**Urbanization and Climate Change in Coastal Metropolises**

A multi-model nesting procedure has been developed to assess the effects of climate change on Urban Heat Island and other meteorological parameters, the study area being the Chicago Metropolitan Area (CMA). The model chain included a global climate (CAM at ~ 200 km resolution), mesoscale (nested WRF-urban spanning 9 to 0.333 km resolution), and microscale (ENVI-met at 2 m resolution) models, delving into a range of scales unattained hitherto.

The nested modeling approach proposed and used is portable to other cities, requiring only the adjustment of model parameters and inputs to suit the locality. The models used are available as easily accessible freeware, although exorbitant computational cost currently limits their utility for operational applications. WRF-urban simulations, which utilize boundary conditions based on five-day period within the present and a single future climate scenario rather than ensemble approaches, may introduce uncertainties. Nonetheless, they do provide a worst-case context to consider potential climate-change effects as well as means to evaluate a previously untested methodology.

The application of the model chain to the specific case of Chicago’s UHI (a building at the De Paul University) provided insights of the role of Lake Breeze. While Lake Breeze in the Future climate may penetrate further onshore than in Present, lake-breeze events will neither increase in frequency of occurrence nor provide relief from daytime UHI. The heightening of overall air temperatures in CMA in Future August could seriously threaten the sustainability of Chicago. Investigations at microscales revealed any benefits of slightly increased average wind speed at DePaul in Future climate are seriously outweighed by increased air temperatures that lead to decreased pedestrian comfort and increased energy consumption.

As numerical modeling capabilities continue to improve at all scales, higher accuracy, lower computational cost, and easier coupling of models will allow significant improvements to nested multi-scale modeling, thus providing a promising tool for scientists, engineers, and policy makers to evaluate climate change impacts and adaptation strategies for urban areas. Upscaling from microscale into mesoscale as well as developing microscale models amenable to unsteady synoptic inputs will also be promising future topics.

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