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On Turbulence and Particle Transport in Closed Rooms.[1] SOM DUTTA, Utah State University, SHYUAN CHENG, University of Illinois Urbana-Champaign, ADITYA PARIKH, TADD TRUSCOTT, Utah State University, PAUL FISCHER, LEONARDO CHAMORRO, University of Illinois Urbana-Champaign —
The Covid-19 pandemic has brought the focus on the airborne transmission pathways of respiratory viruses and pathogens. It has been found to be substantially higher in indoor environments. However, the effect of turbulence generated by flow through HVAC systems on the transport of virus-laden aerosols is not well understood. Studies of room-scale transport have primarily used RANS based turbulence closures coupled with Lagrangian particle tracking based model to simulate the transport of the aerosols. Here, we conduct high-resolution Large Eddy Simulations (LES) of the flow and temperature in a closed room, with an inlet (located near the ceiling) and outlet located at diametrically opposite corners of the room. The flow is coupled with a Lagrangian particle tracking based model for transport of polydisperse aerosols of the diameter range known to be generated during talking, singing, and breathing (0.5 – 20 microns). We will briefly discuss the effect of airflow rate, point of injection, and aerosol size, on residence-time, deposition pattern, and accumulation hotspots of the virus-laden aerosols. We also discuss the early and developed stages of the turbulence within the room, with emphasis on mixing, transport, and large-scale motions as a function of time and asymptotic behavior.

[1]The computational resources have been provided by the National HPC consortium for Covid-19. The simulations were conducted on Frontera and Blue Waters.

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