

Interactive comment on “Temperatures and precipitation totals over the Russian Far East and Eastern Siberia: long-term variability and its links to teleconnection indices” by V. V. Krokhin and W. M. J. Luxemburg

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Dear Sir/Madam

We appreciate your effort for improvement of the article and have changed the paper at quite some points. On other points clarification is added or a justification is provided.

Common:

Term “circulation indices” is changed to “teleconnection indices”.

General Comments:

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The conclusion "We found that interannual variability in the Eastern Siberian and Far Eastern time series of temperature and precipitation anomalies can be represented by the single or two dominant complex principal modes" is incorrect and inconsistent with previous work. The statement may be true for the filtered anomaly series input into the rotated complex PCA, but not otherwise.

REPLY 1: It is a true remark. Conclusion was corrected. Truly, we mean the detrended temperature and precipitation anomaly series.

This is because several methodological mistakes have been made in the preparation of the anomaly time series for analysis. These errors make the results difficult to interpret, unrepresentative of the actual inter-annual variability and of questionable value. The paper also has a number of highly debatable choices, interpretations and assertions. Lastly, apparent weak links to the North Pacific and the Arctic Oscillation for the region are already well established, but represented as much stronger in other correctly-performed analyses.

REPLY 2: We reworked the Section 1 and described the actual state of affairs. We extract from Section 1:

“There has been great interest in the Arctic Oscillation (AO), which was introduced as an annular mode by Thompson and Wallace (1998, 2000). Another well known climate decennial-scale phenomenon, named North-Pacific Oscillation when it was first recognized, has recently been represented by the Pacific decadal oscillation or PDO (Biondi et.al., 2001; Mantua et. al. 1997). Many works have indicated that AO and NP Oscillations significantly influence on regional temperate climates in Northern Hemisphere (for example: Gershunov and Barnett, 1998; Gong et al., 2003; Overland et al., 1999; Thompson et al., 2000).

However, the many details of the timescale and long-term dynamics of the AO and NP Oscillations are not well understood. Especially it is true for the temperate monsoon regional climates, and for the region of East Asian monsoon activity, particularly”.

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Specific Comments:

1. *Errors in formation of anomaly time series:*

a. *Failure to respect the enormous differences in the character of interannual variability from one season to the next, i.e. mixing of inhomogeneous, different climates:*

REPLY 3: We disagree. Many researchers consider the full time series for all seasons (see literature overview in “Yuan, X. and Martinson, D.G.: Antarctic sea ice extent variability and its global connectivity, *J. Climate*, 13, 1697-1717, 2000.”).

Note, that the full definition of climate (Peixoto, J.P., Oort, A.H.: *Physics of Climate*, Springer-Verlag, New York, 520pp, 1992.) is not bounded by a specific (concrete) season.

First definition:

“We will regard the climate in a very broad sense in terms of the mean physical state of the climatic system. The climate can then be defined as a set of averaged quantities completed with higher moment statistics (such as variances, covariances, correlations, etc.) that characterize the structure and behavior of the atmosphere, hydrosphere, and cryosphere over a period of time. This definition of climate includes the more narrow traditional concept of climate based on the mean atmospheric conditions at the earth’s surface”.

Second definition:

"it is important to make clear the distinction between weather and climate. Weather is concerned with detailed instantaneous states of the atmosphere and with the day-to-day evolution of individual synoptic systems. The atmosphere is characterized by relatively rapid random fluctuations in time and space so that the weather, identified as the complete state of the atmosphere at a given instant, is continuously changing. The climate, on the other hand, can be considered as the "averaged weather," completed with some measures of the variability of its elements and with information on the occurrence of extreme events. Thus we may note that the same variables that are relevant in the

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weather and in other branches of meteorology are also those that are important in the characterization of climate. However, what distinguishes the problem of climate from the problem of weather is the neglect of details of the daily fluctuations in the state of the atmosphere. Instead, we include in climate the various statistics produced by considering an ensemble or a sequence of instantaneous states, so that the climate is independent and free from the statistical fluctuations that would characterize any individual realization. Thus we see that the thermo-hydrodynamical conservation laws for mass, momentum, and energy that form the physical foundation for studying the instantaneous behavior of the atmosphere, i.e., the weather, are essentially the same as those required for studying the physics of climate".

Results will be compromises of multiple regimes preferentially occurring at different times of the year but will be biased towards the season (certainly winter for temperature series) with the strongest interannual variability.

REPLY 4: The existence of multiple climate regimes is a disputable question. See papers:

1. "Stephenson D.B., Hannachi A., Neill A.O. On the existence of multiple climate regimes. Q.J.R. Meteorol. Soc., 2004, Vol.130, p.583-605."
2. Stone, D.A., A.J. Weaver, R.J.Stouffer Projection of climate change onto modes of atmospheric variability.// Journal of Climate, 2001, Vol.14, 3551-3565pp.

There will be further distortion from the application of the Butterworth filter which will mistake year to year variability in different seasons as inter-seasonal variability and smooth it.

REPLY 5: Of course, the ideal filters cannot exist. Zero-phase Butterworth filter was used. "After filtering in the forward direction, it reverses the filtered sequence and runs it back through the filter. The resulting sequence has precisely

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zero-phase distortion.”(MATLAB help)

Analyses of interannual variability can only correctly be conducted by treating each season separately.

REPLY 6: We disagree. See reply 3.

b. Inappropriate arbitrary removal of a linear trend from the full 1949-2003 anomaly series: This is always incorrect unless there is an a priori physical reason to expect such a trend. In fact it is more likely that any non-local trends in the temperature data are related to global change, which is decidedly non-linear in at least Eurasian winter temperatures, with the increases dominantly after the 1970s. Thus removal of a linear trend in this instance will at best remove only part of the global change signal and at worst introduce artificial decadal to multi-decadal variability (which we see in Fig. 5a).

REPLY 7: We disagree. We used the complex principal component analysis technique, i.e. Hilbert CEOF. Hilbert transformation should be applied to detrended data.

PCA can accommodate trend signals so this step was unnecessary regardless of whether it was justified or not.

REPLY 8: Note, that we used CPCA, not PCA.

c. Failure to areally-weight the input anomaly time series: Fully one-fourth of the stations are clustered in less than 1/20th of the domain, one-half of them in only one-fourth of the domain. Consequently the PCA results will be strongly biased by these smaller subdomains. The results (aside from the other debilitating problems described in a. and b.) are probably only representative of the Russian Far East and not of Eastern Siberia. This is obviously true from inspection of Figs. 2a and 3a, where the loadings are dominated by the southeastern stations.

REPLY 9: We examined the station data. Use of gridded data is problematic. Not

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of all researchers work with the gridded surface temperature and precipitation data. "it is well known that the interpolation of data, especially precipitation, from individual station locations to a regular grid proved to be critical (White, 2000), and, therefore, we used the stations data only".

2. *Other questions about methodology:*

a. *In the absence of convincing evidence for strong traveling (vs. standing) variability on interannual time scales I am bewildered by the choice of complex PCA for this study.*

REPLY 10: The work is also a study of travelingstanding variability on inter-annual time scales. Any researcher can formulate the working hypothesis and prove it. In scientific research even the negative result is result.

b. *As noted above the Butterworth Filter probably made a bad situation worse.*

REPLY 11: See reply 7.

c. *Rotation is desirable and often necessary in these kinds of analyses, but the results can be seriously compromised if either too many or (but especially) too few modes are rotated.*

REPLY 12: It is a true remark.

The choice to just rotate two complex modes has not been justified and is especially suspect for the precipitation analysis. This could be a further source of distortion of the results from anything resembling actual reality.

REPLY 13: We disagree. Our choice to rotate only two complex modes is based on analysis of variance of first five modes.

At the minimum the explained variances for the first four or five modes should have been tabulated.

REPLY 14: It is a true remark. The explained variances for the first five modes have been tabulated in the paper.

3. Comments regarding interpretation:

a. *Fig. 3a represents standing, not traveling, variability. The loadings are inconsequential outside of the southeastern cluster of stations dominating the analysis (see above) where there is little difference from location to location in phase. The mode is likely representing interannual variability in one season.*

REPLY 15: See Fig.3b. The loadings are sequential. “The relative parity among the weights in the real and imaginary components of the precipitation dominant mode (not shown) indicates that precipitation anomalies have a greater propagational character associated with them than do temperature anomalies. In other words, this mode is a superposition of progressive and standing waves. Some eastward and equator directed spreading of the climatic signal occurs over our domain.”

b. *The time series of the modes should have been displayed.*

REPLY 16: We displayed the time series of the modes.

c. *The coherences in Figs. 5b, 6b, and 7b may be statistically significant, but they are not practically significant.*

REPLY 17: Our task was finding physically significant peaks. Therefore, we analyzed power spectra and cross-spectra simultaneously. “When two time series have significant peaks at particular frequencies and the peaks are coherent, the local and global information constitutes a true climate signal” (citation from: Rodriguez-Puebla et. al., 2001).

Others, using far more direct, simple approaches (like composites means or distributions from samples keyed on index thresholds) have found strong associations between the focus region’s temperature and precipitation in particular seasons and the AO and NP modes. The analysis here has mixed, blurred, and distorted them to insignificance.

REPLY 18: We use the CPCA method.

4. Questionable remarks:

a. p. 1916; "*... the study of observed climate variability may be summarized as a climate model verification problem.*" *I disagree.*

b. p. 1916; "*The most widespread linear correlation techniques are unable to clearly recognize the climatic signal in the short and noisy data series.*" *PCA is a "widespread linear correlation technique" in many of its incarnations.*

c. p. 1917; "*At present the tandem 'spectral analysis + principal component analysis' is more preferable than other methods.*" *I disagree.*

d. p. 1918; "*... we approximated the East Asian monsoon activity via circulation teleconnection indices, i.e. the North-Pacific (NP) index and Arctic Oscillation (AO) index.*" *This statement implies both cause/effect and completeness, neither of which are justified.*

REPLY19: Questionable phrases were removed.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 3, 1915, 2006.

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