

Interactive comment on “Spectral representation of the annual cycle in the climate change signal” by T. Bosshard et al.

T. Bosshard et al.

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We would like to thank the reviewer for the helpful comments.

1 Major remarks

1.1 Generalization to other statistical post-processing methods

We agree that our study does not formally prove that more complex post-processing methods are more strongly affected by natural variability than the delta change
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method. Statistical theory however points in such a direction. We plan to reformulate the last paragraph in the conclusions in a way to make it clear that the statement about the effect of natural variability on more complex methods is not certain but probable:
“We focussed on changes in the annual cycle of mean T and P as used in the delta change method. This is a statistical model of low complexity in the whole variety of statistical post-processing methods. More complex models, such as e. g. bias correction methods involving a mean and variance scaling or quantile-mapping, are possibly even more strongly affected by natural variability than the delta change method.”

1.2 How valid are the results for the commonly derived monthly correction factors?

We will include a new text passage in Sect. 4, par. 2, p. 1170, line 11:

“...by MAs with window widths of 15, 31, 61 and 91 days. Also note that the commonly used monthly climate change signals are a subsample of the 31d MA. The same similarity exists between seasonal climate change signals and the 91d MA. Thus, the shown results also apply to these commonly used averaging intervals.”

1.3 Limitation of the method in cases of a strong annual cycle and large relative changes

As stated in the paper, we based our methodology on the stringent condition that frequencies higher than the optimal order estimated by use of observed time series are assumed to be noise. This assumption is of course a critical one since the spectral characteristics might change in a future scenario period. One could think of other approaches such as estimating the optimal order based on the climate model time series. However, we wanted to test the more stringent condition. The results demonstrate that

in most cases, this stringent condition works well. Thus, the few cases of overshootings do not constitute a severe limitation of the method.

The detection of overshootings, however, is an important step in the methodology. It can easily be done by comparing the minima and maxima in the annual cycle of the climate change signal between an e.g. 31d MA and the spectral smoothing estimate. If severe overshootings occur in many cases, it is an indication of a too low harmonic order and one should consider increasing it.

We will discuss the detection of overshootings in the section 5.2 in the revised manuscript.

2 Minor remarks

We will account for the minor remarks in the final manuscript.

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