

Analysis of Light Data on the DMSP/OLS Satellite Image Using Existing Spatial Data for Monitoring Human Activity in Japan

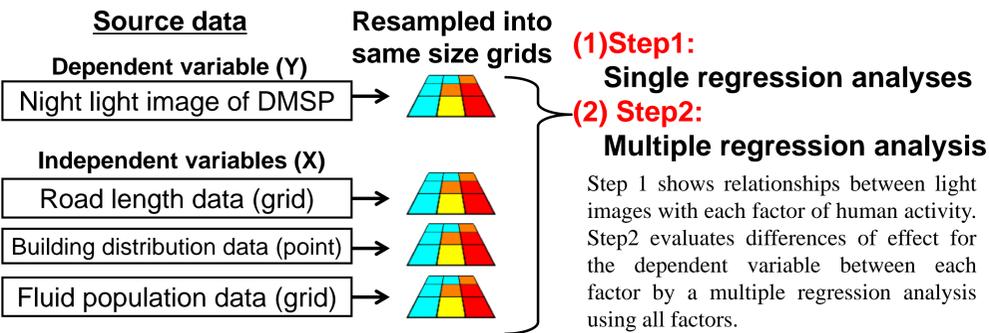
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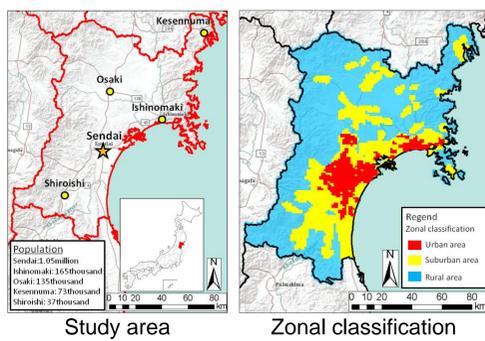
INTRODUCTION

This study shows how much can be monitored various human activities using night light images by the DMSP/OLS from NOAA/NGDC. In Japan, various human activities can be monitored easily without satellite images because there are many kinds of detailed spatial dataset and statistics of Japan. On the other hand detailed spatial data about human activities are not developed adequately in many countries especially in developing countries. It is expected that night light images can alternate such detailed data. Therefore we discuss how to use night light images of the DMSP/OLS for monitoring human activities. This study evaluates performance of satellite images using other spatial data. Especially there are a few studies to evaluate performance of DMSP night light images using detailed spatial data.

ANALYSIS FLOW



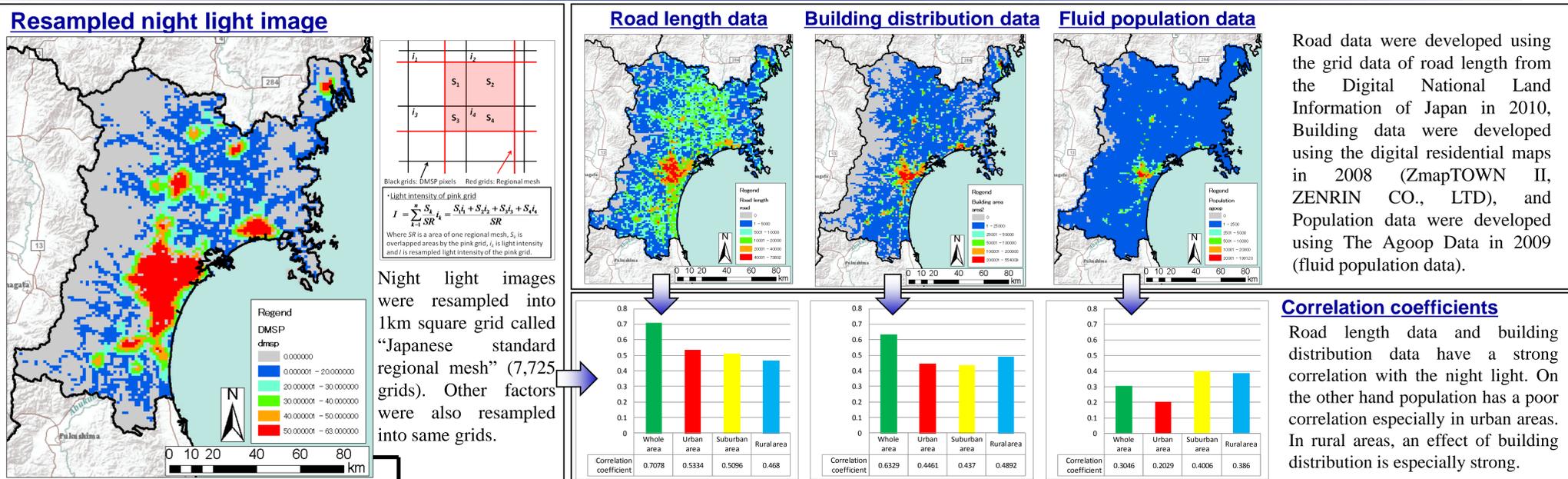
STUDY AREA



A study area is whole area of Miyagi prefecture, Japan. Sendai city, the largest city in the Tohoku region and some small cities are located in this prefecture.

Study area was classified into 3 zones, i.e. Urban area(628 grids), suburban area(2,076 grids) and rural area (5,022 grids) by the Digital National Land Information of Japan in 2006.

DATA DEVELOPMENT AND RESULT OF SINGLE REGRESSION ANALYSES (STEP1)



RESULT OF MULTIPLE REGRESSION ANALYSIS (STEP2)

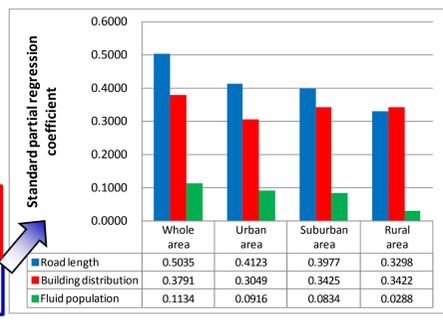
Impacts by road length are strong without relying on areas. It means that lights from cars and night illuminations on road affect the light intensity of DMSP strongly. Impacts by building distribution become strong in suburban and rural area. This is because lights from large-scale factories and waterfront areas and large-scale commercial facilities affect the light intensity. There are few affects by fluid populations.

Using intercepts and coefficients, estimated light intensities can be calculated in each grid.

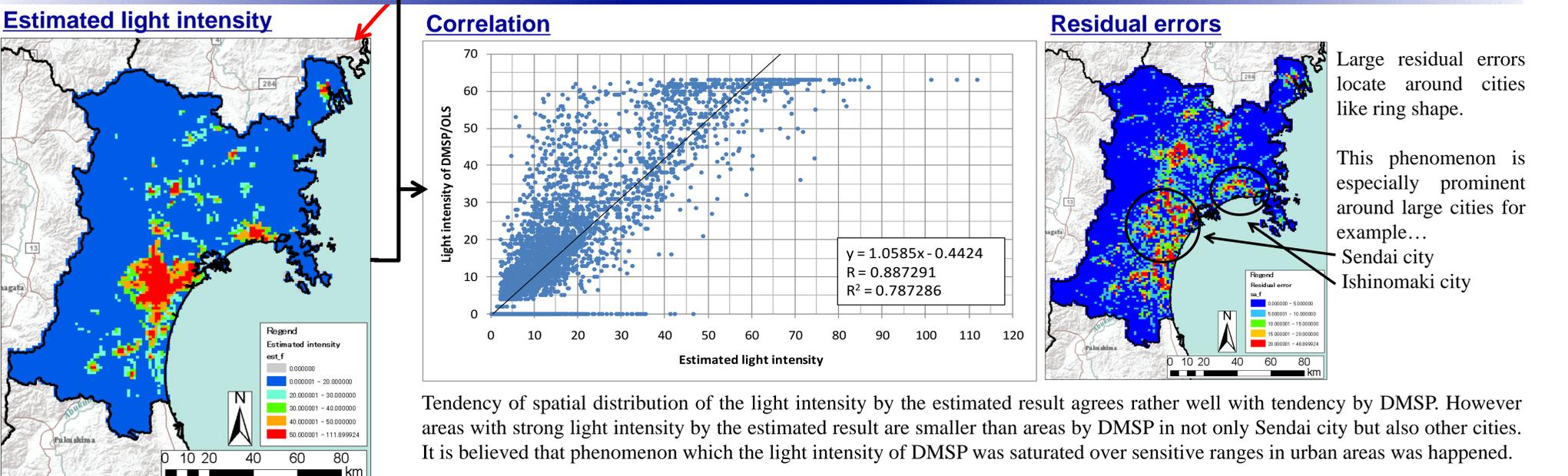
$$y = Rx_1 + Bx_2 + Px_3 + I$$

y: Estimated light intensity
x_n: Independent variables

	Whole area	Urban area	Suburban area	Rural area
Correlation coefficient (R)	0.7495	0.5808	0.5649	0.5770
Coefficient of determination (R ²)	0.5618	0.3373	0.3191	0.3329
Adjusted R ²	0.5616	0.3342	0.3181	0.3325
Standard deviation	11.3193	14.8238	13.8493	5.4556
The number of grids	7725	628	2076	5022
Intercept(I)	2.2768	32.8568	7.0744	0.1868
Coefficient				
Road length (R)	0.001065	0.000468	0.001064	0.000615
Building area (B)	0.000178	0.000064	0.000204	0.000377
Fluid population (P)	0.000505	0.000131	0.001192	0.000851
Standard partial regression coefficient				
Road length	0.5035	0.4123	0.3977	0.3298
Building area	0.3791	0.3049	0.3425	0.3422
Fluid population	0.1134	0.0916	0.0834	0.0288



COMPARISON BETWEEN DMSP AND ESTIMATED LIGHT INTENSITIES



Tendency of spatial distribution of the light intensity by the estimated result agrees rather well with tendency by DMSP. However areas with strong light intensity by the estimated result are smaller than areas by DMSP in not only Sendai city but also other cities. It is believed that phenomenon which the light intensity of DMSP was saturated over sensitive ranges in urban areas was happened.

CONCLUSION

This study showed the relationship between night light images of DMSP/OLS and human activities. Analytical results show that automobile traffics have a major effect on the light intensity of DMSP. On the other hand, the effect by building distribution becomes large in suburban and rural areas. It is also shown that the light intensity of DMSP and accumulation of people do not necessarily accord.