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Interactive comment on “Satellite- and ground-based CO total column observations over 2010 Russian fires: accuracy of top-down estimates based on thermal IR satellite data.” by L. Yurganov et al.

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We thank the Reviewer #1 for his/her very helpful review. Our paper is now under revision and the final response will be posted later. Here we address the most essential remarks and highlight some improvements of the paper.

1. IASI retrieval algorithms. The IASI “standard” algorithms have not been finalized by the time this paper had been submitted (March 2011). We used for IASI a Spectral Fitting Algorithm, which is a modification of CH₄ algorithm for IASI (in preparation),

Full Screen / Esc

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Interactive Discussion

Discussion Paper



which, in turn, is a modification of a “peer-reviewed” algorithm for AIRS CO₂ (Strow et al., 2008).

The ANN IASI CO retrievals are the operational products of EUMETSAT. They are obtained with artificial neural networks which are based on peer-reviewed algorithms developed by Turquety et al. (2004). In the frame of the IASI Science Working Group activities, the IASI L2 operational processor was developed. What is currently operated is an improved version of this algorithm, which was presented at the 2d Internal IASI conference (Annecy 2010) and the Meteorological Satellite User Conference (Cordoba 2010), see August (2010). The new products underwent several validations which were completed by an external review: George and Clerbaux (2010). It is interesting to note that the external study was performed by M. George (the leading author of the suggested alternative product) who concluded on the good and similar quality of the respective CO total columns. Their results were also presented in Annecy 2010 and Cordoba 2010.

We agree, however, that a comparison with the optimal estimation algorithm would be useful, and we will try to do this.

2. Mass balance model is used here primarily to demonstrate how much would be the emission change in a case of more realistic CO data for the lower troposphere. 30% error, estimated by testing, should be the same both for original CO data and for the corrected data. We found that a factor of 1.8–2.0 larger emissions are expected for the corrected data. As we write in the paper under discussion: “This is a simple and fast technique to estimate smoothed daily CO emission rates and total emitted CO. Here, this technique is used primarily as a convenient tool to determine the sensitivity of a top-down estimate to the error of a satellite-borne TIR sounder” (page 12223, lines 5–8). Nonetheless, we appreciate a Reviewer’s minor comment #10, and we will address it in the final response.

3. In this regard, a comparison with other independent estimates of CO emission might

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be a test of validity. Estimates by Konovalov et al. (2011) and Fokeeva et al. (2011) are available now. A new figure (Fig 15 in the paper) will be included in the final revised version of the paper (Fig. 1).

The both approaches come to similar values in the range 34-40 Tg. Conversely, Konovalov et al. (2011) reported just $\frac{1}{4}$ of these values; they used a FRP technique, a regional CHIMERE model, scaling using MOPITT VMR at 900 hPa and locally measured VMR at the surface. Reasons of this disagreement will be discussed in the paper.

4. NIR vs TIR. We modified Fig. 2 and included the SCIAMACHY NIR averaging kernel for CO in Africa (that for China is similar) adopted from Liu et al. (2011). The latter paper is now under reviewing in ACP, positively evaluated, and hopefully the final version would be available soon. As we see, the SCIAMACHY AK is almost ideal. In the revised version we will convolve the most realistic CO profile over Moscow for August 9 with AKs for different sensors and compare the results. Unfortunately, SCIAMACHY CO data for 2010 are still unavailable (personal communications of Ilse Aben and Michael Buchwitz, 2011), and this will demonstrate only the result expected for an ideal NIR sensor and a strong fire plume. So far, according to Liu et al. (2011), monthly mean CO TC for MOPITT and SCIAMACHY are practically coincide over Africa and Brazil during periods of biomass burning. Model results convolved with MOPITT and SCIAMACHY AKs show slightly lower CO TC than observed. If a model reproduces VMR in the lower atmosphere correctly then TC from the convolved/integrated profile should be close to the true TC for the ideal AK. Low TC obtained from MOPITT-convolved models are not surprising due to negligible sensitivity in the BL (both convolved model and satellite data are close to the a priori in the lower atmosphere). SCIAMACHY-convolved model, however, is expected to be much higher, not talking about the SCIAMACHY-retrieved CO TC. This may indicate on insufficient accuracy of both data sets.

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Figure captions

Fig. 1. (Fig. 15, new, in the paper). A comparison of the mass-balance estimate of CO emission (top-down, this paper) with an inventory (bottom-up) by Fokeeva et al. (2011) where two MODIS instruments were used to estimate burned areas.

Fig. 2 (Fig 2 in the paper). Normalized averaging kernels for CO TC retrieved from data of space- and ground-based instruments, various days of 2010 (e.g., 0809 corresponds to August 9 2010). A priori profiles: AP 5.4 corresponds to: CO TC equal

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to $5.4 \text{ E}18 \text{ molec/cm}^2$, etc. "SCIA Africa" is for SCIAMACHY, Central Africa, January 2004 (Liu et al., 2011).

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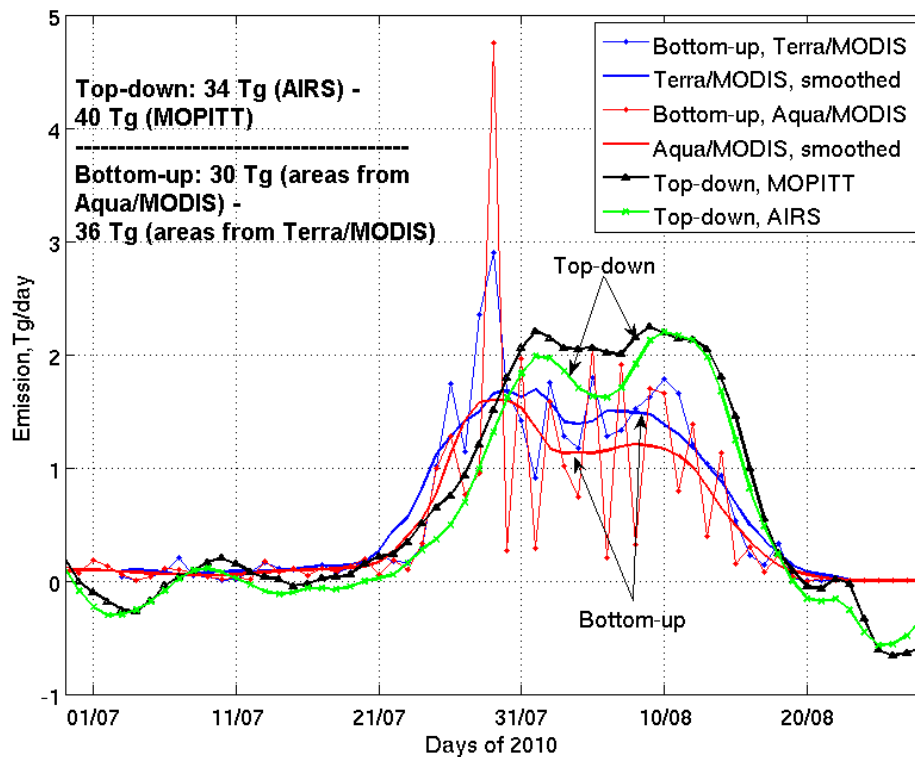
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Fig. 1.

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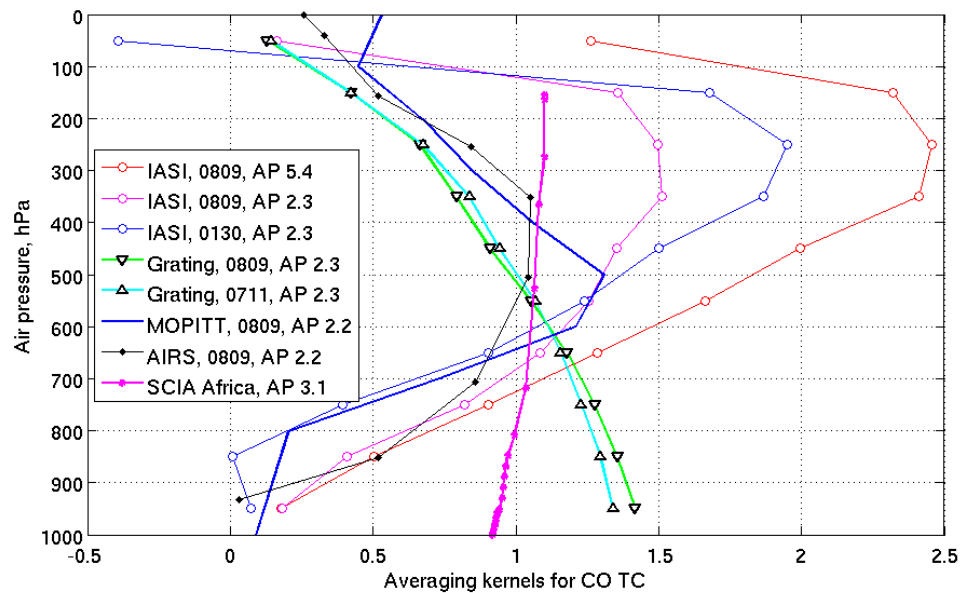
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Fig. 2.

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