DETECTING SPATIOTEMPORAL HEATWAVE IN URBAN, PERI-URBAN, AND RURAL AREAS OF THAILAND USING SATELLITE-BASED THERMAL ANOMALIES

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1. INTRODUCTION

Heatwaves are considered a significant weather-related cause of mortality and morbidity worldwide. However, although it is widely reported that heatwaves threaten sustainable development, human safety, and the environmental system [1], they still receive far less attention from policymakers and the general public [2].

In Thailand, the El Niño Southern Oscillation (ENSO) caused dry and warm conditions, leading to 158 deaths during the heatwave period from 2015 to 2018, particularly in the northern and central regions where the impacts on fatalities appeared to be more long-lasting. The effects of heatwaves on deaths from ischemic heart disease and pneumonia occurred faster [3]. However, less evidence of heatwave investigation is available in this country, and they are critically linked with climate change.

This study, therefore, aims to examine the spatial and temporal variability of heatwave characteristics (number, duration, frequency, magnitude, and amplitude). Furthermore, we attempt to determine the pattern of the heatwave in urban, peri-urban, and rural areas in Thailand. Our findings give decision-makers and the general public a greater understanding of descriptive spatiotemporal heatwave patterns, enabling them to cope with extreme weather incidents and contribute key information for future heatwave forecasting over Thailand's regions.

2. METHODOLOGY

In order to accomplish the study goals, our analysis was conducted in 3 different socioeconomic areas; Bangkok (urban), Pathum Thani(peri-urban), and Saraburi (rural), illustrated in fig 1. We employed land surface temperature (LST) product from MODIS (MOD11A1, MYD11A1) over the period 2000 – 2019. To validate the remotely sensed data, near surface temperature from 10 meteorological stations was examined by Pearson's correlation coefficient (r^2).

Heatwave metrics were measured based on Perkins's framework [4]. In this analysis, heatwave is detected when at least 3 consecutive days are above a calendar-day the 90th temperature percentile threshold.

The non-parametric Mann–Kendall (MK) test to determine the statistical significance of trends in the series of yearly time series heatwaves index results. Theil-Sen's slope were used to estimate the magnitude of the trends in the time series data.

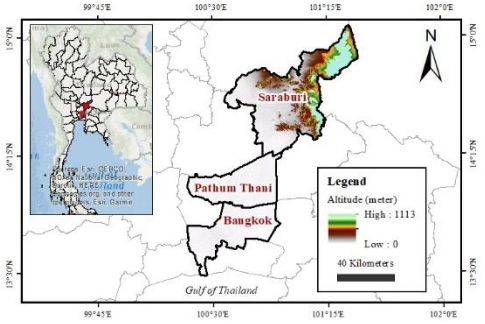

Figure 1. Study area

3. CONCLUSION

The results revealed that throughout a wide metropolitan and peri-urban area, number, frequency, and duration of daytime heatwaves all rose significantly between 1981 and 2019.

Our finding demonstrated that land surface temperature (LST) can be used as a proxy of heatwave like air temperature with high confidence (r^2 = 0.80–0.90). It can be linked to heatwave phenomena specific to those living distant from the methodological station, particularly the duration and frequency of heatwaves.

The densely populated dominated in northern Bangkok and Pathum Thani stand out as a significant region where daytime and nighttime heatwave measurements exhibited the most pronounced intensifications.

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