第Ⅶ部門　**Assessment of Estimation Model of Material Stock of Buildings with S-NPP VIIRS Nighttime Light Data**

名古屋大学工学部　学生会員　○SELENGE DIMA
名古屋大学院環境学研究科　学生会員 西尾文吾　朝隈友哉 正会員　奥岡桂次郎　谷川寛樹

1. Introduction

In 2050, world population will reach 9.5 billion (UN, 2014). Due to urban expansion the global material resource use is likely to continue increasing on current trends. From the viewpoint of natural resources finiteness and environmental impact, it is important to reduce the demand and the wastes of natural resources to achieve a sustainable society.

For sustainable society, it is important to measure "Material stock" which is the natural resource accumulated in society, and grasp its distribution and movement. Material Stock Flow Analysis (MSFA) is known as one of the best methods to analyze the resource accumulated in human society. However, it is difficult to apply MSFA to developing countries because of limited data recourses.

Recently, nighttime light data is becoming recognized as an effective method to solve these problems.

Liang *et al.* (2014) made the estimation model of in-use steel stock in China's infrastructure using Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS) nighttime light data. However, problems relating to saturation were mentioned in this study. S-NPP VIIRS (Suomi National Polar-orbiting Partnership's Visible Infrared Imaging Radiometer Suite) nighttime light was newly released in 2013, and it has enhancements in spatial resolutions.

This study aims to make a material stock estimation models with S-NPP VIIRS nighttime light data in Tokyo. Moreover, the statistical correlation between nighttime light data and material stock of buildings will be clarified.

2. Methodology

2.1 Database in this study

This study is done using datasets from the S-NPP VIIRS (2015). The products are produced in 15 arc-second geographic grids and it has accurate measurements of low light radiances, which leads to enhanced quantitative applications at night.

To compare with the nighttime light data we made material stock of building data using Z-map. We utilized the method that Tanikawa *et al.* (2011) verified. Tanikawa *et al.* (2011) considered the consistency between building floor area calculation result from Z-map TOWN data II and statistical data. Z-map TOWN II is a building-mapping database made by ZENRIN CO., LTD.

2.2 Building floor area estimation model

In this study, we used the estimation equation as shown below.

$$MS = \alpha NTL \qquad (2.1)$$

Where *MS* is the material stock of buildings, *NTL* is the nighttime light data and α is coefficient to be calculated.

Selenge DIMA, Bungo NISHIO, Tomoya ASAKUMA, Keijiro OKUOKA and Hiroki TANIKAWA
seko0512@gmail.com

3. Result and discussion

Figure 1 shows the material stock of buildings distribution in Tokyo. Figure 2 shows the S-NPP VIIRS nighttime light data in Tokyo.

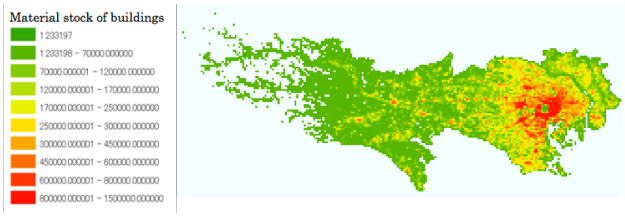

Figure 1. Material stock of buildings distribution in Tokyo (2015)

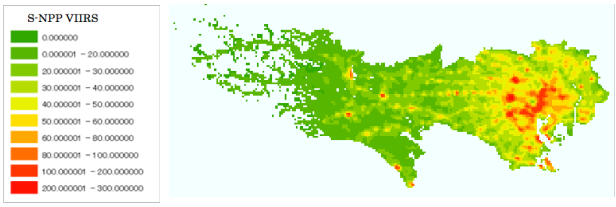

Figure 2. S-NPP VIIRS nighttime light data in Tokyo (2015)

As it can be seen from the two photos the images using material stock of buildings and nighttime light data are very similar to each other.

Figure 3 shows the correlation between material stock of buildings and radiance.

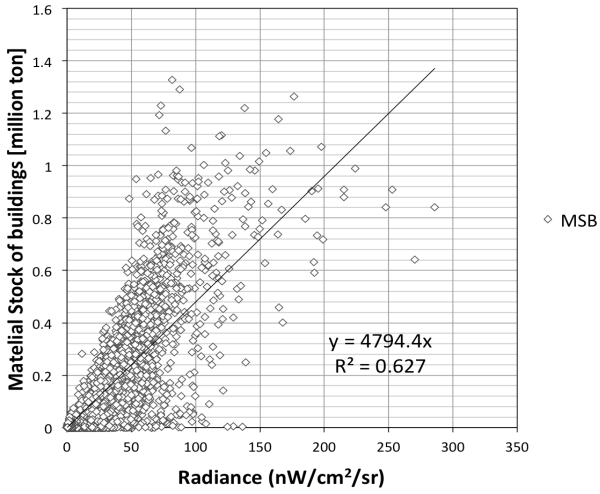

Figure 3. Correlation between material stock of buildings and radiance

Figure 3 shows that there is a statistical correlation between material stock of buildings and radiance (R squared=0.627). However, high radiance can be seen from places with little to no material stock of buildings. One of the reasons for this may be the light emitting from roads. Moreover, lights emitting from airports and ports and may have affected the low statistical correlation between radiance and material stock of buildings.

4.Conclusion and future research

In this study the statistical correlation between radiance of S-NPP VIIRS and material stock of buildings was shown.

This time we only considered the nighttime light data was where buildings were located. However, in reality roads, streetlights, ports and airports have illumination. So, in future researches considering these points can lead to a more accurate estimation model.

References

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