Atmos. Meas. Tech. Discuss., 6, C1003–C1006, 2013
www.atmos-meas-tech-discuss.net/6/C1003/2013/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Mid-upper tropospheric methane retrieval from IASI and its validation" *by* X. Xiong et al.

Anonymous Referee #1

Received and published: 19 May 2013

The paper illustrates the inversion method applied to measurements by the high resolution hyperspectral infrared sounder IASI on-board the MetOp-A satellite for the retrieval of mid-upper tropospheric CH4 profiles and the validation of the resulting products against collocated airborne observations from in situ measurements acquired during the HIPPO airborne campaigns. The outcomes of the activities reported by Xiong and co-authors is of primary interest as dealing with analysis, validation and quality assessment of data about one of the most important short-lived climate forcers in the terrestrial atmosphere. As properly pointed out in Section 4, the results presented in the paper are relevant as being part of the on-going effort to build a 20+ years data archive of CH4 measurements, including retrieval products from three different space-borne missions (IASI, AIRS and CrIS). As clearly stated by the authors, the description

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

of the methodology of the NOAA retrieval system applied to IASI data processing and reported here was already given in more details in previous papers. The new information delivered by this article is mostly concerned with validation of CH4 products. The overall quality of the paper is good and the topics covered are very well suited for the scope of the AMT journal. I recommend, therefore, the manuscript for publication, after minor revisions according to the specific comments/indications and to the technical corrections outlined below.

In the Introduction (Section 1), the difference is highlighted between the NOAA system and two inversion algorithms (by Crevoisier et al., 2009 and Razavi et al., 2009, based on neural network and Optimal Estimation approach, respectively) previously used for CH4 retrieval from IASI and the statement is made that "the data from either of them have not been fully validated". It is not clear, whether the comparison with the aircraft measurements described in this paper is supposed to achieve the "full validation" of NOAA's CH4 products that is missing for the other datasets. If this is not the case, please clarify (e.g., explain which are the major differences compared to the validation of the other CH4 IASI products). Moreover, the valuable set of HIPPO airborne measurements used in this case as the "reference truth" for validation is derived from five field campaigns over the Pacific Ocean. The authors underline the unique character of the HIPPO dataset, but its only feature they mention in an explicit manner is the wide latitudinal coverage. My suggestion is rather to add some comments on the advantages of using measurements acquired over ocean only to validate the satellite data; and, on the contrary, if this choice put some limit to the results of the validation process.

The expressions "peak sensitivity" and "most sensitivity", presumably referring to the same quantitative concept, are used throughout the paper in a vague manner. The concept is not introduced by means of an explicit definition and this makes difficult to interpret some of the statements reported in Section 2 (e.g., page 13, lines 9-10) and in Section 4 (e.g., page 24, lines 15-16). We recommend to add a rigorous definition of

AMTD
6, C1003–C1006, 2013

the “peak sensitivity” and to check that this is used in a consistent manner to describe where CH4 retrieval sensitivity achieves the largest values as a function of altitude and latitude.

A weakness of the NOAA CLASS IASI dataset is that it does not include the averaging kernels in the standard outputs. Consequently, the comparison of IASI products with airborne convoluted data cannot rely on the use of the averaging kernel associated to the individual measurements, but uses spatial and temporal averages of the AKs calculated over a 3x3 degree and on a monthly basis, respectively. This aspect of the validation process is not adequately stressed in the paper, where the convolution of aircraft measurements with IASI averaging kernels is reported (also in the abstract) as if implemented without approximations. The impact of the use of a mean value for the averaging kernels on the comparison between airborne and satellite data should be evaluated. I recommend that the authors include some consideration in the text and report the application of “mean averaging kernels”, at least in the abstract. I strongly suggest including the averaging kernel in the output of the NOAA CLASS IASI data archive for future exploitation. âĂČ Technical corrections

p.3, line 9 - change “e.g.Brassuer” to “e.g. Brassuer”. p.3, line 11 - change “billion(ppb)” to “billion (ppb)”. p.3, line 21 - change “CH4 sources” to “CH4 sources”. p.4, line 13 - change “IR(NIR)” to “IR (NIR)”. p.4, line 13 - change “(with sensitivity” to “(with sensitivity”. p.4, line 14 - change “(with sensitivity” to “(with sensitivity”. p.4, line 23 – Examples of space-borne TIR and NIR observations are given here with reference to the instrument and satellite platform (e.g. IMG on ADEOS, SCIAMACHY on ENVISAT, etc.); I would recommend indicating the name of the instrument (TANSO-FTS) also for the TIR measurements of the GOSAT mission. p.6, line 7 - change “0.25 cm-1” to “0.25 cm-1”. p.6, line 13 - change “280K” to “280 K”. p.6, line 18 - change “are used in order” to “are used, in order”. p.7, line 2 - change “al.(2003)” to “al. (2003)”. p.7, line 11 - change “NOAA CLASS” to “NOAA CLASS.”. p.7, line 17 - change “AIRS CH4” to “AIRS CH4”. p.8, line 3 - change “the CH4 first-guess” to “the CH4 first-guess”. p.12, line 5 -

AMTD
6, C1003–C1006, 2013

change “(2008).As” to “(2008). As”. p.12, line 12 – the acronym HNH is not explicitly defined and is used only once in the paper, while the full expression High Northern Hemisphere is used elsewhere. We suggest either (1) to define the acronym at the beginning and then use it in all cases or (2) not to use the acronym at all. p.13, line 4 - change “(see Table 1).In order” to “(see Table 1). In order”. p.13, line 7 - change “plots the the color” to “plots the color”. p.15, line 4 - change “greater than 0.4;” to “greater than 0.4.” p.15, line 3 – spell out the acronym “FOR” p.15, line 10 - change “CH4 Profile” to “CH4 Profile” p.16, line 15 – spell out the acronym “NSF” p.18, line 1 - change “corresponding the aircraft profile” to “corresponding aircraft profile”. p.18, line 2 - change “so the retrieve” to “so the retrieved”. p.18, line 13 - change “indicates that” to “indicate that”. p.20, line 19 - change “between the the” to “between the”. p.22, line 6 - change “is slight larger” to “is slightly larger”. p.24, line 16 - change “showed that a large” to “showed a large”. p.25, line 8 - change “and better” to “and to better”. p.25, line 18 - change “observation” to “observations” p.25, line 19 - change “source” to “sources” p.34, line 5 - change “Red triangles marks” to “Red triangles mark”. p.34, line 12 - change “Table 1).In” to “Table 1). In”.

Use a consistent notation throughout the paper for “in situ” (not “in situ” and “in-situ”) Use a consistent notation throughout the paper for “first guess” (not “first guess” and “first-guess”).

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 2501, 2013.