Anonymous Referee #2

The revised manuscript from Li et al. addresses all my prior comments and I am happy to recommend it for publication.

My only suggestion is that the experiment in Figure A2 for the relative errors appears to have peak errors for O_3 and NO_3 at the end of the simulation; I would suggest extending the experiment to see if there is further error growth or it can be constrained within a certain percentage. If errors continue to grow, I would suggest labeling the error growth rates in the bottom panel to ensure they are in a reasonable range. This is of particular interest to longer term atmospheric chemistry simulations.

Response:

Thanks for your suggestion. The numerical experiment was extended to a duration of 345,600 seconds. Before the end of the simulation, the error of NO_3 has peaked and remained stable. Although the relative error of O_3 has a trend of continue increase, the error growth rate was stable and extremely low (3.3×10^{-8} %/s). Hence, the relative error remains within the preset *rtol* even if the simulation duration is extended by an additional 2.0×10^6 seconds at this growth rate. We state the error growth rate for O_3 in the manuscript. The modifications to the manuscript are as follows.

Line276-277: The CPU time used by F0AM is recorded by the function *cputime* in MATLAB. The total integration time is 345,600 seconds, and the integration time step is 900 seconds.

Line293-296: Although the relative error of O_3 has a trend of continue increase, the growth rate of the error remains stable and extremely low (3.3×10^{-8} %/s). Hence, the relative error remains within the preset *rtol* even if the simulation duration is extended by an additional 2.0×10^6 seconds at this growth rate. This suggests that the ROMAC result's error can be stably controlled during long-term simulations.

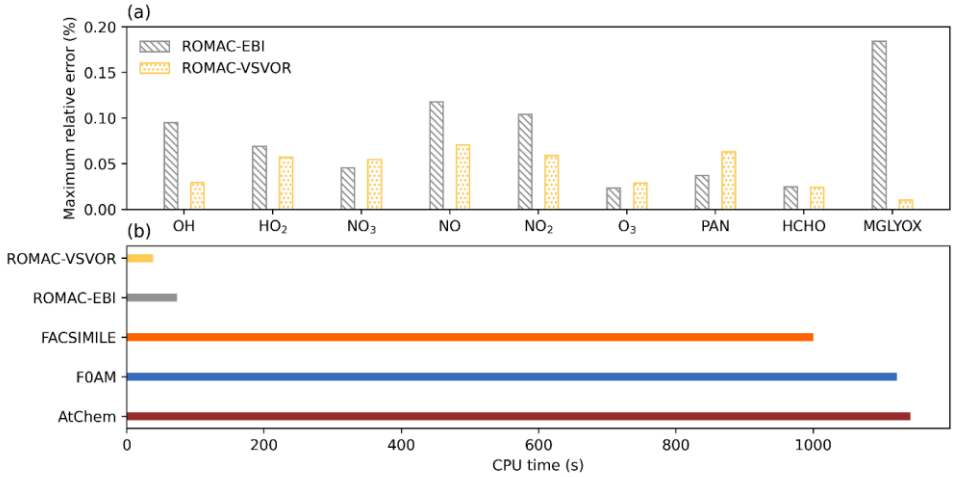

Figure 3. Accuracy evaluation and comparison of model computational efficiency. (a) Maximum relative error between the integration results of ROMAC and AtChem. (b) CPU time used to run compare with other models.

Table A2. CPU time used by the EBI solver at different integration time step sizes (unit: seconds). *Nonconvergence* represents that the EBI solver fails to converge.

Time step	1	10	50	120	900
CPU time	256	73	*Nonconvergence*	*Nonconvergence*	*Nonconvergence*

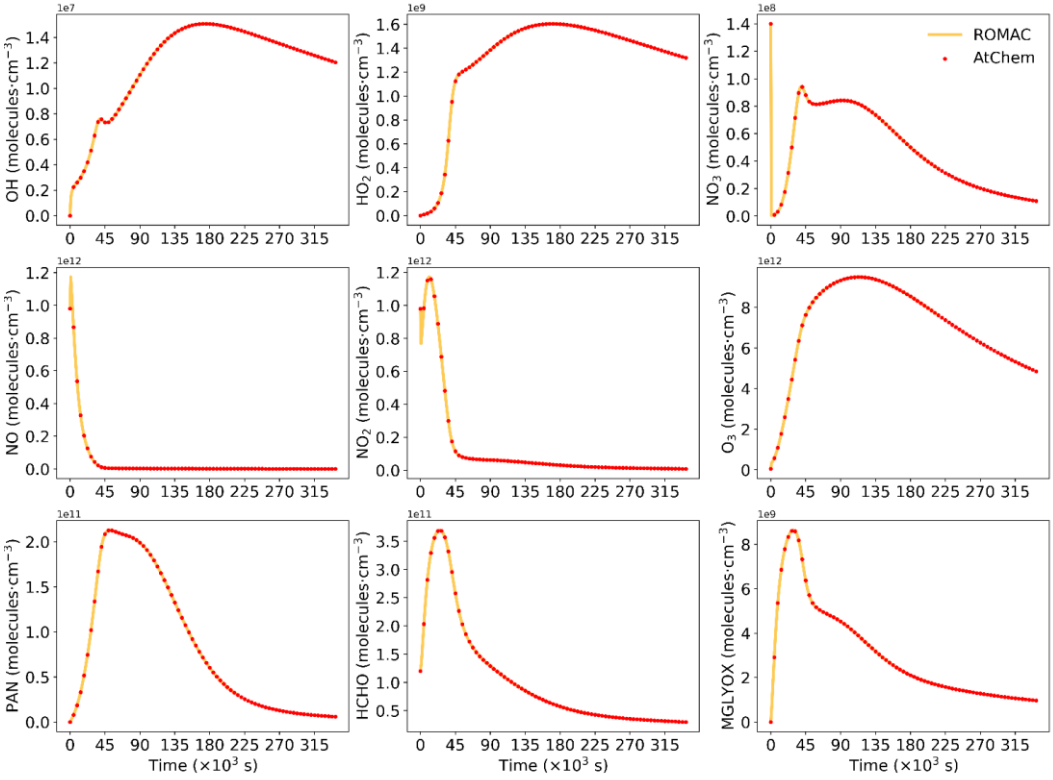

Figure A1. Comparison of the simulation results between ROMAC and AtChem for nine substances. ROMAC used the VSVOR solver in this test.

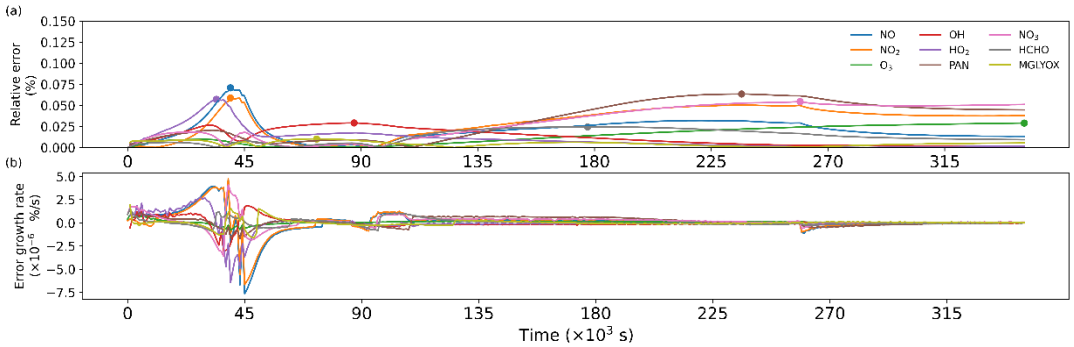

Figure A2. (a) Time series of relative errors, with dots marking the maximum values. (b) Growth rate of relative errors.