

Interactive comment on “Validation of OMI, GOME-2A and GOME-2B tropospheric NO₂, SO₂ and HCHO products using MAX-DOAS observations from 2011 to 2014 in Wuxi, China” by Yang Wang et al.

Anonymous Referee #1

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In this paper, Wang et al. presented MAX-DOAS retrievals of NO₂, SO₂, and HCHO over Wuxi, a city within the heavily polluted Yangtze River Delta region in eastern China. They compared the MAX-DOAS retrievals with various OMI and GOME-2A/2B products. They also investigated the effects of a priori profiles and aerosols on satellite retrievals. The paper presents an interesting study that should be of interest to satellite trace gas retrieval community, especially the section discussing the effects of vertical profiles and aerosols on retrieval biases. The paper is generally well organized (given the multiple species/products/topics covered) and figures are mostly clear, although some improvement in writing would help. That said, I don't feel that the paper is quite

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ready for publication in its current form. It is very long with a lot of long, complicated sentences that are not easy to understand. I also feel that some of the 21 multi-panel figures are not completely necessary and can be removed or moved to the supplemental material. Overall, I'd recommend that the authors try to make the paper more concise and focus more on the key points.

Specific comments: The introduction part may be a bit too long and can be shortened.

The authors used the entire section 3.1 and several figures (Fig. 2-6) in the main text to introduce how temporal/spatial averaging is done to match MAX-DOAS data with satellite data for the comparison. To me, such a lengthy discussion would be justified if the data averaging time and/or spatial averaging radius could be used for other validation/comparison studies. But I doubt that would be the case, given the location of the site and the inhomogeneous surface properties and trace gas loading over the area (Fig. 1). I feel that this section is probably best included in the supplementary material.

How was eCF calculated? And how was daily mean satellite VCDs calculated? Did the authors consider the size of the each satellite ground footprint?

Section 3.2: the NASA SO₂ product essentially uses the same AMF for all pixels (regardless of viewing geometry and other conditions) that may lead to additional errors and affect its correlation with MAX-DOAS retrievals.

Section 3.2: Fig. 8, 10, 13, these figures may be replaced with a table.

Section 3.3: Fig. 14 – one would expect that the AMF calculated from TM4 profile would be on average smaller than AMF calculated using MAX-DOAS profile? Note that Fig. 14e and Fig. 15e show the same sign in AMF difference. The TM4 shape in Fig. 14a shows larger weight than MAX-DOAS in the lowest part of the profile, the IMAGES profile in Fig 15a, on the other hand, shows smaller weight than the MAX-DOAS profile in the in lowest layers.

Fig. 18, the authors may want to point out that GOME-2/OMI ratio for NO₂ may be

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much more meaningful than that for SO₂, given the overall smaller retrieval uncertainty. Fig. 19: did the authors use MAX-DOAS profiles to correct for retrievals to isolate aerosols as a source of error in satellite retrievals?

Fig. 20 and section 3.6: can the authors specify the aerosol optical properties and size distribution assumed in the RTM calculations? Particularly, for the UV wavelengths especially 319 nm?

Section 4: instead of simply repeating the results already presented in the paper, the authors may consider condensing this part or provide some more in-depth discussion.

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