

This is a competent, detailed and commendably thorough paper describing the processing of trace gases from IASI, but suffers from being too wordy – there are numerous instances of misspellings and poor sentence structure. In addition to responding to specific comments and corrections listed below, I urge the authors to rewrite the paper to make it more concise.

Corrected spellings shown below in bold type.

Abstract:

There is far too much detail in the abstract. Just make it one or two paragraphs of what's been done. There's no need for something like DOI's and data volumes in the abstract; things like that should stay in the main part of the paper.

Line 47: In **order** to ensure ultimate benefit ...

Fig 1: "SSP" is not defined.

Line 91: high spectral **resolution**

Line 92 and elsewhere. Put comma after "e.g." (e.g., Clerbaux et al., 2009).

Line 130: a **tar file** with the **orbit-wise** netcdf files

This number is for the typically 28 orbits per day of **the two satellites**.

Lines 135 and 211: Define Jacobians (at least briefly) the first time it's used outside of the abstract.

Line 175: EUMETSAT L2 PPF **version 6** data are

Line 184: For this **purpose** we use

Line 188: **subtropical** regions, where cloud-free conditions generally prevail.

Paragraph at Line 214: "We show trace gas Jacobians for **a** uniform increase of the trace gases throughout the whole atmosphere: 100% for H₂O and HDO, 10% for N₂O and CH₄, 50% for HNO₃. The respective values are reasonable approximations to the typical atmospheric variabilities of these trace gases." (note correction)

I was confused by this. A Jacobian is a derivative, not a step change, and it should not be assumed that they are linear much outside the value of the trace gas concentration where they would be calculated. Why wouldn't a 100% change in the H₂O be so non-linear that it would give an incorrect Jacobian?

Line 220: Define "a.s.l." the first time it's used.

"Atmospheric temperature variations close to the surface affect mainly the radiances below 1300

cm^{-1} and variations at higher altitudes mainly the radiances above 1300 cm^{-1} .”

Again, this is confusing. If I’m not mistaken, IASI frequencies go as low as 645 cm^{-1} and can so capture very strong, stratospheric-sensitive lines in the 14 micron CO_2 band.

Figure 4: The panels do not show Jacobians, but rather step changes in the radiance from arbitrary changes in a gas’ mixing ratio, skin temperature, etc.

Paragraph at line 229: I suggest moving this to where it can be discussed in the context of error calculation.

Line 269: “because they allow ~~considering~~ the correct a priori statistics”

Line 299: “Surface skin temperature and the spectral frequency shift are also components of the state vector; however, they are not constrained during the retrieval procedure.”

Why not? How would an optimal estimation retrieval work if they are unconstrained?

Line 314: “nudged” is a colloquial term. Suggest using quotes: “the meteorological fields are “nudged” towards meteorological analysis ...”

Line 319: **seasonal** cycles

Figure 5 caption: depicted as **violet** thick solid line

Line 334: “Above the troposphere we smoothly connect the tropospheric δD values with the typical stratospheric δD value of -350% .”

This seems too high in the lower stratosphere for δD : Wang et al. (*Remote Sens.* **2018**, *10*, 166; doi:10.3390/rs10020166) report values of -550 to -650% depending on latitude.

Figure 7 caption: the a priori assumption **and** the coloured line

Line 440: for all individual **observations**

Line 574: the natural **variability** of δD , N_2O ,

Line 616: understood by the **forward** model

Line 619: “However, occasionally the measured spectra is very poorly understood by the forward model and the residuals can not be described as a white noise instead the residuals show systematic signatures.”

This is unclear. A forward model produces synthetic spectra. How can measured spectra be “understood” by the forward model?

Line 637: The standard files provide for all **observations**

Line 755: we need from the side of the **MUSICA** IASI data,

Line 771: The MUSICA IASI full retrieval product **provides information**

Line 804: on the MUSICA IASI a **priori** settings and constraints

Line 815: Furthermore, the **additional** supply of constraint matrices

Line 817: information available **offers** excellent data reuse

Line 844: “For a general introduction on vector and matrix algebra we recommend dedicated textbooks.”

This is annoyingly didactic.

Line 874: the **identity** operator

Figure B1 caption: of the footprints of the used **exemplary** orbit

Figure B1 and B2 captions: thick solid **violet** line

Line 899: used for **modifying** the retrieval settings

Line 914: profile is **occasionally** even outside

Line 920: the averaging **kernel**

Line 930: is **relatively** low

Line 939: Suggest “the linear scale analytic calculations have worse agreement with the full retrievals”

Line 940: “The reason is that the CH₄ a priori is much weaker modified than the H₂O a priori (see Fig. B1). “

The meaning is unclear.

Line 972: Change “This is here an approximation,” to “This is an approximation,”

Suggest changing “should be the actual insted of the retrieved mixing ratios.” to “should be the actual mixing ratios instead of those retrieved.” ?