

A spatial relationship analysis between the high resolution PM2.5 estimated distribution and transportation network by the R and the GIS applications

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The PM2.5 is a group of suspended particulate matter in the air which aerodynamic radius is about 2.5 micrometers or less. The analysis of the spatial concentration distribution of PM2.5 are important information for the consideration on the human health. Because there are not sufficient numbers of the PM2.5 observatories, there are not enough information about it. Therefore, the high-resolution estimations are performed using the time-series analysis and the Kriging method on the observed concentration of PM2.5. In this study, a correlation analysis between the high-resolution estimated spatial concentration distribution of the PM2.5 and the transportation networks were performed using R and GIS.

The target area of this study is located at the south part of the Okayama prefecture, Japan. It has a about 40 km length from east to west and about 30 km length from north to south, and it contains the Okayama city and Kurashiki city. Observed concentration data of the PM2.5 about the region were obtained from the Okayama prefectural website of the environmental data. The geospatial data for the region were acquired from the open data which were distributed by the Japanese government-affiliated research institute. The spatial statistical analysis were performed using the R (R core team, 2015) and its spatial statistics library maptools (Bivand and Lewin-Koh, 2014), rgdal (Bivand, Keitt and Rowlingson, 2014) and gstat (Pebesma, 2014). The geographical spatial calculation about the transportation network and the qualitative analysis of the results were performed using the QGIS (QGIS Development Team, 2015) and the Google earth (Google, 2014). Note that the rgdal and QGIS are developed under the Open Source Geospatial Foundation and constitute the part of the FOSS4G software.

At first, there is no clear relationship between the estimated spatial distribution of the PM2.5 and the buffer distance of the primary traffic network about the overall target area. At the second, some relationships were found on the subdomain area which roughly based on the geomorphology and the city area. In the case of the consideration of the spatial correlation of the high-resolution PM2.5 estimated distribution and transportation network, the determination of the analysis area by the appropriate terrain classification in addition to the density of the transportation network may be required.

Keywords: PM2.5, Transportation network, Spatial statistics, Kriging, R-language, FOSS4G