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Atmospheric Chemistry and Physics Discussions

Interactive comment on "First space-based derivation of the global atmospheric methanol emission fluxes" *by* T. Stavrakou et al.

Anonymous Referee #2

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Stavrakou et al. present the first global emission inventory of methanol derived from space-based observations. They used the IASI retrieved methanol total columns as constraint of the biogenic and fire methanol sources. The inversion is based on a variational method using the adjoint of the IMAGES model. The a priori methanol columns are inferred from two different emission inventories: one given by Jacob et al. (2005) and one calculated using the MEGANv2.1 algorithm specifically updated for methanol emission fluxes in this study. The authors show that the retrieved methanol emission fluxes are in good agreement with the MEGANv2.1 inventory on average with strong regional differences. The paper is well written with detailed explanations and references when necessary. This work is suitable for ACP publication and I recommend it after the following comments are addressed.

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Discussion Paper

General comments

1) The uncertainties on the a priori emissions and on the observations are only slightly discussed in the paper. The authors write that the uncertainties on the IASI observations are large (50% + 1016). Do these large uncertainties permit to reduce the error estimate on the a posteriori emissions? Is there a real gain using these observations? The paper would be much stronger if this point is addressed. A view of the variation of the spatial variability of the errors of the observations correlated with the regions not considered for the inversion would be helpful for the reader. Another issue concerning the IASI observations is their vertical sensitivity. The author mentioned they use different averaging kernels to reproduce a similar vertical sensitivity in the model. Providing a representation of this sensitivity would also help the reader. Are the IASI observations sensitive to the lower troposphere, the free troposphere?

2) Another interesting information to quantify the gain using the IASI observations as constraint would be to use the Jacob et al. (2005) inventory as a priori for the inversion. Does it lead to similar results and conclusions?

3) Regional differences between the two a priori methanol distributions, the a posteriori distribution and the IASI distribution are extensively discussed. However, no specific comment is given on the differences observed over Siberia with the optimized inventory (and MEGAN also). The agreement is better between IASI and the columns calculated from the Jacob et al inventory than between IASI and the MEGAN and the optimized inventory. Comments would be welcome.

4) The comparison with the different aircraft campaign is made using the model simulations in 2009. However, the aircraft measurements usually occur at different years. What about the interannual variability of methanol? Is it negligible?

Specific comments

- Paragraph 5.1 – discussion on the IASI errors: it is not clear if the error given here

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reports to the monthly averaged column or the each individual column.

- P 5239 – lines 10-15: The authors discuss the methanol emission capacity of desert vegetation. However, they mention earlier in the text that the IASI observations are perturbed over desert due to large changes in emissivity. Can the observations over the regions discussed here also affected by this emissivity issue and then lead to "erroneous" columns?

- Fig. 3 and Figures comparing IASI and model columns: Do the modeled columns represented include the averaging kernel of IASI? It is not written in the caption. I would recommend to plot the modeled columns smoothed with the averaging kernel in order to compare similar product.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 5217, 2011.