

Assessing the relationship between air temperature and satellite-derived land surface temperature in Metro Manila, 1988–2024

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ABSTRACT

The relationship between air temperature (AT) and land surface temperature (LST) varies across land use/land cover (LULC), time of day, and meteorological conditions. AT represents the thermal state of the atmosphere close to the ground, whereas LST describes the radiative temperature of the surface of the Earth. Satellite-derived LST is widely used in urban climate studies because it provides large spatial coverage that is difficult to obtain using conventional weather stations. However, LST and AT represent different components of the surface-atmosphere system, and their relationship is not spatially or temporally uniform. Locally, efforts have been made to relate AT and LST on national and city levels but there seems to be limited studies on a regional scale, i.e., Metro Manila. Therefore, we aim to test the AT-LST relationship to know whether LST can be used as a proxy or predictor for AT in Metro Manila. Next, we will characterize the seasonal (DJF, MAM, JJA, SON) and long-term (1988-2024) spatial and temporal patterns of LULC, urban heat island intensity (UHII), LST, and AT. Lastly, we will analyze the relationship between LULC, UHII, LST, and AT, and identify the driving forces of LULC change and UHI intensification. Surface reflectance and LST data from Landsat will be acquired through Google Earth Engine. The AT data will be requested from PAGASA, and Manila Observatory through their network of automated weather stations. Additional meteorological variables will be sourced from the ERA5-Land reanalysis dataset. Once we have backcasted the spatial distribution of AT and UHII in Metro Manila, we will be able to link urbanization to local climate. We expect an increasing trend in AT and LST throughout the study period, and a strong correlation between built-up, UHII, and temperature due to the thermal property of impervious urban surfaces. The findings of this study would provide a greater understanding of the AT-LST relationship in a heterogeneous urban region.

Keywords: air temperature, land surface temperature, land use/land cover, urban heat island