

Evaluation Analysis of Estimation of Population Distribution by DMSP/OLS Satellite Images Using GPS Log Data of Mobile Phones

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Abstract: Monitoring of population distribution is relatively easy in developed countries thanks to development of high resolution spatial data and census data. On the other hand, Methods to estimate distribution of population in broad areas are required in developing countries because these data are not developed adequately. Therefore many previous studies have attempted to estimate distributional areas of population using satellite images. Especially one of the well-known methods to estimate them is using night light images by the DMSP/OLS.

However, reliability verifications of estimated results by the DMSP/OLS images in previous studies are limited to cross-check them with relatively macro-scale census data, e.g. population census aggregated into administrative units. There are no studies to compare, or cross-check them with spatially and temporally micro-scale population distribution data in consideration of image opportunity. The main reasons why previous studies have not cross-checked with such kind of micro-scale data are because there are no spatial data which can monitor micro-scale distribution of population in any opportunities.

On the other hand, distributions of dynamic and residence populations in any hours can be estimated using GPS log data by mobile phones in recent years. Dynamic population and residence population can be aggregated by arbitrary spatial units because GPS log data by mobile phones are disaggregated point data.

Therefore this study compares estimated distributions of population calculated by light intensity of the DMSP/OLS nightlight images with dynamic and residence populations by GPS log data, and residential population by the Japanese population census in Miyagi prefecture, Japan. At first, 500m square grid data of dynamic and residence populations are developed to analyze GPS log data by mobile phones in whole 1 year between August 1st, 2010 and July 31th, 2011 and to accumulate locations of persons who are staying and moving. Second, 500m square grid data of

population census is also developed using the Japanese population census to compare with existing population census. Third, estimated population data is developed to reaggregate the DMSP/OLS light intensity into same grid. Finally, we evaluate estimated result of population distribution by the DMSP/OLS to compare it with dynamic, residence, and census populations. As a result, we show which value, i.e. dynamic, residence, and census population have a strong correlation with estimated population by the DMSP/OLS light intensity.

Keyword: DMSP/OLS, estimation, mobile phone, GPS, population