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Supplementary Material

Article

A Conceptual Framework for Modeling Spatiotemporal Dynamics of Diesel Attenuation Capacity: A Case Study across Namyangju, South Korea

Livinia Saputra [1,2,†], Sang-Hyun Kim [1,2,†], Kyung-Jin Lee [1], Seo-Jin Ki [3], Ho-Young Jo [4], Seunghak Lee [1,2,5,*] and Jaeshik Chung [1,2,*]

1. Water Cycle Research Center, Korea Institute of Science and Technology (KIST), Seoul 02792, Republic of Korea; livinia@kist.re.kr (L.S.)
2. Division of Energy and Environmental Technology, KIST School, Korea University of Science and Technology (UST), Seoul 02792, Republic of Korea
3. Department of Environmental Engineering, Gyeongsang National University, Jinju 52725, Republic of Korea
4. Department of Earth and Environmental Science, Korea University, Seoul 02841, Republic of Korea
5. Graduate School of Energy and Environment (KU-KIST Green School), Seoul 20841, Republic of Korea

* Correspondence: seunglee@kist.re.kr (S.L.); jschung@kist.re.kr (J.C.)

† These authors contributed equally to this work.

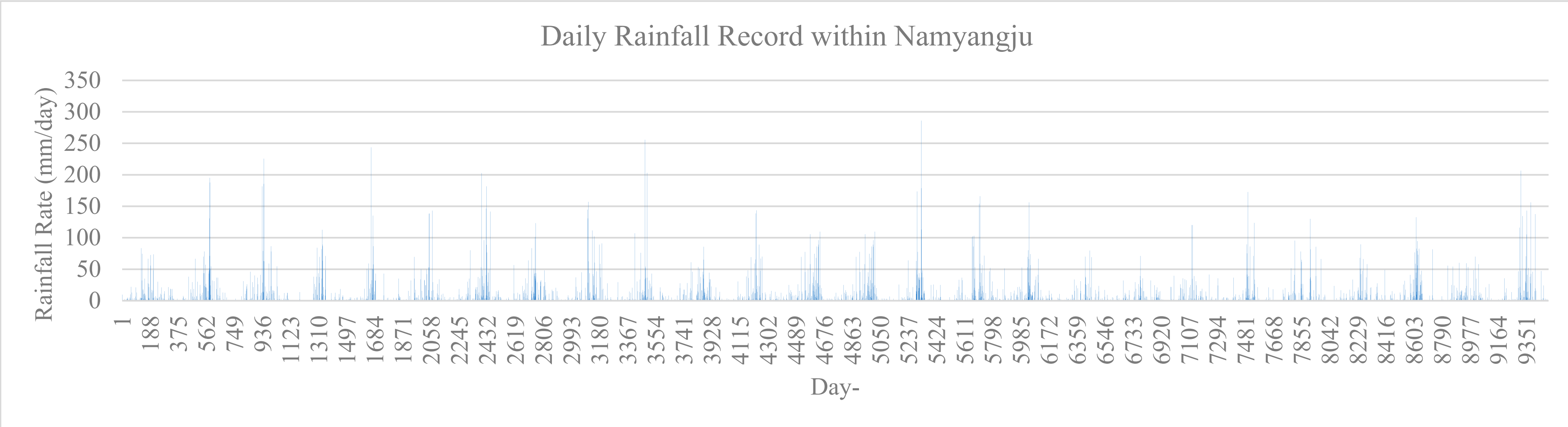


Figure S1. Daily precipitation (mm) record in Namyangju from 1997 – 2022.

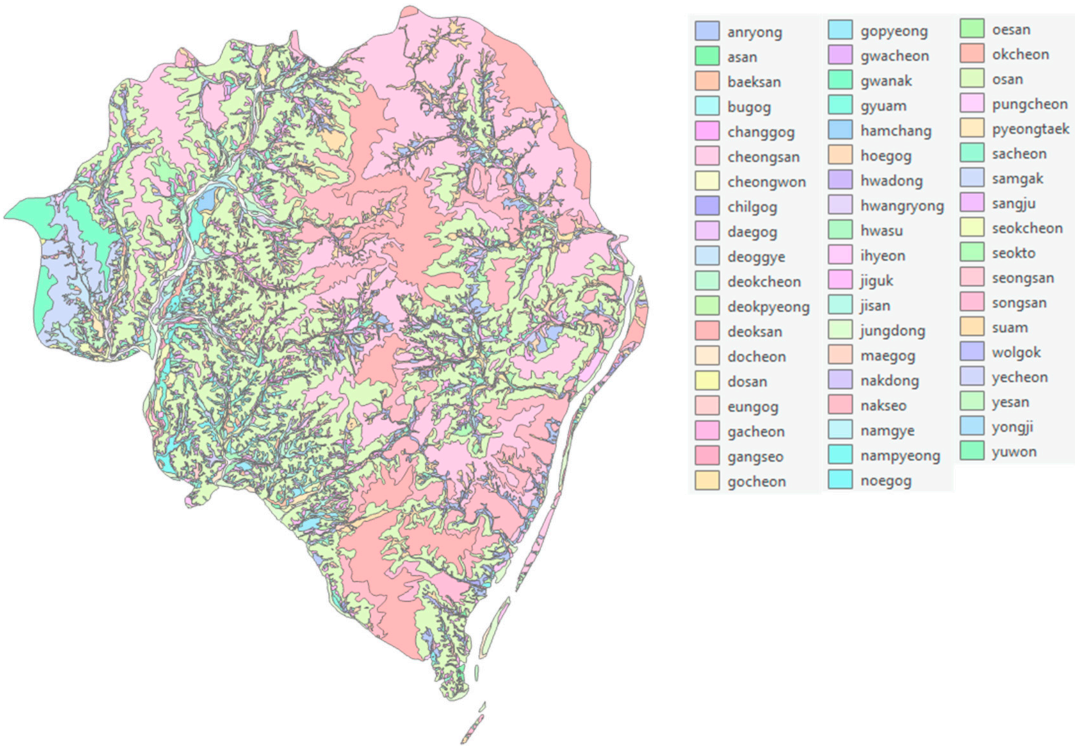
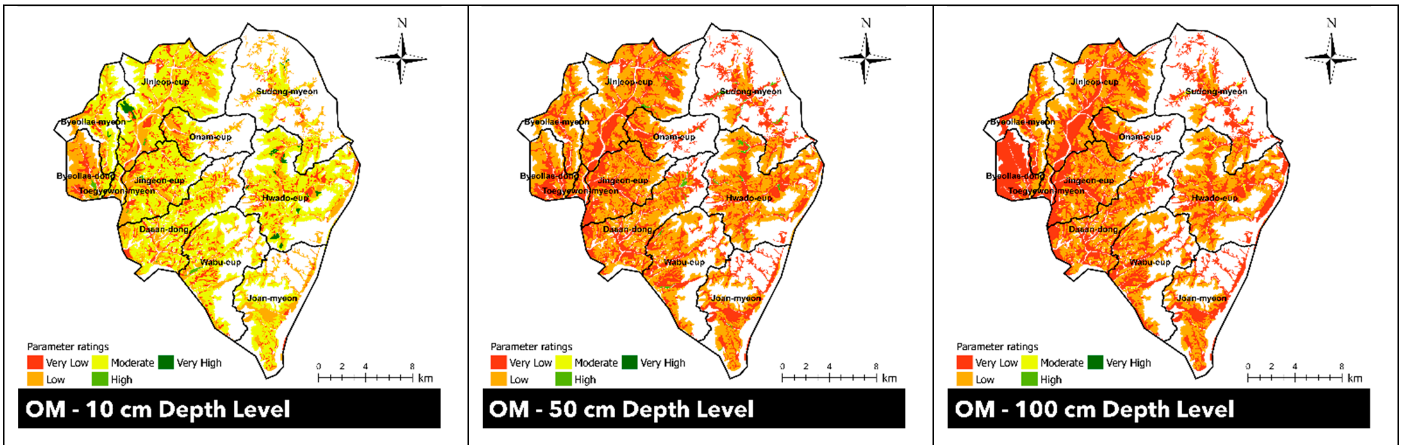
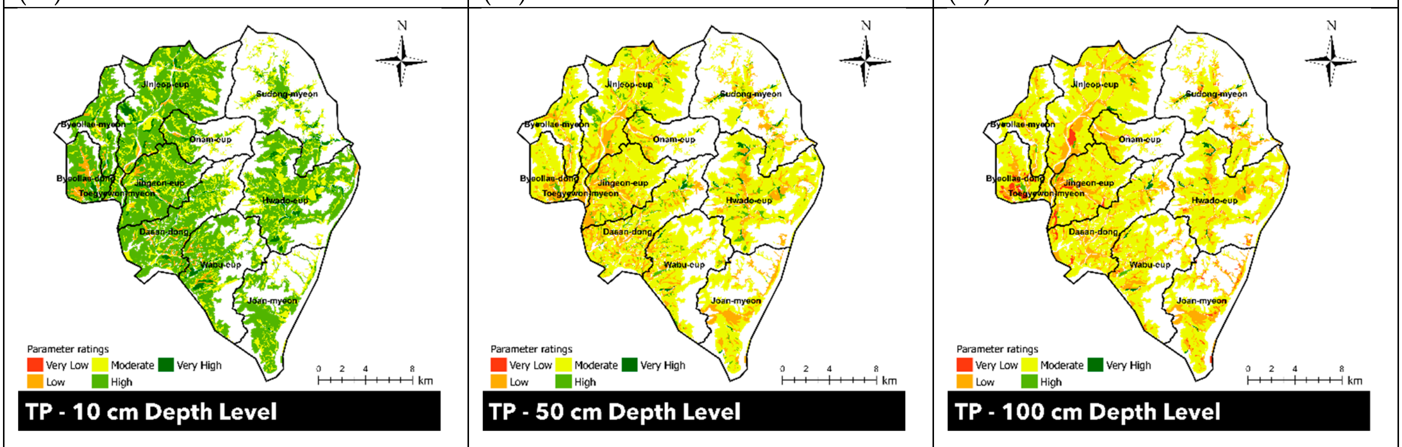


Figure S2. 46 soil series in the studied area.



(a1) (a1) (a3)



(b1) (b2) (b3)

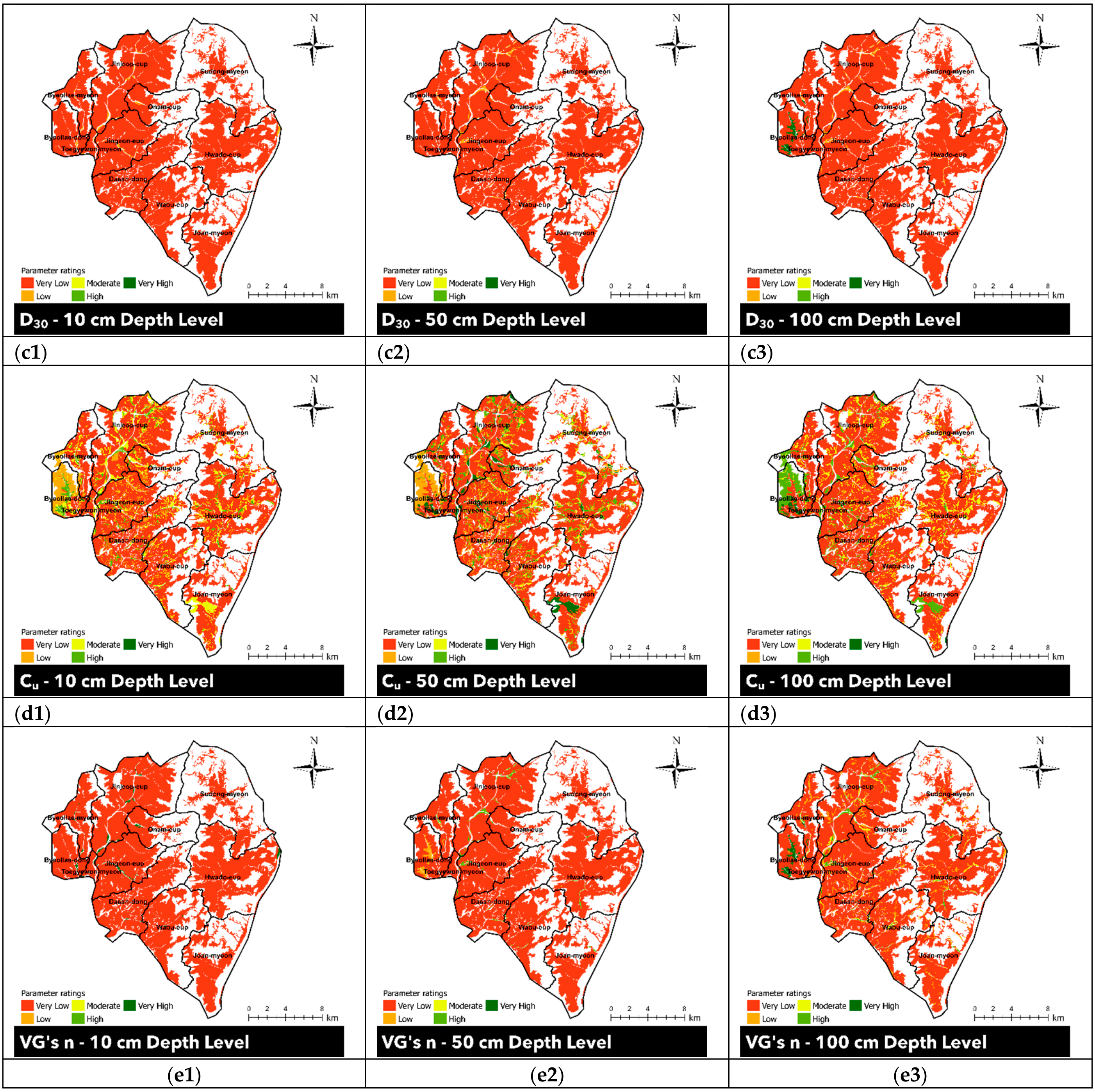


Figure S3. Rated static parameter spatial distribution maps (**a**) OM, (**b**) TP, (**c**) D_{30}, (**d**) C_u, (**e**) n in Namyangju at (**1**) 10 cm, (**2**) 50 cm, (**3**) 100 cm.

Table S1. Minimum and maximum values for parameters and the attenuation capacity before normalization.

Parameter	10cm		50cm		100cm	
	Min	Max	Min	Max	Min	Max
Organic matter (OM)	0.4655	6.1030	0.2069	4.4307	0.0172	3.9652
Total phosphorus (TP)	169.5935	367.0295	132.9702	333.411	63.09573	322.4916
Particle size distribution D_{30}	0.0021	0.1473	0.0023	0.4194	0.0033	0.6189
Coefficient of uniformity (C_u)	14.6601	269.7049	12.3704	327.7551	3.7788	271.6618
Parameter n	1.3819	1.6719	1.3456	2.7281	1.3613	3.1305
Saturation Degree (SD)						
• Stationary	0.2	1.4	0.18	1.25	0.44	1.25
• Annual (1997-2022)	0.4735	0.9971	0.1289	0.8671	0.0980	0.8787
• Summer (1997-2022)	0.5250	0.9984	0.1582	0.9537	0.1211	0.9581
Attenuation Capacity (AC)						
• Stationary	5.65	17.75	5.46	18.61	2.95	18.17
• Annual (1997-2022)	4.44	20.03	1.83	19.05	1.83	19.98
• Summer (1997-2022)	3.88	19.95	1.83	19.05	1.83	19.98

Text S1

Although AC itself is not measurable, the comprising parameters in Eq. (1) can be measured, thus we tried to validate the model with the AC calculated from a random soil within the study area (see below figure).

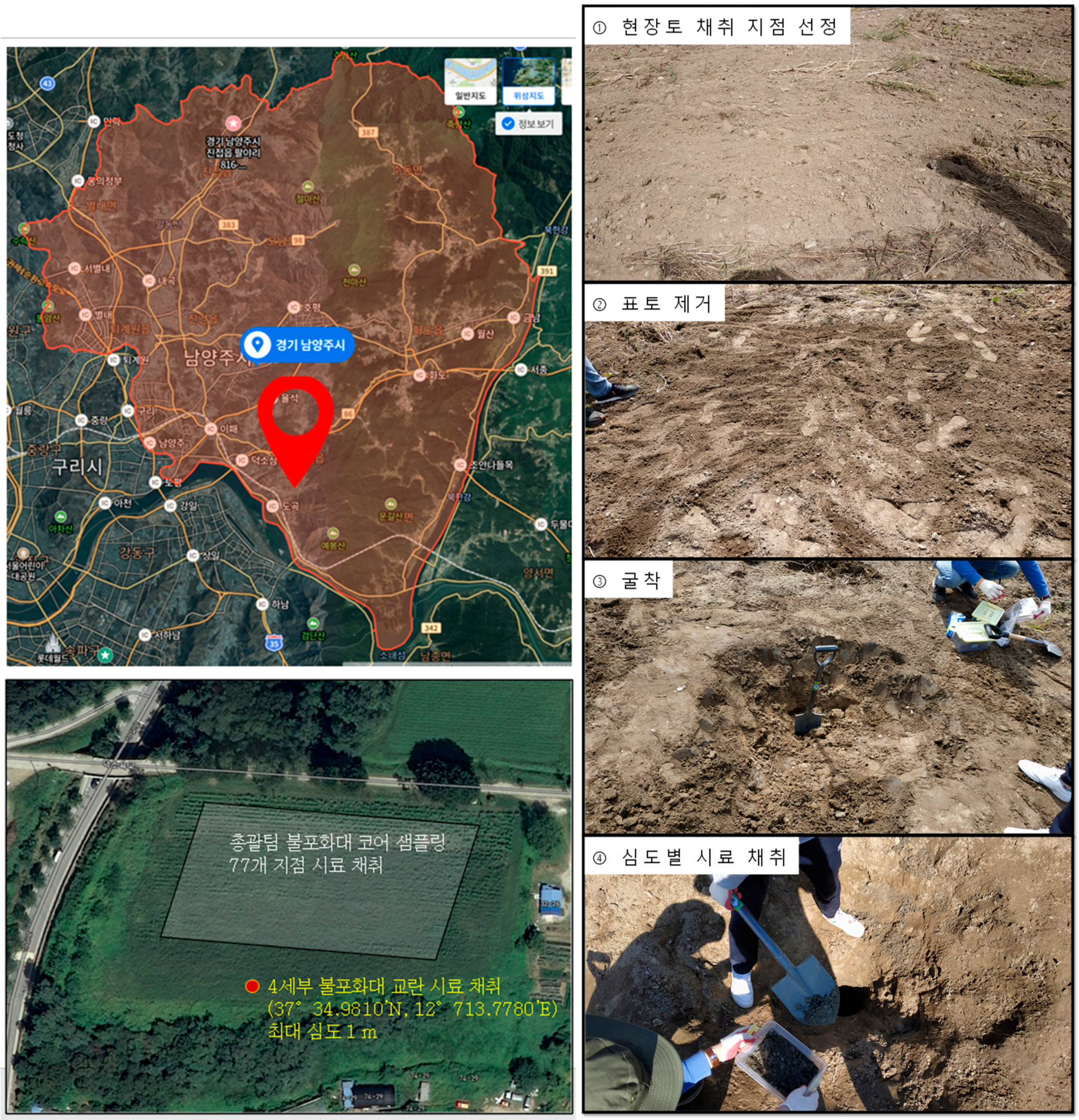


Figure S4. left) Sampling point (red dot), right) Sampling process.

The sample was collected within the first 20-30 cm of depth and was mixed before drying and analysis. The AC for the sample was calculated based on laboratory analysis results of OM, TP, D_{30}, Cu, n parameter, and SD. Here, we obtain a pretty good result between the AC calculated based on field sampling data and the one based on estimations using public data (in this study), where the values are 16.31 and 16.309 respectively. Although one data point comparison is not enough, this result provides a positive indication of agreeable fit, at least, between field data and the estimation approach we used in preparing the input data.

Table S2. Parameter rating, weight, and AC of field sample.

Parameter	Value	Rating	Weight	Rating x Weight
OM (%)	2.92	3	1	3
TP (mg/kg)	1623.81	5	2.7	13.5
D_{30} (mm)	0.063721	1	-0.82	-0.82
C_u (-)	13.24615	1	0.93	0.93
n (-)	1.4063	1	0.82	0.82
SD (%)	48.36	2	-0.56	-1.12
AC				**16.31**

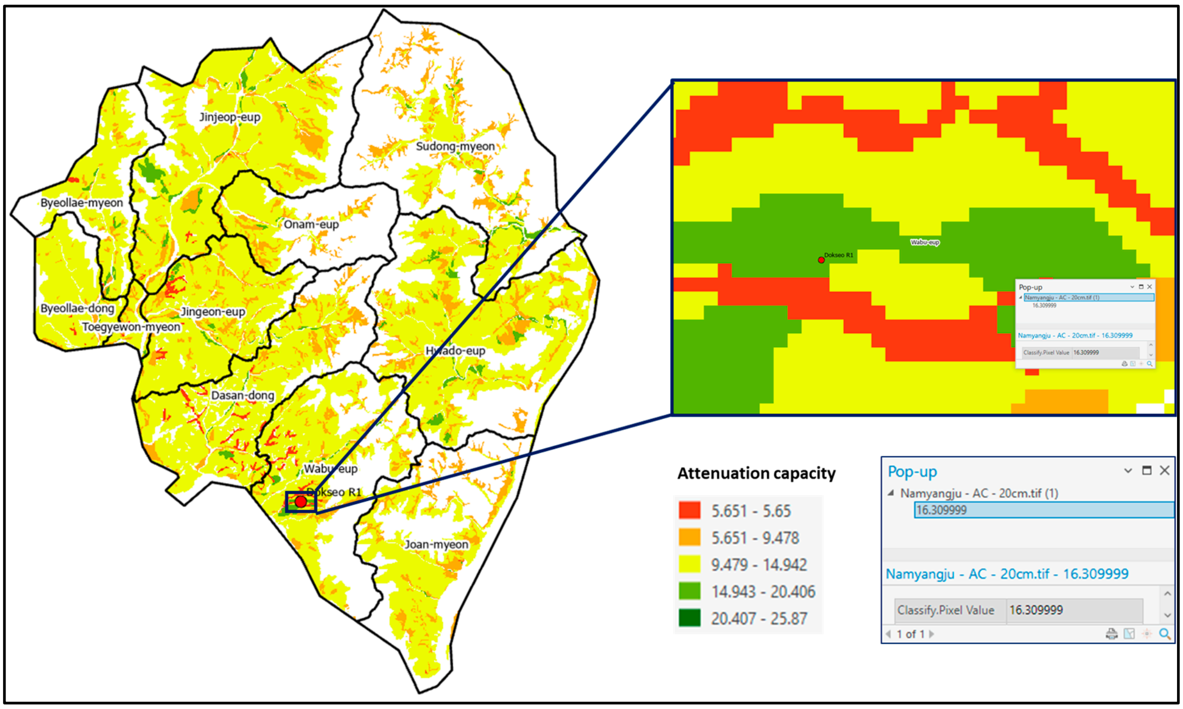


Figure S5. The sampling point (red dot) shown in the AC map and the corresponding AC value generated from public data.