Research about environment evaluation index focused on the fluctuation of carbon dioxide concentration in Ibaraki

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The Japan Meteorological Agency has reported that the atmospheric CO_2 concentration has been on the increasing trend since the Industrial Revolution. The annual average carbon dioxide concentration in 2015 exceeded 400 ppm and it updated to the highest value. These data were obtained in isolated islands and mountains where there is little influence from human activity.
On the other hand, we have measured CO_2 concentration in the living area of Ibaraki since 2007. It is thought that the carbon dioxide concentration obtained by measuring in the living zone can include the influence of geographical conditions (i.e. terrain, population, traffic, land cover, etc.) around the observation points. So far, increase and decrease, the fluctuation pattern of CO_2 concentration is different for each region and is affected by the amount of vegetation around the measurement points. Then, our research group proposed the new environment evaluation index focusing on this feature. The index was suggested to quantify one day' s fluctuation of CO_2 concentration and it is given as (Index) = (CO_2_max - CO_2_min) / CO_2_max. Here, CO_2_max is the maximum CO_2 concentration of time mean, and CO_2_min is the minimum CO_2 concentration of time mean. However, in the past research, we did not fully verify the effectiveness of the index.
In this paper, we aimed to calculate the index from CO_2 concentration for about three years and to investigate correlation with geographical information (e.g. land use, green coverage and population). The table shows that correlation between the information and environment evaluation index from 2014 to 2016. As a result, we found the high positive correlation with vegetation in summer and positive correlation with human activity in winter. Therefore, we conclude the nature of the index changes according to the season. Especially, analysis from the spring to autumn, we confirm that the index can express the CO_2 absorption level and the activity of vegetation by season. In winter, few green spaces and the brisk areas of human activity, the index is increasing. From these results, they are shown the environment evaluation index derives from the fluctuation of CO_2 concentration related to land cover near the observation points.

Keywords: Carbon dioxide concentration, Environment evaluation index, Geographic information, Green coverage

Correlation (2014)

△: Positive Correlation ▼: Negative Correlation		Correlation Coefficient			
Geographical Information		Spring	Summer	Autumn	Winter
Vegetation	Forest	△0.43	△0.80	△0.28	▼0.48
	Forest + Rice Field	△0.64	△0.88	△0.33	▼0.30
	Forest + Rice Field + Farmland	△0.81	△0.81	△0.64	▼0.01
	Green Coverage	△0.71	△0.89	△0.66	▼0.01
Human Activity	Building Site	▼0.39	▼0.68	▼0.25	△0.53
	Population	▼0.49	▼0.68	▼0.38	△0.40

Correlation (2015)

△: Positive Correlation ▼: Negative Correlation		Correlation Coefficient			
Geographical Information		Spring	Summer	Autumn	Winter
Vegetation	Forest	△0.28	△0.83	▼0.39	▼0.70
	Forest + Rice Field	△0.50	△0.75	△0.01	▼0.46
	Forest + Rice Field + Farmland	△0.71	△0.65	△0.37	▼0.21
	Green Coverage	△0.52	△0.73	△0.22	▼0.29
Human Activity	Building Site	▼0.28	▼0.54	△0.26	△0.70
	Population	▼0.39	▼0.45	△0.07	△0.53

Correlation (2016)

△: Positive Correlation ▼: Negative Correlation		Correlation Coefficient			
Geographical Information		Spring	Summer	Autumn	Winter
Vegetation	Forest	△0.17	△0.57	△0.20	
	Forest + Rice Field	△0.33	△0.75	△0.52	
	Forest + Rice Field + Farmland	△0.52	△0.89	△0.79	
	Green Coverage	△0.44	△0.89	△0.72	
Human Activity	Building Site	▼0.05	▼0.76	▼0.32	
	Population	▼0.06	▼0.91	▼0.48	