Geophysical Research Abstracts
Vol. 19, EGU2017-3136-1, 2017
EGU General Assembly 2017

The Effects of Building–roof Cooling on Flow and Air Quality in urban street canyon

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The effects of building–roof cooling on flow and air quality in urban street canyon were investigated using a coupled CFD–chemistry model. Flow characteristics were analyzed first in urban street canyons in the presence of building–roof cooling. A portal vortex was generated in urban street canyon, producing dominant reverse and outward flows near the ground in all the cases. The building–roof cooling increased horizontal wind speeds at the building roof and strengthened the downward motion near the downwind building in the street canyon, resultantly intensifying street canyon vortex strength. The flow affected the distribution of primary and secondary pollutants. Concentrations of primary pollutants (NO_x, VOC, CO) was high near the upwind building because the reverse flows were dominant at street level, making this area the downwind region of emission sources. Concentration of secondary pollutant (O_3) was lower than the background near the ground, where NOX concentrations were high. Building–roof cooling decreased the concentration of primary pollutants in contrasted to those under non–cooling conditions. In contrast, building–roof cooling increased O_3 by reducing NO concentrations in urban street canyon compared to concentrations under non–cooling conditions.