Thermally Driven Flow in a Mock Street Canyon

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SHAN PAN, Nanyang Technical University — Under conditions of low synoptic winds and high
solar radiation, non-uniform heating of building walls and the ground in an urban street canyon in
duces thermally-driven airflow. These effects have mainly been studied using wind-tunnel expe
riences and numerical models, but only a few field-scale experiments have been performed. Ho
ever, this is an important topic of interest because of its implications for air quality and
emergency response planning. A field experiment was carried out in collaboration between
the Singapore-MIT Alliance for Research and Technology (SMART) and the University of Notre
Dame. The study was conducted on the campus of Nanyang Technical University in Singapore,
and consisted of an ‘idealized’ building canyon constructed with two rows of shipping containers
aligned in the North-South direction. The site was carefully instrumented with sonic anemometers
(for wind speed and direction and virtual temperature), weather stations (wind speed and di
rection, temperature, relative humidity, pressure, and rain fall), and thermocouples (surface tem
perature of buildings). Measurements were recorded for 9 days, which included periods of
sunshine and high convective activity that created thermal circulation between the buildings.
Using a fog machine, flow visualization was carried out to observe circulation patterns. An over
view of the experiment and the results will be presented.

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