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Large-Eddy Simulation of Chemically Reactive Pollutant Transport from a Point Source in Urban Area

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Most air pollutants are chemically reactive so using inert scalar as the tracer in pollutant dispersion modelling would often overlook their impact on urban inhabitants. In this study, large-eddy simulation (LES) is used to examine the plume dispersion of chemically reactive pollutants in a hypothetical atmospheric boundary layer (ABL) in neutral stratification. The irreversible chemistry mechanism of ozone (O_3) titration is integrated into the LES model. Nitric oxide (NO) is emitted from an elevated point source in a rectangular spatial domain doped with O_3 . The LES results are compared well with the wind tunnel results available in literature. Afterwards, the LES model is applied to idealized two-dimensional (2D) street canyons of unity aspect ratio to study the behaviours of chemically reactive plume over idealized urban roughness. The relation among various time scales of reaction/turbulence and dimensionless number are analysed.