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Reply to “Comments on ‘Short-Term Precipitation and Temperature Trends along an Elevation Gradient in Northeastern Puerto Rico’ ”

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This commentary is in response to [Torres-Valcárcel and González-Avilés \(2017\)](#). They claimed that the citation of [Torres-Valcárcel et al. \(2015\)](#) in [Van Beusekom et al. \(2015\)](#) is “flawed, inaccurate, and misleading” because the main focus of [Torres-Valcárcel et al. \(2015\)](#) was “evaluating urban versus nonurban average temperature values, not about inferring about temperature trends” ([Torres-Valcárcel and González-Avilés 2017](#)). We claim that [Torres-Valcárcel et al. \(2015\)](#) do present trends as a finding in their paper. First, the stated objectives of [Torres-Valcárcel et al. \(2015, p. 1649\)](#) include: “In [the] third section, we analyze a century of data with different methods to test hypotheses that, after controlling for potential variability related to ecological life zones, there are significant differences in *temperature trends* between urban and rural areas, with higher absolute values and *warming trends* in urban areas” (our emphasis). Second, section 3.3.2

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(labeled “Station *temperature trends* descriptive analysis”; our emphasis), section 3.3.3, Table 8, and Figures 7–13 of [Torres-Valcárcel et al. \(2015\)](#) are all based on trends. Third, they state in section 2 ([Torres-Valcárcel et al. 2015](#), p. 1652) that “the significance level for all statistics was set at the conventional 95% ($\alpha = 0.05$),” and the last sentence of section 3.3 ([Torres-Valcárcel et al. 2015](#), p. 1655) says “we addressed the differences of between the urban and non-urban landscapes within each HELZ using ANOVA and Student’s *t*-test where appropriate.” Calling these patterns “trends,” stating they are computed from a Student’s *t* test, and saying all tests are at significance level 95% imply the patterns presented in section 3.3 are statistically significant trends detected at the significance level 95%. If the authors did not detect significant trends, they should have stated this in section 3.3.3. Therefore, we stand by our assertion.

We do not say in [Van Beusekom et al. \(2015\)](#) that the *p* value is influenced by the setting of the significance level, as the commentary asserts. That is a misunderstanding of the statement in our paper. We say a reduced *p* value allows a trend to be reported at a higher significance level. It cannot be assumed that data producing a low *p* value with fitting linear parametric trend line would produce a low *p* value with fitting a nonparametric trend line and, moreover, a parametric test inappropriately applied is not reliable ([Gibbons and Chakraborti 2011](#)).

Extreme values can also affect trend results, for example, the study of [Mahmood et al. \(2006\)](#) reassessed their earlier work ([Mahmood et al. 2004](#)) to test for the influence of outliers on the trends found there. The Student’s *t* test has been shown to have an erratic false rejection rate (indicating a trend for synthesized data with no trend) with daily environmental data that violate the test assumptions ([Hess et al. 2001](#)). Although the data in [Torres-Valcárcel et al. \(2015\)](#) are not daily but monthly, seasonally, and annually, extreme values were found in the distributions of the data of [Torres-Valcárcel et al. \(2015](#), see section 3.3.3), and it cannot be certain that these non-Gaussian attributes would have no effect on the Student’s *t* test computed trends. The work by [Hess et al. \(2001\)](#) found the best results with environmental data were achieved by using the Seasonal Mann–Kendall (non-parametric) test ([Hirsch et al. 1982](#); [Hirsch and Slack 1984](#)). The citation in [Van Beusekom et al. \(2015\)](#) was not meant to criticize [Torres-Valcárcel et al. \(2015\)](#) or to say that no trends were possible but instead to explain why studies of the same region (Puerto Rico) may have found trends at higher significance than the trends found in [Van Beusekom et al. \(2015\)](#).

The objectives of [Torres-Valcárcel and González-Avilés \(2017\)](#), as stated in the abstract, is to “clarify the methods and justification for using them [in [Torres-Valcárcel et al. \(2015\)](#)] and to educate readers about the use of some conventional statistical tools and tests.” A paragraph of the commentary discusses the data and methods surrounding the use of ANOVA and R^2 in [Torres-Valcárcel et al. \(2015\)](#). The citation in [Van Beusekom et al. \(2015\)](#) does not discuss the data and methods surrounding the use of ANOVA and R^2 in [Torres-Valcárcel et al. \(2015\)](#).

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References

- Gibbons, J. D., and S. Chakraborti, 2011: Nonparametric statistical inference. *International Encyclopedia of Statistical Science*, M. Lovric, Ed., Springer, 977–979, doi:[10.1007/978-3-642-04898-2_420](https://doi.org/10.1007/978-3-642-04898-2_420).
- Hess, A., H. Iyer, and W. Malm, 2001: Linear trend analysis: A comparison of methods. *Atmos. Environ.*, **35**, 5211–5222, doi:[10.1016/S1352-2310\(01\)00342-9](https://doi.org/10.1016/S1352-2310(01)00342-9).
- Hirsch, R. M., and J. R. Slack, 1984: A nonparametric trend test for seasonal data with serial dependence. *Water Resour. Res.*, **20**, 727–732, doi:[10.1029/WR020i006p00727](https://doi.org/10.1029/WR020i006p00727).
- , —, and R. A. Smith, 1982: Techniques of trend analysis for monthly water quality data. *Water Resour. Res.*, **18**, 107–121, doi:[10.1029/WR018i001p00107](https://doi.org/10.1029/WR018i001p00107).
- Mahmood, R., K. G. Hubbard, and C. Carlson, 2004: Modification of growing-season surface temperature records in the northern Great Plains due to land-use transformation: Verification of modelling results and implication for global climate change. *Int. J. Climatol.*, **24**, 311–327, doi:[10.1002/joc.992](https://doi.org/10.1002/joc.992).
- , S. A. Foster, T. Keeling, K. G. Hubbard, C. Carlson, and R. Leeper, 2006: Impacts of irrigation on 20th century temperature in the northern Great Plains. *Global Planet. Change*, **54**, 1–18, doi:[10.1016/j.gloplacha.2005.10.004](https://doi.org/10.1016/j.gloplacha.2005.10.004).
- Torres-Valcárcel, A. R., and C. J. González-Avilés, 2017: Comments on “Short-term precipitation and temperature trends along an elevation gradient in northeastern Puerto Rico.” *Earth Interact.*, **21**, 1–4, doi:[10.1175/EI-D-16-0018.1](https://doi.org/10.1175/EI-D-16-0018.1).
- , J. Harbor, A. L. Torres-Valcárcel, and C. J. González-Avilés, 2015: Historical differences in temperature between urban and non-urban areas in Puerto Rico. *Int. J. Climatol.*, **35**, 1648–1661, doi:[10.1002/joc.4083](https://doi.org/10.1002/joc.4083).
- Van Beusekom, A. E., G. González, and M. M. Rivera, 2015: Short-term precipitation and temperature trends along an elevation gradient in northeastern Puerto Rico. *Earth Interact.*, **19**, doi:[10.1175/EI-D-14-0023.1](https://doi.org/10.1175/EI-D-14-0023.1).

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