

Interactive comment on “Potential of the future thermal infrared space-borne sensor IASI-NG to monitor lower tropospheric ozone” by P. Sellitto et al.

Anonymous Referee #2

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This paper describes a feasibility study, where the superiority of IASI-NG versus IASI is demonstrated by retrievals based on simulated measurements. This topic fits well into AMT. The scientific content seems sound to me but there are a lot of presentation issues.

Abstract: About a third of the abstract is general background which belongs in the introduction of the paper but not in the abstract.

Intro: Indeed a good motivation for the study with a large number of references. Also a lot of references to pre-existing work in the field of satellite remote sensing. Well done!

I am not a specialist in this area but if instruments like GOME GOME-II, SCIAMACHY or OME also have contributed to this research field, this deserves to be mentioned. Some minor comments:

p7027 l24 genetive missing: "precursors' concentration" or "concentration of ozone precursors"

p7028 l10 "topical task" not sure if this expression is correct in this context. Please check.

p7028 l15 "a nadir geometry" not sure if "a" is correct.

p7028 l29 "how it is in general...". Is "how" appropriate? Wouldn't "that" be clearer?

p7019 l20 radiance unit: I think the sr also needs a "to the minus one".

p7019 l23 "added value" to me means improvement of something existing, which exists in parallel. I am not sure if its application to a future replacement (where the initial thing no longer exists) is appropriate.

Sect 2.1.

p7031 l1-2: I am sure you have not reduced the grid of MOCAGE but you have resampled its output on a finer grid for the radiative transfer calculation. If so, please reword accordingly.

p7031 l14/15: "The two instruments ... are defined by their technical specification" Not sure what this sentence is supposed to tell me. Do you intend to say "Radiative transfer calculations for generation of pseudo-measurements have been performed according to the instrument specifications of IASI and IASI-NG, in terms of spectral resolution, line-shape, field of view and NESR"?

p7031 l21/22: What are "observations"? I.e. what is the thing actually counted? Is "observation" equivalent to "nadir spectrum"? This question might sound silly, but in Rodgers retrieval theory applied to spectra an observation is a single spectral gridpoint.

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Interactive Discussion

Discussion Paper



Thus I recommend to be clearer here.

p7031 l24: Has "SSI" been defined before?

p7031 l27: improve BY a factor of ...

Sect 2.2

p7032 l1 KOPRAfit: the usual reference for this inversion tool is: Hoepfner, M., Blom, C. E., Echle, G., Glatthor, N., Hase, F., and Stiller, G.: Retrieval simulations for MIPAS-STR measurements, edited by: Smith, W. L., IRS 2000: Current Problems in Atmospheric Radiation; Proc. of the Internat. Radiation Symp., St. Petersburg, Russia, 24–29 July 2000 Hampton, Va., DEEPAK Publ., 2001.

p7032 l10: I suppose you use the Tikhonov implementation using the squared first order finite differences matrix, which minimizes differences between values at adjacent profile gridpoints. The Tikhonov family contains a lot of variants, including a scheme involving a diagonal regularization matrix, which is similar to optimal estimation without consideration of covariances, and higher order schemes. Please state explicitly what you use. Some further information is needed: On which altitude grid are the retrievals performed (this grid is not necessarily the same as that on which the radiative transfer calculations are performed). Which other variables are retrieved besides the ozone profile. What about surface emissivity, surface temperature, etc?

p7032 l20: Does "this" refer to the Dufour et al paper? If so, then "their" would be less ambiguous than "this".

Sect 3.1

p7033 l13-15: errors due to model parameters can well be random; the term systematic is misleading.

p7033 l17 ff: the averaging kernel matrix should be A , not AvK , first because A is the established symbol, and second, AvK looks in the equations like a product of two

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matrices and a vector.

p7033 l24: Eq 1 in the given form is valid only if (a) the a priori is a climatological priori information, and if S_a is a real climatological covariance. Be careful (a) not to use any ad hoc a priori (e.g. altitude constant profile) and not to use any Tikhonov type regularization matrix instead of the true S_a to evaluate the smoothing error. For the retrieval settings chosen here, Eq. 1 is correct, but the statement on bottom 7033/top 7034 sounds a little over-generalizing to me.

p7034 l3 "FigureS 1a,b show" or "Figure 1a,b showS"

p7034 l3 The smoothing error depends on the S_a , so it is essential to report how S_a has been built. Further, the smoothing depends on the grid on which it is evaluated. For the same instrument and the same altitude resolution you get two different smoothing errors if you evaluate them on two different altitude grids! So the grid has to be reported, and it has to be checked that in any comparison of smoothing errors (and in consequence in all comparisons of total errors) all involved smoothing errors have been evaluated on the SAME altitude grid. Otherwise such intercomparison is meaningless.

p7034 l28: Have Eremenko and Dufour evaluated their smoothing errors on the same grid? If not, don't use the smoothing error and report only the quadratic sum of noise and parameter error, and report the altitude resolution or DGFs separately, but don't use the smoothing error.

p7035 l1-4: The grid-dependence of the smoothing error discussed above is another candidate explanation for inconsistencies between assessments.

Sect 3.2

p7035 l12: as acronym for averaging kernel in the text, AvK is acceptable, but why is it in italic bold face? As a mathematic symbol, bold face A is appropriate (see above).

p7035 l18: "(information)... coming from the a priori: not quite true. In the case of

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Tikhonov type 1st order finite differences smoothing, the information does not come from the a priori but from other altitudes of the true atmosphere. The information comes from the a priori if optimal estimation is used.

p7037 l13: since no systematic errors are investigated, "precision" would be the appropriate term, not "accuracy". Or is the focus here actually on biases?

Sect 4: A lot of different cases are presented. I am not sure if this is justified because the conclusions of all these cases are quite similar. I do not want to force the authors to remove some of these studies but I would also have been happy with a smaller selection of cases.

Sect 4.3

p7042 l5/7 I think "these" is more appropriate than "those"

p7043 l4/7 dto.

p7044 l26: (besides my concern about the term "added value" in this context) remove hyphen in "added value"

p7045 l11 dto.

Table 2: Upper case in North-Land ... South-Sea is confusing, because it suggests it is a proper name. Wikipedia says: "South Sea or South Seas or Southsea may refer to: Geographic region of the Pacific, The Pacific Ocean south of Panama, South Sea Islands (Polynesia), Oceania, east of Australia." Is this really what you mean? I suppose you have intended to use these terms in a generic sense, thus I suggest lower case initials.

Fig 2: If you take monthly means over averaging kernels, and if their shape varies, the mean averaging kernel will be wider than the original ones.

Fig 4: "Mean values and standard deviations are also reported." Where? In this figure?

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Fig 8: The figures are too small. Split on 2 pages.

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