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Interactive Comment

Interactive comment on "Extreme associated functions: optimally linking local extremes to large-scale atmospheric circulation structures" *by* D. Panja and F. M. Selten

Anonymous Referee #1

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Review of 8220;Extreme associated functions: optimally linking local extremes to large-scale atmospheric circulation structures8221;, by Panja and Selten

This paper presents an interesting methodology to relate a time series with a time varying field. The authors apply this technique to temperature in the Netherlands and large-scale atmospheric circulation data. The methodology is rather clearly explained, but I think that some features should be improved.

Comments 1. The reanalysis temperatures are not observations. Would the same results hold with direct temperature observations in the Netherlands?

2. The equations of the EOF/PC properties (Eqs. (1-4)) can be found in classical textbooks [von Storch and Zwiers, 2001] and are not necessary in the paper.

3. The authors should clarify what is meant by 8220;Often it turns out that using 40 years of data or so, the clusters identified are the results of sampling errors, due to too few data points8221; (l. 17, sec. 3). Clusters are generally computed in the winter (90 days) over 40+ years, i.e. 3600+ data points.

4. Concerning the new methodology exposed by the authors, it should be clarified how it relates (or does not) to Canonical Correlation Analysis (CCA) [von Storch and Zwiers, 2001]. I do not quite understand why the two variables b and T have such dissymmetrical roles in Eq. (5). For instance b is normalized by its standard deviation (which is a norm), while T^n is divided by its mathematical expectation (which is not a norm). Why not do a regular CCA between b and T^n, and use all the standard statistical properties of CCA? The authors are able to solve the algebraic problem of minimizing Eq. (2), but the statistical properties of the estimators are omitted (and I doubt that it is possible to obtain them in a straightforward fashion). In particular, using CCA between b and T^n would have the advantage of having $r_k^{(L)} \in (-1, 1)$, which is always a nice feature.

5. My second concern on the terminology is that taking an exponent for T indeed gives more weight to large values, but extremes are often defined in terms of exceedances of quantiles [Coles, 2001]. To me, the methodology relates local large deviations to large-scale patterns, and not necessarily extremes. For instance, Figure 6 suggests that the 10 largest values of temperature (i.e. the upper quantile) are not necessarily given by the largest EAF1 loadings. Conversely, the 10 largest EAF1 loadings do not give the 10 highest temperatures. Rewording the text for large deviations instead of extremes seems appropriate.

6. There are criteria for determining the number of EOFs to be retained to describe a field [von Storch and Zwiers, 2001]. Why are they not used in the EOF selection

(section 4)?

7. The fact that the EAFs are stable when the analysis period, geographical domain, etc. are changed does not stem from the analysis method, but from the stability of the relation between temperature and the atmospheric circulation. Robustness is an intrinsic statistical property of an estimator. The authors have just shown that the patterns are stable, not that the method is robust.

I recommend that the methodology is adapted to use a real norm for (the results might not change by much, but I will feel much more comfortable), and that some rewriting is done (change "extreme" to "large deviations").

References

Coles, S. (2001), An introduction to statistical modeling of extreme values, xiv, 208 p. pp., Springer, London; New York.

von Storch, H., and F. W. Zwiers (2001), Statistical Analysis in Climate Research, Cambridge University Press, Cambridge.

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