

***Interactive comment on* “Statistical regularization for trend detection: An integrated approach for detecting long-term trends from sparse tropospheric ozone profiles” by Kai-Lan Chang et al.**

Anonymous Referee #1

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The article proposes a new method to compute temporal trends in ozone vertical profiles. They take stock of auto-correlation in the vertical dimension to minimize uncertainties in the estimated trends.

Most of the paper is devoted to statistical considerations, with very little geophysical discussions, so that I agree with Anonymous Referee #2 that such a paper would have been more suited for a statistical journal.

But the manuscript remains well written and the topic of trend detection for tropospheric

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ozone is important and relevant to Atmos. Chem. Phys. so that I see little ground for not supporting its publication.

General comment

My main frustration is that the added value of the integrative method is only tested in terms of trend estimate, whereas in atmospheric ozone studies the significance of the trend is also often challenging to assess. The benefit of this method in terms of significance would deserve to be discussed.

It is not fully clear how European and Chinese IAGOS profiles are treated but an “aggregate” is mentioned P8L1. It is very questionable to average all profiles collected over a whole continent, and subsequently seek to assess such subtleties in the estimated trend.

The benefit of the new method could be considered relatively marginal. It would be interesting to provide more discussion on tropospheric ozone trends to demonstrate the importance to refine these estimates.

Specific comments

In several occasions in the manuscript, I would avoid the term “noise”. The vertical structures documented by atmospheric profiles are not due to instrument random uncertainty but they carry an actual “signal” to understand atmospheric variability. I understand that this variability is not in the focus for long term trend studies, but they can not be considered as “noise”. In turn, the regularization applied in eq 4 is very questionable, and the impact of this step on the overall findings should be assessed through a sensitivity study.

Abstract: Add the number of years available in GMD/IAGOS

P8L30: a geophysical interpretation of the 2010 anomaly should be provided.

P8L32: the figure does not provide anomaly for the seasonal cycle, so that this state-

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ment is poorly supported

P10L18: I find figure S4 more insightful than Figure 6, suggest swapping both

P11L22: which geophysical process could explain the difference vertical correlation depending on the region?

P12L2: add percentiles in the figure legend

P14L5: this sentence seems misplaced

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