



IBTIHAJ ALSIYABI

The Impact of Movement Restrictions during Covid 19 on Concentrations of Nitrogen Dioxide in GCC Countries

Ibtihaj Alsiyabi, GCC-Stat Centre, Muscat, Sultanate of Oman

iAlsiyabi@gccstat.org

Abstract:

Imposing restrictions on movement of individuals and the partial or total lockdowns due to COVID-19 pandemic have had impact on the environment including air quality. The purpose of this paper is to investigate the correlation between lockdowns in Gulf Cooperation Council (GCC) countries between February and June 2020 and the Nitrogen Dioxide (NO₂) concentrations in air. Statistics gathered from Air Matters App. and Copernicus satellite images have proved that lockdowns have resulted in better air quality and less NO₂ concentrations in major cities in GCC countries in the period from February to June 2020.

Keywords:

COVID-19; NO₂ Concentration; air quality; lockdown; curfew.

1. Introduction:

The COVID-19 pandemic was unavoidable and posed a challenge to all countries around the globe. Not only it spreads rapidly, but it is also transmitted directly and indirectly. It is transmitted directly via the respiratory droplets of the infected individuals when sneezing or coughing. It is also transmitted indirectly by surfaces. Research has also shown that even asymptomatic people can transmit the disease (Petrovic & Kocic, 2020). Different measures have been taken around the world to control or minimize the spread of the disease and consequently mitigate its impact on health. One common measure resorted to by governments limiting the movement of citizens within the country through lockdowns, curfews, prohibition of gatherings and cancellation of events. Such restrictions were meant to minimize human interaction as much as possible and in turn minimise the spread of the infection because it has been proven by research that the virus spreads when individuals come in close contact with each other (Nadikattu, Mohammed and Wig, 2020).

Imposing lockdowns and restricting the movement of people meant less use of means of transport, one of the main sources of NO₂ discharges in the air. Although COVID-19 has resulted in negative impact on some sectors (which are not in the domain of this paper), its effect on the environment in general and air quality in particular has been positive since the limited or restricted movement of people resulted in less use of transport whether public or private. The situation also applies to the GCC countries. For example. In Oman the first preventive ‘Stay Home’ action was taken on 29 March, 2020. A complete closure was imposed on Muscat from 10th to 22th April, 2020, extended twice and then lifted on 29 May, 2020. Similarly, the ‘‘Stay Home’’ action was declared on 24th March, 2020, and a curfew was imposed starting from 26th March and was eased gradually starting from 11 May.

This has led to decreasing concentrations of NO₂ in the air in the whole world and in the GCC countries. Copernicus Satellite images in 2020 show the concentrations of NO₂ in the GCC countries. It is evident that the highest concentrations are in major cities in the countries.

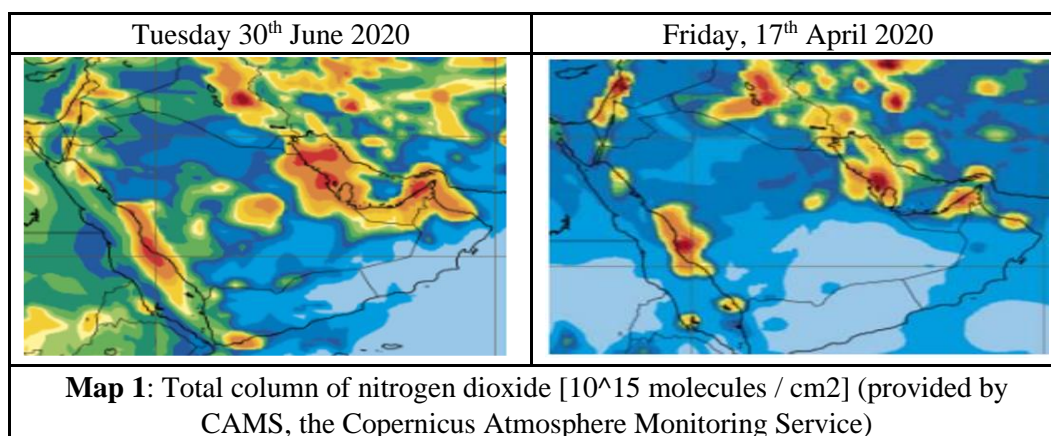


Image taken on two different month's show that NO₂ concentrations were at their lowest in April 2020. However, with the partial relaxations of measures and restrictions, concentrations increased slightly in June.

2. Methodology

The methodology adopted in this paper was collections of data from multiple sources including Air Matters Application that provides real time index for air quality and the Copernicus Satellites Image. Air Mattress has been utilized mainly as a source for daily statistics of NO₂ concentrations in the capital cities of the six GCC countries in the period from February to June. Daily statistics were compiled and the average NO₂ concentrations were calculated on monthly basis for aforementioned months. The choice of the time period of February to June was based on the fact that this were the months of lockdowns and curfews in the GCC countries. Statistics were compared against the lowest air quality standard, which was that of Kuwait Stat at 112 $\mu\text{g}/\text{m}^3$ (GCC Stat, 2020). Records were kept of the measures or restrictions imposed by GCC countries and their relations to NO₂ concentrations.

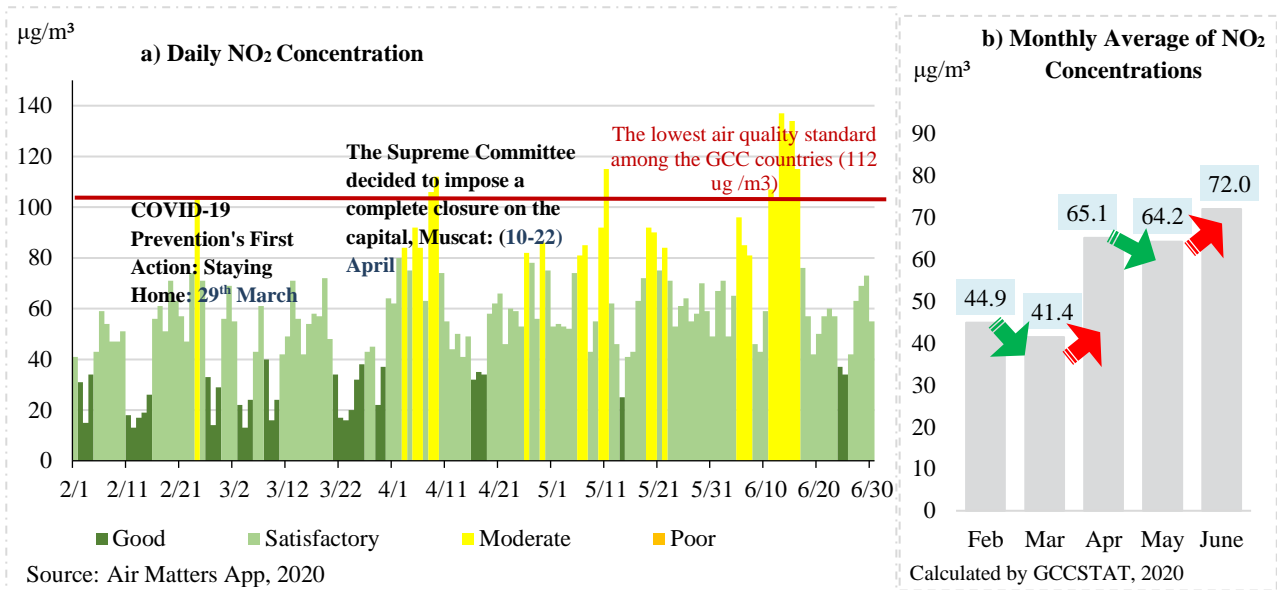
3. Results:

Statistics have shown that strong correlation exists between NO₂ concentrations in the air and lockdowns in the GCC countries. Restricted movement of individuals by means of transport due to lockdown from February to June lead to better air quality with less NO₂ concentrations as evidence shows in selected GCC countries. Images captured by Mohammed Bin Rashid Space Centre has shown a considerable drop in NO₂ emissions in GCC due to fewer vehicles on the road (Al Serkal, 2 April, 2020).

3.1 Sultanate of Oman (OMN)

Reading Recorded in Seeb, which is, located in Muscat City show that NO₂ concentrations of March were less then February by 7.8%. Another decrease followed between April and May 2020, which was 1.4%. This coincided with the closure imposed in between 10th April until 22nd April 2020. Lifting restrictions in June led to an increase by 12.1% in comparison to May 2020.

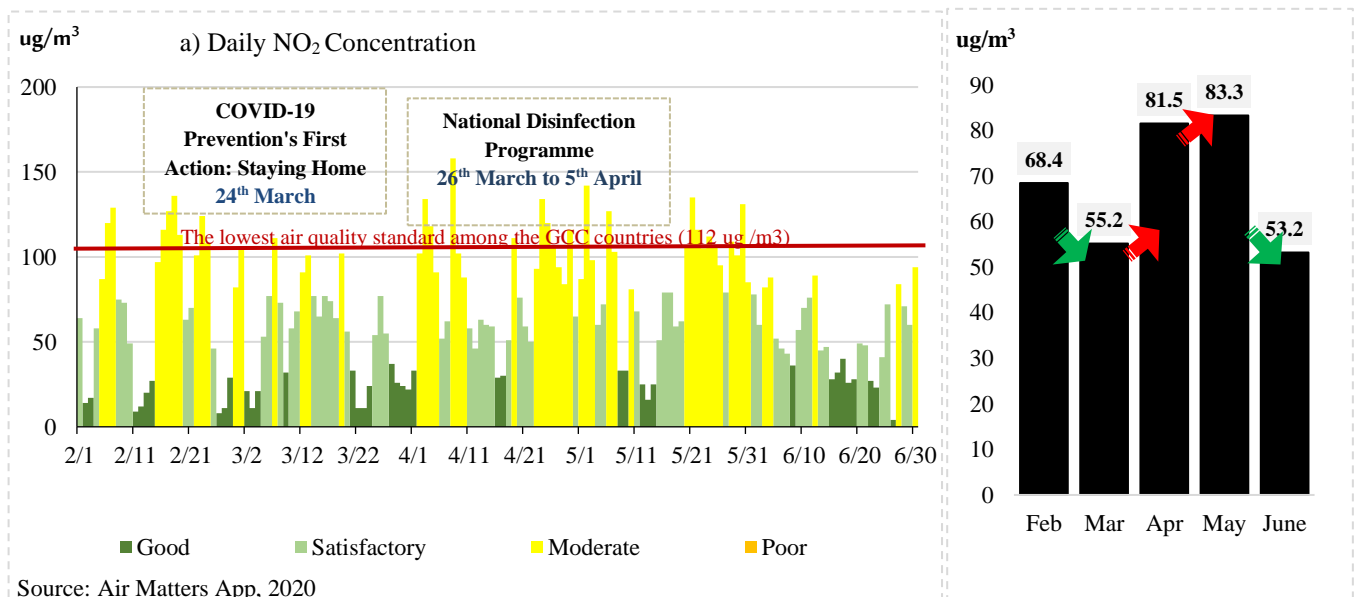
Figure 1: Daily NO₂ Concentration (µg/m³), and Monthly average of NO₂ Concentration (µg /m³) in Seeb Station, Muscat, OMN, and February-June 2020



3.2 United Arab Emirates (UAE)

Figures taken in Al Markaziyah West Station of Abu Dhabi reveal that NO₂ concentrations decreased by 36.1% in June 2020 compared to May 2020. Likewise, the NO₂ concentrations in March 2020 were less than those of February by 19.3%. This is attributed to the measures taking in the country namely the shutdown of shopping malls and the temporary suspension of certain activities such as cinema theatres, fitness gyms and other recreational activities

Figure 2: Daily NO₂ Concentration (µg/m³), and Monthly average of NO₂ Concentration (µg /m³) in Al Markaziyah West Station, Abu Dhabi, UAE, and February-June 2020



4. Discussion and Conclusion:

Measures taken by GCC countries to combat that rapid spread of COVID-19 among its populations have resulted in positive impact on NO₂ air concentrations. Monitoring and NO₂ concentrations in stations in capital cities and investigating their relation with the lockdowns have proved that lockdown, curfews and shutdowns between February and June 2020 resulted in decreasing NO₂ concentrations in the air. This is explained by the fact that lockdowns were directly connected with less use of means of transport considered responsible for NO₂ emissions.

References:

1. Air Mattres. (2020), Al Markaziyah West Air Quality data , Available at: https://air-quality.com/place/ united-arab-emirates/al-markaziyah-west/ea570042?lang=en&standard=aqi_us
2. Air Mattres. (2020), Seeb Air Quality data, available at : https://air-quality.com/place/oman/seeb/0661138a?lang=en&standard=aqi_us
3. Al Serkal, M.M. (2 April, 2020) Coronavirus: Dubai Sat image proves NO2 decline in GCC, Gulf News, Available at <https://gulfnews.com/uae/environment/coronavirus-dubai-sat-image-proves-no2-decline-in-gcc-1.1585821203968> Accessed on 22 March, 2020
4. Gulf Cooperation Council Statistics Center (GCC Stat), (2020). A training course on the environment Statistics Development Framework (FDES) according to the United Nations classification and linked with emergency conditions (Coronavirus - Covid-19), available at: [GCC Statistical Center - - عن بعد - وفقاً لتصنيف الأمم المتحدة - عن بعد - 2020](https://gulfnews.com/uae/environment/coronavirus-dubai-sat-image-proves-no2-decline-in-gcc-1.1585821203968)
5. Nadikattu, R and Mohammad, S and Whig, P, (2020). Novel Economical Social Distancing Smart Device for COVID-19 (July 1, 2020). International Journal of Electrical Engineering and Technology (IJEET), 2020, Available at SSRN: <https://ssrn.com/abstract=364023>
6. Petrovic, N and Kocic, D (2020) IoT-based System for COVID-19 Indoor Safety Monitoring, Available at: https://www.researchgate.net/publication/343231422_IoT-based_System_for_COVID-19_Indoor_Safety_Monitoring
7. The Copernicus Atmosphere Monitoring Service. (2020). Nitrogen Dioxide forecasts. Retrieved from: https://atmosphere.copernicus.eu/charts/cams/nitrogen-dioxide-forecasts?facets=undefined&time=2021032100,3,2021032103&projection=classical_northern_africa&layer_name=composition_no2_totalcolumn