

Interactive comment on “Modeling the impact of heterogeneous reactions of chlorine on summertime nitrate formation in Beijing, China” by Xionghui Qiu et al.

Anonymous Referee #2

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The manuscript of Qiu et al., reported the influence of chloride chemistry to particulate nitrate formation in the framework of CMAQ. The authors included several chloride reactions into the CMAQ chemical mechanism. This topic is in the scope of ACP, and would benefit the knowledge of the heterogeneous reactions in the formation of particulate nitrate in Beijing, China. While in this paper, the detail of the parameters lacking the foundation and the analysis of model result seems common. Some of the conclusions seems can't obtain from the model result analysis (see major comments). The following comments should be addressed before publishing in ACP.

Major comments:

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1. Line 250-252, the treatment of aerosol surface area by time 5 or 10 in this model is unconvinced. Should provide more evidence to support the rationality.
2. The sensitivity tests used an O₃ uptake coefficient enlarged by a factor of 10 without any reference, while the Cl₂ simulations do not significantly improved in general. Other possible Cl₂ formation channel shall be tested or at least discussed.
3. Line 398-402, I cannot agree with that the parameterization method including chloride of the uptake coefficient of N₂O₅ has a better performance, at least this kind of conclusion cannot be deduced from the authors analysis (cf. figure 1).
4. I suggest that the authors may present a table to summarize all the revisions of the parameters related to the uptake coefficient as well as the related heterogeneous reactions.

Minor comments:

1. Line 206, Bertram et al., 2009 correct to Bertram and Thornton, (2009).
2. Line 335-line 340, this part is confused. Did you mean more N₂O₅ convert to nitrate due to the N₂O₅ uptake coefficient calculated by Bertram and Thornton, (2009) is higher than the base case? And the non-significant nitrate increase may be due to the ClNO₂ yield buffered the increasing caused by the application of new N₂O₅ uptake coefficient?
3. Line 289 the section title should not be the estimation of uptake coefficients of O₃ and N₂O₅, but the influence of the change of these parameters.

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