Abstract Submitted
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Study of airflow and aerosol deposition characteristics within human airways using large-eddy simulations DIVYAJIT MAHIDA, ELI DURANT, University of Tennessee at Chattanooga, PURUSHOTAM KUMAR, Corning Inc., REETESH RANJAN, University of Tennessee at Chattanooga — Aerosolized drug delivery in human airways is typically used for the treatment of several pulmonary diseases. In this study, large-eddy simulation (LES) is used for the study of the airflow and the aerosol deposition characteristics within the upper human airways. The geometric model comprising of the extrathoracic and a part of the intrathoracic airways corresponds to a truncated portion of a realistic human airway model based on the SimInhale benchmark case. LES is performed using the well-established Eulerian-Lagrangian approach where the airflow is modeled as an incompressible flow using the Eulerian formulation, and the aerosol evolution is tracked in a Lagrangian manner under the dilute suspension conditions using a one-way coupled approach. The closure of the subgrid-scale stress in the Eulerian equations is performed using the locally dynamic one-equation based model, and for the subgrid dispersion in the Lagrangian equations, a stochastic model is used. The accuracy of the LES results is first assessed in terms of the prediction of the turbulence statistics and the regional/global aerosol deposition by comparing with the past results corresponding to the full geometry. Afterward, the effects of inlet Reynolds number on the flow and the aerosol deposition are analyzed.

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