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Scaling the urban-breeze circulation

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During the experimental campaign CAPITOUL (Toulouse, March 2004 - March 2005) a situation of urban-breeze circulation was identified for a very stable summer day (4^{th} of July, 2004). High resolution numerical simulations using the atmospheric model Méso-NH (Lafore et al., 1998) coupled with the urban surface model TEB (Town Energy Balance, V. Masson 2000) con?rmed the existence of this local circualtion. Urban-breeze is a mesoscale response of the atmosphere to horizontal variations in temperature. The cause is the differential Surface Energy Balance (SEB) cycle between urban environments and its countryside creating a differential temperature advection into the city at low levels and a divergent flow at the top of the Boundary Layer (BL). Modelling studies demonstrate that urban-breeze circulation can steers pollution from industrial areas and trap it in the BL.

Several external forcing as atmospheric stability, wind field and sensible heat flux, affects the urban-breeze circulation development and evolution. The study investigate how external forcing pilots the speed, vertical length and horizontal length scales. Three-dimensional high resolution idealized numerical simulations with Meso-NH are used to generate a set of urban-breeze circulations forced by a idealized urban environment. The size of the city, the surface sensible heat flux gradient between the city and its surrounding and the atmosphere stability are modified to simulate diurnal and nocturnal urban conditions with or without large-scale wind flux. The objective is to develop a set of simple scaling laws describing the urban-breeze features in function of governing variables.