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# Poster Book

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**Unleashing Potentials  
Shaping the Future**

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# Night Light Changes in Kuala Lumpur caused by Human Activities due to the Pandemic COVID-19

## INTRODUCTION

In reaction to the COVID-19 pandemic, the Malaysian government has established extensive physical distancing measures to prevent and control the spread of the virus. Visible Infrared Imaging Radiometer Suite Day/Night Band (VIIRS-DNB), a new generation of spaceborne low-light imaging, has the potential to detect changes in nighttime light (NTL) caused by changes in human activities. However, to understand how the community has complied with COVID-19 regulation by measure the value of NTL before, during and after the occurrence of COVID-19. Therefore, this study aims to measure night-time light (NTL) before and during COVID-19 using multi-year monthly time series data (2019–2021) obtained from the VIIRS night-time light (NTL) product. This study covers urban areas in Kuala Lumpur and NTL has been processed using the Google Earth Engine (GEE) platform.

## DATA & METHODOLOGY

1. The National Oceanic and Atmospheric Administration (NOAA) produces monthly composite products and conducts VIIRS-DNB at the Suomi National Polar Orbit Partnership (Suomi-NPP).
2. The product spans the globe from 75 N to 65 S latitude and is stored with a 15-second arc geographic grid (about 500m at the equator). The monthly product's average radiance value is expressed in nanoWatts/cm<sup>2</sup>/sr, and the data accuracy is eight decimal places.
3. With data set size up to petabytes, remote sensing (RS) needed a great system to manage and analyse large volumes data and it was impractical to use standard software packages and desktop computing to process all the RS images.
4. Therefore, Google has developed a cloud computing platform called Google Earth Engine (GEE) to address the challenges of big data analytics effectively. Starting in 2010, the platform has proven its high potential for different applications until the last few years.
5. The GEE platform is used to access VIIRS DNB data using JavaScript code.
7. Meanwhile, information on movement control orders (MCO) was obtained from the National Security Council (NSC) (<https://www.mkn.gov.my/web/ms/>).

## RESULTS

Night-time radiance in Kuala Lumpur from 2019 to 2021

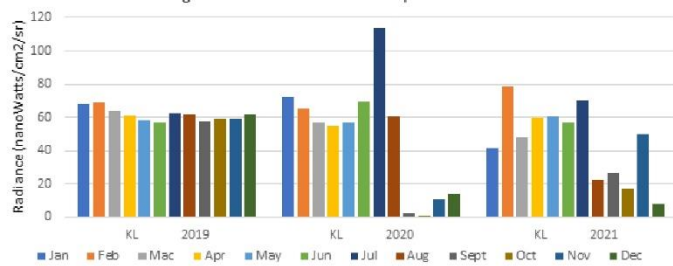


Fig. 1: Bar graph of nighttime light in radiance for Kuala Lumpur from VIIRS data

Night-time radiance in Kuala Lumpur from 2019 to 2021

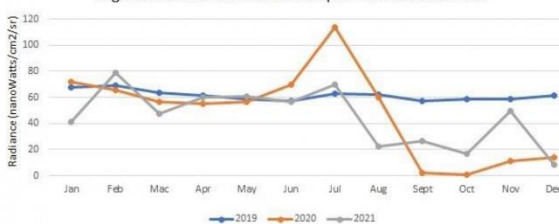


Fig. 2: Line Graph of monthly NTL values from 2019-2021

## PROBLEM STATEMENT

Numerous studies in applied economics have recently used satellites to measure nighttime light (NTL). The vast majority understood the connection between human actions and our environment globally without depending on frequently disparate national statistics. There are two data sets give the NTL values are from the Defense Meteorological Satellite Program (DMSP) and the Visible Infrared Radiometer Suite (VIIRS). Compared to DMSP, VIIRS data demonstrated an 80 per cent higher efficacy for data on subnational GDP. No other studies in Malaysia use NTL from satellite remote sensing to detect human activities. Thus, this study aims to measure NTL before and during COVID-19 using multi-year monthly time-series data (2019–2021) obtained from nighttime light products (NTL) VIIRS covering urban area in Kuala Lumpur to comprehend how people have complied with COVID-19 dealings within two years of the outbreak. These images are processed in the GEE platform.

## OBJECTIVES

To measure NTL before and during COVID-19 using multi-year monthly time-series data (2019–2021) obtained from nighttime light products (NTL) VIIRS covering urban area in Kuala Lumpur to comprehend how citizen have complied with COVID-19 regulations within two years of the outbreak.

## RESULTS

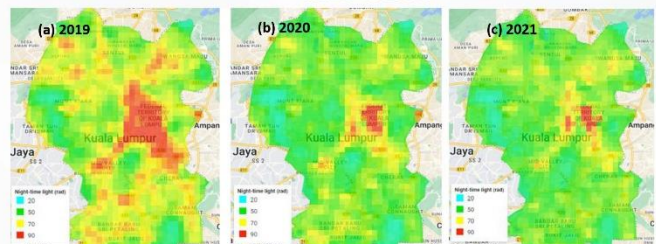


Fig. 3: Map of nighttime light in radiance for Selangor, KL and Putrajaya (a) 2019, (b) 2020 and (c) 2021 from VIIRS images



Fig. 4: Centre of Kuala Lumpur showing NTL Map from 2019-2021

The zoom-in map (Fig. 4a-4c) of KL for 2019 clearly shows red with a large area compared to the map in 2020 and 2021. The bright red area is the main city centre area namely Bukit Bintang, Pudu, Brickfields, Mid Valley City, Chow Kit, Kuala Lumpur Sentral, Kampung Baru and Titivangsa Central. Different from the 2020 and 2021 maps, the areas that show bright red are only Bukit Bintang and Kuala Lumpur City Center.

An independent sample t-test was used to check for NTL reduction before COVID-19 and during COVID-19 for Kuala Lumpur. The p value for Kuala Lumpur is 0.01687 and less than 0.05 means that there is a significant difference between the reduction of NTL before and during COVID-19.

## CONCLUSION

Examination of night light (NTL) data from VIIRS satellite images (DNB) proves that night light can be used to estimate human activity before and during the COVID-19 pandemic quite accurately. Next, this study also shows that high-quality night light datasets can be efficiently developed on a large scale coverage using cloud computing in Google Earth engine.

## NOVELTY

There was no study yet to determine human activities in Malaysia using NTL from satellite images.

## PUBLICATION

This study is part of a study from research published in articles DOI: 10.1109/ICSGRC55096.2022.9845177