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Interactive comment on "Power of parametric and non-parametric tests for trend detection in annual maximum series" *by* Vincenzo Totaro et al.

Anonymous Referee #3

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The manuscript investigates the performances of parametric and non-parametric tests for trend detection. Specifically, the non-parametric Mann-Kendall test is compared with parametric Likelihood Ratio and Akaike Information Criterion Ratio tests. Analyses are conducted by Monte Carlo controlled experiments, using samples drawn from a GEV distribution with reliable parameters' values in representing daily-rainfall yearly maxima in Mediterranean climate.

Synthetic non-stationary time series were generated imposing a linear model (as a function of time) for the local GEV parameter, but keeping constant the shape and scale parameters, while for stationary time series all parameters were kept constant.

The analyses focus mainly in the evaluation of the power of the tests under the null hypothesis of stationarity. Results clearly quantify the degree of deficiency of the tests

in rejecting the null hypothesis in non-stationary samples, depending on various features, including the slope of the trend and the shape of the distribution, demonstrating also that performances of non-parametric tests can be affected by the shape of the underlying distribution of the sample.

General comments

The paper is timely and technically sound, and certainly of interest for HESS readers. Besides the specific comments listed below (which I consider minor by a technical point of view), the paper needs a careful proofreading for English language.

Specific comments

1) Lines 113-116. Description of Sen slope estimation and equation (2) should be revised: If N is the number of univocal (non-repeated) couples and j is an index for the j-th couple (x_i, x_k), why should be $j > k$? Maybe the authors mean $i > k$? Please check and better specify the role of j index. Remove also "Sorting in ascending order ....", declaring that the median values is the final estimate is enough and the reader understand.

2) Lines 179-188 + Appendix. These lines + Appendix should be removed. All the analyses in the manuscript are based on ML estimates, thus there is no reason to keep a description of PWM and L-moments.

3) Section 2.5. It should be written that stationarity is assumed as null hypothesis (e.g. in line 207 and 210)

4) Section 2.5, lines 201 and 209. Just a curiosity: why experiments are conducted with a different number of samples (2000 vs 10000)?

5) Section 2.5, line 198. Authors can provide a reference for the sentence "1-to-4 trade-off between α and β is accepted"?

6) Lines 214-219. I understand the choice of GEV parameters and it is reasonable to

my knowledge of rainfall maxima in Mediterranean climate. I was wandering whether it can be more informative to present results and figures in a more general way, e.g. as a function of the relative trend ζ_1/ζ_0 (which has dimension 1/time)?

7) Line 236. "a multi-peak . . ..": are you sure that it is not a sampling effect? Increasing the number of simulations is the result the same?

8) Lines 267-273 and Table 1. Similar to previous comment: are you sure that variability observed for different σ (but keeping constant the other constraints) are not a sampling effect? Increasing the number of simulations is the result the same?

9) Line 301. I would specify here that series are stationary.

10) Section 3.4 (and maybe other parts of the manuscript, figures and tables). GEV parameters are always estimated by ML, thus I suggest to avoid the use of the prefix "ML-" before the symbol of the parameter (e.g. in Line 310 and 313). This would made more clear text, figure and tables.

11) Line 316. "Figs. 6 and 9": usually figures should be ordered as they are cited.

12) Figures. Please consider the opportunity to use larger fonts for labels, they are not readable here, and most probably Figure will be reduced in the final formatting.

13) Figure 6. Use the same range of scales (e.g. 0-0.6) in the y-axis for a fair comparison.

14) Figure 9. Again: are you sure that fluctuations are not due to sampling effects? See e.g. the subplot in the right part of the Figure 9.

15) Figures 7, 8, 10, 11, 12, 13 are not much informative. Please show only a selection of the most representative case. An additional option is to move these figures as supplementary material.

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363, 2019.