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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Tracking the emission and transport of pollution from wildfires using the IASI CO retrievals: analysis of the summer 2007 Greek fires" *by* S. Turquety et al.

Anonymous Referee #2

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1 General Comments

This paper clearly demonstrates the capability of the IASI instrument aboard the METOP-A satellite to monitor carbon monoxide plumes emitted by large biomass burning events. This observational capability opens up new opportunities for the top-down characterisation of biomass burning on the one hand side and the quantification of transport of air pollution and air quality impairment on the other hand side. The capability is demonstrated for the example of the forest fires that ravaged Greece in August 2007. Thus the paper also contributes to the characterisation of this extreme event. The presented CO column retrievals and source inversions are very convincing and

clearly suitable for publication in ACP.

However, the conclusion regarding the ability to derive information on the general altitude level of plume transport is in my opinion over-optimistic. The presented averaging kernels imply a capability to distinguish plume at 10 km altitude from plumes at 5 km altitude. However, such a capability is irrelevant for the selected case of the Greek plumes and cannot be demonstrated with them since they remained below about 5 km altitude. The presented material still shows an influence of the plume height below 5 km on the retrieved CO profile. But I would not dare to derive any relevant plume height information from the retrieved CO profiles. Furthermore, I agree with referee 1 that section "1 Introduction" and, additionally, "2 IASI CO retrieval" give some irrelevant general information and could be shortened. At the same time, some more specific information should be given and several statements should also be substantiated with suitable references. See below for detailed suggestions.

2 Specific Comments on Plume Height Determination

(p.7414, l.14,24-26; p.7432, l.1-12; p.7435, l.5-7) You find that the measurement contains 1.7 pieces of independent information and then claim that you can distinguish more, namely 3, different plume altitude levels: lower, middle and upper troposphere. This cannot be true and you have not shown any determination of plume height from the IASI CO observations. I suggest removing the conclusion l.24-26 from the abstract. It seems appropriate to mention this issue in an outlook on further studies at the end of the Conclusions section though.

(Fig.3,4,12) The averaging kernels (Fig.3,4) exhibit vanishing sensitivity at 1 km altitude, while the retrieved profiles (Fig.12) vary distinctively near this altitude; even the sign of the slope varies. What is the cause of this variation? Since it does not seem to be induced by the observation, I wonder whether it might be induced

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by the a priori error covariance matrix. Can you discuss the lowest 4 km of the retrieved profile shapes? Anyway, you should explicitly and quantitatively state the a priori error covariance matrix in section 2, as it is a key component of the presented retrieval method.

(Fig.11,12) Fig.12 shows that your retrieval can produce profiles with a pronounced maximum near 2 km altitude. This is exactly what the independent CALIOPE LIDAR observations indicate in Fig.11. Why did the retrieval not reproduce the maximum in this case?

3 Other Specific Comments

(p.7415, l.23 – p.7416, l.3) Portuguese fires seem irrelevant. I suggest deleting.

(p.7417, l.27 – p.7418, l.2) Please either give a reference or move this statement to the conclusions section.

(p.7420, l.1) How where the temperature and humidity profiles generated? Are they from the ECMWF operational analysis?

(p.7423, l.14-15) Cite your source of burnt area estimates.

(p.7426, l.4-5) You state that that the iterative nature of the retrieval approach would act to lower the retrieval error estimate in the retrieval error covariance matrix. According to my understanding of optimal estimation this is not true: According to your Eq. 2, the retrieval error covariance matrix solely depends on the a priori and measurement error covariance matrices and the Jacobian at the retrieved state vector. This is independent of how many iterations were needed to determine the retrieved state vector. Please check and clarify the source of the retrieval error underestimation.

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(p.7429, l.18-19) Please state the assumed values for specific fuel load, burning efficiency and CO emission factor, and cite your source.

(p.7434, l.8-10) This was not shown in the paper. Please provide reference or label as "not shown here".

(p.7434, l.16) Please cite reference for the assumed anthropogenic emissions.

4 Technical Comments

(p.7418, l.9) "features" of what? Do you refer to "features of the global atmospheric CO field"?

(Eq.3) Only the averaging kernels are used in this work. I suggest deleting Eq. 3 and its discussion in the following paragraph.

(p.7422, l.9-11) Reformulate considering that $\mathbf{S}_\epsilon$ is the "measurement error covariance matrix", not "measurement error". Also add a reference justifying your assumption for its values.

(p.7427, l.15) Replace "water profile" with "water vapour profile"

(p.7428, l.6) Replace "compared" with "comparison"

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