

Interactive comment on “First year of upper tropospheric integrated content of CO₂ from IASI hyperspectral infrared observations” by C. Crevoisier et al.

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Response to Anonymous Referee 2

We wish to thank the referee for his/her very supportive comments. Concerning the suggestion to include simulations from an atmospheric transport model (ATM), we wanted to keep this paper on an observation side only, and thought that the comparison with surface and tropospheric observations were proof enough for the validation of our retrievals. The comparison with simulations is of course an important next step and will be the subject of future studies, but more than one ATM should be used in such a study, and the availability of retrievals over both land and sea would make any

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comparison with simulations easier, especially while talking about vertical transport (to be closer to the source) and tropospheric ventilation of CO₂.

• *More specific suggestions: p. 8196 second paragraph: instrument noise level is above all the sensitivities – is that a concern ? if not why not ?*

IASI radiometric noise in the longwave is about 0.2 K for the channels we are interested in, and thus about twice as high as a typical variation of CO₂ (0.1 K for a 1% change of its concentration). Now, the ‘spectral averaging’ through the use of many channels helps improving the signal to noise and neural networks are known to be good filters of noise. However, since the signal is only at the level of detectability, an averaging of the retrievals is still necessary.

• *last paragraph: ‘allows retrieval of tropospheric integrated content. . .’ – really upper troposphere CO₂ – no ?*

Upper has been added.

• *p 8198 ‘. . . a set of representative patterns . . .’ do you mean profiles ? can you be more precise ?*

‘Patterns’ has been changed into ‘situations’. One situation is a set of IASI and AMSU brightness temperatures (BT) simulated for one TIGR atmospheric situation associated to one value of CO₂.

• *p. 8199 first paragraph: how many output variables ? just one – right ? maybe add*

There are 15 output variables (15 “predictands”): “The output layer of the network is composed of: (1) the difference between the ‘true’ value of CO₂ concentration (associated with inputs) and the ‘reference’ one (372 ppbv), and (2) 14 differences between the ‘true’ IASI BT (associated with the true CO₂ concentration value) and the ‘reference’ one (associated with the reference CO₂ concentration value), once again to constrain the solution.”

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- p. 8200 '*. . . IASI channels . . . mostly sensitive to UPPER tropospheric variations*' ?

Text changed.

- p.8201 '*All together, 11 tests. . .*' *what do you mean by tets ? can you be more precise?*

There are 11 thresholds tests used to detect clouds. For each detection test, we make the difference of BT between 2 channels (given in Table 3) and keep the IASI spot only if this difference is in a given range (the thresholds are also given in Table 3).

- Last paragraph: 'upper tropospheric integrated . . .*' *do you mean 'mean' instead of integrated ? if integrated be more precise ?*

We use 'integrated' instead of 'mean' because the vertical sensitivity of the CO₂ content we retrieve is weighted according to the averaging kernel plotted in Fig. 3.

- p. 8202 *first paragraph: please include surface record in figure*

The CO₂ seasonal cycle measured at various stations in the tropical band has been added to support the text, but on a different figure to avoid having too many lines on the same figure.

- p. 8204 *first paragraph: 'Monthly CO₂ averages have been removed from both datasets ' unclear what you mean – do you detrend ? explain more carefull / detailed. Also here would have been nice to include model simulations.*

CO₂ has been detrended to plot the figure.

- p. 8207 '*However, the retrieved cycle is lagged . . .*' – *I think you could document this a bit more – its possibly the most interesting bit. Next sentence: 'phasing of seasonal cycle with altitude . . . a feature not well simulated by atmospheric transport models ' I think we don't really know – you should to give a reference or proof yourself.*

Text has been changed in the conclusion.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 8187, 2009.

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