Viral Spread in a Classroom Setting

Scientific Achievement

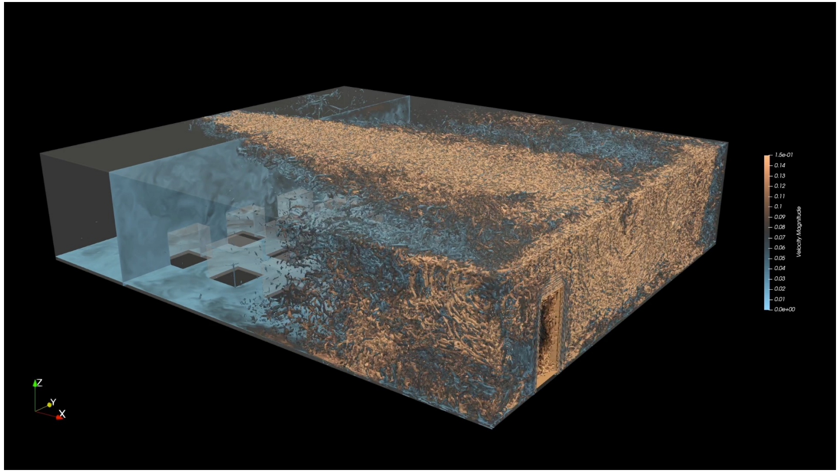
Researchers at Argonne National Laboratory ran detailed large eddy simulations (LES) of flow coupled to the dynamics of small particles suspended in the air to study how particles containing the SARS-CoV-19 virus can spread in a classroom setting. The study identified “dead zones” where small aerosol particles accumulate and remain airborne for long periods of time.

Significance and Impact

Aerosols in these dead zones that carry a high viral load can make the enclosed space highly infectious. Fully resolved LES, at realistic flow conditions, are necessary to understand the conditions under which dead zones form and to devise strategies for improving the ventilation in order to mitigate the risk of airborne infection.

Research Details

The researchers used the highly scalable computational fluid dynamics code Nek5000, which is tuned to run efficiently on NERSC’s Cori supercomputer. The calculations use ~1 billion grid points and up to 250K aerosol particles. The team used 15M CPU hours on Cori, employing up to 8,192 nodes (557K cores) per run.



This simulation shows airflow in a model elementary school classroom (where the cubes denote student units). In a typical setting, flow comes in from a HVAC duct on the left wall and goes out a door on the right wall. This arrangement results in the creation of dead zones where the virus can accumulate and linger for long periods.

Ramesh Balakrishnan, Rao Kotamarthi, and Paul Fischer. "Large Eddy Simulation of Isothermal and Non-isothermal Turbulent Flows in Ventilated Rooms.” 13th International ERCOFTAC symposium on engineering, turbulence, modelling and measurements (2021).

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