An analysis of atmospheric suspension period of PM 2.5 by GIS and R

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A time dependent change of PM 2.5 concentration in the southern part of Okayama prefecture was analyzed using GIS, Geostatistical method and time series analysis method. The data acquisition period was from the beginning of June 2017 to the end of August 2017, the analysis period is 5 days of late July in the period.

Observation data of PM 2.5 concentration required for analysis was acquired from Okayama prefecture's environmental data website. Geographical information data necessary for the analysis was JPGIS (Geographical Survey Institute, 2017) which is the government open data. GIS used in this research was QGIS (QGIS Development Team, 2016), the part of the FOSS4G (Open Source Geospatial Foundation). R (R core team, 2017) was used for the geostatistical analysis and the time series analysis.

First, the concentration of the entire target area were estimated from the PM2.5 observation data by using the Kriging method. Then the fluctuation periods of the PM2.5 concentration were investigated by the autocorrelation of time series change of estimated concentration. During the data acquisition period, the meteorology suddenly changed due to the arrival of the yellow sand or the passage of the typhoon, but there is a relatively stable weather for the 5 days in late July, so the time dependent change of the concentration of the PM2.5 was investigated for the period. As a result, we found a fluctuation period of about 45 hours in the concentration of PM 2.5. This indicates that the concentration of PM2.5 does not return to the base value in the one day.

Considering that weather, traffic volume and biological activity that thought to have a great influence on the concentration change of PM 2.5 have about 1 day cycle, the variation period of about 45 hours shown that the concentrations of PM2.5 are likely to be accumulated in the atmosphere. In order to prevent the concentration increase of PM2.5, it is necessary to consider this cycle, that is, the atmospheric retention period. Since this period is influenced by terrain, features and weather, etc., it is necessary to estimate for each region.

GIS can be effectively used for preparation of geographical information data necessary for geostatistical analysis of global environmental data and map representation of the result of the analysis. Further dissemination in the study of earth planetary science is desired.

Keywords: GIS, Kriging, gstat on R, Autocorreration analysis, FOSS4G, PM2.5