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CFD simulation of Urban Environment to study building energy and Urban Heat Island (UHI) implications NEGIN NAZARIAN, JAN KLEISSL, Mechanical and Aerospace Engineering, University of California San Diego — Numerical simulations are used to study the street-scale urban environment investigating air flow and heat transfer that affect Urban Heat Island formation and urban energy use. Simulations are performed based on Reynolds-averaged Navier-Stokes equations and Large Eddy Simulations using ANSYS/FLUENT. Comprehensive simulations of the daytime urban environment are presented accounting for various contributing factors such as building aspect ratio, stability, and radiative properties of surfaces. Buoyancy and co-occurrence of forced and mixed convective flow regimes are accounted for and the local Richardson number inside the canyon and near building surfaces are examined. A three-dimensional regular building array is used for air flow simulation and thermal analysis. Periodic boundary conditions are used in both stream/span-wise directions representing fully-developed flow and wind profile above the canyon and vortex formation inside the street canyon are studied. The simulations are performed on a clear day in southern California and corresponding daytime solar load is applied for heat transfer purposes. Considering the coupled behavior of thermal effects and flow in the urban environment, we examine surface and canopy air temperature versus building energy use.

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