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Atmospheric Measurement Techniques Discussions

Interactive comment on "Improving algorithms and uncertainty estimates for satellite NO_2 retrievals: Results from the Quality Assurance for Essential Climate Variables (QA4ECV) project" *by* K. Folkert Boersma et al.

Anonymous Referee #2

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The paper "Improving algorithms and uncertainty estimates for satellite NO2 retrievals: Results from the Quality Assurance for Essential Climate Variables (QA4ECV) project" by Boersma et al. describes the improvement of NO2 retrieval algorithms for GOME, SCIAMACHY, OMI and GOME-2, and the production of a multi-decadal record of global NO2 columns. This manuscript provides an overview of the NO2 retrieval results from the QA4ECV project, which have been partially reported in earlier papers. Furthermore, first comparisons have been made between the OMI tropospheric NO2 data and ground-based MAX-DOAS measurements at one site in China.

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Discussion paper

The topic of the manuscript is within the scope of AMT and it is of interest to the scientific community. It can be recommended for publication, if the authors make an effort to address the comments listed below, and improve the manuscript accordingly.

Specific comments:

Section 3

Table 2 The spatial resolution of GOME-2A was changed to 40x40 km2 on 15 July 2013.

P18 The diffuser plate also causes spectral structures in the GOME-2 solar irradiances, but the effect is much smaller than for GOME/ERS-2.

Section 5.1

The manuscript discusses a consistent NO2 retrieval for GOME, SCIAMACHY, OMI and GOME-2, and Table 4 lists the specific DOAS settings for the 4 satellite instruments. However, in the text only the analyses of the fitting results for OMI are discussed in detail. Considering the specific instrument characteristics affecting the DOAS retrieval (as described in Sect. 3), a short discussion on the NO2 fitting results for the other instruments should be included, and the consistency between the results of the 4 instruments discussed.

P23-24 The differences in the NO2 slant column shown in Fig. 4 are significant. As described in the text, the differences are mainly a result of the intensity vs optical density fit and the intensity offset (while the stratospheric AMF effect is very small). These two key DOAS subjects should be discussed in more detail in this section. In particular, I suggest adding a discussion/recommendation about the intensity vs optical density fit method.

Fig 5b The illustrated scenario (SZA=VZA=0) is not really a typical OMI viewing geometry. Please use a realistic mid-latitude OMI measurement scenario.

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Section 5.2

P27 Here it is mentioned that NO2 SCDs are assimilated in TM4, while at the end of Sect. 5.3 TM5 is mentioned.

P28 Please provide examples of “particular applications” of the two different STS approaches.

Section 6.2

Tabel 5 Are the “Symbols” for the three “Contribution to the uncertainty of . . .” entries correct?

Section 7

As also mentioned in the text, the ground-based validation discussed in the paper is for one site only and has a very limited time range. Although it is understandable that in this manuscript only a first validation is presented and a dedicated validation paper is in preparation, it is problematic to draw conclusions about OMI retrieval uncertainties based on regression/differences analysis of such a small data sample. If the validation and uncertainty analysis are illustrated for one site then a longer data period should be used to increase the number of measurements and to be able to account for seasonal variations. Why has the site Tai’an been selected if only campaign data for a short period is available? (also considering the fact that the authors have access to longer MAX DOAS data records for several other sites).

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