Decade-Long Analysis: Unravelling the SpatioTemporal Dynamics of PM_{10} Concentrations in Malaysian Borneo

ABSTRACT

High levels of particulate matter in the air, caused by air pollution from neighbouring countries, have always been a major problem in Malaysia. For many years, Malaysia has experienced a hazy atmosphere due to high levels of particulate matter (PM_{10}) from regional biomass burning and other human activities. This study aims to analyse the changes in PM10 levels over time in Malaysian Borneo. Data collected from air quality monitoring stations over a 10-year period (2006–2016) were obtained from the Malaysian Department of Environment (DOE). Statistical analyses were conducted using the Mann Kendall test to examine trends in PM_{10} concentrations. The study divided Sabah and Sarawak into three regions: Northern Malaysian Borneo, Central Malaysian Borneo, and Southern Malaysian Borneo. Throughout the studied period, the highest levels of PM_{10} were primarily found in Southern Malaysian Borneo, with the highest concentration recorded in Sibu (434.38 μg m^{-3}). The monitoring stations in Miri, Limbang, and Kota Kinabalu showed an increasing pollution trend, while Kuching, Sri Aman, Bintulu, Kapit, Sandakan, Tawau, and Keningau showed a significant decreasing trend. No significant trend was observed in Kota Samarahan and Sarikei. The highest annual PM_{10} exceedances, surpassing the Recommended Malaysian Ambient Air Quality Guideline (RMAAQG) of 150 μg m^{-3}, occurred in 2015 and 2009 with 80 and 65 days respectively in 2006. Biomass burning is identified as the primary source of emissions, contributing to the significant monthly and seasonal variations in this region. Meteorological conditions and the El Niño phenomenon were observed to exert a significant influence on the concentration and distribution of PM_{10} in this area. In order to improve air quality in Malaysian Borneo, it is necessary to take a multifaceted approach encompassing source emissions reduction, inter-country collaboration, region-wide strategies for land and forest management improvement, and reinforced cooperation on pollution monitoring, reporting and reduction efforts.