COVID-19 Socio-economic Impact Assessment Using Night-time Light Earth Observation

H. Miyazaki
Center for Spatial Information Science, University of Tokyo
Contact: <heromiya@csis.u-tokyo.ac.jp> Web: < http://heromiya.net/>

(1) Introduction: The COVID-19 forced people to stay home, keeping away from businesses and operations, and left a notable socio-economic impact in the countries. The consequences need to be measured for the governments and public agencies for allocating budgets and investments for recovery from the recession. Night-time light earth observation is a useful data resource with a high-frequency, real-time, and broad coverage, beneficial in the emergency. This study aims to develop a method to measure socio-economic impact from satellite night-time light observation.

(2) Method: This study used VNP46A1 - VIIRS/NPP Daily Gridded Day Night Band 500 m Linear Lat Lon Grid Night published by NASA on the website (NASA, 2020). The image data represents night-time light intensity from ground objects, such as buildings, industrial firms, aurora, and wildfire. Although the data is distributed on a daily, it is hard to acquire daily observations because of cloud contaminations and lunar reflections, causing inconsistent baselines among days. Therefore, we aggregated the daily data on a monthly basis by pixel. The aggregation was with calculating median value by pixel among the monthly periods so that outlier pixel values like cloud covers were eliminated. We applied the aggregation to the data set for the period between December 2019 and July 2020 to compare pre- and post-crisis of COVID-19, covering target areas around the Tokyo Metropolitan Region.

(3) Result: We observed a reduction of the night-time light from April 2020 to May 2020, during the state of emergency, and still in a decreasing trend for June 2020 even after deactivating the state. The degree of reduction differed by areas. For example, the commuting areas for the business center districts reduced the night-time light emission intensively while the business center districts likely kept brightness over the months. As the results indicate, the outputs are useful to identify places and areas with the most impact of the COVID-19. Not only with the public health crisis, but it would also be helpful for humanitarian responses to large-scale
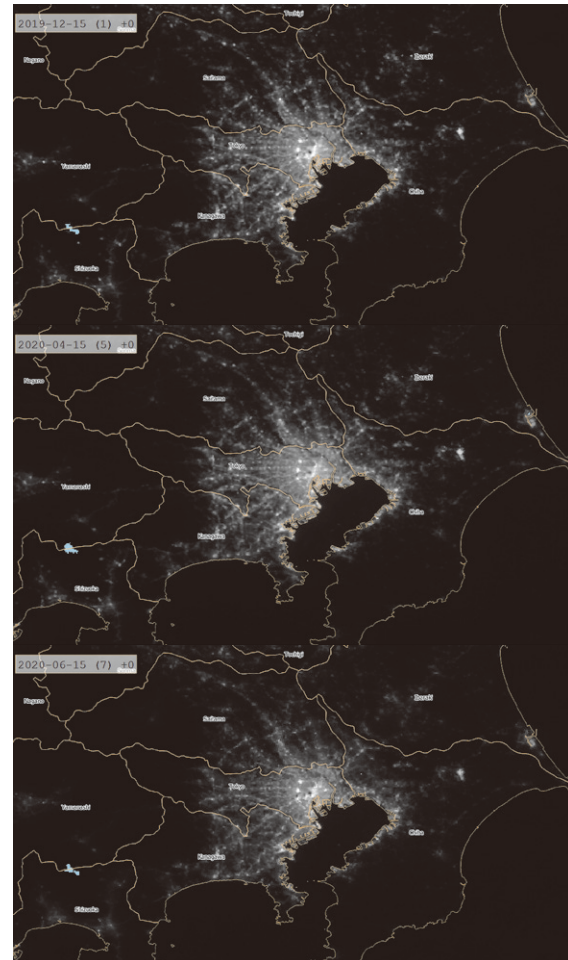

Figure1: Night-time light observation around Tokyo Metropolitan Region. Top: December 2019, middle: April 2020, bottom: June 2020

natural disasters, such as earthquakes, typhoons, and floods.

(4) Data:

· VNP46A1 - VIIRS/NPP Daily Gridded Day Night Band 500 m Linear Lat Lon Grid Night

(6) Reference：

NASA (2020), VNP46A1 - VIIRS/NPP Daily Gridded Day Night Band 500 m Linear Lat Lon Grid Night, visited 30 September, https://ladsweb.modaps.eosdis.nasa.gov/missions-and-measurements/products/VNP46A1