SIIC008

EVALUATION OF AIR POLLUTION IN MALAYSIA BASED ON HAZE PHENOMENA FROM 2000 TO 2019 USING SATELLITE DATABASE

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Abstract:
Air pollution in Malaysia based on haze phenomena from year 2000 to 2019 by using satellite database was evaluated. Haze phenomena is a phenomenon that happened almost every year in Malaysia. Usually, the pollutants emitted from haze were based on API readings that was provided by DOE using API. For this research work, satellite database was collected to compare the correlations between ground-based data and remote sensing data. The satellite database used was from GIOVANNI which was a portal that accommodates multiple satellite sensors that provides various parameters which some of them were haze pollutants concentrations ($PM2.5$, SO2, CO, Ozone). The study areas selected for both ground-based and satellite database collected were at Sarawak and Sabah as some of the hazardous and worse haze pollutant concentrations values are at these study areas. For data analysis, linear regression analysis was conducted between ground-based data and remote sensing data to find out the correlation and relationship of the model. The linear regression analysis was done using Microsoft Excel and from that analysis, R and p values were obtained to find out how strong the correlation coefficient and statistical significance of the linear models. The R values ranged from weak, moderate to strong relationship while all the p values obtained are below 0.05 which meant that the analysis of the model was statistically significance. The factors that contributed to haze phenomenon was also investigated by collecting meteorological data such as wind speed and surface temperature and it can be concluded that both factors have a strong inversely proportional relationship with haze pollutions.
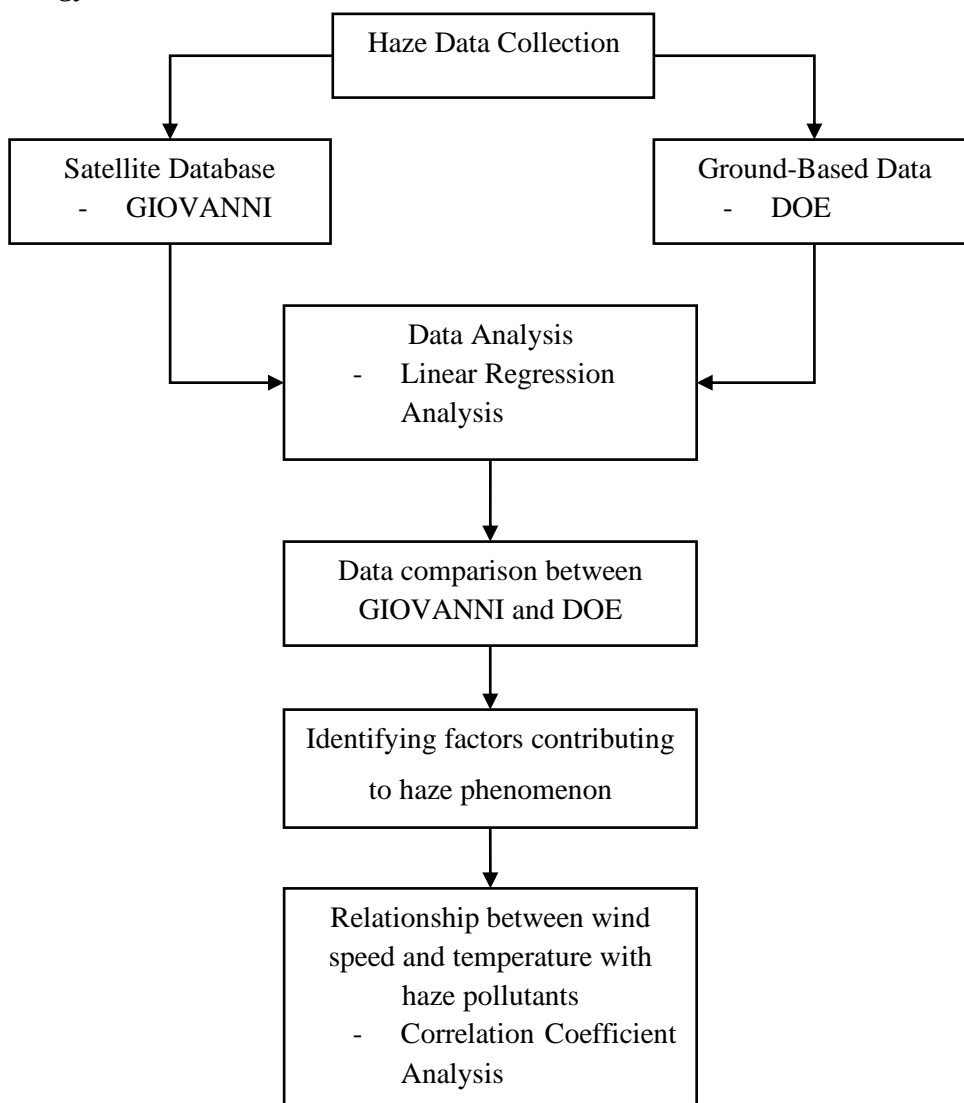
*Keywords***:**
Haze, GIOVANNI, remote sensing, air pollution index, $PM_{2.5}$

Objectives:

- To collect the remote sensing data related haze phenomenon in Malaysia by using GIOVANNI, satellite database.
- To investigate the significant of remote sensing variables data towards API data using linear regression analysis related to haze phenomena.
- To determine the relationship between meteorological factors with the haze pollutants in Malaysia.

Methodology:

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                    ┌─────────────────────────┐
                    │   Haze Data Collection   │
                    └─────────────────────────┘
            ┌──────────────────┘         └──────────────────┐
┌─────────────────────────┐              ┌─────────────────────────┐
│   Satellite Database     │              │    Ground-Based Data     │
│    -   GIOVANNI          │              │    -   DOE               │
└─────────────────────────┘              └─────────────────────────┘
            └──────────────┐    ┌──────────────────┘
                    ┌─────────────────────────┐
                    │     Data Analysis        │
                    │   -  Linear Regression   │
                    │      Analysis            │
                    └─────────────────────────┘
                                │
                    ┌─────────────────────────┐
                    │  Data comparison between │
                    │   GIOVANNI and DOE       │
                    └─────────────────────────┘
                                │
                    ┌─────────────────────────┐
                    │ Identifying factors      │
                    │ contributing to haze     │
                    │ phenomenon               │
                    └─────────────────────────┘
                                │
                    ┌─────────────────────────┐
                    │ Relationship between wind│
                    │ speed and temperature    │
                    │ with haze pollutants     │
                    │  -  Correlation          │
                    │     Coefficient Analysis │
                    └─────────────────────────┘
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Results:

API vs PM$_{2.5}$ in Sarawak and Sabah
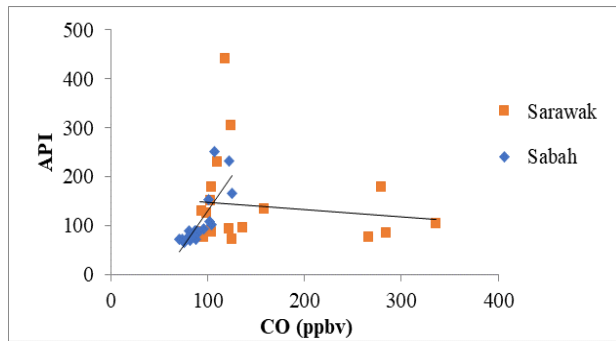

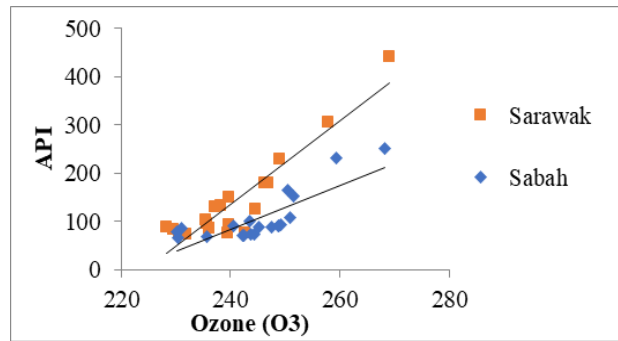**API vs SO$_2$ in Sarawak and Sabah**
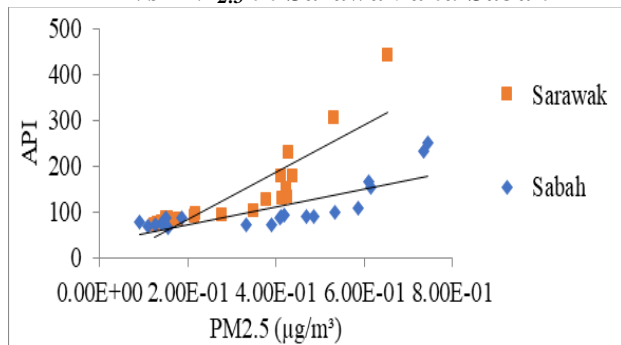
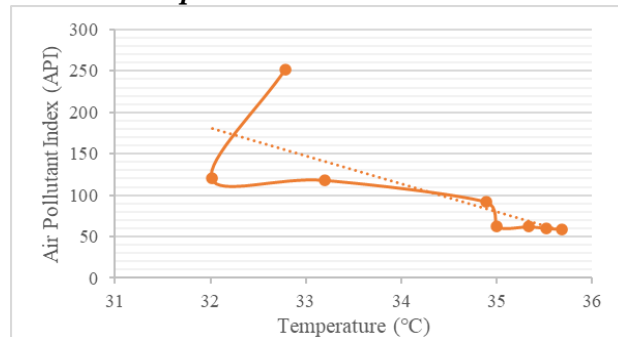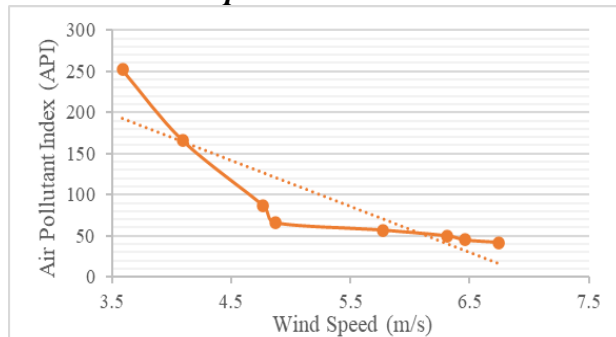**API vs CO in Sarawak and Sabah**
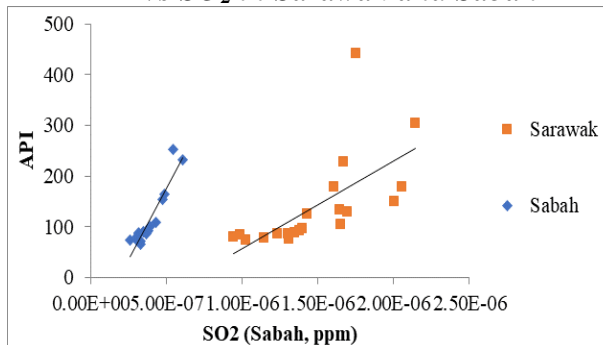
API vs O$_3$ in Sarawak and Sabah

API vs Wind Speed in Sarawak and Sabah

API vs Temperature in Sarawak and Sabah

Conclusion:

This study investigated the evaluation of air pollution based on haze phenomenon by analyzing the data collected from ground-based data which is from Department of Environment (DOE) and from satellite database which is from GIOVANNI over Malaysia, specifically at Sarawak and Sabah during the period of 2000 to 2019. For the data analysis between the ground-based data (API) and satellite database ($PM_{2.5}$, SO_2, CO and O_3), linear regression analysis is done where the R^2 values ranged from weak, moderate to strong correlation relationship while all the p values for the analysis are below 0.05 which indicates that the analysis is statistically significant. Based on the correlation analysis, the wind speed has a strong negative correlation with API with the value of R being -0.87499, indicating that both variables have an inverse relationship that when wind speed increased, the API value will be decreased. The meteorological condition for temperature has also moderate and negative correlations with API value, resulting the value of R being -0.72701.