

# ***Interactive comment on “Trend analysis by a piecewise linear regression model applied to surface air temperatures in Southeastern Spain (1973–2014)” by P. Campra and M. Morales***

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Reviewer 1 (Rew1 now on) seems to have misunderstood the scope of this research, and some statements in the manuscript. We answer one by one to these questions:

-“There seems to be no innovation in the methods” As the title states, this is a statistical analysis of data to estimate trends of change, using both conventional linear regression and a non-linear regression. The innovation here relies in the use of a piecewise fit algorithm, very scarcely used in climatic trend analyses, mostly based on linear regression. As we show by rigorous statistical analysis, simple linear fit offers a poor description of time changes, compared to non-linear techniques. Whether applying existing algorithms to data is “innovative” or not is just an opinion that we do not share

at all.

-“ In what concerns the analysis of results, I generally found it unconvincing,” Rew1 states that our statistical analysis is “unconvincing”, but gives no statistical analyses or reasons to support that subjective opinion.

- “The recent deceleration of global warming is a global process, not specifically linked to anything peculiar of SE Spain”, Rew1 has clearly misunderstood our statements to put in context the interest of using new statistical approaches to time series analysis. In our manuscript we have never linked global deceleration to local SE trends. We simply say that global averaged time series reflect trend changes that can be detected in many local series, as happens with the called “hiatus” from the early 90s. It is out of the scope of this research to discuss about the statistical significance of this hiatus, in global or local series, or about the proposed hypothesis of physical mechanisms. We just mention the existence of a reduction in warming rates throughout the world (as the IPCC last report 5AR does), as a starting point of observations to motivate the use of non-linear approach.

- “Attributing the global deceleration to specific land use changes in a very localized region is certainly wrong” We have never done so. We just speculate in the discussion on the possibility that differences in breakpoints between local series might be due to land use changes, or simple to internal variability. We do not give any definitive conclusion on this respect.

- “I believe that a global analysis of mean or of spatially distributed surface temperature would probably find a breakpoint in the beginning of 2000s” Again, this is a subjective opinion not based on data analyses used to argue against our statistical approach. Visual inspection of data is again just an starting point of observation that can not be used to refute data analysis.

- “he so called "hiatus" seems to be over, after the record breaking temperatures in 2015” Again, a subjective opinion not based on data analysis. As we have said, here

we do not analyze or discuss this global hiatus. Anyway, as this Rew1 must know, one year does not make significant changes in long term statistics.

-“Finally I found the discussion supported by Table 2-4 rather weak. The piecewise approach will always produce a better fit, the question being the statistical support for the extra degrees of freedom.”

We chose piecewise regression rather than simple linear regression in an attempt to obtain a better fit as well as to improve the predictive performance. The empirical results with the analyzed data suggest that the choice was appropriate, in our opinion. Certainly, the number of parameters is higher when using piecewise regression and it affects the value of the coefficient of determination. However, the so-called adjusted coefficient of determination, where the effect of the number of parameters is removed, also shows a clear edge for piecewise regression. Furthermore, in cases where linear regression provides a very poor fitting, for instance when analyzing maximum temperatures in Almeria with an adjusted  $R^2=0,00172$ , the piecewise regression yields a fairly good fitting (adjusted  $R^2=0,4978$ ). We would be happy to substitute  $R^2$  by the adjusted  $R^2$  if the Referees deem it appropriate. Also, table 2 displays the residual standard error, which is not affected by the differences in number of parameters. These RSE are lower in piecewise regression than linear regression except in minimum temperatures in MA. Hence, we believe the differences in the breakpoints found in nearby stations are not a side effect of the statistical model used, but they could be instead explained by local forcings of simply natural variability. Though it is out of the scope of our research, we have studied deeply the case of the effect of land use changes in Almeria in other papers reflected in the References section, using both data analysis and numerical simulations (Campra et al, 2008 and Campra and Millstein, 2011)

-“ The large differences found in the location of the breakpoints in nearby stations mostly makes me feel uncomfortable about the robustness of the individual results and not excited to look for the physical explanation of those differences.” Again, Rew1 gives opinions or feelings not based on statistical analyses. Again, he misunderstands the

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scope of our work, not related to give any physical explanations, but solely to offer a better non-linear trend analysis for climate changes than conventional widespread simple linear analyses.

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