Analysis of Extreme Heat Land Surface Temperature at a Tropical City (1988-2022): A Study on the Variability of Hot Spot during El Niño Southern Oscillation (ENSO)

ABSTRACT

Weather and climate in Malaysia, situated in Southeast Asia, are influenced by El Niño Southern Oscillation (ENSO), monsoons, Madden Julian Oscillation (MJO), and Indian Ocean Dipole (IOD). Previous studies on ENSO's impact on temperature lacked detailed spatial information due to limited meteorological stations and cost constraints. This study utilizes remote sensing techniques, employing Landsat satellite data and Oceanic Niño Index (ONI) data, to analyze the spatial pattern of extreme land surface temperature distribution during ENSO events. Preprocessing includes radiometric and atmospheric corrections before converting digital numbers to land surface temperature values. Results indicate increased hotspot areas (>30°C) during El Niño events, with respective hotspot areas of 89.32 km² and 97.8 km² in 2015 and 2016, and 61.23 km² and 59.73 km² during La Niña in August and October 2018. Heat concentration areas remained consistent during the 1998 El Niño (89.32 km²) and the 2011 La Niña (55.82 km²). These findings highlight ENSO's influence on altering hotspot distribution patterns. The increased hotspot area during El Niño events (34-36 km²) led to a 20-30% surge in electricity consumption as residents and offices in Kuching City, Sarawak, sought temperature regulation. This spatial information aids the government in identifying affected areas and implementing suitable measures to mitigate the impact of El Niño events.