

## ***Interactive comment on “Analysis of IASI tropospheric O<sub>3</sub> data over Arctic during POLARCAT campaigns in 2008” by M. Pommier et al.***

### **Anonymous Referee #1**

Received and published: 30 January 2012

This paper by Pommier et al. focuses on a comparison of the IASI ozone profiles at high latitudes with the POLARCAT aircraft measurement campaign and lidar measurements. It is a valuable analysis for users of the IASI O<sub>3</sub> data, and a detailed evaluation of these observations over Arctic, which is a region with cold surfaces and low thermal contrasts. I found this manuscript appropriate for publication in ACP. However it needs some corrections before publication. I have some remarks that could help to improve the clarity of the manuscript. Indeed most of the results are not well highlighted or are tarnished by others conclusions. Also the text lacks of proper English writing and tend to make it difficult to understand the text. Here we suggest some corrections, but the text will need some polishing before publication.

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## General comments

- In the introduction, the author stated that the aim of this paper is "the analysis of IASI O3 data over the Arctic (p33132, 14)". Is it an analysis or a validation (as presented later in the text)? It seems more to be an evaluation.

- As the evaluation of the IASI tropospheric data is the major findings of this work, it deserves to be treated a bit more carefully. The authors wrote:

"p33140, 23-25: this shows the difficulty IASI has in capturing the variability of tropospheric O3 in Arctic with sufficient precision as already noted in the discussion about the DOFS distribution". It is frustrating that the authors do not give more description and/or explanation of the reasons of such discrepancies.

"p33142, 16-17: consistent with the inability of IASI to capture the variability of the O3 close to the surface." If the authors find that IASI is not able to capture the ozone feature close to the surface, why do you keep considering it, as it degrades the agreement and the validation? At some point, the authors should state from which pressure level IASI give a reasonable agreement. And then keep this threshold level and discard the lower levels.

"p33142, 21-23: these differences are due to the lack of vertical resolution in the IASI retrievals and the correlation of vertical information with retrieved profile in the stratosphere". Here a difference of 130% is effectively "not very good", please rephrase. You should not write "IASI profiles present good agreement between 0 and 8km!" but "IASI ozone profiles are usually biased (by less than XX%) between 0 and 8 km" etc... I think that the conclusions have to be clearer and more considered.

- A longer discussion about DOFs is needed to a better understanding of the text: Please note that you should rather write DOFs instead of DOFS (here and everywhere in the text) p33135, 15-16: There is a contradiction between this sentence "during both seasons... , the DOFS varied between more than 1.0 to 4.0..." and the next paragraph.

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Maybe could you add a map of DOFs for total profile in addition of Fig4 and Fig5 for [0-8km] O3 columns? Could you clarify whether the DOFs varied between more than 1.0 to 4.0 or range from 0.04 in spring to 0.7 in summer? Are you sure of what you show? What information can you have with a DOF lower than 1? Or equal to 0.04? What sort of issue could bring DOFs lower than 1?

After these comments are taken into account, the author would probably need to correct their abstract and conclusion (especially 33147, lines 8 to 15)

Specifics comments and typos

p33130,5: replace "each" by EVERY.

p33131,5: Please rephrase: (e.g. "The satellite measurements of tropospheric ozone include...")

p33131,25: Please rephrase (e.g. "This project aims to assess the quantification...")

p33133,7: Here indicate the key atmospheric species (O3,CO, etc...) that are measured by IASI.

p33134, 19-22: Is there any reason, reference or previous study that suggests such data selection? Or is it arbitrarily chosen ?

p33135, 1-4: I don't understand the link between the two sentences.

p33135, 10: Here and everywhere else change DOFs instead DOFS.

p33136: Here we suggest different titles for the section, which are in better agreement with the text: "Aircraft O3 measurements used for evaluation" for Sect.3, "Evaluation in Artic free troposphere..." for Section 5.1.1, and "Evaluation using ozone lidar measurements..." for Section 5.1.2

p33136, 15: Why the ATR-42 data have not been corrected? Please correct the sentence and explain.

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p33137, 18: Remove "less than".

p33138, 11: Why did you use data in February to make a spring climatology?

p33138, 14: Please change to "the maximum altitudes for IASI profiles ..."

p33139, 13: Please change to "All IASI and smoothed profiles are averaged BOTH by altitude and by aircraft: ... "

p33140, 1: Please, change than to THAT.

p33140, 20: Could you explain or give insight on the reason of this discrepancy?

p33141, 4-6: Please refer to a figure to help the reader.

p33141, 27-29: Please rephrase.

P33141, 30: The author stated that the two aircraft carried the same instruments. But what is your point? How does it contribute to the agreement/disagreement between aircraft and IASI. Please clarify.

p33142, 14: Please change to "these data can be used to validate higher altitude measurements..."

p33142, 19: Please change to "The agreement is RATHER POOR... "

p33143: Please change "... according surface" to "according to surface". Also could you give more information on the lidar capability in the UTLS?

P33143, 15: We suggest for the section title: "Influence of the surface properties".

p33144,1-2 : "this difference is less than 25% over sea nut reaches 40% over land close to the surface..." Why still considering surface as the author stated previously IASI is not good enough near the surface (as explained in section5.12)? This lowers your agreement and the reader might think at the end that IASI has a too large bias...

p33144, 4-5: Why the seasonal difference over land is in better agreement in summer

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than in spring? Please explain.

P33144, 21: Change Table 3 to Table 2.

p33144, 23: Change Table 4 to Table 3.

p33144, 27: Change Table 3 to Table 2.

p33145, 2: Change "the lower tropopause" to "a lower tropopause".

p33145, 16: Why FLEXPART is used to determine the tropopause altitude?

p33145, 19 Change "the IASI O3 concentrations retrieved by FORLI at the tropopause..." to "the IASI O3 concentrations retrieved by FORLI in the UTLS..."

p33145, 22-23: Change to "the variability OF this ratio provideS information..."

p33145, 28: Change "in THE northern part..."

p33146, 20: Change "shows HOW IASI can provide..."

p33146, 26-27: Replace "in air masses" by "FOR air masses"... "As well as air masses in the upper troposphere".

p33147, 1: Replace "For the comparison" with "For comparison purposes..."

p33148, 5: Replace "by stratospheric air masses" with "UTLS air masses".

p33155: Update of the reference Wespes et al, 2011.

p33160, Fig 1a: Please improve the resolution. The legend is hardly readable. The zoom on ATR-42 flight area is too small to give enough information of the flight tracks.

p33161, Fig2: Having the same scale on both graphs would be helpful to the reader.

p33162, Fig3/Fig4: DOFs instead of DOFS

p33165, Fig6: "errors bars represent the variability of measurements". Is it  $1\sigma$ ,  $2\sigma$ ,  $3\sigma$  ?

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p33171, Fig 12: The legend is not clear. Please rephrase: "along with the flight track".

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 33127, 2011.

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