Climate of the Past Discussions

Clim. Past Discuss., referee comment RC1
https://doi.org/10.5194/cp-2022-10-RC1, 2022

Comment on cp-2022-10

Anonymous Referee #1

Referee comment on "Statistical reconstruction of daily temperature and sea level pressure in Europe for the severe winter 1788/89" by Duncan Pappert et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2022-10-RC1, 2022

Summary:

the manuscript presents a spatially resolved reconstruction of daily temperature and SLP during the extremely cold European winter of 1789/1790. The reconstruction is based on early instrumental data from a set of stations , by applying a two-step procedure: first, a search for analogues in a gridded modern data set (after with a suitable pre-processing) and a refinement with an Ensemble Kalman Filter.

The reconstructed data are dynamically interpreted, essentially the cold temperatures being a result of an extreme meridional flow (negative North Atlantic Oscillation).

The novelty of this study is precisely the spatially resolved reconstructions ate a very short time scale (daily), which allows to have a glimpse into the temporal structure of a very cold winter. This structure is also compared with modern cold winters, revealing their similarities but also their differences.

Recommendation: I think this is a very interesting study. The manuscript is also well written, although some technical steps will require the attention of the reader. The method is not applied here for the first time and the interested reader can check out previous studies by the authors using this methodology.

In my opinion, the article can be published almost as is. I have a few minor comments that the authors may want to consider

1) The annual cycle is removed by filtering out the annual frequencies. However, the analogs themselves are chosen from candidates with a calender date within a temporal window centered on the target. I wonder whether the filtering of the annual cycle is really necessary, since all analogs candidates are located in the same 'season' as the target. I do not think the filtering is damaging, but in my view it is not necessary. Perhaps the authors may like to add a couple of sentences to inform the reader

2) Background state in the EnKF. The background state is chose as the best analog. I also wonder whether this is consistent with the calculation of the covariance matrix using all n-nearest neighbour analogs. It seems to me more logical to choose either the average of all n-analogs or possibly the member of the analog ensemble with median distance. Again, perhaps the auhors may want to comment on this

3) The Kalman filter set-up is generally used to combine two independent estimations, for instance one from a model run and one from a noisy observation. Both need to be independent for the method to be statistically sound. Here, however, both estimations are not independent: one is the best analog, which uses the observations, and the second is the observation itself. Thus, the separation is not clean, if I am not mistaken.

I would not be very picky here, since the authors test their results with independent observations and the method, pragmatically, indeed works: the EnSK is able to improve the analog-based estimation. However, the more theory-inclined reader may frown upon this dependency. The authors may again want to include a warning or a comment.

4) ' The RMSE also shows an improvement from 3.4 to 2.7 °C, as does the mean bias from 0.67 to -0.13'

The units for the bias are missing