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Discussions

Interactive comment on "Nonstationary weather and water extremes: a review of methods for their detection, attribution, and management" *by* Louise J. Slater et al.

Anonymous Referee #2

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A review paper serves a very specific purpose. A reader seeks to read a well-structured paper providing a well-developed synthesis of the literature in a clear and concise manner. This paper in my opinion succeeds in its role and offers an excellent addition to the literature. Since there aren't any major issues with the manuscript, I can only offer some minor points that might be useful to the authors. These are mainly some thoughts emerged as I was reading the manuscript line-by-line.

1.11 This definition is too simplistic and misses the join properties. Yes, indeed this is a property of a stationary process, but we can easily create a process that has the same distribution over time but a changing autocorrelation. So, I you wish to keep it as

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simple as possible and avoid the formal definition just add "…statistical properties of the distribution and correlation do not…"

12.14 I am not sure if I understand this. Definition of nonstationarity is mathematical and precise; in simple terms any process that does not fulfill the formal mathematical conditions of stationarity is a nonstationary process. Thus this should not be linked with the data. Identifying nonstationarity or stationarity from data is another issue and doesn't differ than any other data-driven inference. Please clarify.

12.16 Whether a record is short or long, or sufficiently large for trend detection does not depend only on the absolute record length. So, I am a bit skeptical about such statements. Heavy tailed distributions for example introduce larger uncertainties.

13.7 Not necessarily, the variance does not affect the significance of a trend and it is incorporated in the test. Or a process might change only in its very high values. Anyway, if you have a reference about this statement please add it as I am not sure if it is absolutely correct.

13.19 This depends on what you define as trend here and is a bit confusing. If trends refer to a local systematic increase or decrease this is a property of the dynamics of a process or of the external factors causing this change. So it "feels" a bit confusing saying that trend depends on period of record. To clarify, a trend in the record is a trend anyway, but we assess if this is significant (for whatever reason) based on the properties of the process (inferred from the record).

14.21 Just recheck this. I think the Theil-Sen is not a test, it's just an estimator based on the median slope of all pairwise point of the record. Sometimes provides better results that the regression slope sometimes not. Still you can use also an intercept estimate based on Thel-Sen and show the fitted trend line.

19.22 Large scale variability cannot be a driver of nonstationarity, unless you define nonstationarity in a "local" or short-term way. Long term variability causes local trends,

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but the process can still be stationary. This is very easy to show with MC simulations. For example, multidecadal oscillation can could cause multi decadal trends but this does not imply nonstationarity based on the formal definition.

20.7 This is an assumption that circulates but it need more investigation as there are contrasting results regarding the light precipitation https://doi.org/10.1029/2019JD030855

20.10 Also you can add information of the literature on convective non convective events and changes e.g. https://doi.org/10.1175/JCLI-D-17-0075.1, https://doi.org/10.1038/ngeo1731

27.12 KS has a lot of theoretical issues and the AD should be favor. If I'm correct there's a tendency to slowly stop using the KS test.

If the authors wish they can add more information on downscaling of climate model since it relates with nonstationarity, see e.g., https://doi.org/10.1029/2009RG000314

Summarizing, I am happy I do not have much to report. This is well-written review paper on the topic. It was joy to read and it offers an excellent addition to the literature.

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