

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.

Anonymous Referee #2

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This manuscript investigates NO_x emissions and chemistry in East Asia. NO₂ columns from CMAQ and GOME are compared and large discrepancies are found. The CMAQ-predicted NO₂ columns produced larger values than the GOME-derived NO₂ columns over South Korea for all seasons. The CMAQ-predicted NO₂ columns produced smaller values than the GOME-derived NO₂ columns over North China for all seasons except summer. Hypotheses are discussed but firm conclusions are not reached about the discrepancies. I recommend publication in ACP only after major revisions are completed.

There is much discussion about the effects of possible of errors in the isoprene emis-

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sion inventory influencing the modelled NO_x concentrations. Hypotheses include 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 emissions should be included to estimate the implications for CMAQ-predicted NO₂ columns.

The conclusions describe a simulation being conducted with corrected emissions. Inclusion of the results from this simulation would address the issues in the previous paragraph.

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 isn't very relevant. Figure 9 conveys little information beyond that in Figure 7.

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

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. It seems inconsistent with the conclusion that NO_x emissions were underestimated by 10% compared with the CAPSS and the date-back ANL inventories.

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

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