Urban regional precipitation simulations - comparison of pseudo-global-warming with local forcing

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ABSTRACT:
In this research, we compare the results of parametric numerical simulations of local urban anthropogenic heat forcing with large scale changes of moisture levels in the Pearl River Delta region. The 3-member ensemble simulation of a benchmark case shows that precipitation in the urban coastal areas is affected by different sensitivities, depending on advection of moist surface air from the sea or from the land areas. Differences in simulated clouds and atmospheric stability are found for different moisture conditions and urban effects on local urban precipitation as described in our previous publications is retained for different background moisture conditions, indicating that local convection is less sensitive to background moisture changes than advection effects, driven by larger scale flows. One can conclude that the local convective forcing effect of anthropogenic heat fluxes on precipitation is robust for different atmospheric moisture contents, however the cloud penetration depth and near surface urban heat effects show interesting differences, e.g. increased sensitivity of surface air temperatures to anthropogenic heat fluxes under drier conditions with less sensible heat transferred to latent heat. This is counter intuitive in coastal subtropical cities during summer, where the reference condition is close to saturated during most days and the net specific humidity is almost unaffected by the initial reduction of moisture, because of the proximity to the warm sea surface.

KEYWORDS: Urban climate sensitivity, precipitation

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