

Interactive comment on “Evidence for an unidentified ground-level source of formaldehyde in the Po Valley with potential implications for ozone production” by J. Kaiser et al.

Anonymous Referee #2

Received and published: 13 November 2014

1. Does the paper address relevant scientific questions within the scope of ACP? Yes
2. Does the paper present novel concepts, ideas, tools, or data? Yes
3. Are substantial conclusions reached? Yes
4. Are the scientific methods and assumptions valid and clearly outlined? Yes
5. Are the results sufficient to support the interpretations and conclusions? No, see comments below
6. Is the description of experiments and calculations sufficiently complete and precise

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to allow their reproduction by fellow scientists (traceability of results)? Yes

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes
8. Does the title clearly reflect the contents of the paper? Yes
9. Does the abstract provide a concise and complete summary? Yes
10. Is the overall presentation well structured and clear? Yes
11. Is the language fluent and precise? Yes
12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes
13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? In case, the eddy turbulence discussion can be shortened based on real measurements from the 3D wind, the supplement could be shortened and completely included in the manuscript
14. Are the number and quality of references appropriate? Yes
15. Is the amount and quality of supplementary material appropriate? See above (13)

General remarks:

The manuscript describes detailed measurements of atmospheric trace gases taken within the planetary boundary layer from a Zeppelin airborne platform compared to a modeling study of air chemistry in the early morning hours. The measurements cover a wide range of chemical components compiled to constrain a direct comparison between model and experiment to identify possible gaps in our knowledge of sources and sinks of air chemistry or pollution relevant compounds. The paper is well structured and written in a concise way. It is made clear, that the model and experiment differ significantly in the concentrations of formaldehyde. However, the statement that the

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most probable source of missing HCHO is the direct emission from the soil and plant matter below the Zeppelin is not confirmed by the data given.

Specific comments:

Model simulations: The model is using a global background concentration of methane, a precursor of formaldehyde (not measured from the Zeppelin, nor on the ground) of 1760 ppb. That is probably not realistic in the Po-Valley where major methane emissions are from agriculture (rice paddies and livestock). With the diurnal variation of the planetary boundary layer nighttime methane concentrations in agricultural areas could be far higher. (see for example www.gi.ethz.ch/news/Bamberger_etal.pdf). Such a variability of the methane, which is one of the precursors of formaldehyde in the Po valley, is not discussed but could affect also the early morning chemistry. Methane also provides a large fraction of the OH reactivity especially in the lowest layers (Fig.4). There are also other sources for methane in the vicinity of the SPC station which could contribute to the diurnal variability and nighttime enhancements below the nocturnal inversion. Within the Po-valley there are at least 50 natural gas fields, several very close to SPC.

It should be discussed how such variable methane concentrations affect the model results.

Model sensitivity to turbulent mixing (supplement): This discussion shows the variable eddy diffusion is not changing the results. This discussion could be shortened in case, the model can be constrained to the measured 3D wind –measurements (page 25145, line 12).

Potential sources of HCHO: page 25149 line 16 to 29. A source region of Bologna (southwest of SPC) could be more simply excluded using a HYSPLIT backtrajectory, and on line wind measurements onboard the Zeppelin. A backtrajectory analysis could also help to investigate whether other sources of HCHO (or CH₄?, or biofuel) could possibly be located upwind of SPC.

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Implications for ozone production: Are there any ground based ozone measurements available at SPC that could be use to confirm the model? How do they agree with ozone measurements from the Zeppelin?

printing errors in the supplement page 3, line 17, remove ..as..

page 4, line 6: significantly

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 25139, 2014.

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