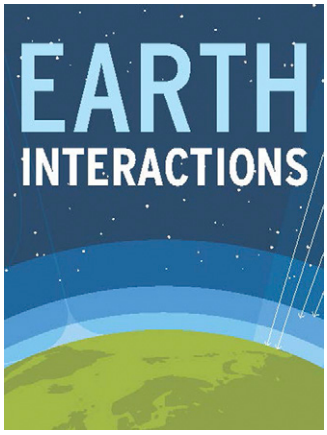

Reply to "Comments on 'Short-Term Precipitation and Temperature Trends along an Elevation Gradient in Northeastern Puerto Rico' "

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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 (nonparametric) 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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