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EFFECT OF URBAN CHANGES ON CARBON MONOXIDE SPATIAL VARIATION USING LST AND URBAN INDICES OF LANDSAT 8 OLI

RABIATUL NAJWA BINTI BAHRIN

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ABSTRACT

Carbon Monoxide (CO) is one of the major threats to communities' health and the environment. In relation to spatial features affecting the increasing CO over cities, it is crucial to understand CO spatial variation concentration due to the built-up areas, vegetation, and temperature. This research aims to determine the effect of urbanization on the spatial variation of Carbon Monoxide (CO) for the years 2014, 2016, 2018 and 2020 in Selangor using annual Air Pollution Index (API) and Landsat 8 OLI/TIRS satellite-derived of Land Surface Temperature (LST) and Urban Indices. In this study, the spatial statistical approach of Multi Geographically Weighted Regression (MGWR) was used to determine the spatial variation of air pollutants in the Selangor area based on the relationships between CO with LST, Normalized Difference Vegetation Index (NDVI), Normalized Difference Built-Up Index (NDBI) and Urban Index (UI). The results from MGWR have shown that there were strong and significant correlations in 2014 ($R^2 = 0.989$) while 2016, 2018 and 2020 ($R^2 = 0.992$) in the relationships between CO and the urban parameters. The finding indicates the local spatial variations of CO concentrations due to the NDVI, NDBI, UI and LST where the areas with low vegetation, dense urbanization, and high LST are consistently associated with increased concentrations of CO. This outcome will aid urban and environmental planners in developing urban planning policies and making Selangor more resilient to the effects of air pollution.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

Air pollution is recognized as one of the most significant issues in urban areas. Outdoor air pollution is primarily caused by urbanization, industrial expansion, and uncontrolled consumption of fossil fuels (Johansson et al. 2008; Shi et al. 2014; WHO 2008). Pollutants can be irregular depending on the time, and they can also be in either a scattered or concentrated form in the atmosphere. (Azid et al. 2013) With an increasing population and pollution emissions, widespread air pollution has become a significant issue in Malaysia. According to World Health Organization guidelines, Malaysia's air quality is moderately unsafe; the most recent data show the country's annual mean concentration of PM2.5 is 16 g/m3, which exceeds the recommended maximum of 10 g/m3. Malaysia's poor air quality is primarily caused by transboundary haze, industrial fuel burning, petroleum production and refining, rubber and palm oil processing, vehicle emissions, and waste burning. According to available data, Kuching, Kuala Lumpur, Petaling Jaya, and Bayan Lepas all have high levels of air pollution. Continuous exposure to air pollution would endanger public health, and this situation necessarily requires close government monitoring, particularly in certain areas, to prevent deterioration of air quality. (Hua 2018).

As reported in the Environmental Quality Report 2020 published by the Department of Environment (DOE) Malaysia, the primary sources of air pollutants were power plants, industries, motor vehicles. Other sources of air pollutant emissions from residential, commercial, and non-energy sources. The increase in industrial sources and the number of motor vehicles could result in severe air pollution if pollutant emissions, including smoke emissions, from both sources, are not effectively controlled. Malaysian air quality is measured using the Continuous Air Quality Monitoring (CAQM) Stations, established by DOE. (Figure 1.1). Air Pollutant Index (API) is an indicator of the air quality status in any area. The API value is calculated using average concentrations of air pollutants such as Sulphur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO), Oxygen (O3), particulate matter (PM2.5), and PM10. DOE (2012). The API is