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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Extending the Community Multiscale Air Quality (CMAQ) Modeling System to Hemispheric Scales: Overview of Process Considerations and Initial Applications" *by* Rohit Mathur et al.

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This is a very interesting paper and an admirable endeavor to extend CMAQ to hemispheric scales. I was especially interested in the handling of alkyl nitrate lifetime. Our group has done similar analysis of alkyl nitrates with comparisons to satellite and aircraft observations in using the CMAQ with CB05 chemistry and CAMx with CB6r2 chemistry (Canty et al., 2015, Goldberg et al., 2016).

What is the lifetime of NTR in this new model framework? Our modification of NTR

so that its lifetime is much shorter (∼1 day), expected if hydroxynitrates are the most abundant species, has led to a better representation of NTR in CB05 when compared to aircraft observations taken during DISCOVER-AQ. Across our model domain, tropospheric column NO2 from CMAQ was in better agreement with satellite observations when the NTR lifetime was decreased. The faster decomposition of NTR also led to an increase in modeled surface ozone. Based on this, the decrease in ozone reported in Fig 4 of this manuscript was a surprise. Is this decrease due to transport or to increased deposition processes? The improved speciation of NTR in the CB6r2 chemical mechanism led to a shorter lifetime of NTR, in the model, without any needed changes to the NTR chemistry.

Great job with this analysis!

- Tim Canty

Canty, T. P., et al, Ozone and NOx chemistry in the eastern US: evaluation of CMAQ/CB05 with satellite (OMI) data, Atmos. Chem. Phys., 15, 10965-10982, doi:10.5194/acp-15-10965-2015, 2015.

Goldberg, D. L., et al., CAMx ozone source attribution in the eastern United States using guidance from observations during DISCOVER-AQ Maryland, Geophys. Res. Lett., 43, 2249–2258, doi:10.1002/2015GL067332, 2016.

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