



An analysis of urban heat island impact toward increasing of afternoon thunderstorm frequency in Taipei, Taiwan

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Each year, average of Earth's temperature rises and the urbanized cities, are warming at a significant rate than the surrounding rural areas. This phenomenon is called Urban Heat Island (UHI). UHI is a consequence of human activities in urban area and it has possibilities to impact weather and climate on regional or global scale. Precipitation is one of the basic hydro-meteorological phenomena that could be affected by UHI trend with thunderstorm as a part of precipitation. As the UHI level rises from year to year, the pattern of precipitation could change. However, this issue is still underdeveloped, thus, this work tries to comprehensively understand the hydrological response to UHI.

This research selects Taipei city as the study area and explores the connection between UHI and precipitation pattern's change. The data used here are hourly temperature and precipitation data collected from 21 Taipei weather stations collected from Central Weather Bureau (CWB) Taiwan. In order to reveal specific details and trend of non-linear relation from both time domain and frequency, Hilbert-Huang Transform (HHT) is adopted in this study. The HHT results are compared between each station. Later, empirical orthogonal function (EOF) also being used to extract main spatial pattern of precipitation in Taipei city.

The results show that the urbanization in Taipei city contribute to increasing trend of 0.5 – 1 °C in daily UHI and also increase of 27% in the afternoon thunderstorm frequency for this past 20 years. The increase of thunderstorm would result into a bigger rain water flow to the river and a fewer time for it to percolate to the ground. If there are more thunderstorms in the future, it is possible the phenomenon could lead to the lack of groundwater discharge and depletion of groundwater reserve. This result could be utilized in the future to understand more about UHI mitigation and thunderstorm in Taipei.

Keywords: urban heat island, thunderstorm, Hilbert-Huang Transform, empirical orthogonal function

