

Interactive comment on “Lower tropospheric ozone over the North China Plain: variability and trends revealed by IASI satellite observations for 2008–2016” by Gaëlle Dufour et al.

Anonymous Referee #1

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* Overall an interesting and relevant paper. The data are well presented, the measuring and analysis methods seems sound, but the text could greatly benefit from an extra text editing. I also suggest some corrections below.

* The negative trend of ozone in the lower troposphere from IASI compared to other satellite based products makes me frown a bit. The authors try to provide a reasonable explanation for this, but to my opinion, it remains inconclusive. It makes me uneasy in assessing this manuscript, although the analysis made on the data seems to be sound. The authors analyzed different possible factors but in the end a remaining -0.1 DU/yr trend remains unexplained, which is more than half the trend (-0.17 DU/yr).

C1

The only argument for understanding the negative trend is based on a speculation that increasing VOC emissions at the surface are responsible for the increasing trend of ozone observations near the surface from ground stations. But the authors do not show data that would demonstrate that. What is more, this VOC's hypothesis does not explain why the UV based sensors do observe a positive trend. To my knowledge these sensors are also not very sensitive for ozone near the surface. This is really puzzling. I would suggest to elaborate a bit on this assumption by looking to for instance formaldehyde data (see paper Jin et al., 2017, JGR: 10.1002/2017JD026720).

* What happens if the whole tropospheric column of IASI is considered, instead of LT? Which trends are then revealed? And what if one only considers the upper troposphere, UL? Which trends are then computed? Could this add some more support in understanding the negative trend?

* Is there any trend in the thermal contrast retrieved from the IASI data?

* In the deseasonalized data there seems to be a dip in LT ozone at the start (January?) of 2011 (fig 2(e), fig 4. Is there any explanation for this?

P1L14-15: "... decrease in NO₂ tropospheric columns since 2013 attributed to ...";

P1L16: "... remains unclear.";

P1L19: "... leading to an overall significant trend of ...";

P1L21: "... from IASI may be attributed to a reduction ...";

P1L23: "... applied CO proxy.";

P1L23: "... from background surface ozone(?) measurements ...";

P1L26: "... , without any conclusive explanation so far.";

P1L28-29: "... from the comparison concerns the impact of the spatial and temporal sampling of the datasets on the calculated trends.";

C2

P1L31: "... increasing pollutant ...";

P2L2: remove "...for the major pollutants"

P2L3: "... attributed to the emissions increase to both surface as well as in the lower troposphere...";

P2L25: "... as processes that modify...";

P3L3-5: Rephrase this sentence. Needs at least a proper verb;

P3L8: use "with respect to" instead of "in regards";

P3L11 and 18, etc: use "operational" instead of "in flight"; also check and replace in other parts;

P4L29-30: This method is based on the difference between the actual month and the average value for that month for the period 2008-2016?

P4L32: So when I see a computed linear trend in the text, figures or tables it is always based on the Theil-Sen estimator? If not please specify.

P5L32: use "etc" instead of "...";

P6L2: "... one region, ...";

P6L3: "... have been observed in recent years. Thus, the hypotheses is that reductions in surface emissions of NOX might cause a decreasing trend in lower tropospheric ozone levels.";

P6L7: introduce white spaces before and after the equation;

P6L10-11: "The significance of including or excluding a variable is ...";

P6L13: "Variable that were not significant were remove from the final fit.";

P6L18: "... from daily data, ...";

C3

P6L30: I believe that it is "... have also been tested. ";

P6L32: "were";

P6L34: "After the fitting procedure, the significant variables are: ...";

P6L35: "The normalized ...";

P7L30: "... changes in emissions addressed by CO as proxy.";

P7L30-31: I do not understand what the authors try to say. Please clarify and rephrase. Transport effects?

P7L34: "more" should be at the end of the sentence;

P8L6: "... but requires up-to-date emissions inventories ... "; this can be achieved by using OMI NO2 and other data;

P8L19: "However, time series of monthly skin temperature show ...";

P8L29: "... calculated insignificant trend of ...";

The linear trends computed in Figure 5: are they based on the deseasonalized data? If not, why not? They should! Please clarify.

P9L13: "... but not significant"; since $p > 0.05$;

P9L14-16: This is a bad sentence. Please rephrase!

P10L4-5: "... might not be attributed to...";

P10L15: do you mean "relaxed" instead of released ?

P10L33: "small bias";

P11L23: "... can completely change...";

P12L1-2: "... (daily, hourly)...";

C4

Figure 2: Please add on the y-axis “Deseasonalized” LT ozone; Add in caption how the 2013 breakpoint is chosen;

Figure 5: Are the associated linear trends based on the monthly timeseries or on the deseasonalized series?

Figure 5. Please add the deseasonalized timeseries of the thermal contrast!

Figure 8. Should be “four stations”;

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