**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "The global atmospheric budget of
ethanol revisited" *by* W. V. Kirstine and
I. E. Galbally

Anonymous Referee #2

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Review of: The global atmospheric budget of ethanol revisited by Kirstine and Galbally, 2011, submitted to ACPD

The paper describes the estimation of the global budget of ethanol by using flux measurements, mixing ratios in different parts of the atmosphere and available information about the degradation/deposition of ethanol from the atmosphere. The method itself is straightforward and the results would add new insights into the global budget of ethanol if the way how this is done is described in a comprehensive manner.

I am not in favour of publishing the manuscript in ACP in its present form and I suggest major revisions. However, I am certain that authors can revise the manuscript

accordingly and that afterwards it will be possible to publish it in ACP.

General: 1. Sources: I had big difficulties in following the way how the sources and sinks have been calculated. This is crucial for the reader of the paper, as these values are considerably higher than those found in previous peer-reviewed literature. Therefore, I would suggest that authors either describe it in a way that the reader can really follow how these numbers have been created. This could be done in the main part of the paper or by adding a section with supplementary material. For example, I could follow how emissions of 0.2-0.8 g ethanol/m2/yr have been calculated from the Kirstine et al.(1998) publication (P.25913, L. 13-16), as all the information is there. But I was unable to calculate the 0.2-0.4 g ethanol/m2/yr from the Fukui and Doskey work (P. 25913 L. 3-13). Here with the information I got, I would multiply for example the lower number of 206 ug/m2/h of ethanol by 2000 h (growing season, as specified in the paper) and I get 0.4 g ethanol/m2/yr, which is the higher number of the range. This does not make sense. For the calculation of the Schade and Goldstein (2001) fluxes information is missing about the assumed temperature range for the yearly estimate. From Figure 9 of Schade and Goldstein (2001) I would assume something in the range of 20 °C. This is the information the reader needs, otherwise he/she cannot follow the numbers at all.

2. Sinks I also cannot follow the global sink calculation of the authors for the OH degradation. If I just use some very basic assumptions I get 27 Tg/yr, as a maximum for the OH gaseous sink term. My calculation goes as follows: I assume globally 1 ppb of ethanol (which is the highest value used in the paper (in the CBL)), and globally 1E6 OH radicals/cm3. If I then take the Jimenez value of 3.2E-12 cm3/molecule/ s for k in the ethanol-OH reaction. The calculation would be: $1/(3.2 \times 10^{-12} \times 1E6) = 3.6$ days lifetime of ethanol relatively to OH This means that the ethanol in the atmosphere is overturned 365/3.6, roughly 100 times a year. Then I calculate the burden (only in the troposphere) 1ppb x 1.44E20 mol. This results in 1.44E11 mols of ethanol, which is 270 Gg of ethanol. This multiplied by the 100 times overturn per year gives 27 Tg/yr.

As this has been done using 1 ppb (the highest number), the sink has to be smaller in reality.

Also here I strongly suggest that authors provide the information of how this was actually calculated in the supplement.

Minor issues P. 25910, Line 1: I would not label ethanol as biogenic (as it also has anthropogenic sources, also mentioned in the paper). Oxidised VOC?

P. 25910, Line 8-10: The sentence starting with "The observational . . . could possibly be omitted, as it contains no valuable information

P. 25920, Line 21: Albeit the fact that the ocean is a net source, the deposition has to be taken into account. Only if the study which is referenced has taken this into account already and the sum of both processes is calculated then it would be ok. Please check and specify in the text if this has been done in this way.

P. 25922, Line 5-14: The short-term differences of sources and sinks should level themselves out during the course of the year. I don't think that this point is justified to be made. So I would suggest to delete it.

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