

Interactive comment on “Investigation of NO_x emissions and NO_x-related chemistry in East Asia using CMAQ-predicted and GOME-derived NO₂ columns” by K. M. Han et al.

K. M. Han et al.

Received and published: 17 December 2008

First of all, thank you for your valuable comments and suggestions. In the revised manuscript we tried to clarify this manuscript by eliminating, modifying, and adding several parts from/into the original text (the added or modified parts are painted in a red color in the revised manuscript). Also, following the suggestions from both reviewers, we improved the clarification of figures (Figs. 3, 4, and 7) and added new figures (Figs. 9, 10, 11, and 13) into the revised manuscript. Below are our replies to your specific comments:

1. There is much discussion about the effects of possible of errors in the isoprene emission inventory influencing the modeled NO_x concentrations. Hypotheses include

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper



errors in the NO_x loss rates and the NO₂/NO_x ratios. Yet, no sensitivity simulations are conducted to demonstrate the magnitude of the effect on the CMAQ-predicted NO₂ columns. As a result the discussion remains speculative. Can a change in isoprene emissions alter the CMAQ-predicted NO₂ columns enough to significantly affect the comparison with GOME-derived NO₂ columns? A sensitivity study that changes isoprene emission.

Reply) The sensitivity runs of CMAQ model were performed, using 100%, 50%, 30%, and 0% of GEIA isoprene emissions for the summer episode. As shown in the text, it was found from the sensitivity studies that NO_x chemical loss rates was not enhanced even with decreases in the isoprene emissions, although the OH concentrations increase drastically (as expected). This is due to the isoprene nitrate formation, which was not discussed in the previous manuscript. We therefore investigate this issue further. The NO₂/NO_x ratios also decrease with decreases in the isoprene emissions, as expected. In addition, we discuss several uncertainties that could occur in this type of comparison study between CTM-modeled and satellite-derived NO₂ columns. Please, refer to p.19:9-22:22 & p.22:23-23:22 and newly-added Figs. 9, 10, and 11 (also, Table 2 and 3).

2. The manuscript could be reduced substantially without affecting the conclusions. Reactions 1-16 and Figure 8 present basic information that is readily available in textbooks. Figure 12 is not very relevant. Figure 9 conveys little information beyond that in Figure 7.

Reply) Following your comments, we shrank many parts of Sect. 3.2.3. Reactions R7-R13 were removed. Some corresponding discussions were also eliminated. However, we wish to keep R1)-R9) and Fig. 8 for the sake of readers convenience. We also got rid of Figs. 9 and 12. Please, take a look at the revised Sect. 3.2.3.

3. The stated error in the GOME-derived NO₂ columns is $5 \times 10^{14} - 1; 1 \times 10^{15}$ molecules cm⁻² for monthly averages over polluted regions. This is much smaller than estimated

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

by Boersma et al., JGR, 2004 and van Noije et al., ACP, 2006. Boersma et al. find that the errors in the GOME-derived NO₂ columns over polluted regions are about 40% due to the AMF. This would translate to 5x10¹⁵ molecules cm⁻² over North China. van Noije et al. find systematic differences between GOME-derived NO₂ columns for different groups. Differences in North China are especially large. The effect of errors in the GOME-derived NO₂ columns should be discussed thoroughly.

Reply) We added some more discussions about the possible errors and uncertainties from the retrieval procedures of GOME NO₂ columns. Actually, these discussions were already made in many other publications, as you mentioned. Please, see p.10:15-11:8.

4. The abstract states that NO_x emissions in North China are underestimated by 50%. How is this value determined? It should be justified in the body.

Reply) It was based on Mean Normal Gross Error (MNGE). It is now shown in the text (please, see p.24:1-2 & p.26:2-26:3). In addition, please note that in the revised manuscript the numbers (percentage) were changed, based on our new sensitivity analysis.

5. The font size should be increased in figures 2,3,4,7, and 9 for legibility.

Reply) We re-drew Figs. 2,3,4,7, and 9 with larger font sizes. Please, check them out.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 17297, 2008.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)