

Aerosol processes relevant to the indoor environment simulated in a detailed chemistry and aerosol microphysics model

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Aerosol processes relevant to the indoor environment simulated in a detailed chemistry and aerosol microphysics model

S.P. O'Meara^{1,2,*}, G. McFiggans² and N. Carslaw³

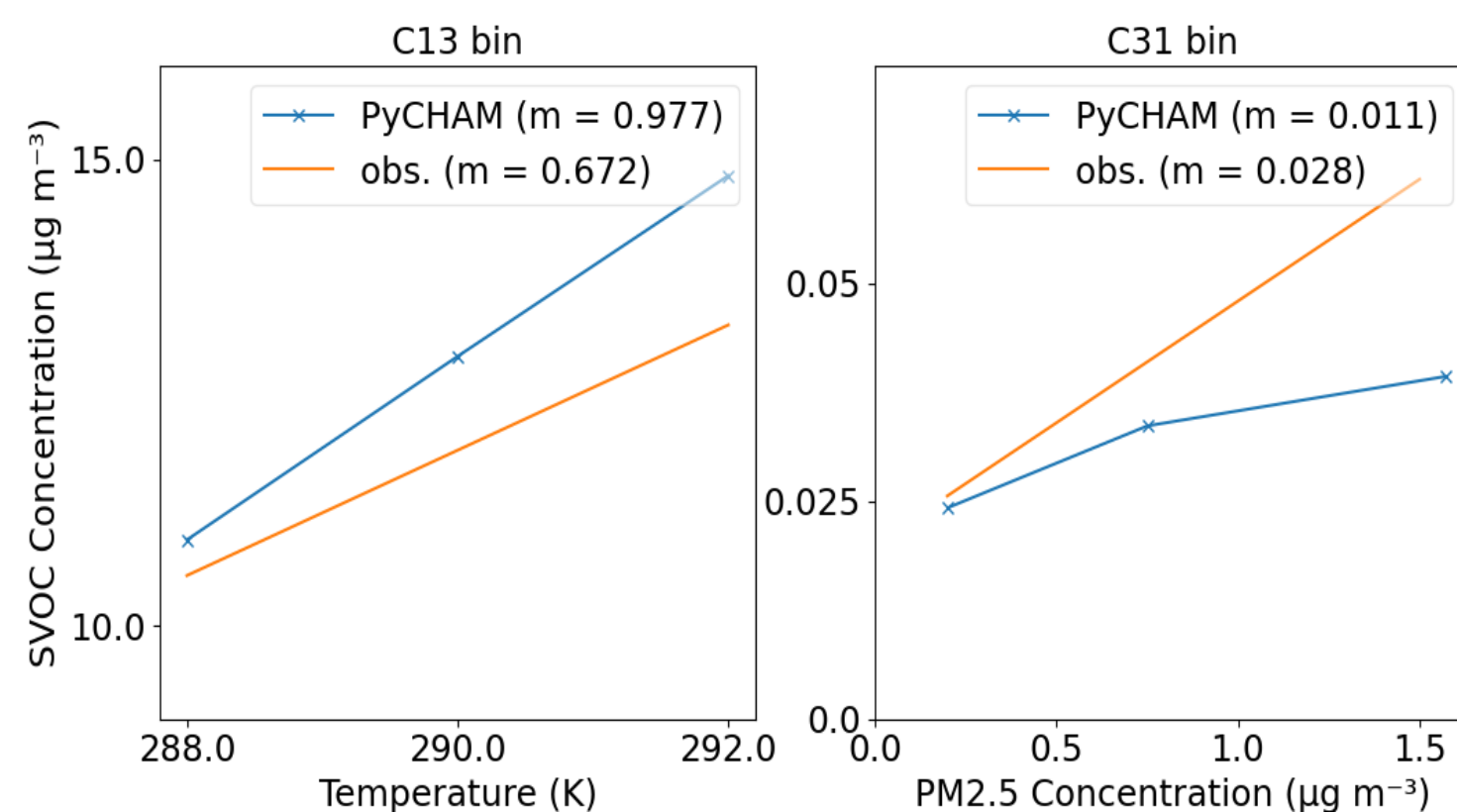
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Introduction

The updated and open-source CHemistry with Aerosol Microphysics in Python (PyCHAM (2023)) box model is here verified against indoor observations and used to test the role of Highly Oxygenated Molecules (HOMs).

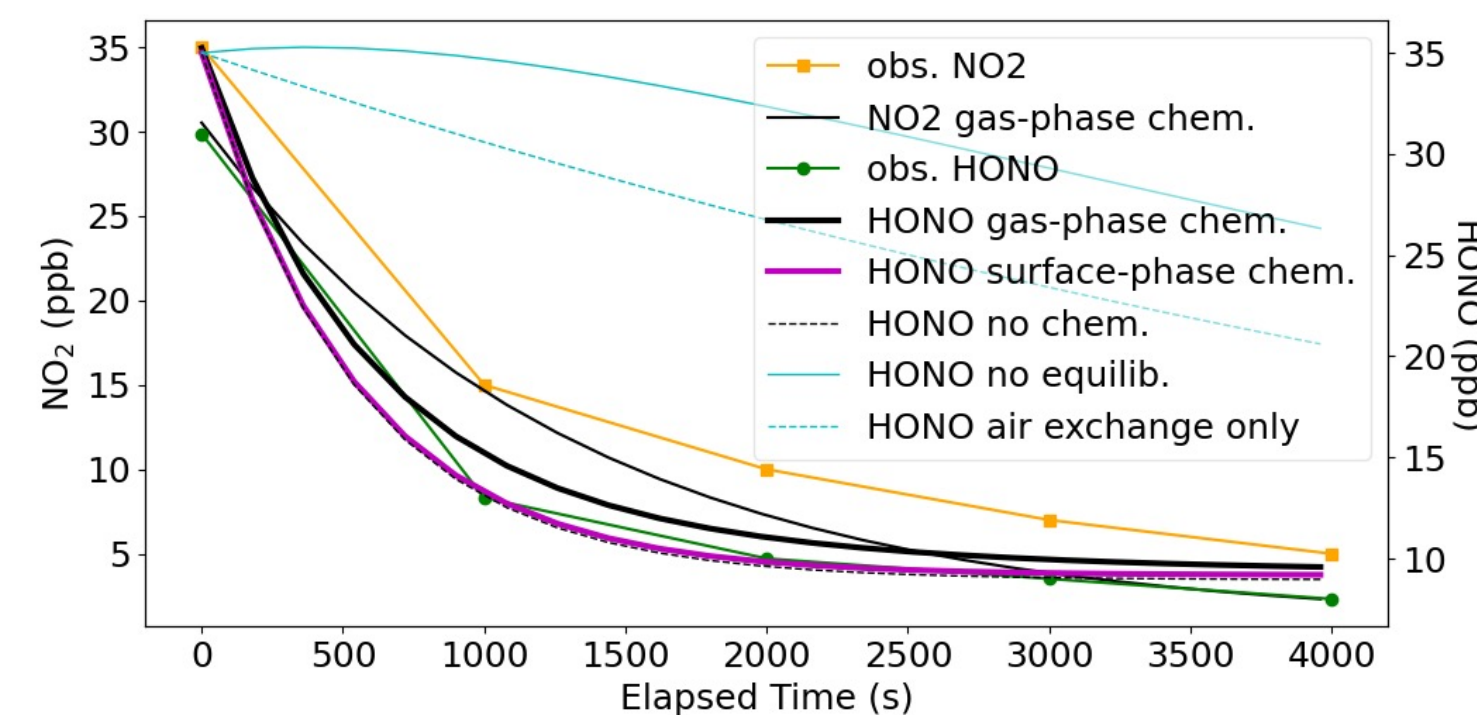
Surface-Gas-Particle Partitioning

Lunderberg *et al.* (2020) show that organics on indoor surfaces modulate gas-phase and particle-phase concentrations. Below we reproduce their gas-plus-particle observations for organics with vapour pressures equivalent to alkanes with carbon numbers (C) 13 and 31 in response to varying indoor temperature and particulate loading, respectively.



Surface Reactions

Collins *et al.* (2018), show that the gas-phase concentration of nitrous acid (HONO) is driven by surface chemistry of nitrogen dioxide (NO₂) and modulated by the resulting surface reservoir. Below we reproduce their observations of HONO decay following combustion.

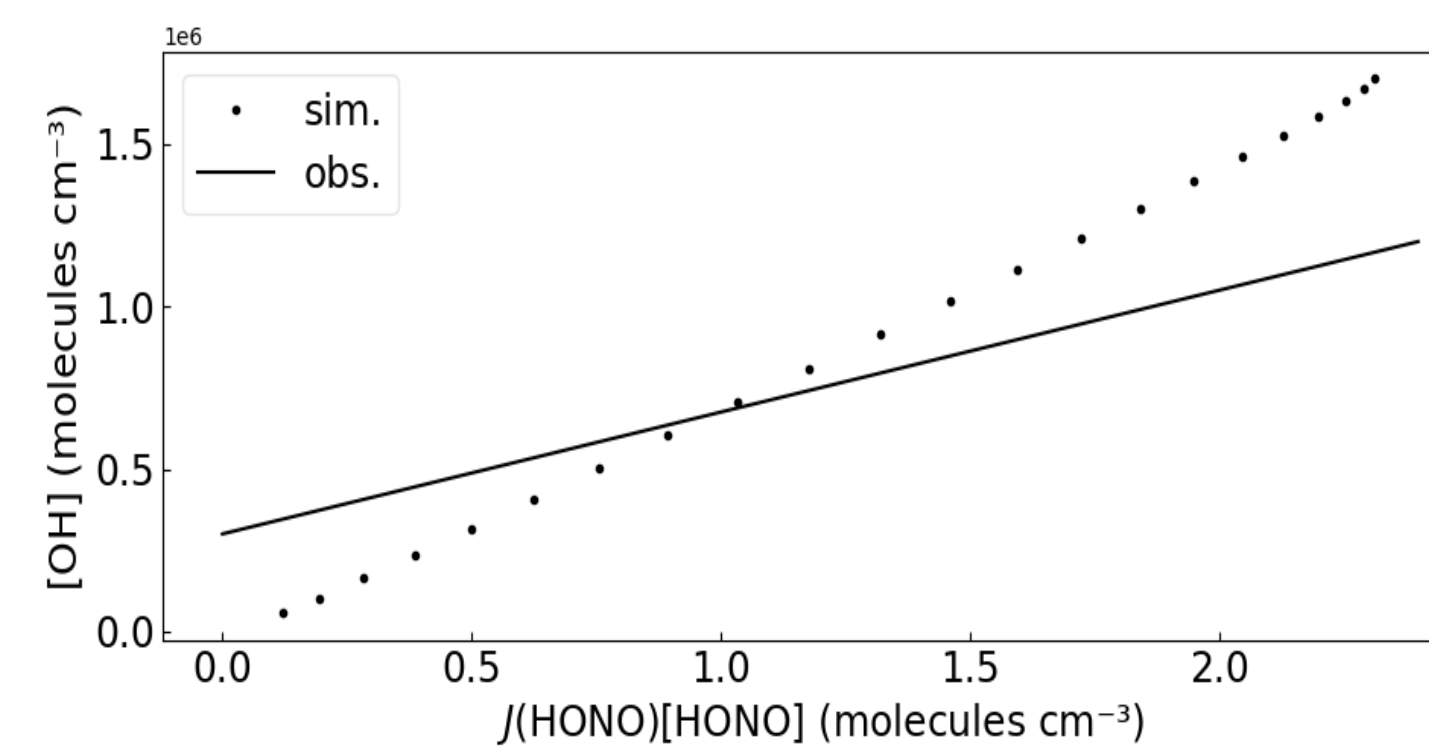
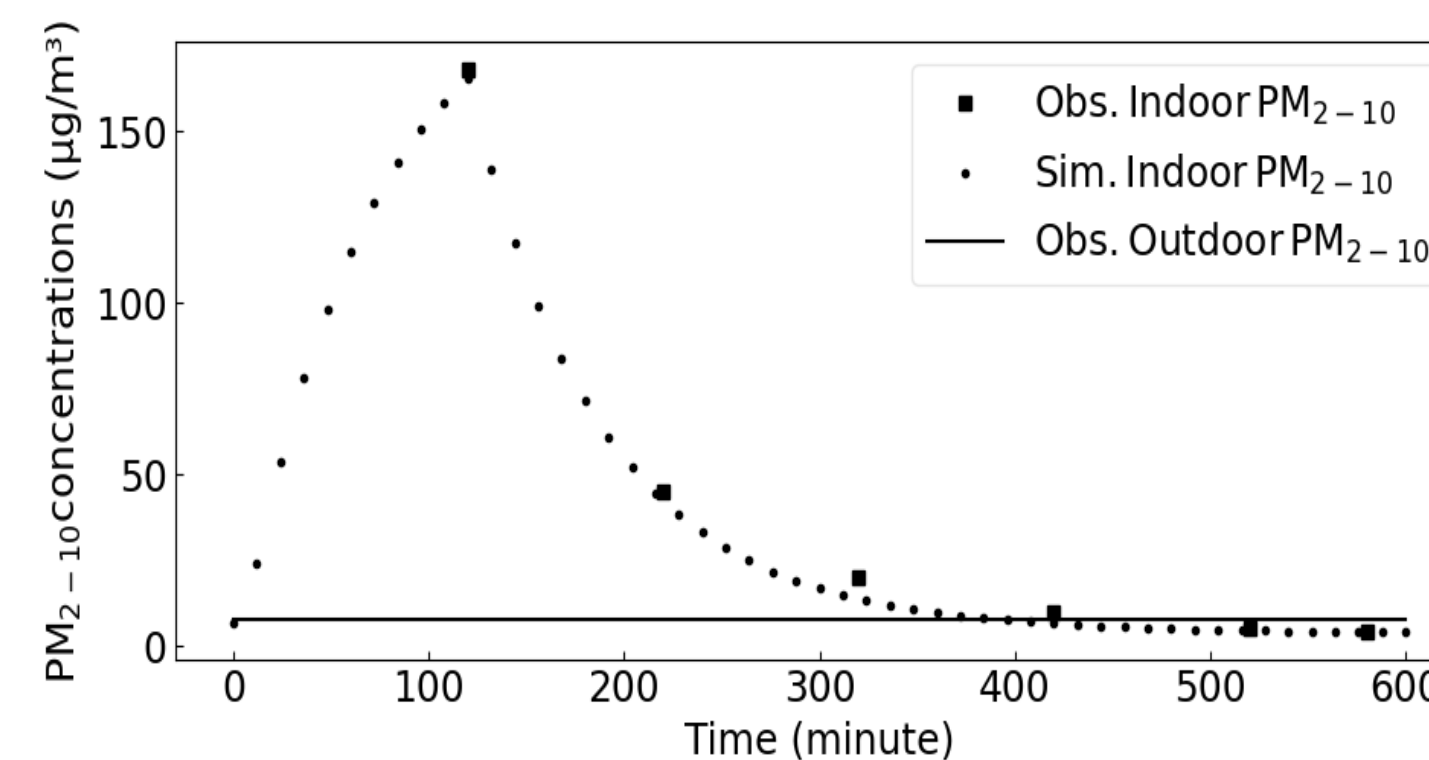


Light Transmission Through Windows, Indoor Emission of Gases, Indoor-Outdoor Exchange of Gases

Using the observed light transmission factor, right we reproduce the measured hydroxyl radical (OH) concentrations as a function of photolysis rate from Alvarez *et al.* (2013). NO₂ from outdoors, and volatile organic compounds (VOCs) from indoor and outdoor sources affect results.

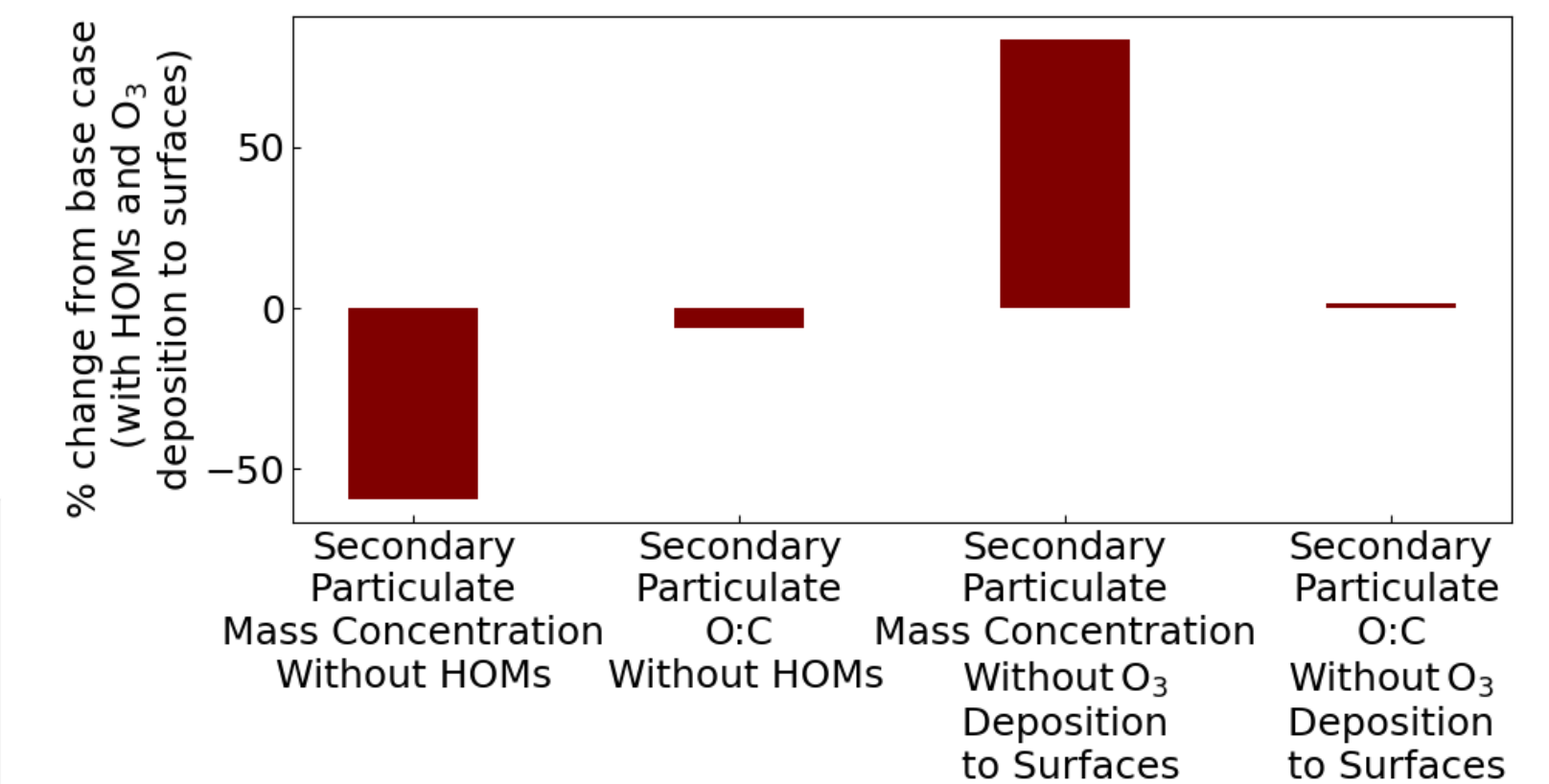
Particle Deposition to Surfaces, Indoor Emission of Particles, Indoor-Outdoor Exchange of Particles

Following indoor activity, simulating outdoor particle ingress, and using the observed particle loss rate to surface, below we reproduce the observed decay of particles from Tran *et al.* (2017).



Role of HOMs

Highly oxygenated organic molecules (HOMs) were simulated in combination with all processes evaluated here.



References

Lunderberg *et al.* 2020, doi: 10.1021/acs.est.0c00966
Collins *et al.* 2018, doi: 10.1021/acs.est.8b04512
Alvarez *et al.* 2013, doi: 10.1073/pnas.1308310110
Tran *et al.* 2017, doi: 10.1177/1420326X15610798
PyCHAM 2023, github.com/simonom/PyCHAM (/ind_AQ_ex for poster input)

Acknowledgements

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