The impact Analysis of Pandemic Covid 19 on Air Pollution : A Comparison Between Turkey and Malaysia Port Cities by Using an Artificial Intelligent Technique.

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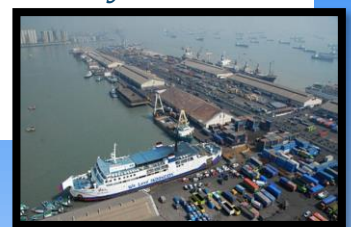


1.0 INTRODUCTION AND BACKGROUND

- Rapid population growth causes many environmental problems especially air pollution.
- It has become important to prevent sustainable environment and outbreaks.
- The origin of the Covid-19 virus is thought to have spread from the wild animal market in Wuhan, China.,
- Infectious diseases occur faster than in the past,
- The rate of spread increases with increasing human contact,
- The causes and possible consequences of the outbreak have not yet been adequately studied,
- Corona virus and the measures taken in Turkey (Covidien-19) the impact on air quality due to the outbreak of Konya of searched.

Air Quality Standards for the European Union and World Health Organisation Standards

Column Header Goes Here	*European Union Air Quality Standards	**WHO Guidelines	Malaysia Air Quality Standards	***Turkish Air Quality Standards (2019)
$PM_{2.5}$ (24-hr mean)	NA	25 µg/m^3	50 µg/m^3	NA
$PM_{2.5}$(Annual)	Limit Value, 25 µg/m^3	10 µg/m^3	25µg/m^3	NA
PM_{10} (24 hours)	Limit Value, 50 µg/m^3	50 µg/m^3	120µg/m^3	60 µg/m^3
PM_{10}(Annual)	Limit Value, 40 µg/m^3	20 µg/m^3	45µg/m^3	NA
O_3 8-hr mean	Target Value, 120 µg/m^3	100 µg/m^3	120 µg/m^3	NA
NO_2 (Hourly)	Limit Value, 200 µg/m^3	200 µg/m^3	300 µg/m^3	250 µg/m^3
NO_2(Annual)	Limit Value, 40 µg/m^3	40 µg/m^3	75 µg/m^3	NA
SO2(Hourly)	Limit Value, 350 µg/m^3	500 µg/m^3 (10 Minutes mean)	300 µg/m^3	NA
SO2 (24-hour)	Limit Value, 125 µg/m^3	20 µg/m^3	90 µg/m^3	125 µg/m^3
CO(1-hrdaily mean)	NA	26 ppm	35 mg/m ^{3}	NA
CO (8-hrdaily mean)	Limit Value, 10 mg/m^3	9 ppm	10 mg/m ^{3}	10 µg/m^3

Your logo here

*Sources : EU Air Quality Directive (2008/50/EC), **WHO,2006, Air Quality Guidelines: Global update 2005.(https://ec.europa.eu/environment/air/quality/standards.htm) and ***Air pollution in Istanbul (rvo.nl) (2017)

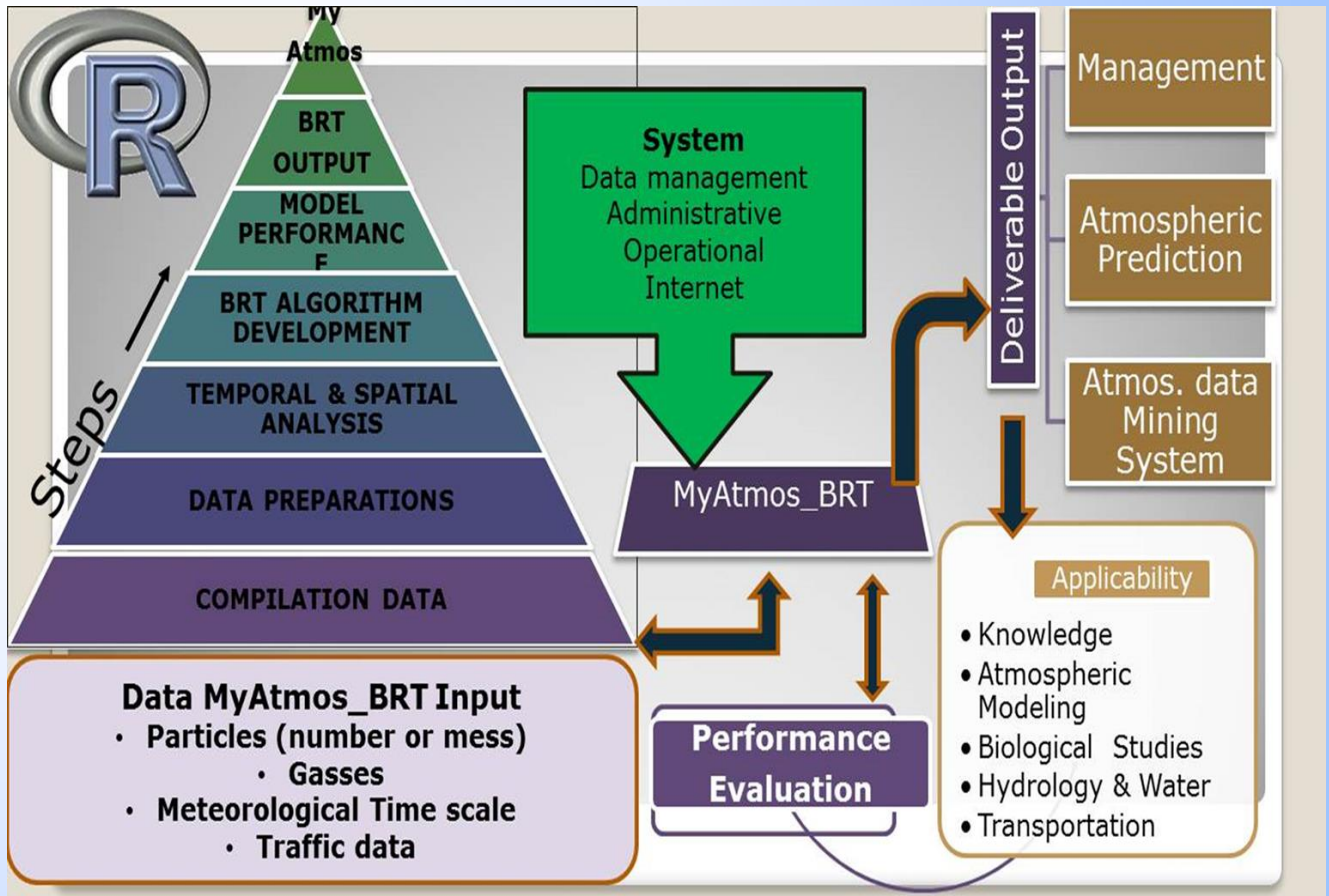
Background COVID-19 in Turkey In Glance

- ✓After the occurrence of infections in Turkey, it is very quickly becoming a part of the fight against various measures.
- ✓In this context, after March 16, all schools were vacationed then online study started, in the Turkey, Konya as well.
- ✓Mass worship was interrupted in mosques.,
- ✓Quarantine measures were implemented in metropolitan cities,
- ✓Mobility has been reduced in cities. Citizens over the age of 65 and then under the age of 20 are forbidden to go out.
- ✓On the weekends, a curfew was introduced for all age groups.
- ✓Commercial/touristic flights were cancelled with many countries where the pandemics was widespread.
- ✓The impact on air quality due to the measures taken were investigated in Konya City, Turkey.

MATERIALS AND METHODS OF BRT(MYATMOS) WORKING SYSTEM

- To The objectives of this study are to:
- i. Collect simultaneous air pollution and meteorological data at Konya City, Turkey;
- ii. Study the spatial and temporal distribution of pollutants in urban environments; and
- iv. To apply an emerging statistical or an artificial intelligent approach to air pollution data, namely, Boosted Regression Trees.

R-program, an open code statistics program, was used to create the distribution maps of the data.

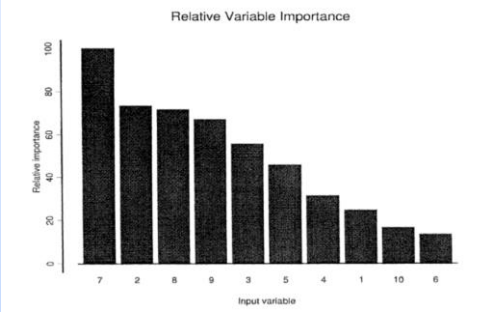


BRT Output 1 : Relative Importance of Predictor Variables

Friedman developed an extension of a variable's 'relative influence' for boosted estimation by using tree-based methods (Friedman, 2002). This method estimates the approximation of the relative influence of a variable x_j, which is applied to the equation as

$$I_j^2 = \frac{1}{M} \sum_{m=1}^{M} I_j^2(T_m)$$

where I_t^2 is the incremental improvement by splitting x_j at that point. The extension averages the relative influence of variable x_j across all the trees generated by the boosting algorithm. The measure of variable influence can be determined based on the number of times a variable is selected for splitting and weighted by the improvement in the overall model.

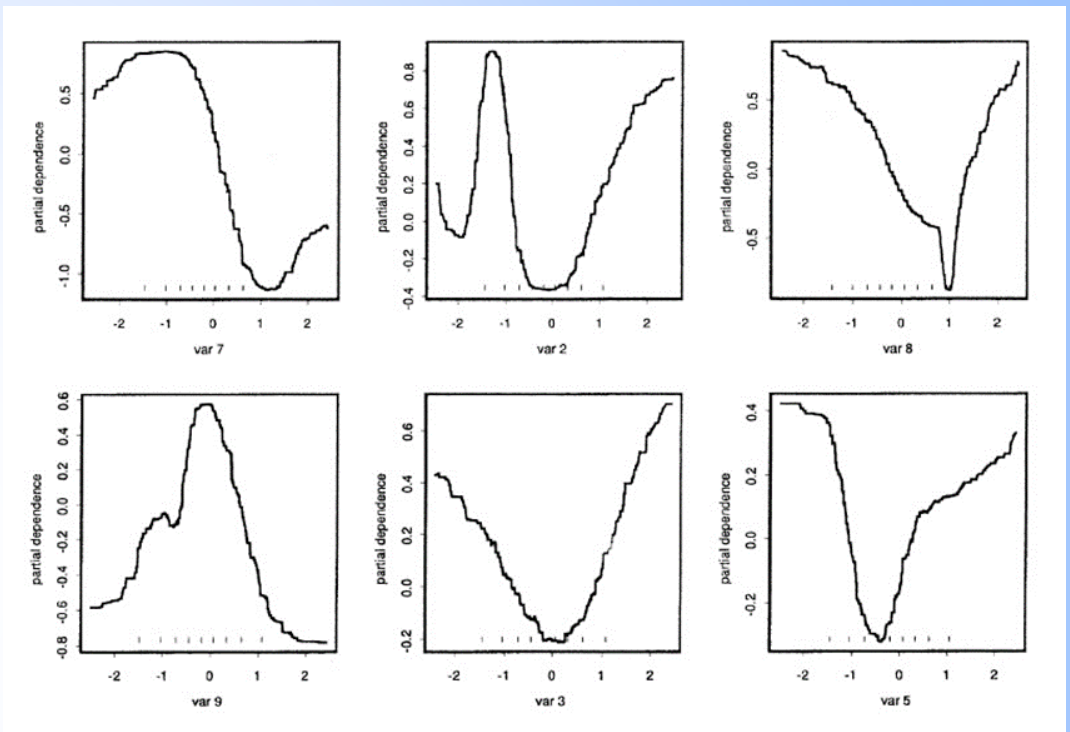


BRT Output 2 : Theory of Partial Dependency Plots (PDP)

Constructing a PDP (3) in practice is rather straightforward. To simplify, let $z_s = x_1$ be the predictor variable of interest with unique values $\{x_{11}, x_{12}, \ldots, x_{1k}\}$. The partial dependence of the response on x_1 can be constructed as follows:

1. For $i \in \{1, 2, \ldots, k\}$:
   (a) Copy the training data and replace the original values of x_1 with the constant x_{1i}.
   (b) Compute the vector of predicted values from the modified copy of the training data.
   (c) Compute the average prediction to obtain $\bar{f}_1(x_{1i})$.
2. Plot the pairs $\{x_{1i}, \bar{f}_1(x_{1i})\}$ for $i = 1, 2, \ldots, k$.

Algorithm 1: A simple algorithm for constructing the partial dependence of the response on a single predictor x_1.



1. Single Predictor Plots

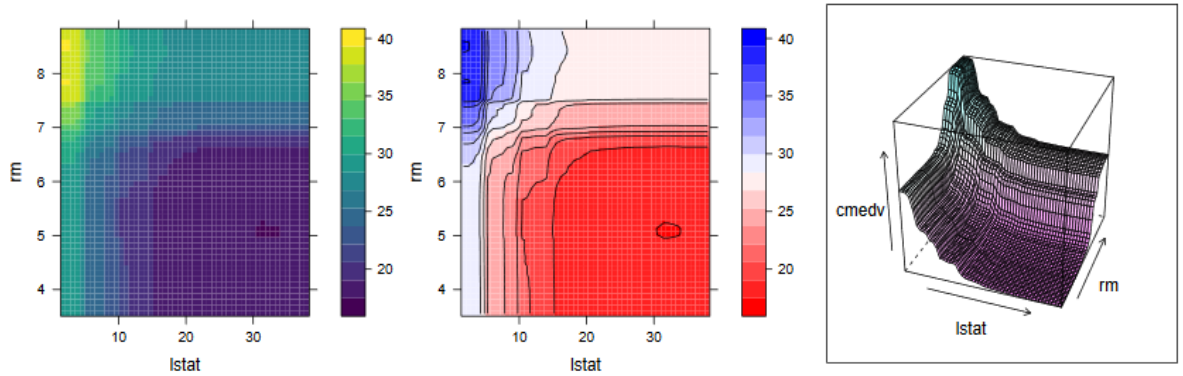


Figure 3: Partial dependence of `cmedv` on `lstat` and `rm` based on a random forest. *Left*: Default plot. *Middle*: With contour lines and a different color palette. *Right*: Using a 3-D surface.

2. Multiple Predictor Plots

Source : https://pdfs.semanticscholar.org/cdfb/164f55e74d7b116ac63fc6c1c9e9cfd01cd8.pdf

BRT Output 3 : Variable interactions Theory of Friedman's H-statistics

- First, a two-way interaction measure that tells us whether and to what extend two features in the model interact with each other;
- second, a total interaction measure that tells us whether and to what extend a feature interacts in the model with all the other features.
- The statistic is 0 if there is no interaction at all and 1 if all of the variance of the PD_{jk} or if is explained by the sum of the partial dependence functions.

$$PD_{jk}(x_j, x_k) = PD_j(x_j) + PD_k(x_k)$$

- where $PD_{jk}(x_j,x_k)$ is the 2-way partial dependence function of both features and $PD_j(x_j)$ and $PD_k(x_k)$ the partial dependence functions of the single features
- Mathematically, the H-statistic proposed by Friedman and Popescu for the interaction between feature j and k is:

$$H_{jk}^2 = \sum_{i=1}^{n} \left[PD_{jk}(x_j^{(i)}, x_k^{(i)}) - PD_j(x_j^{(i)}) - PD_k(x_k^{(i)}) \right]^2 / \sum_{i=1}^{n} PD_{jk}^2(x_j^{(i)}, x_k^{(i)})$$

Advantage of H-statistics interaction index

- The interaction H-statistic has an **underlying theory** through the partial dependence decomposition.
- The H-statistic has a **meaningful interpretation**: The interaction is defined as the share of variance that is explained by the interaction.
- Since the statistic is **dimensionless**, it is comparable across features and even across models.
- The statistic **detects all kinds of interactions**, regardless of their particular form.
- With the H-statistic it is also possible to analyze arbitrary **higher interactions** such as the interaction strength between 3 or more features.

2.0 MATERIALS AND METHODS to calculate Percentage of Difference (%)

In this study, we estimate the impact of COVID-19 on air pollution by using Eq. (1) given by Mohd Talib et al. (2021):

Percentage of Difference (%) or PD = ((A – B) / B) x 100,

where
A = Concentration of air pollution recorded during the MCO in 2020.
B = The concentration of air pollution recorded in the same period in 2019 or 2018

SITE LOCATIONS INPROGRESS

REPUBLIC OF TÜRKİYE
MINISTRY OF ENVIRONMENT, URBANIZATION AND CLIMATE CHANGE

T.C. ÇEVRE, ŞEHİRCİLİK VE İKLİM DEĞİŞİKLİĞİ BAKANLIĞI

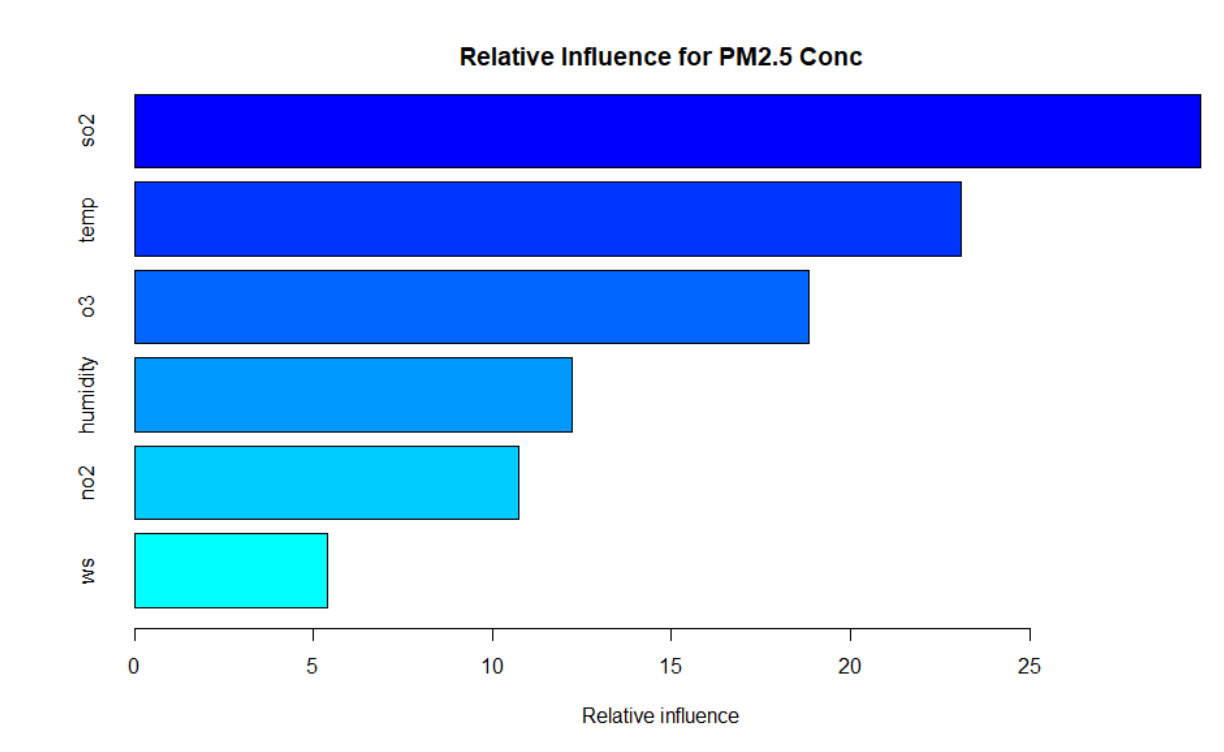
İSTANBUL TEKNİK ÜNİVERSİTESİ 1773

Antalya is the fifth-most populous city in Turkey as well as the capital of Antalya Province. It is seen as the "capital of tourism" in Turkey.
Located on Anatolia's southwest coast bordered by the Taurus Mountains, Antalya is the largest Turkish city on the Mediterranean coast outside the Aegean region with over one million people in its metropolitan area.
Antalya has a hot-summer Mediterranean climate (Köppen: Csa) or a 'humid' dry-summer subtropical climate
The highest recorded air temperature reached 45.4 °C (113.7 °F) on 1 July 2017 which normally averages as high as 34.4 °C (93.9 °F) and the lowest record dropped to −4.6 °C (23.7 °F) in February.

SITE LOCATION: ALTANYA CITY Air Quality Monitoring Station

To investigate the Relative Variables Important (RVI) values (%) between variables that influenced to the formation of PM2.5 concentrations before and during MCO by using boosted regression tree (BRT) technique.

Relative influence for PM2.5 concentration 2020



Variables	Relative influence in %
SO2	29.78
O3	18.88
NO2	10.71
TEMP	23.07
HUMIDITY	12.22
WS	5.39
WD	NA

To estimate the Strength of Interaction (SIE) Index between variables to the formation of fine particles before and during MCO using boosted regression tree (BRT) technique.

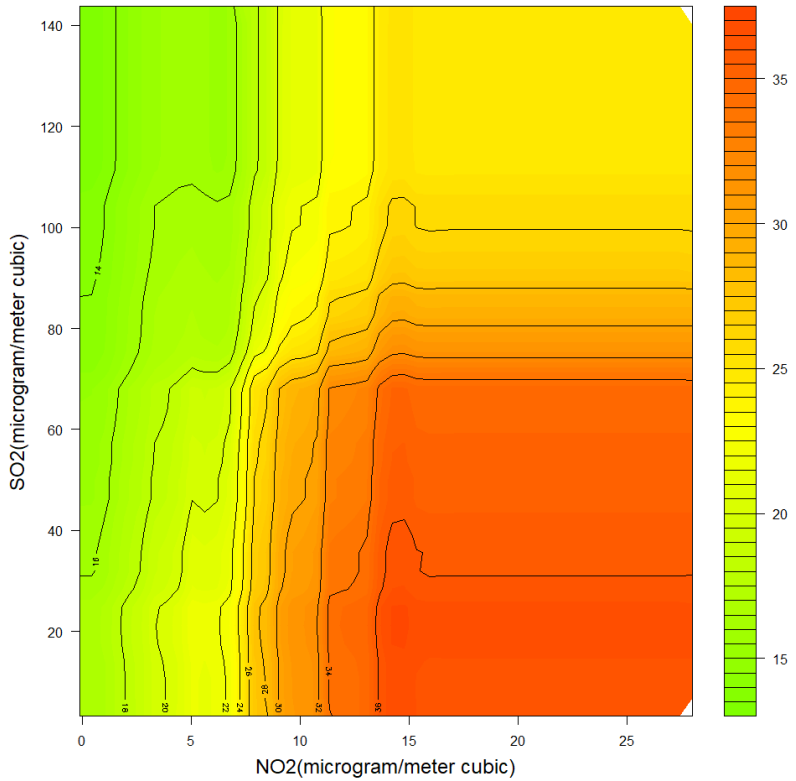
The Boosted Regression Trees Algorithm Setting for Altanya 2020 station

```
altanya2020BRT<- gbm(pm2.5 ~ no2 + so2 + o3 + ws + temp + humidity,
data = altanya2020NEW,   distribution ="gaussian",   n.trees = 10000,
# number of trees  shrinkage =0.001,
# shrinkage or learning rate, 0.001 to 0.1 usually work
interaction.depth = 5,
# 1: additive model, 2: two-way interactions, etc
bag.fraction = 0.5,
train.fraction = 0.7,
cv.folds = 10,
keep.data = TRUE,  verbose = TRUE,
n.minobsinnode = 10)
```

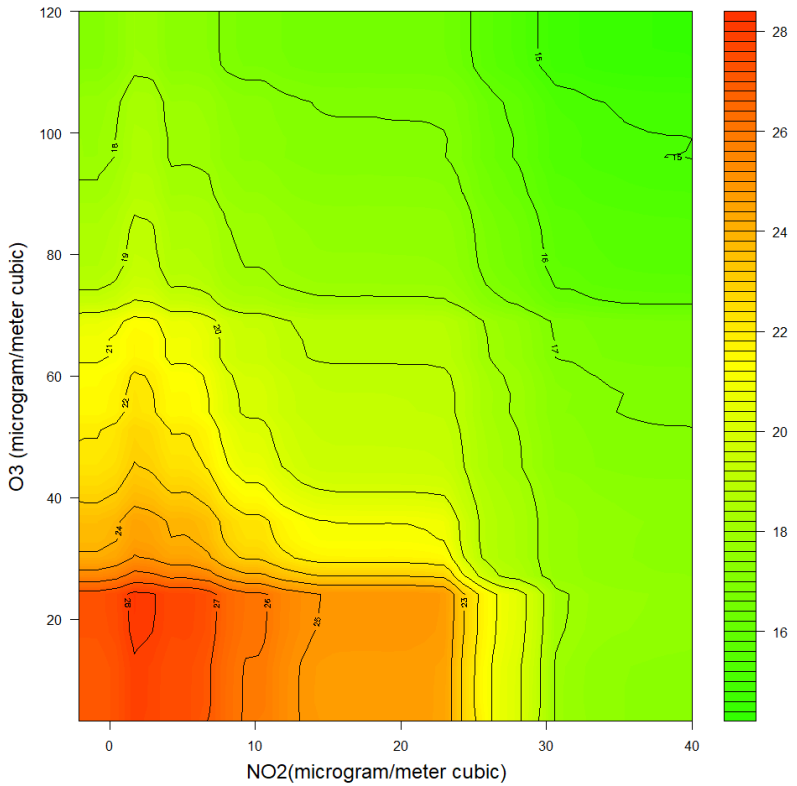
Variables	Variable Name	Interactions 2020 (CURRENT-MCO)
2-1	NO2-SO2	0.34
2-3	NO2-O3	0.12
3-4	O3-ws	0032
1-3	NO2 –O3	0.440
1-6	NO2 - WS	0.075
2-4	SO2 - WS	0.045
3-4	O3-WS	0.033
1-5	NO2- TEMP	0.27
2-5	SO2-TEMP	0.284
3-5	O3-TEMP	0.
4-5	WS-TEMP	0.096
1-5	SO2-TEMP	0.284
1-6	NO2-HUMIDITY	0.14
5-8	SO2-HUMIDITY	0.20

Strength of Interaction Effects (SIE) for PM2.5 in Antalya Station in 2020

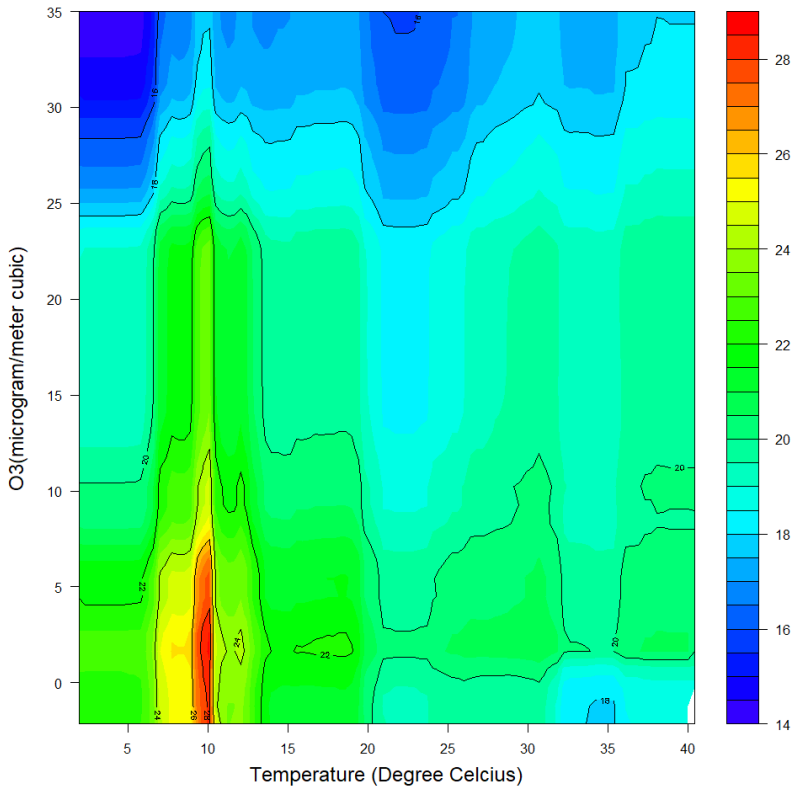
Strength of Interaction Effects (SIE)
NO2 and SO2 = 0.34



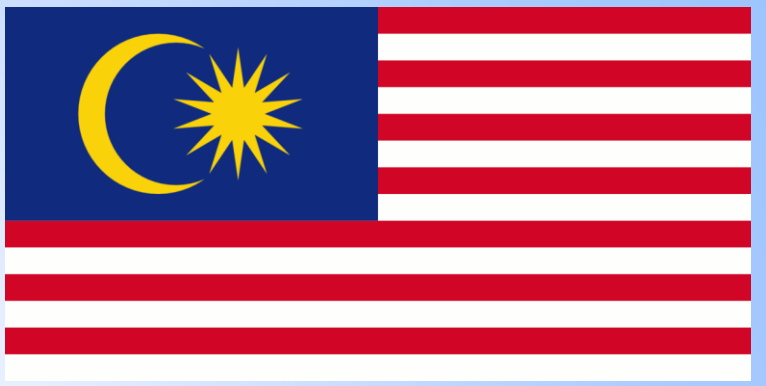
Strength of Interaction Effects (SIE)
NO2 and O3 = 0.44



Strength of Interaction Effects (SIE)
O3 and Temperature= 0.40



2 Country is MALAYSIA



- Malaysia
- Country in Asia
- Malaysia is a Southeast Asian country occupying parts of the Malay Peninsula and the island of Borneo. It's known for its beaches, rainforests and mix of Malay, Chinese, Indian and European cultural influences. The capital, Kuala Lumpur, is home to colonial buildings, busy shopping districts such as Bukit Bintang and skyscrapers such as the iconic, 451m-tall Petronas Twin Towers. — Google
- Population: 32.37 million (2020) World Bank
- GNI per capita: 27,370 PPP dollars (2020) World Bank
- Population growth rate: 1.3% annual change (2020) World Bank
- Fertility rate: 1.98 births per woman (2019) World Bank
- Life expectancy: 76.16 years (2019) World Bank
- Official language: Malay

Your logo here

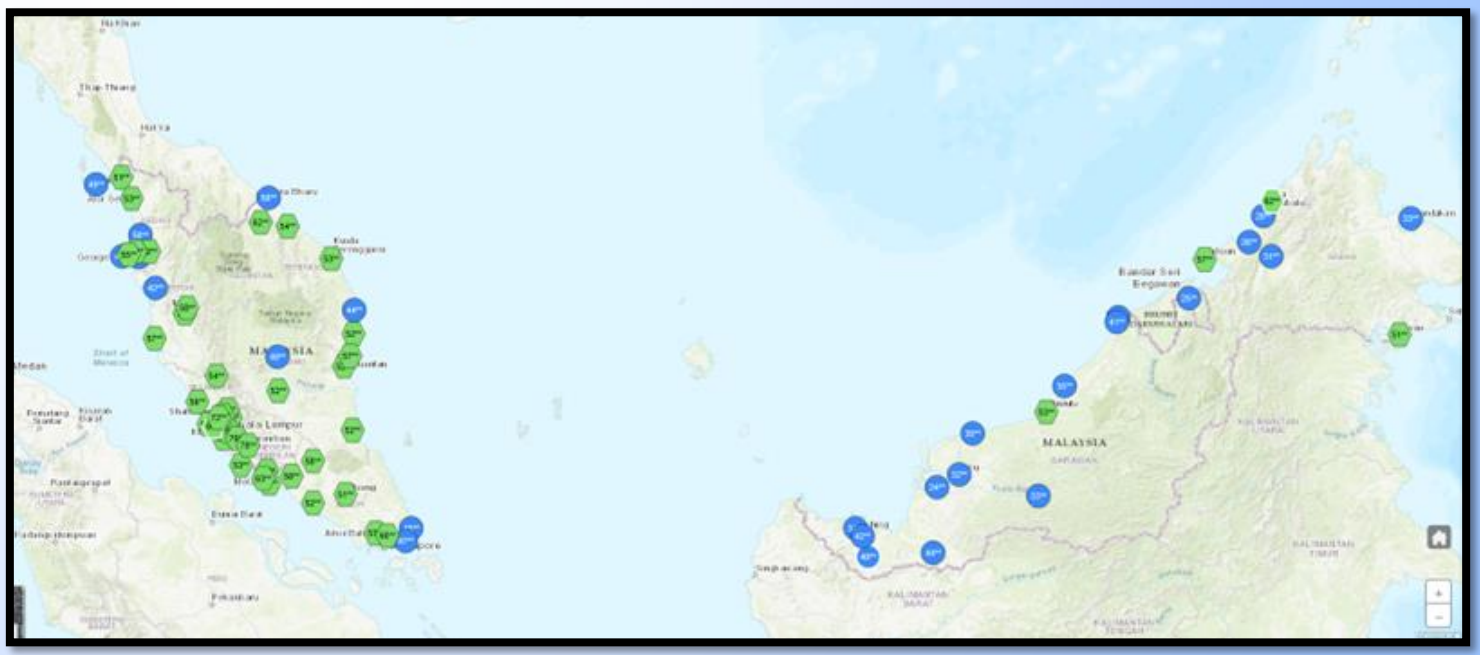
The 65 Continous Air Quality Malaysian by station classifications

CAQM stations through out Malaysia and its Air Quality Indexs taken on 20/4/2022

This study will analyse sixteen (16) major cities in Malaysia including Sabah and Sarawak consisting of 5 industrial category stations out of 7, 3 urban category stations out of 10, 2 rural category stations out of 12, 5 sub-urban category stations out of 35 and 1 background category station. The five categories of stations were selected to understand the past and current variability of ambient air pollutants and meteorological parameters.

This enables compare with the Malaysia Air Quality Guidelines as part of the baselines study.

ITEM	CLASSIFICATIONS	NO. CAQM STATIONS
1	INDUSTRIAL	7
2	URBAN	10
3	SUB-URBAN	35
4	RURAL	12
5	BACKGROUND	1



Case Study in Klang Port City in Malaysia

Study area (Klinik Kesihatan Pandamaran, Klang, Selangor)

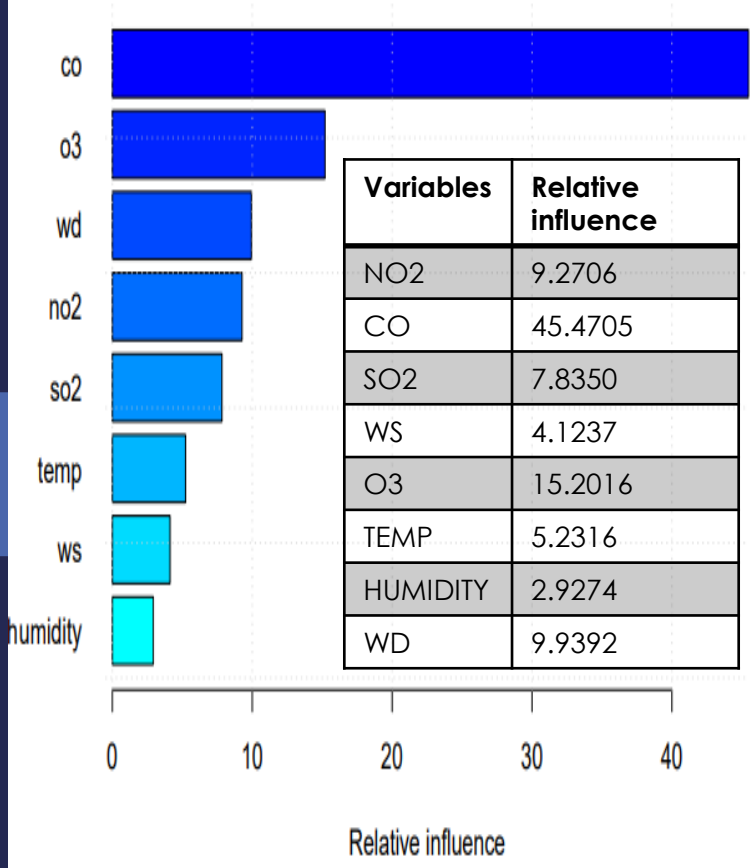
(3° 00' 05.14" N, 101° 23' 34.19" E)

3.0 Results
Comparison between variables for the year 2019 and 2020

PARAMETER	PM2.5	PM10	SO2	NO2	O3	CO	WS	WD	TEMP	HUMIDITY
2019 MEAN CONCENTRATION	33.050	41.487	0.0013	0.0179	0.0137	1.048	1.400	163.77 0	28.58 0	78.960
2020 MEAN CONC.	23.238	33.770	0.0014	0.0150	0.0160	0.787	1.345	164.14 0	28.52 0	80.830
PERCENTAGE DIFFERENT (%)	34.8636	20.5084	-7.2464	17.6829	-15.5405	4.0072	4.0073	0.2257	0.2101	2.3406
INCREAMENT (positive or negative)	positive	positive	negative	positive	negative	positive	positive	positive	positive	positive

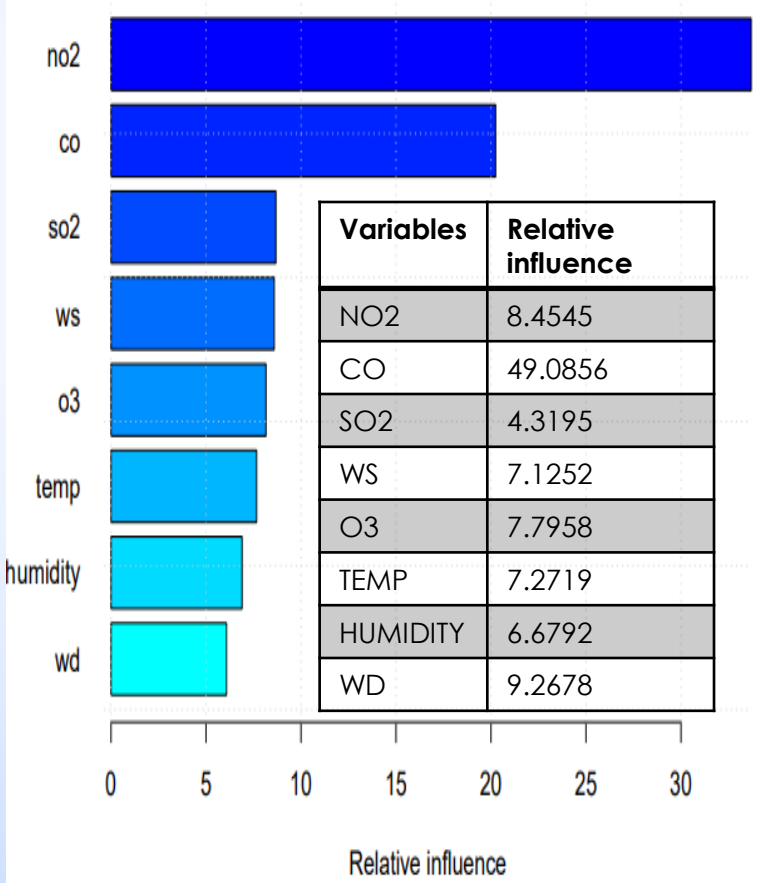
To investigate the Relative Variables Important (RVI) values (%) between variables that influenced to the formation of PM2.5 concentrations before and during MCO by using boosted regression tree (BRT) technique.

Relative influence for PM2.5 concentration 2019



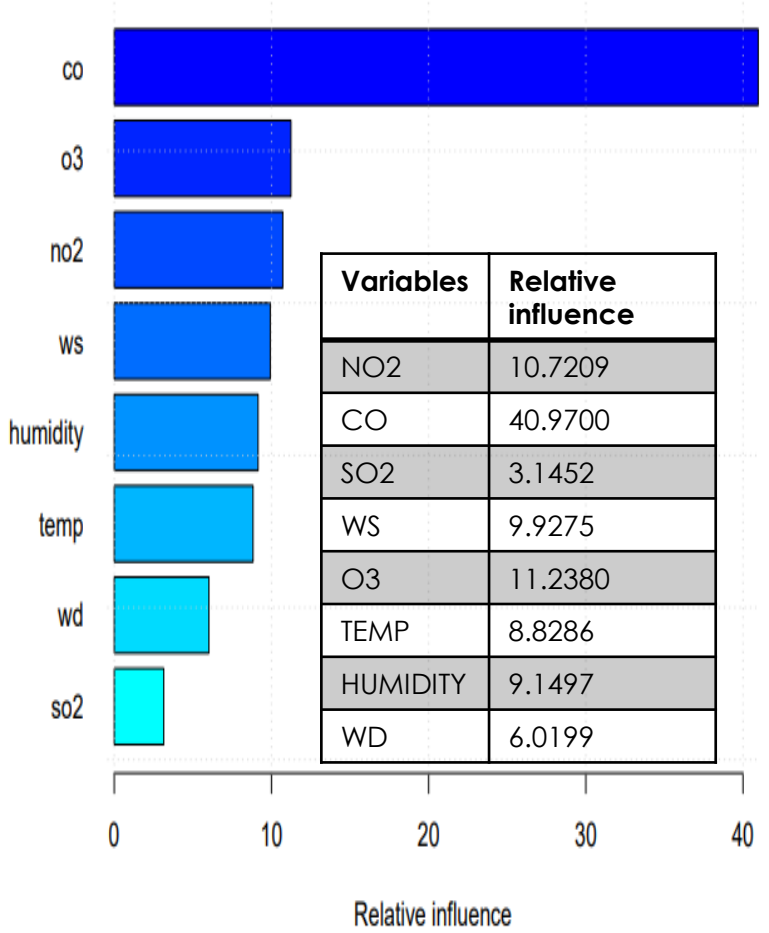
Variables	Relative influence
NO2	9.2706
CO	45.4705
SO2	7.8350
WS	4.1237
O3	15.2016
TEMP	5.2316
HUMIDITY	2.9274
WD	9.9392

Relative influence for PM2.5 concentration 2020



Variables	Relative influence
NO2	8.4545
CO	49.0856
SO2	4.3195
WS	7.1252
O3	7.7958
TEMP	7.2719
HUMIDITY	6.6792
WD	9.2678

Relative influence for PM2.5 concentration 2021

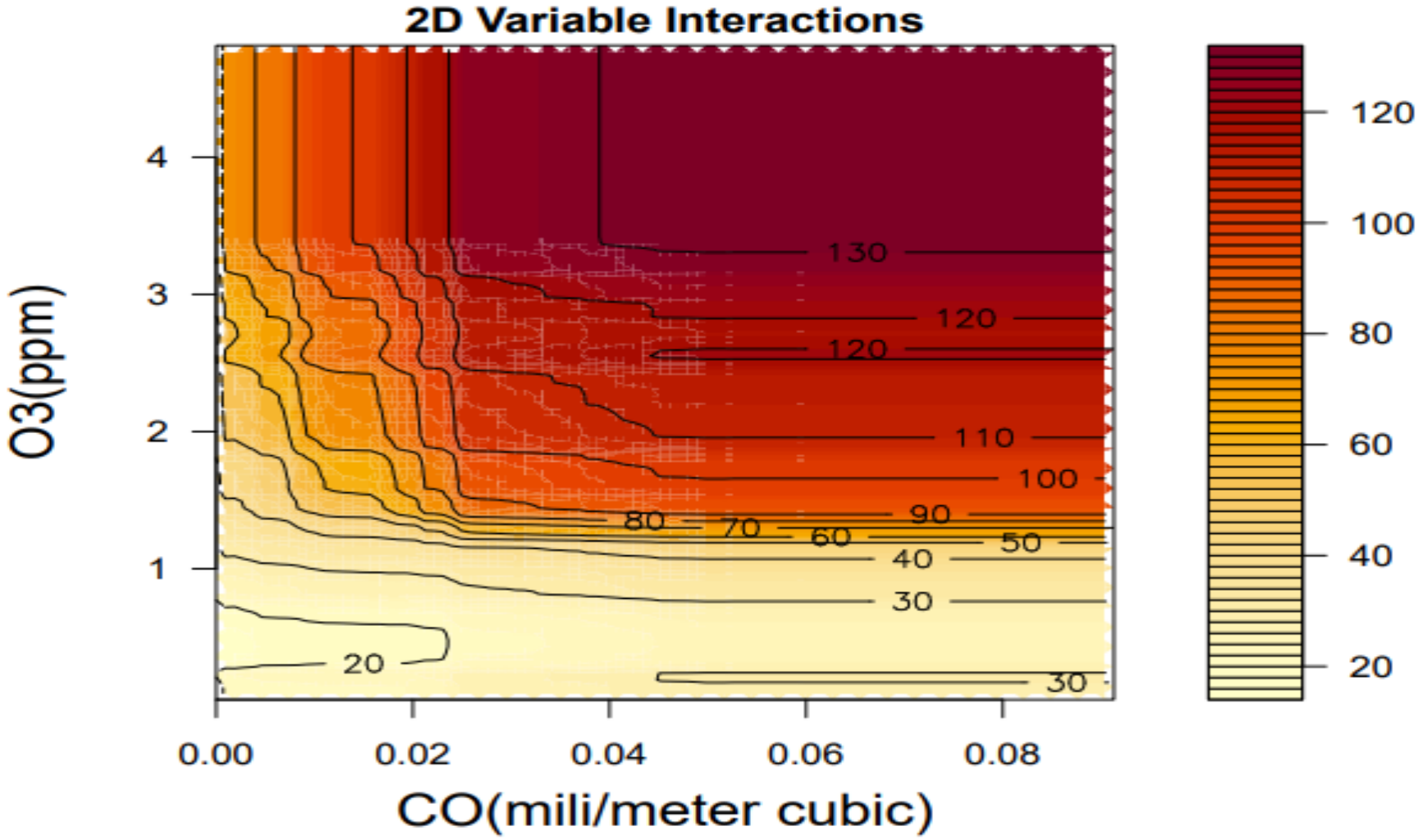


Variables	Relative influence
NO2	10.7209
CO	40.9700
SO2	3.1452
WS	9.9275
O3	11.2380
TEMP	8.8286
HUMIDITY	9.1497
WD	6.0199

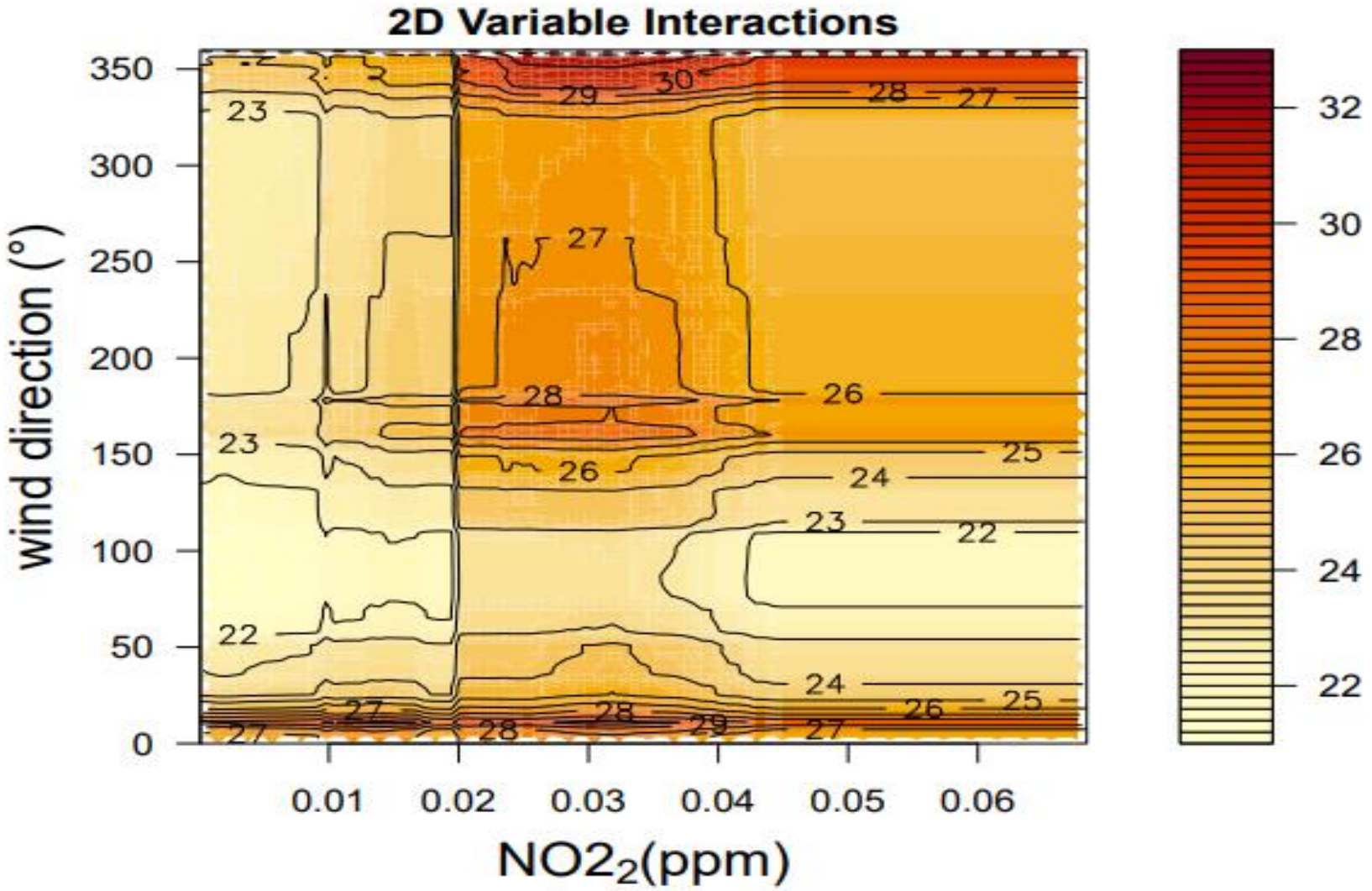
To estimate Strength of Interaction (SIE) Index between variables to the formation of fine-particles before and during MCO using boosted regression tree (BRT) technique.

Variables	Variable Name	Interactions 2019 (NON-MCO)	Interactions 2020 (CURRENT-MCO)	Interactions 2021 (AFTER-MCO)
2-1	NO2-SO2	0.0580	0.1255	0.0372
2-3	NO2-O3	0.0757	0.1958	0.14301
3-4	O3-CO	0.4464	0.1085	0.2877
2-5	NO2-WS	0.0929	0.0313	0.0811
1-6	SO2-WD	0.0932	0.2400	0.1920
6-7	WD-TEMP	0.0627	0.0330	0.2433
6-8	WD-HUMIDITY	0.0335	0.0538	0.2308
2-6	NO2-WD	0.0999	0.2555	0.0608
2-7	NO2-TEMP	0.0182	0.0357	0.1062
2-4	NO2-CO	0.2084	0.0783	0.1127
1-7	SO2-TEMP	0.0157	0.0474	0.1642
1-8	SO2-HUMIDITY	0.1053	0.1029	0.0794
5-7	WS-TEMP	0.0282	0.0920	0.1245
5-8	WS-HUMIDITY	0.0743	0.0411	0.1893

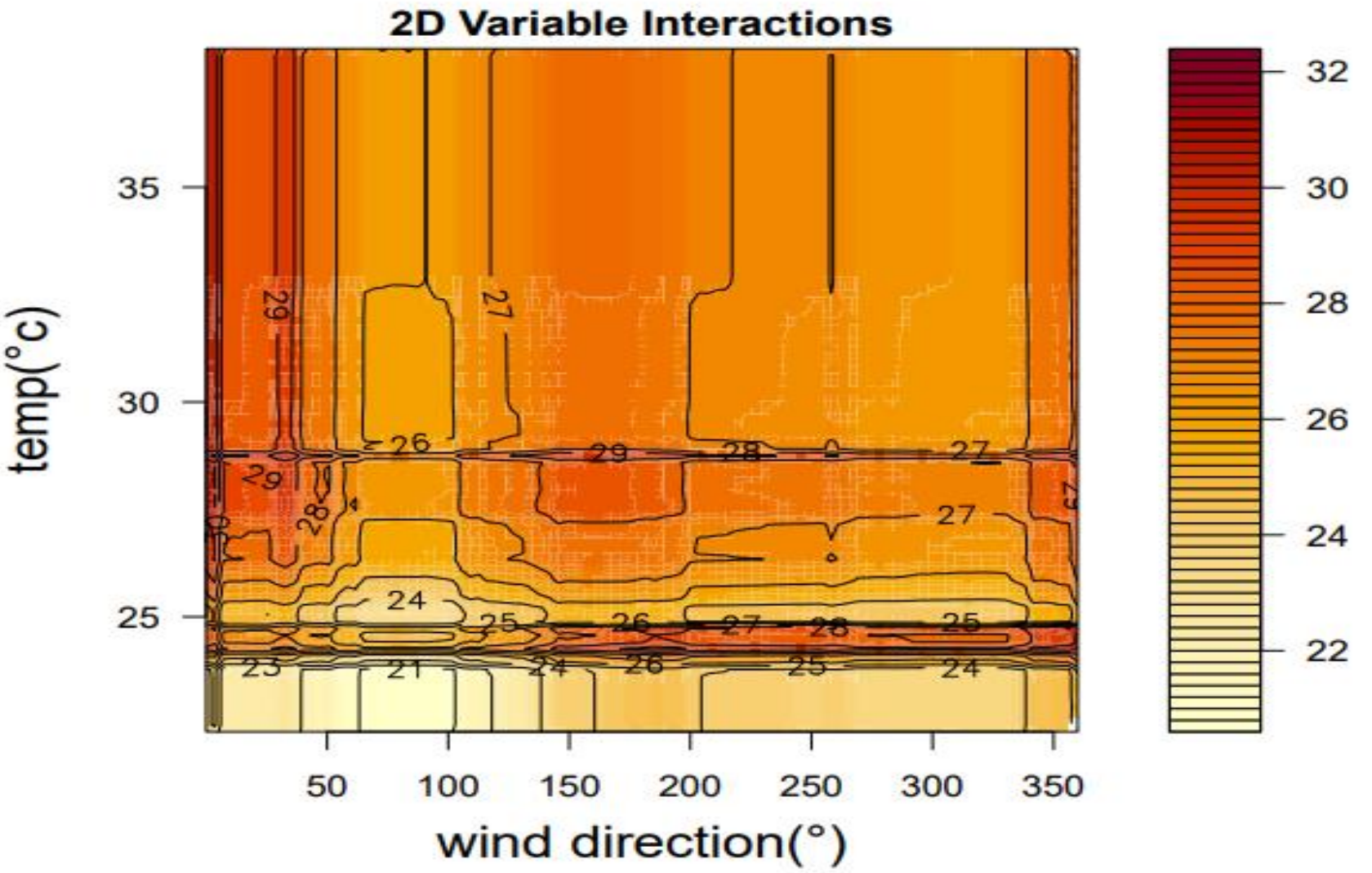
Interactions 2019
(NON-MCO)



Interactions 2020
(CURRENT-MCO)



Interactions 2021
(AFTER-MCO)



4.0 CONCLUSION

- Understanding the RVI and SIE are crucial for the planner and scientist to understand more about the sciences interactions in Port Cities that are not well explained;
- Studying the characteristics of PM_{10}, CO and O_3 was important for improving the quality of life, physical health and the living environment of inhabitants especially when that happening in Port cities;
- However, the factors that influenced to these phenomena are still in study in most cities and expanded locally and globally. The Covid-19 outbreak may be a turning point in combating global climate change as the behaviors of traveling and peoples movement are restricted.
- Further analysis by using The Boosted Regression Trees are still in progress in which will determined factor influenced and interaction between variables and the impact of Pandemic Covid 19 conditions elsewhere;

SAVE THE DATES AND ALL ARE WELCOME TO MALAYSIA

THE CLEAN AIR FORUM SOCIETY OF MALAYSIA

we care for clean air

Terima kasih banyak kerana dapat mengambil bahagian, saya mengucapkan selamat berjaya dan semoga berjaya.

katılabildiğim için çok Teşşekür ederim, Size kolay gelsin ve iyi günler diliyorum.

Thank you very much for being able to participate, I wish you good luck and have a nice day.