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Climate of the Past
Discussions

Interactive comment on "The 1816 'year without a summer' in an atmospheric reanalysis" *by* Philip Brohan et al.

Anonymous Referee #1

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Summary/Major Points While the approach used in this paper shows the potential of atmospheric reanalyses, it makes a number of claims that are not correct. Additionally, the assessment of how good the reanalysis for 1816 is only considers recently digitized temperature, pressure and other weather data (e.g. Auchmann et al., 2012 and Brugnara et al., 2016). Other long daily temperature series appear to have been ignored. The series that have been ignored are the Central England Temperature (CET) series, which is available daily from 1772. Also ignored are the daily series from Uppsala, Stockholm and also Milan and Padua. The latter two may have been used, but the sources that developed these long series are not given. It is surprising that CET is ignored as it was used in Raible et al (2016), and most of the authors were part of this extended review of the impacts of Tambora. This included a plot of daily CET values for 1816. The temperatures from the Reanalysis should be compared with CET. CET

values for 1816 are just daily mean temperatures, but it is relatively simple to average the sub-daily reanalysis temperature to a daily average. The agreement may not be great, but there are a number of MSLP values entering that should ensure that the basic wind directions across southern Britain should be well captured. The other long daily temperature series have been available in a special issue of Climatic Change from 2002 (Camuffo and Jones, 2002) that was also published as a book. Within this special issue there are papers on each of the stations which then had long and available records (e.g. Jones and Lister, 2002 for St Petersburg). St Petersburg is probably slightly too far east, but Stockholm, Uppsala, Milan and Padua have records. These could be looked at the same way you have Geneva (i.e. the whole of 1816).

Minor Points (they become major when the ignore most of the past literature)

1. The abstract says that we cannot reconstruct smaller space scales from tree-ring observations. This is incorrect. Tree-ring reconstructions are always local in scale, where the trees grow. They are not on the daily timescale, but they will be of the growing season average. They can and have been used to look at the impacts of climate change on small areas. When spatially combined, they have been used to show that the summer of 1816 was exceptionally cold across much of the mid-to-high latitudes of the Northern Hemisphere (e.g. Briffa et al., 1998). It is trees and ice cores that have clearly shown the impacts of major volcanic eruptions on summer temperatures.

2. A better reading of Raible et al. (2016) would have shown reconstructed temperature, pressure and precipitation maps for the summer of 1816. These should be compared with those in Figure 3. These sort of reconstructions are also available for individual months as well, which again could be compared with those produced by the Reanalyses. The paper reads as though these are the first time such maps have been produced, ignoring much of the past literature.

3. In the paragraph at the end of Section 1 (lines 34-41), the authors are making the

mistake of comparing local temperature change with global averages! This has been known about for decades, since the first attempt at an NH temperature average was produced in the 19th century. There have been numerous papers that have looked at this, some in the context of volcanic impacts. Europe often seems to be affected when major explosive volcanic events occur, but not always. Other regions of the world (e.g. further east into European Russia might be less affected). A possible reference for looking at the impacts of volcanic events regionally is Jones et al (2003). This paper looks at the effect of numerous eruptions (including Tambora) on regional temperature series (from CET, Fennoscandia and Central Europe). Looking regionally is very difficult to see a signal because of the much greater signal-to-noise ratio, but an analysis for Fennoscandia would be very interesting as instrumental temperatures from the northern part of this region suggest that 1816 was a normal, and not an extremely cold summer (see e.g. Klingbjer and Moberg, 2003).

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