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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Performance of the line-by-line radiative transfer model (LBLRTM) for temperature and species retrievals: IASI case studies from JAIVEx" *by* M. W. Shephard et al.

Anonymous Referee #2

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1 General Comment

This is a good paper that describes the new characteristics of the LBLRTM model, which among the generic radiative transfer models is likely to be that widely used by the science community involved in applications such as the infrared remote sensing of earth's atmosphere. The paper mostly deals with the performance of the new model, which has been assessed based on a set of night-time IASI spectra, recorded during the JAIVEx experiment. The paper is clearly written and represents a good guide for LBLRTM users and not only, and, therefore, I recommend publication. Some weak points, which could be easily handled by the authors, are here outlined:

- references could be improved in order to better represent contributions from IASI European colleagues;
- the paper does not provide a mathematical description of the LBLRTM methodology and approach, but rather its performance. I think that the paper could benefit by dealing a bit more with its physical and mathematical aspects, but I think this could be left to the initiative of authors;
- the paper only shows results based on eight IASI spectra, these IASI spectra have been further reduced through averaging, so that in the end only two mean spectra are considered for calculations and comparisons. On this last point, I think that the authors could make proper reference to other works published in the ACPD IASI special issue, which address similar aspects, but with a larger statistics.

2 Specific Questions/comments

2.1 Section 1

1. Pag. 9316, lines 7 to 12: IASI has been under development since 1993. Early works to the performance and quality of the spectrometers dates back to Amato et al. 1995 and should be acknowledged here.
2. The concept of closure experiment should be made explicit both in the text and in the Figure 1. The authors should mention previous closure experiments (Tobin et al. 1999 and Serio et al. 2008).

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2.2 Section 2

1. LBLRTM is one of the widely used line-by-line radiative transfer for the earth atmosphere. LBLRTM users may have benefit with the knowledge of the difference between the release 11.6 and 11.3 (the last public release available for download) of the code.

2.3 Section 3

1. The authors should be cautioned that the IASI ISRF is not a Gaussian.

2.4 Section 4

1. The IASI instrument has very good instrumental noise performance. In the spectral range between 645 and 2000 cm^{-1}, it is, in terms of NEDT @ 280 K, less than 1 K. For this reason I do not understand why the authors averaged 4 spectra. This operation introduces a very large "interpixel variation" in the region where the IASI radiometric noise increases ($\sim$ 2400 cm^{-1}).

2. In Figures 3 and 4 it is incorrect to compare interpixel variability and the NEDT @ 280 K. In the region around 2400 cm^{-1}, the spectral brightness temperature is around 230 K. It might be better to use the radiance scale for the panel a-d, and to show the NESR in the residuals panels.

2.5 Section 5

1. The paper needs more details for the description of the retrieval procedure.

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2. About the Figures 5 to 10, the retrieved profiles are shown up to 100 hPa. Do the authors mean that the retrieval procedure is limited to this altitude range? If not, please shows the complete retrieved profiles.

2.6 Section 5.1

1. The new parameterization for CO_2 and the continuum of CO_2 are two of the most important aspects in this paper. Especially for the continuum the author should provide more details on its mathematical formulation. If not yet published, these details should be described here.

2.7 Section 5.2

1. Since the water vapour continuum is defined in terms of the "local" line shape in order to use the new line strength for water vapour, the MT_CKD have to be modified according the new line parameters. Did you import the new line strengths in the water vapour continua?
2. In Figure 16 a) it might be useful to indicate the absolute value of the water vapour mixing ratio.

3 Typo

- Pag. 9331, line 22, change 16(a) in 16(b);
- Pag. 9333, line 14, change Figure 18 in Figure 17.

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References

U. Amato et al. (1995). International Journal of Remote Sensing, vol. 16; p. 2927-2938, DOI: 10.1080/01431169508954599.
D.C. Tobin, et al. (1999), J. Geophys. Res., 04 (D2), 2081-2092. DOI:10.1029/1998JD200057.
C. Serio, et al. (2008), Optics Express, 16, p. 15816-15833, DOI:10.1364/OE.16.015816.

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