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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global impact of monocyclic aromatics on tropospheric composition" *by* David Cabrera-Perez et al.

Anonymous Referee #2

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In this study, the authors have applied a global chemistry-climate model (in a chemical transport model mode) to study the impact of monocyclic aromatic species on tropospheric gas-phase composition. They assess the changes in the distribution of several air quality and climate relevant chemical species, including OH, O3,NOx, HCHO, glyoxal and CO as a result of including aromatics in the chemical mechanism. The authors find that the impact of aromatics is small on a global scale but have a bigger impact regionally. Despite finding a small impact on a global scale, the authors recommend that global models include aromatics. I do not think that the authors make a convincing case for this. Moreover several global models already include aromatics (e.g., GEOS-chem, MOZART-4). The paper in its current form does not advance our scientific understanding of the role of aromatics in chemistry and climate. Specific comments are provided

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Discussion paper

to improve the paper:

P6, section 3: Comparison with observations is important to build confidence in the simulation of aromatics by the model. How do we believe the model is simulating aromatics in the right place for the right reasons? Are there any comparisons with observations? P5,L101: Why 2004-2005 time period was chosen? Why not a more recent period as I would imagine that emissions have evolved since 2005. P5, L114-115: Which RCP emissions are being used here? P6, L146: Despite high levels of surface aromatics simulated over India and central Africa in the AROM run, why is there not a concomitant increase in day time OH over the highly polluted northern Indo-Gangetic plains or central Africa between REF and AROM? P7, L155: Where are these results shown? Figure 3. How significant are the differences, especially the small numbers, shown here. Presumably the black line on the lower right plot shows the tropopause level, please indicate this in the caption. P8,L171: Please clarify the statement "Although there is ubiquitous decrease in NOx this does not seem to limit OH formation." P8, L172-174: How significant are the decreases in the remote southern hemisphere oceanic regions? Figure 2 shows zero concentrations of aromatics in this region and given their short lifetimes I do not think they are being transported into this region? Possibly CO is being transported. If so, can you please provide a plot of changes in CO distribution with a significance estimate. P8,L174: Figure 5 should be moved to Figure 4 if it is being discussed before the existing Figure 4. P9, Table 2: Please clarify in the caption that the global methane lifetime refers to lifetime of CH4 in the global boundary layer. Also suggest explicitly showing how this lifetime is calculated. In particular, how is the boundary layer diagnosed? P10, L187-188: How do the tropospheric methane lifetime compare against those from other models, for example the ACCMIP models for year 2000? P10, L195: High NOx can also result in titration of ozone. P10, L203-218: Please point to figures in the supplementary in this discussion. P 9, Figure 4: The figure shows O3 changes while the caption mentions OH changes. Please correct the caption. P13, L259: Is deposition of individual aromatics considered in this study? If so, how are the dry deposition velocities calculated? P18,L348: The van Vuuren et al

reference is wrong.

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