

## ***Interactive comment on “Instantaneous longwave radiative impact of ozone: an application on IASI/MetOp observations” by S. Doniki et al.***

### **Anonymous Referee #1**

Received and published: 7 August 2015

First of all I have to admit that the topic of this paper is somewhere at the border of my personal research field. That means that I am not aware of all the existing literature in this field and I also may be unaware of the current state of the art. Instead I concentrate in my review on the conclusiveness of the arguments, the consistency and the organization of the manuscript. Since ACP is not only read by retrieval experts, I paid particular attention to the understandability by atmospheric scientists from other research fields.

Summary: I find the paper useful and well organized and I haven't detected any major problems with the paper. Thus I recommend publication in ACP (subject to the caveat above). The authors may wish to consider the following comments listed below:

Title: The title adequately represents the content of the paper.

C5715

Abstract: The abstract adequately represents the main contents of the paper. All statements in the abstract are supported by the main part of the paper.

Introduction: The introduction puts the work presented in the manuscript in the context of existing work and justifies why the topic of the manuscript is important. I have only one very minor comment:

p21179 l24/25: The 'A' in 'AR5' seems to stand for 'assessment'. Wouldn't it thus be more intuitive to use the term 'IPCC assessment report' (instead of 'IPCC report' only) also in the text?

Section 2 IASI: This Section reads well and seems to contain all required information.

Section 3: Calculations with FORLI: This section describes the retrieval algorithm used. Not many technical details are presented but this seems adequate because for these other papers are referenced and thus pure duplication of existing literature is avoided. Minor comments:

p21182 l20: I find it preferable to avoid acronyms and proper names in the section header. Couldn't a more generic wording be used, e.g. 'The retrieval algorithm' or something similar?

p21182 l22: The abbreviation 'ULB' seems not to be defined.

p21182 l24: The meaning of 'level 1C radiance observation' should be defined. It cannot be expected that every ACP reader knows the hierarchy of data products and the meaning of related abbreviations.

p21182 l25: Rodgers (2000) certainly is a correct reference for OEM. In his book, however, Rodgers does not use the term 'optimal estimation method'. This contradiction can be solved by either referencing some other work by Rodgers (e.g. Rev. Geophys. 1976) where he still uses the term 'optimal estimation method' or by mentioning that in his book the method is called 'maximum a posteriori'.

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p21182 l27: To a reader whose research field is not high-resolution radiative transfer calculation it may not be clear what the meaning of the LUTs is and why they are important. Please insert '... look-up tables (LUTs) of absorption cross-sections...' or whatever specification is appropriate.

p21183 l12: For the retrieval it is adequate to discard cloud-covered pixels in order to avoid retrieval artifacts. However, if you have only clear-sky data available, will the estimated radiative impact of ozone be representative also on a global scale, or will there be a clear-sky sampling bias in your estimates?

p21183 l18/19: What you do here is certainly adequate, but a reader from outside the retrieval community might miss the point here. Perhaps add some further information of the kind: 'Since the retrieval does not use the whole ozone band which is relevant in the context long wave radiative forcing but only those parts which contain most information on the ozone vertical distribution,...'

p21183 l26: Here a reference to the concept of averaging kernels and degrees of freedom by Rodgers may be adequate.

p21184 l8-23: The reader may ask to which degree the remaining biases affect the estimate of the radiative forcing contribution. My first idea would be that spectroscopic error might indeed cancel out here: wrong spectroscopic data cause wrong ozone amounts, but I would expect first order cancellation of both these errors when these quantities are then used to estimate the radiative forcing impact. This would then be a further advantage of your method. The adequate place for the discussion of this issue would be the end of Section 5.1. If my argument is valid or not, however, depends on how the LWRE errors are actually estimated, and the suggested cancellation may not actually happen.

Section 4: IASI instantaneous radiative kernels This technical section seems to include all relevant information. I admit that I have not double-checked the entire formalism. Just a few minor comments:

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p. 21186 l13: Why adverb 'arbitrarily'. 'Precision' is a noun, thus wouldn't the adjective 'arbitrary' be correct?

p. 21189 l1/2 While the acronym FORLI has already been defined, the acronym FORLI-O3 has not been defined, and the reader can only guess that this might mean FORLI along with the O3 LUTs. Please specify.

Section 5: Longwave radiative effect Also this section reads convincing.

p21192 l12: THE top row (?)

p21194 l5: not sure if the term 'artifact' is adequate here. It is somewhat counterintuitive to call something an 'artifact' if it is closer to truth. Perhaps '...but this is a cancellation of errors owed to...'

p21194 end of Sect. 5.1: c.f. my comment to p21184 l8-23. The line intensity error, however, is not (fully) included in the error obtained from the RMS. Thus my suggested error compensation does not happen. I have, however, another question w.r.t. the error estimation: The retrieval error is inferred from the RMS, i.e., it uses the information from the residual between the modeled and the measured spectrum. Thus it seems not possible in any straight forward manner to attribute a different retrieval error to different altitudes of the retrieved ozone profile. Instead only one retrieval error per observation can be inferred. The long wave radiative effect, however, depends also on the distribution of ozone over altitude; attribution to the ozone amount to the incorrect altitude may also cause an error of the long wave radiative effect. Beyond this, as stated above in the paper, the smoothing error makes a considerable contribution. As far as I can see, these error sources are not considered in the error estimate of the LWRE.

Section 6: Conclusions The Conclusions adequately summarize the main finding of the paper, and useful recommendations are provided.