

Interactive comment on “Flexible approach for quantifying average long-term changes and seasonal cycles of tropospheric trace species” by David D. Parrish et al.

Anonymous Referee #1

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Major comments:

The manuscript suggests using the power series and Fourier harmonics to represent long-term change and seasonal cycle of a time series, with an application to two gas species at Mace Head, Ireland. Overall, the manuscript is well written, the methodology is reasonable and the topic is of interest for the AMT journal. My only concern is the interpretation of the result (e.g. p5. l14.). The existence of a curvature in a time series does not automatically imply that there exists a meaningful or significant trend onward. It is extrapolating the fitted curve to an unobserved future based on a second order polynomial (due to it only allows one turnaround point), and is potentially misleading to

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the reader.

An obvious example is that in the spirit of change point detection of a time series, one might reckon a significance of quadric term as a significance (or an existence) of one change point, and a non-significance of cubic term can be considered as no second change point occurred. The currently developed change point detection algorithms are designed for the detection of “mean“ or “variance” change, and often fail to detect the change of the “trend”, this is a big conceptual difference. Another example is that in the trend analysis of long-term of total ozone, many researchers use piecewise linear trend scheme to account for the ozone depletion since late 1970s and potentially recovery in late 1990s, but until now the latter trend for total ozone is yet to be significant in many literatures. Therefore the power series fit should not be over-interpreted as long-term changes, at least it is not representative for the trend after the maximum/minimum have reached (as stated in p10, l15 & l25, and in the conclusion the authors mention that trends after 200 and 2008 are not significant).

Minor comments:

P3. L30.: This statement only holds true if temporal sampling scheme does not introduce any bias to the monthly means. For example in the historical period some of the monthly means from ozonesonde might have only averaged from a very few profiles, it is then hardly be representative to the monthly means if there was an over- or under-sampling issue. The authors should clarify this point or be conservative to the statement.

P10. L21.: The term “robust” has a very specific meaning for the median or quantile regression in the statistics. The power series fit is still depended on the mean value and the ordinary least square, it is not allowed any breakdown point in the data, so it should not consider to be a robust approach.

Figs 7 & 8: The plot legends have labeled “tau” and “correlation factor”, but these terms are not defined or mentioned in the main text.

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