Going Mobile to Address Emerging Climate Equity Challenges in the Heterogeneous Urban Environment

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Background/Objectives. Predicting how climate change will impact the Earth's climate system is a longstanding goal that has motivated the development of an array of global climate models. Historically, climate models have been focused on predicting how climate change will impact natural environments. As most of the world's population now lives in cities there has been growing interest in understanding how climate change will impact urbanized environments and in turn city dwellers. The urgency of this need is revealing itself as the frequency of weather extremes increases highlighting weaknesses in urban infrastructure and threats to human quality of life.

Urban environments are visibly complex with their mix of land use and array of surface types. The high-level of heterogeneity and small scale of urban elements further motivates the general trend towards developing higher-resolution models, which in turn drives the need to collect more comprehensive observations that can provide guidance in an equitable way across communities.

Approach/Activities. The recently established Brookhaven National Laboratory Center for Multiscale Applied Sensing (CMAS) made significant headway as it completed the assembly of a one-of-a-kind mobile observatory tailored to the study of highly heterogenous urban environments. In this presentation we describe the features of the CMAS mobile observatory that enable its rapid deployment either on or off the power grid, as well as its instrument payload that can collect, among other things, wind measurements throughout the atmospheric column, something which remains poorly documented in urban environments. Beyond its unique layout, the observatory benefits from operating a new smart sampling paradigm that optimizes data collection in the obstacle-laden urban environment. Besides these technical descriptions, we present first-light demonstrations of the types of data and studies that this capability enables.

Results/Lessons Learned. During its first few deployments, the mobile observatory captured unique observations. Among them are vertical air motion measurements along the faces of the supertall One Vanderbilt skyscraper in Manhattan, New York, which are shown to hold pivotal information about how buildings impact the transport of heat, pollution, and contaminants in urban street channels. Also, air temperature measurements collected in motion along a transect between Nassau County and Manhattan, New York offer a high-resolution view of the urban heat island and reveal that temperature disparities also exist within the urban dome across different communities.

Ultimately, the datasets collected by CMAS are poised to help guide equitable urban planning by highlighting existing disparities and characterizing the impact of urban features on the urban microclimate with the goal to improve human comfort.