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Large-eddy simulation of an idealized urban heat island

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The surface-atmosphere interactions processes play an important role in the microclimatic conditions of a region, through the moment and heat exchanges in the Planetary Boundary-Layer (PBL). Particularly, the human activities depend and modify these microclimatic conditions by the intensive land use, deforestation, burning fossil fuels and urbanization processes. The urbanization is one of the most visible anthropogenic changes of the landscape that is associated with the Urban Heat Island (UHI) (Grimmond, Theoretical and Applied Climatology 2006; Roth, International Journal of Climatology 2007). In this work, a modified version of Moeng's large-eddy simulation model (Moeng, Journal of the Atmospheric Sciences 1984), including the virtual potential temperature integration and support to surface heterogeneities, is used to investigate the influence of the UHI in the vertical structure of an adiabatic and non-saturated PBL. The idealized UHI is represented by bi-dimensional surface patches with different Bowen ratios. Results obtained by different resolutions indicate that the surface heterogeneity is able to induce the formation of an intense updraft over the warm (urban) patch. This circulation pattern allows the humidity transport from the adjacent areas up to the PBL top over the warm patch, and can contribute to the clouds formation over the UHI.