Atmos. Chem. Phys. Discuss., 9, C705–C707, 2009
www.atmos-chem-phys-discuss.net/9/C705/2009/


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "IASI measurements of reactive trace species in biomass burning plumes" *by* P.-F. Coheur et al.

**Anonymous Referee #1**

Received and published: 11 May 2009

The authors report on the ability of the IASI instrument to probe various reactive species in biomass burning plumes. They selected two strong fire events to support their analyses: fires that occurred in Greece in August 2007 and fires that occurred in Siberia and East Mongolia in spring 2008. They show that spectral signatures of ammonia, ethene, methanol, formic acid, peroxyacetyl nitatre and acetic acid, attributed to fire emissions, can be observed and assigned in specific IASI spectra. They also show that the IASI observations allow probing the spatial and temporal extent of the plume. Finally the authors derived an estimate of the total mass emissions for NH3, C2H4 and CH3OH for the Greek fires as well as enhancement ratios relative to carbon monoxide in order to give insight in the chemical processes occurring during the transport.

General comments

1) The main concern about this work is the lack of details and precisions about the quality of the products retrieved. The authors derive atmospheric columns of several species that would be very interesting and promising but they do not give any information about the characteristics of the retrieval (errors, averaging kernels, degrees of freedom, etc). This information, especially concerning the errors, is essential in order that the reader can judge of the ability to retrieve significant products and can judge of the relevance of the products for the discussion about the total mass emissions and the enhancement ratios derived. Indications about the a priori columns (and/or profiles) and typical background concentrations would also be welcome to give an idea of the enhancement for each emitted species. In Fig. 5, which is the vertical significance of the profiles (right panel) provided? I can believe that total columns can be retrieved but I'm sceptic for relevant profiles.

2) The authors state that several species can be firmly detected from IASI spectra (p8768, line23). The spectral signatures are clearly visible in the residuals for NH3, C2H4, HCOOH, PAN in the examples chosen (Figs 3 and 5). However, the case of methanol is much less convincing. The Q-branch is very close to the noise level of the residuals and details about the retrieval would certainly help to determine if this species can be detected firmly or not. Are the two spectra chosen the best for this trace gas? Clarify the noise level?

As mentioned in the first point, the authors did not give enough information about the quality of their retrievals in order that we can evaluate the relevance of the discussion. If the two main points are addressed and if the results confirm the relevance of the measurements for the use that is done in this paper (total mass emissions and enhancement ratios), the work proposed would be of interest and would show the ability of IR nadir sounders to probe reactive species during strong pollution events. If these conditions are filled, the paper will be suitable for ACP publication.

Specific comments



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9, C705–C707, 2009

1) The authors should mention the atmospheric lifetime of the different measured species.

2) Part 2.2: How well is known the surface emissivity? Which is the impact of an error on this parameter in the method applied to detect plumes?

3) Part 2.3: The level 2 operational products of IASI (temperature, humidity, pressure) are used for the retrievals. If any validation of these products exists, the authors should refer to.

4) In the conclusion, the authors write p8773, line 9: "This result is a comprehensible demonstration that thermal infrared sounders are capable of probing the atmospheric composition down to the boundary layer in favourable situations (e.g. positive thermal contrasts)". The authors should mention that this ability also depends on the combination between the shape of the profile and the sensitivity of the measurement. For the species studied here, most of the information comes from the lowest layers of the atmosphere and it is possible to conclude that one probe these layers because the concentrations of the species are larger in the boundary layer than in the other parts of the atmosphere to which the instrument is sensitive.

Technical corrections

P8766, line 14: it should be "(right panel of Fig. 1)" and not "(left panel of Fig. 1)"

Fig. 2. in the color scale, the minus sign is missing before 3.0.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 8757, 2009.