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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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