ESTIMATION OF TRANSPORT DEMAND USING SATELLITE

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- We propose a new approach to estimate transport demand using the night-time light satellite image taking the case of Chiang Mai Metropolitan area.
- We found a soft relationship between the night-time light intensity and trip generation/trip attraction.
- Night time light data is spatially more precise than zones of travel demand survey and it has monthly frequency.
- Applying the relationship between transport demand and night-time light intensity, we propose a method to update the transport demand with higher spatial resolution.
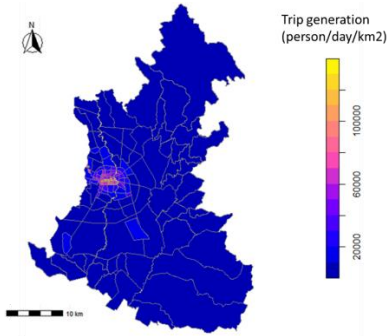

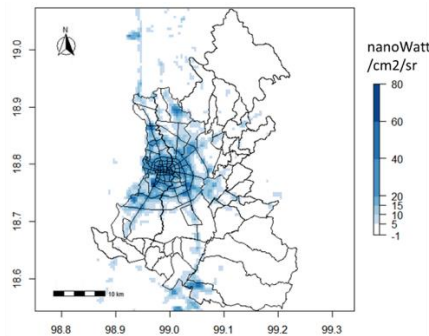Fig.1 Spatial distribution of trip generation

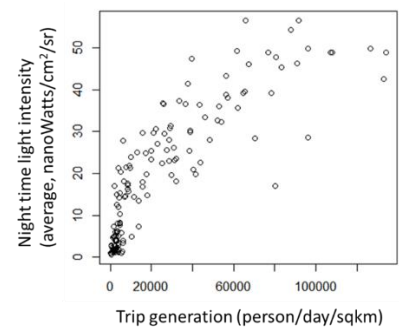Fig.2 Night-time light intensity

Fig.3 Trip generation and night-time light intensity

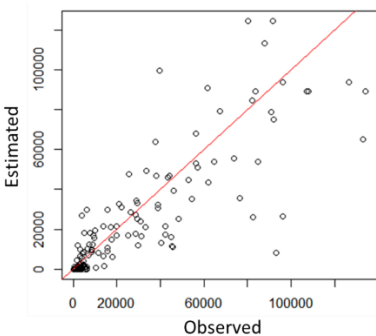Fig.4 Observed and estimated trip generation (trips/sq.km./day)

$$\frac{q_j}{a_j} = \alpha_0 l_j^{\alpha_1}$$

q_j : trip generation or attraction at mesh j, a_j : area of mesh j, l_j : night-time intensity at mesh j, and α_0, α_1 are parameters.

$$\frac{Q_i}{A_i} = \alpha_0 \frac{\sum_{j\in\Omega_i} l_j^{\alpha_1} a_j}{\sum_{j\in\Omega_i} a_j} = \frac{\alpha_0}{|\Omega_i|} \sum_{j\in\Omega_i} l_j^{\alpha_1}$$

Ω_i : set of mesh in zone i, Q_i: trip generation/attraction, A_i : mesh area in zone I, $|\Omega_i|$: number of mesh.

Table 1: Estimated parameters

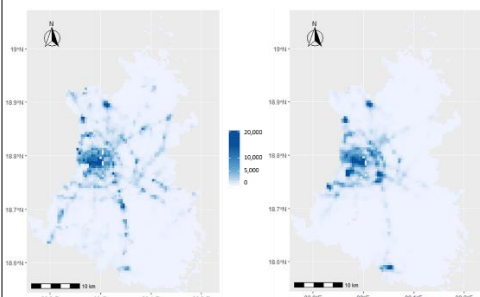|	Trip generation		Trip attraction	
	parameter	t-value	parameter	t-value
α_0	12.73	3.45	183.5	2.94
α_1	2.28	30.29	1.58	17.42
R^2	0.70		0.74	

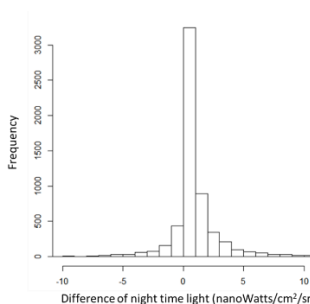Fig.7 Estimated trip generation (left: adjusted, right: non-adjusted)

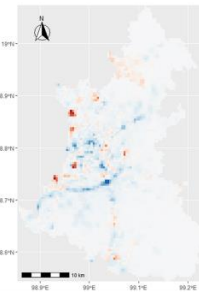Fig.8 Difference of night-time light between 2016 and 2019

Fig.9 Spatial distribution of night-time light change

Taking the case of Chiang Mai Metropolitan Region 2016, we found that night-time light intensity observed by satellite and trip generation have non-linear positive relationship and we estimated a model to calculate the travel demand from night-time light intensity.