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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Identifying non-normal and lognormal characteristics of temperature, mixing ratio, surface pressure, and wind for data assimilation systems" *by* A. J. Kliewer et al.

Anonymous Referee #1

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Review of the manuscript 'Identifying non-normal and lognormal characteristics of temperature, mixing ratio, surface pressure, and wind for data assimilation systems' by A. J. Kliewer, S. J. Fletcher, A. S. Jones, and J. M. Forsythe

Accepted for publication with MINOR REVISIONS

The present article presents a set of statistical tests, two of them for checking non-normality (Shapiro–Wilk, Jarque–Bera) and the third one for checking log-normality (qui-square) of the temperature, mixing ratio and surface pressure data assimilation (DA) background fields on a grid point basis. The composite (logical conjunction) of the overall accepted test hypotheses (null or alternative) gives a hint for using a DA

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background term according to normal or lognormal error statistics. From that, it suggests an offline method, with possibilities to become an online one, of optimizing the appropriate error statistics and modify the DA cost function accordingly. This goal is well accomplished in the paper that is well written and succinctly presented. Minor points to discuss

1 - Pg. 1367, line 1: The assumption of x and xb being independent is not true. In fact xb is generally strongly correlated with x since xb is a good approximation of x for most of the state vector x conditions. Therefore in order to be consistent, substitute the sentence in the text by '. . .x and xb assumed to be jointly Gaussian, then the difference of these variables is also a normally-distributed random variable' The independence is too strong and generally not true. In a equal fashion, if log(x) and log(xb) are jointly Gaussian, but not necessarily independent, then log(x/xb) is Gaussian. Change text accordingly please.

2- Pg 1371. Authors must say that the m(i) are the expected order statistics issued from a given pdf f(x) to be tested. According to the article, f(x) is the normal pdf. What is the theoretical pdf for the test SW under a Gaussian pdf f(x) and for Gaussian realizations of x?

3 - It is useful to say that vector a in Eq.7 is the Mahalanobis norm of m and SW, being proportional to an inner product, is a concordance measure between a and x.

4 – The statistical tests are independent. In fact when log-normality is accepted by the qui-square test, in general the SW and JB lead to non-normality. Are there contradicted cases in performed analysis? i.e. cases of accepted normality (by SW or JB) and accepted log-normality (by the qui-square test). Maybe for parameters where normal and log-normal pdfs look quite similar that could happen. Discuss a little this case.

Typos (change to :)

Pg. 1367, line 22: Fletcher Pg. 1369, line 23: autocorrelation Fig 1 and Fig. 11: Year

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1005 instead of 2005 appears in some panels Pg 1374 line 18: a forecast Pg. 1375, line 11: occurence Pg. 1380, line 18: Bayesian Pg. 1381, line 22: moment

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