On the mitigation alternatives to a warming climate for building energy demands in dense coastal-urban environments

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ABSTRACT

Accelerated global warming impacts are amplified in coastal-urban environments reflected in increasing surface air temperatures and humidity. This rise in extreme temperatures increases human discomfort and energy demands for air conditioning placing population and energy infrastructure at higher risk of vulnerability. This vulnerability is amplified in compact cities where anthropogenic heat removal from the built environment further increases the temperature of the urban canyon with feedback on human comfort and energy demands. Although there has been prior work reported on mitigating energy demands due to rising temperatures, these studies are focused mostly on the building scale, where the two-way interaction between the urban climate and buildings is missing. This work will describe the development of new methodologies for quantifying human discomfort index and peak air conditioning energy demands for different passive and active building-integrated mitigation technologies. The specific goal of the study is to identify different technological scenarios that promote environmental and energy sustainability of the urban environment in the context of a warming climate. The tropical coastal city of San Juan metropolitan area, Puerto Rico is used as a first case study for a typical coastal urban city. Statistical and dynamic downscaling of bias-corrected Global Circulation Modeling ensemble reflects increases in extreme heat events in the Caribbean, with clear departures at the mid of the century for the high emissions scenarios. The role of potential scenarios for improving the overall human comfort, reducing urban heat island, and air conditioning demands are explored for present and future climate change scenarios.

BIOGRAPHY

Prof. Gonzalez is the CCNY Presidential Professor of Mechanical Engineering at the City College of New York. He conducts research and teaches in urban climate, urban energy sustainability, and coastal-urban environmental processes. Professor Gonzalez holds a Ph.D. degree from Georgia Institute of Technology. He is an ASME Fellow; Team Lead Coast-Urban Environmental Research Group; Director of NSF IUCRC on Buildings Energy Smart Technologies; and Joint Appointee Brookhaven National Lab.