Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

The Role of Roof Material in Diurnal Urban Air Quality: A Coupled Large-eddy Simulation and Surface Energy Balance Analysis
SAURABH SAXENA, NEDA YAGHOOBIAN, Florida State University — Due to the increasing and adverse effects of the urban heat island phenomenon, heat-wave events, and high urban air pollution, it has become increasingly important to have an in-depth understanding of the urban microclimates for mitigation purposes. The main objectives of this study are to analyze the relationship between building roof types/materials and the diurnal urban flow characteristics to assess the diurnal urban microclimates and street ventilation capacities. Through a series of novel computational simulations, involving detailed surface energy balance analyses coupled with large-eddy simulations, this study compares the thermo-fluid dynamics and pollution dispersion effects of asphalt, reflective, and green roofs. The results have shown significant differences in street ventilation capacity and pollution dispersion between the different roof-type cases. While the use of green roof reduces the urban air temperatures, a decline in the urban street air quality due to pollutant trapping has been observed at particular times throughout the day.

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Date submitted: 03 Aug 2020 Electronic form version 1.4