



Investigating the vertical dimension of Singapore's urban heat island through quadcopter platforms: an pilot study

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In numerous cities, measurements of urban warmth in most urban heat island (UHI) studies are generally constrained towards surface or near-surface (<2 m above surface level) levels across horizontal variations in land use and land cover. However, there has been hitherto limited attention towards the measurement of vertical temperature profiles extending from the urban surface, urban canopy layer through to the urban boundary layer. Knowledge of these profiles, through (a.) how they vary over different local urban morphologies, and (b.) develop with respect to synoptic meteorological conditions, are important towards several aspects of UHI research; these include validating modelling urban canopy lapse rate profiles or estimating the growth of urban plumes. In this novel study, we utilised temperature sensor-loggers attached onto remote controlled aerial quadcopter platforms to measure urban temperature profiles up to 100 m above ground level in Singapore, which is a rapidly urbanizing major tropical metropolis. Three different land use/land cover categories were sampled; a high-rise residential estate, a university campus, and an urban park/green-space. Sorties were flown repeatedly at four different times – sunrise, noon, sunset and midnight. Initial results indicate significant variations in intra-site stability and inversion development between the urban canopy and boundary layers. These profiles are also temporally dynamic, depending on the time of day and larger-scale weather conditions.