

ABSTRACT

CHARACTERIZING THE URBAN HEAT ISLAND PHENOMENON IN CABANATUAN CITY USING WEATHER RESEARCH AND FORECASTING (WRF) MODEL

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Cabanatuan is one of the emerging cities in the country and the center of commerce and industrialization in the province of Nueva Ecija. Land conversion from green spaces into impervious surfaces is imminent in the recent years and population in the area are continuously increasing. With this, the researcher hypothesized the existence of Urban Heat Island (UHI) phenomenon there. This study aimed to investigate and characterize UHI phenomenon in Cabanatuan using Weather Research and Forecasting (WRF) model (Skamarock et al., 2008). Rainfall and non-rainfall events were identified and correlations of meteorological parameters with Tmax, Tmin and diurnal temperature range (DTR) on each events and seasons were established. Relative humidity and rainfall were found to have a significant inverse relationship with Tmax, Tmin and DTR. Trend detection for Tmax, Tmin and DTR using historical observations and WRF model outputs were established. For historical observations, Tmin was found to be significantly increasing in both season, resulting into a significant decreasing trend in DTR in both seasons. The trend of Tmax in both seasons were found to be not significant. Using WRF model outputs, the established trends were quite different. DTR trend were not significant in both seasons, and Tmax and Tmin both have an increasing significant trend. This may be due to unresolved minute characteristics of the location of synoptic station in the model. The WRF modelling system was compared and evaluated against synoptic observations. It was found to be satisfactorily demonstrate skill in simulating near-surface air temperature. During northeast (NE) monsoon season, two peaks are discernable in the diurnal UHI intensity evolution: (i) before the sun rises (0.510C); and (ii) before the sun sets (0.58 0C). On the average, the temperature in the city is relatively hotter compared to neighboring non-urban areas during this season. The UHI intensity during southwest (SW) monsoon season is lower compared to NE monsoon season with only peak during late afternoon (0.18 0C). The outgoing longwave radiation (OLR) during SW monsoon was also found to be generally lower than during NE monsoon season. This affects the radiative cooling in both areas, therefore, the magnitude of UHI Intensity Spatio-temporal analysis of temperature variation in the area showed that temperature in the study area is highly dependent with topographical height. The cross-sectional plot of residual temperature (without the effect of topography) shows the typical spatial trend of UHI intensity in the night of NE monsoon season, however, gradient is relatively small. Overall, our current modelling efforts showed that UHI in Cabanatuan City is relatively small in magnitude as well as small in temperature gradient between urban-to-non-urban areas.

Keywords: urbanization, WRF modelling, UHI, DTR Trends