualization. The following are some comments. 1) p. 3747. The authors may wish to add some descriptions on the importance of examining sub-daily data for studying appropriate weather/climate impacts."

In a revised version we mentioned some further advantages (p.3747, line 23) of studying daily and sub-daily data in climate science as follows: For the assessment of changes in climate variability and extremes, daily to sub-daily data resolution is indispensable (Brandsma and Können, 2006; Alexander et al., 2006). In our study, temporal attribution of the summer 1816 cooling (e.g. rather morning or afternoon cooling) as well as the analysis of a combination of parameters (e.g. cloud cover and temperature) cannot be conducted by using mean data. In contrast to measured values (i.e. the sub-daily data used in this study), they do not represent a state of the atmosphere. Both methods may contribute to a better understanding of the structure of the cooling and provide some new details into processes and mechanisms involved.

"2) p. 3748. How is no further reduction of pressure (constant 10 R) irrelevant as compared to the standard (0 C)?"

We added an explanation on p. 3748, line 16: This is different to nowadays standard (0°C). However, this is irrelevant for our study as we only use standardized pressure anomalies and pressure tendency.

"3) Overall, description of data and metadata, as well as the methods, are pretty good. With observations twice a day (p. 3749), the record does not get at a complete diurnal temperature analysis as some unique "hourly" observatory stations, and the authors may note this."

As mentioned in our paper, the two observation times were chosen to capture the daily maximum and minimum temperature. A daily temperature cycle clearly can't be captured with twice observations daily. To further clarify this point we integrated an additional note on this (p. 3749, line 6): Of course, twice daily observations can not capture a complete diurnal cycle, in contrast to e.g. hourly observations.

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"4) Base period of 1799-1821 looks fine. Note that Chenoweth (2001, Geophysical Research Letters) conducted a somewhat similar analysis like this and included 1816."

In the paper mentioned above (Chenoweth, 2001, p. 2963, see chapter 1. Data and Methods) the reference period is a 14 year period comprising the years: 1807, 1811-1814,1819-1827. Thus, as I n our study, 1816 is also excluded from the reference period.

"5) I think that the graphics can be much improved. They are clear as currently presented, but if one prints out the manuscript in Black and White (which is common), it would be difficult to analyze the graphs. The authors should revise the graphs so that any printout in black and white can show the graphs clearly. Just to offer some suggestions: a. Fig. 2 can have thicker lines for the standard deviation, and dashed lines for the max/min temperatures. b. Figs. 3, 4, 5, 6 and others, instead of filled red bar graphs, make this a filled red pattern? c. Fig. 4. It would be best to avoid red when mostly displaying precipitation (use blue, purple, brown, green etc.)."

This is a very helpful comment: We edited/improved all relevant figures (Fig. 2, 3, 4, 5, 6, 8) according to the reviewer's suggestions, so that e.g. black and white prints can also be clearly analyzed.

"6) The description of the temperature results look sound and I like the cloud analysis added in (ex. p. 3753), but I wonder if the negative temperature anomalies/distribution for afternoon could relate to an exposure to the north, or something like that?"

There were no changes in the location of the instruments reported. Thus, an exposure to the north or any other location related reasons might not lead to negative temperature anomalies as it is the same exposure for the reference period and 1816.

"7) The weather pattern analyses looks fine. However, Fig. 7 only shows the sea-level pressure anomalies. It would be very useful to also include a map that shows actual sea-level pressure values (mb), as the actual patterns of the highs and lows could be

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clearly seen."

We added absolute reconstructed SLP contours (Küttel et al., 2009) to Figure 7 for the months June to August.

"8) Monte Carlo simulations look fine."

"9) I am pleased to see the scatterplots in Fig. 9, but the different color symbols should perhaps also be different symbol types (triangles and squares) to make visualization more apparent. I would expect some non-linearity, particularly on the precipitation, so a Spearman (non parametric) correlation may be useful to add on here."

We also added the Spearman correlations to Figure 9 and adjusted the figure caption accordingly in the following: Figure 9. Scatter plot showing the observed temperature anomalies (left) and precipitation sums (right) as a function of their predicted values based only on the weather types information. The years in the reference period are indicated in red, the years that were excluded from the reference period are shown in grey, 1816 in black. Correlation (r) and non parametric Spearman correlation (rsp) coefficients are shown for only the reference period (subscript ref, red number) and all years (subscript all, black number).

Furthermore, we added the following references, which arose from the correction process:

Alexander, L.V.: Global observed changes in daily climate extremes of temperature and precipitation, J. Geophys. Res., 111, D05109, doi:10.1029/2005JD006290, 2006.

Brandsma, T. and Können, G.P.: Application of nearest neighbor resampling for homogenizing temperature records on a daily to sub-daily level, Int. J. Climatol., 26, 75-89, 2006.

All edited Figures are attached as supplement.

"Best wishes to the authors."

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Please also note the supplement to this comment:
http://www.clim-past-discuss.net/7/C2408/2012/cpd-7-C2408-2012-supplement.zip

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Interactive comment on Clim. Past Discuss., 7, 3745, 2011.