Abstract Submitted
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Characteristics-based sectional modeling of aerosol nucleation, condensation and transport EDO FREDERIX, Multiscale Modeling and Simulation, Applied Mathematics, University of Twente, The Netherlands, ARKADIUSZ KUCZAJ, MARKUS NORDLUND, Philip Morris International R&D, Philip Morris Products S.A., Switzerland, MILOS STANIC, BERNARD GEURTS, Multiscale Modeling and Simulation, Applied Mathematics, University of Twente, The Netherlands — Aerosols can be generated by physical processes such as nucleation, condensation and coalescence. To predict spatially varying statistical properties of such aerosols, e.g., the size distribution of the droplets, these processes must be captured accurately. We model nucleation using classical nucleation theory, whereas the condensational growth is captured with a molecular diffusivity model. The droplet size distribution is discretized using a sectional approach, in which droplets are characterized in terms of a number of fixed droplet size bins. Often, in such a formulation, the numerical time step restrictions arising from condensation and nucleation are more pronounced than those of the corresponding fluid flow, thereby significantly limiting the global time step size. We propose a moment-conserving method in which this limitation is avoided, by utilizing the analytical solutions of the spatially homogeneous nucleation-condensation subproblem. The method is validated against experimental and numerical data of a laminar flow diffusion chamber, and shows an excellent agreement while being restricted only by a flow-related time step criterion. The research presented in this work was financially supported by Philip Morris Products S.A.

Edoardo Frederix
Univ of Twente

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