

Monitoring Urban Growth Process with Remote Sensing Techniques: An Empirical Study of Shanghai, China

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(1) Motivation: Shanghai is the largest Chinese city by population. As one of the most vital cities in Asia, Shanghai has booming economy and vitality of expanding the city to react the globalization and Chinese economic reform since the 1990s. By utilizing the remote sensing techniques, the urban growth process can be monitored in a certain time interval. This study aims to detect the social structure change in a macroscopic perspective by using several kinds of satellite image datasets with remote sensing techniques.

(2) Approach: In order to monitor the city changes, not only the land use and land cover (LULC) changes, but also the pattern changes of human economic activities, three different kinds of datasets are used to monitor the study area by each 12 years since 1988 year.

LULC change map: The Landsat program provide the worldwide middle resolution satellite data (30m). With object based image classification, the LULC map can be derived.

Energy consumption intensity (ECI) map: DMSP-OLS nighttime lights of world data program started from 1992. With the stable averaged nighttime lights data, the intensity map of anthropogenic heat flux emission can be estimated year by year.

In order to understand the relationship between ECI map and LULC map, the correlation analysis was calculated, which showed a strong relationship. On the other hand, the population data were utilized to verify the calculated result.

(3) Data: Three kinds of dataset are used in this study including the LandScan population world data 2000 to 2013 (the data of Shanghai statistics yearbook were used for the year before 2000), DMSP-OLS nighttime lights of world data 1992 to 2013 and Landsat EM/ETM/OLI 30m satellite images.

(4) Results: Through this study (Fig.1), several various kinds of dataset were used to monitor the urbanization process in Shanghai. The results show that an incredible rapid expanding of urban fringe was happened. The percentages of the built-up areas were increased from 6.8% to 44.9% since 1988. In addition, Fig.2 shows the urbanization rate from city center of 1988, 2000 and 2013. Moreover, by using the ECI map, LULC map and national statistics data, an approximate energy emission can be estimated.

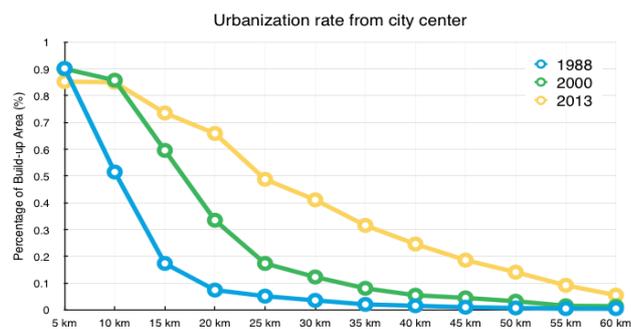


Figure 2: Urbanization rate from city center for Shanghai 1988-2013.

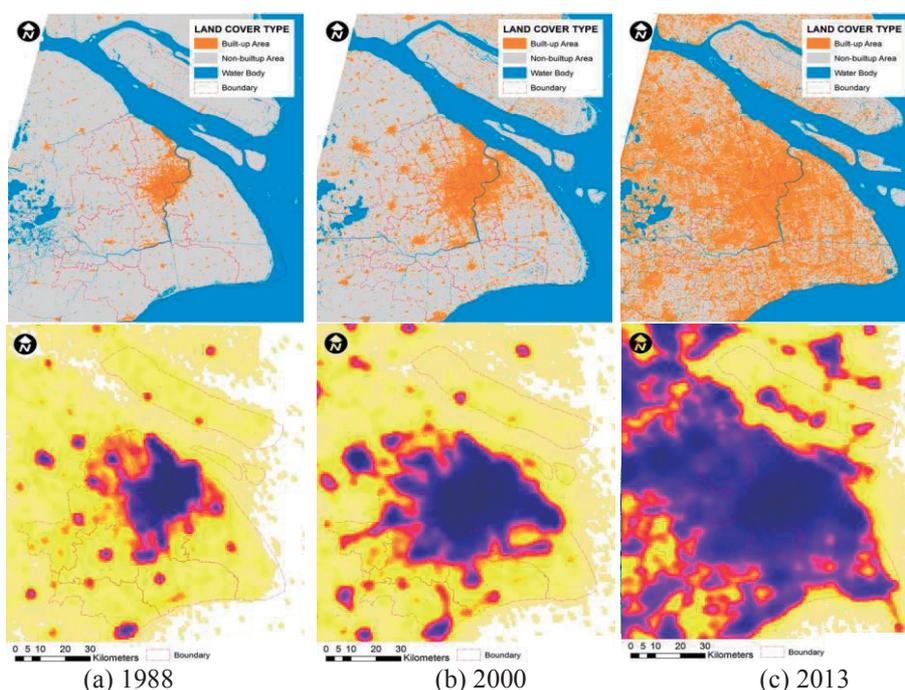


Figure 1: LULC map and energy consumption intensity map for Shanghai