

## ***Interactive comment on “The 2007–2011 evolution of tropical methane in the mid-troposphere as seen from space by MetOp-A/IASI” by C. Crevoisier et al.***

**Anonymous Referee #1**

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Review of the paper by Crevoisier et al. entitled: The 2007-2011 evolution of tropical methane in the mid-troposphere as seen from space by MetOp-A/IASI.

This paper by Crevoisier et al. presents and analyses the retrieval of methane from space using IASI instrument on MetOp for the period 2007-2011. It presents the data, compare then with aircraft measurements from CONTRAIL and CARIBIC, presents the seasonal and latitudinal variations of the IASI data and discuss the internannual changes and their links with recent tropical methane emissions.

Satellite retrievals of greenhouse gas columns are very important data to constrain the budget of these gases. Methane is probably the GHG with the most different types of

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data available (surface, tall towers, aircraft, FTIR from the surface and satellite). Although methane has been observed from Space since 2003 with SCIAMACHY, IASI data are very important because 1/ SCIAMACHY is not operational anymore and 2/ it had biases difficult to represent and possibly shifting in time. The paper is well organized, the data are original and the objectives well announced and developed, but I think it lacks a more detailed analysis of errors and comparisons with FTIR measurements.

### General comments

Analysis of errors on the retrievals There is no analysis of errors on the IASI retrievals given in the paper. Only ranges of variability seem to be given on figures 2 and 4. As the process of retrievals is complex and has many steps, assumptions, and caveats, I think this is a big part missing. The authors should provide an estimate on uncertainties on their retrievals, both for random errors and possible biases. Comparisons with SCIAMACHY errors would be also an added value on this matter.

FTIR measurements I was surprised that no mention of FTIR measurements is made in the paper. FTIR data seem to be the more natural data to compare satellite columns with. The TCCON data are available for comparison (<http://tcccon.ipac.caltech.edu/>). The authors should consider such comparisons in their paper or justify why they do not perform them. At least, mentioning these FTIR data seems a minimum.

### Specific comments

Abstract I19 : decrease in wetlands emissions for the period 2099-11 as compared to 2007-2008. The global growth rate being smaller but still positive, it might be good to refer to previous period

P23733 – L6 : the average concentration . . . : the sum of sources and sinks equals the change in methane concentration according to the mass balance equation and not to the concentration itself. Please correct.

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P23733 – L9 : for anthropogenic emissions, other citations may be used such as EDGAR inventory maybe

P23733 – I14 : IPCC 2007 should be Denman et al., 2007 (reference of chapter 7)

P23733 – I17-18 : for the range of the sink, a more recent estimate than Fung et al 91 would be better. Maybe the IPCC range (table 7.6 in Denman et al., 2007)

P23733 – I29 : I would add Prinn et al., 2005 with Dentener et al., 2003.

P23734 – I11 : resolve REGIONAL methane fluxes

P23734 – I16 : “smaller sensitivity of ..” : please quote Bousquet et al., 2011 on this.

P23734 – I22 : I would introduce the aircraft measurements used after and mention FTIR observations at the end of the introduction.

P23735 – I24 : develop a bit the consequence of replacing AMSU 7 by AMSU 8 in the retrieval process.

P23736 – I14 : Is there any hope to extend the retrievals in latitude. I suggest the authors write a few words on this and possible ways to get retrievals for higher latitudes.

P23735-23736 : §2.2 : an analysis of the errors attached to the retrievals is missing (see general comments)

P23736 – I20 : aircraft campaigns : what about the HIPPO campaigns ? It should be mentioned as well. Why not comparing with IASI ?

P23737 – I26 : No mention is made of FTIR observation from the TCCON network. The authors must quote these data and justify why not comparing with these data, more representative of columns than aircraft measurements (see also general comment)

P23738 – I27 : “. . . in the free troposphere, LOWER than the maximum sensitivity of IASI retrievals” (suggestion). A justification of the altitude of OH loss can probably be found in Voulgarakis et al., 2012, ACPD, Analysis of present day and future OH and

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methane lifetime in the ACCMIP simulations

P23739 – I5-8 : Why IASI retrievals should be closer than NOAA04 scale than to NIES94 ? this bias correction is unclear. How much of the bias can be attributed to scale differences ? Please precise.

P23739 – I15 : what is the standard deviation of IASI data. No value is given. Please be more precise.

P23740 – I13 : “higher concentrations. . .” How much higher ? please be more precise in the text.

P23740 – I18 and following : the authors mention the lack of retrievals on Jan 18th ? please be more precise. Evaluate how much it may affect the comparison. Also, no detailed analysis is given for the large discrepancies of Dec 12th. Please provide hypotheses.

P23741 – I14 : “good agreement” : I would say there is more a statistical consistency (considering the errors) than a good agreement there.

P23741 – I7-8 : what about the growth rate in 2010 ?

P23741 – I21-22 : Show/explain more the extrapolation procedure or remove 2007 from the table. Else it is hard to say how this extrapolation influences the high growth rate inferred. Why should it be higher because only half of the year is available ?

P23743 – I16-17 : I suggest to add : R08 finds a large but uncertain change in OH concentrations in 2007 as compared to 2006 ( $-4 \pm 14\%$ )

P23743 – I23-25 : decrease of methane emissions in the tropics, AS COMPARED TO PREVIOUS YEARS.

P23743 – I25 : precipitation decreased in 2009-11 after increasing from 2005 to 2008. Maybe precise the year of the maximum precipitations over tropical lands.

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P23745 – I9-10 : again FTIR observations are completely absent there. Please correct this.

Figure 2 & 4 : What are the envelopes for IASI ? Variability ? uncertainties ? please be more clear (see also general comments)

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 23731, 2012.

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