**Atmospheric
Chemistry
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Discussions**

Interactive
Comment

Interactive comment on "How much CO was emitted by the 2010 fires around Moscow?" *by* M. Krol et al.

Anonymous Referee #1

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The aim of the paper is to estimate CO emissions from biomass burning during the extensive fires that occurred in Moscow area in July-August 2010, using a data assimilation framework ingesting CO columns from IASI in the TM5 global model. The main finding is that fire CO emissions between mid-July and mid-August lie between 22 and 27 Tg CO, significantly higher than prior estimates. Furthermore, sensitivity calculations showed that these values are only slightly dependent on the choice of the a priori inventory used, on diurnal variations, and on injection heights.

The subject of the paper is well within the scope of the journal. The article is written in a clear way. The results look correct, and the conclusions seem robust. I propose that the manuscript is published after the following points are properly addressed and elucidated.

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Comments :

1. The sensitivity studies demonstrate that the assimilation is strongly driven by the IASI measurements, as it exhibits hardly no dependence on the a priori inventory used. I find, however, that the range of the a posteriori emission strengths is quite narrow (22-27 Tg CO), and I suppose that this is due to a combination of the very large amount of available observations and of presumably small errors assigned to the IASI observations during the assimilation. By assigning larger errors to IASI observations, e.g. a two- or four-fold increase, and carrying out a sensitivity inversion could help to determine whether the assimilation results remain robust towards the choice of the IASI errors.

2. Konovalov et al.(2011) reported that 2010 fires in Moscow region and surroundings emitted around 10 Tg CO, i.e. more than 85% of the total annual anthropogenic CO emissions. Further, they estimated that 30% of total CO fire emissions in European Russia originates in peat fires. Is the present study capable to make a rough estimate of the contribution of peat fires to the derived CO emission from IASI?

3. The Russian fires emitted massive amounts of smoke and aerosols into the atmosphere. However, there is no mention about aerosols in the paper and their potential impact on the IASI retrieval. This could be a strong source of uncertainty and to address it would benefit the paper a lot.

4. *The CO column is measured with 10% accuracy or better* (p.28709, l.17) The errors are then inflated by a factor of 7. Please explain how this factor comes up and what is finally the IASI error used in the assimilations. The fact that the assimilation is strongly constrained by the IASI observations could be due to IASI errors assumed too low in the assimilation system. Furthermore, it is highly recommended that error bars for IASI and MOPITT columns are plotted in Fig. 2, or better in a separate plot.

5. p.28711, l.1-5: Please provide details about the a priori direct anthropogenic CO, and biogenic emissions, as well as the CO produced from anthropogenic and biogenic precursors as simulated by TM5 for the regions under investigation (R1 and R2).

6. Apart from the comparisons with MOPITT, the findings are not confronted to independent validation datasets, especially from ground-based measurements. Aren't really any data available?

7. Negative emission updates are inferred in region R2 (Fig. 3). The color bar does not allow to quantify the actual increment. Could you comment on these negative values?

8. No details about the assimilation method are given here. Even for those familiar with the method, a section describing the settings and the assumptions of the assimilation is required.

Minor comments

1. p.28707, l.2: *The fires around Moscow in 2010*, please specify the period.

2. p.28707, l.23: Konovalov et al.(2011) reported maximum daily mean CO observed in Moscow reaching 10 mg m^{-3} and not 20 mg m^{-3} as is stated here.

3. p.28709, l.4 : *with of resolution*, please correct.

4. p.28711, l.23: read *dotted*

5. p.28713, l.4-6: *Emitting CO...lofted CO,* I cannot find these lower emission estimates (4 Tg CO in R2) in the paper. Is this the result of a sensitivity calculation that is not shown?

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6. p.28714, l.18-21: *The high bias in GFAS..assigned to 30 July*. I'm afraid I cannot understand the meaning here. Please explain.