An analysis of time-series variation of urban density in Tokyo 23 wards using GIS

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1.Purpose

The puorpose of this study is to clarify the characteristics of the variation of urban density in the Tokyo 23 wards from 1991 to 2001. The urban density includes some aspects of the buildings in urban area, such as the number of buildings, floor area of buldings and the number of stories of each bulding. We analyzed the change of urban density mainly from three aspects: the change of total floor space, verticalization of buildings, and the change of the purpose of buliding usage.

2.Backgrounds

In the beginning of the 1990's, the bubble economy was collapsed in Japan. The pattern of land use in the central part of Tokyo was changed due to the economic recession. The number of offices and workers are decreased in the central part of Tokyo while the large amount of office bulidings and MDUs(Multi-dwelling units) had been supplied. After the middle of 1990's, however, the number of permanent population turned to increase for the first time in last 30 years in three central Tokyo wards(Chiyoda-ku, Chuo-ku and Minato-ku). The key factor of constant construction of bulidings in the area is the radical change of land use such as increase of vacant lots due to the collapse of many factories or warehouses.

3.Methods and data

Quantitative measure of building usage change area is made by overlaying the building map as of 1991 and 2001, by using GIS software ArcGIS 9.1 Data used in this study are as follows.

a) Urban planning GIS data, 1991, 1996, 2001

These data are owned by Tokyo Metropolitan government. The data include various information of each building such as shape, the number of stories, bulding usage purpose and so on.

b) Detailed digital information of Tokyo Metropolitan Area, 1989

These data are the land use data of 10 m grid. There are 16 classifications for land use patterns in this data, for example, commerce and business, roads, industry, low-rise residence, dense residence, etc..

4.Results

1) Change of office buildings

Quite large amount of total floor space has been provided in the central part of Tokyo, such as Minato-ku, Shibuya-ku and Koto-ku(Figure 1a). The number of office buildings has increased at a grate rate in the suburb of Tokyo 23 wards such as Setagaya-ku, Nerima-ku and Katsushika-ku.

2) Change of MDUs

The spots where the total floor space of MDUs showed remarkable increase are distributed in the Tokyo 23 wards, contrasted with the office buildings (Figure 1b). A large amount of MDUs were provided in the eastern part of Tokyo. The amount of total floor space nearly doubled from 1991 to 2001 in Chiyoda-ku, the central ward in Tokyo 23 wards, although the amount was lower than other wards. The average number of story changed from 4.9 to 7.1 in Chiyoda-ku because of the construction of many high-rise MDUs.

3)Change of land use

Characteristics of former land use of office buildings or MDUs differ from one area to another. Particularly, numbers of MDUs have been taken place of factories or warehouses in the eastern part of Tokyo, while low-rise residences were previously located in the western part.

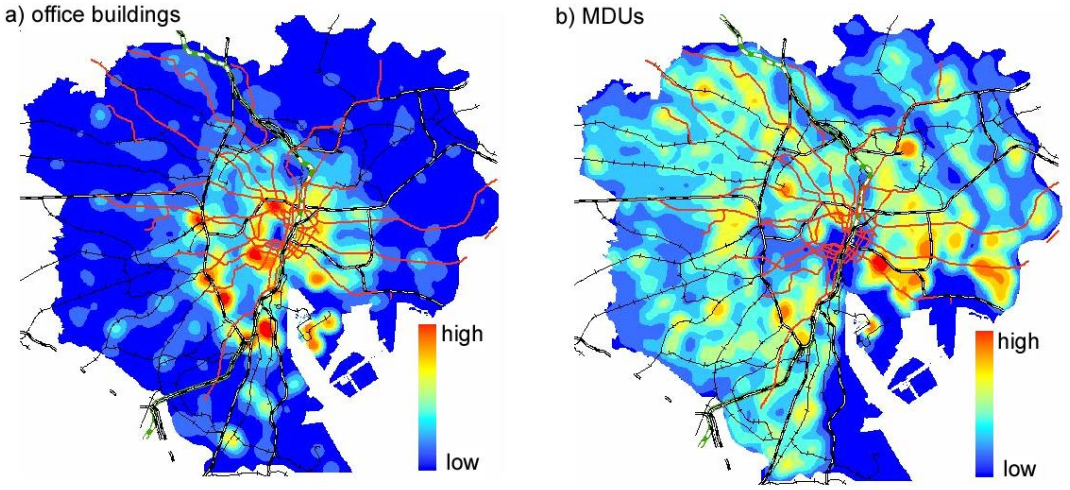

Figure 1 Density of total floor space of constructed buildings, 1991-2001