Abstract Submitted
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Regional airflow and particle distribution in the lung with a 3D-1D coupled subject-specific boundary condition[1] JIWOONG CHOI, YOUBING YIN, ERIC HOFFMAN, The University of Iowa, MERRYN TAWHAI, The University of Auckland, CHING-LONG LIN, The University of Iowa — Correct prediction of regional distribution of inhaled aerosol particles is vital to improve pulmonary medicine. Physiologically consistent regional ventilations of airflow and aerosol particles are simulated with a 3D-1D coupled subject-specific boundary condition (BC). In 3D CT-resolved 7-generation airways, large eddy simulations are performed to capture detailed airflow characteristics and Lagrangian particle simulations are carried to track the particle transport and deposition. Results are compared with two traditional outlet BCs: uniform velocity and uniform pressure. Proposed BC is eligible for physiologically consistent airflow distribution in the lung, while the others are not. The regional ventilation and deposition of particles reflect the regional ventilation of airflow. In this study, two traditional BCs yield up to 98% (334%) over-prediction in lobar particle ventilation (deposition) fraction. Upper to lower particle ventilation ratios of both left and right lungs read $\sim$0.4 with the proposed BC, while those for the other two BCs vary with the error up to 73%.

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