

Remote sensing monitoring and driving force analysis of urban expansion in Guangzhou City, China

Ruisong Xu, Yueliang Ma,
Yuan Xu, Xiulian Fan

Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou, China

2015-8-19

Remote sensing research methodology

- [Pre-treatment of image data](#). For study of urban expansion change, it is necessary to perform geometric calibration and radiation level normalization of multi-temporal remote sensing images
- [Classification of remote sensing images](#)
- There are many ways for classification of remote sensing images, but here in this paper only the maximum likelihood algorithm will be used for supervised classification
- [Download full-size image](#). Here superimposed analysis serves as an important means for study of land use change
- [Analysis of urban expansion](#). Analysis of urban expansion rate.
- [Analysis of driving forces for urban expansion](#). Topographic elements, Economic growth elements , Population growth elements,
- Resident income elements, City infrastructure construction elements, City planning and policy elements

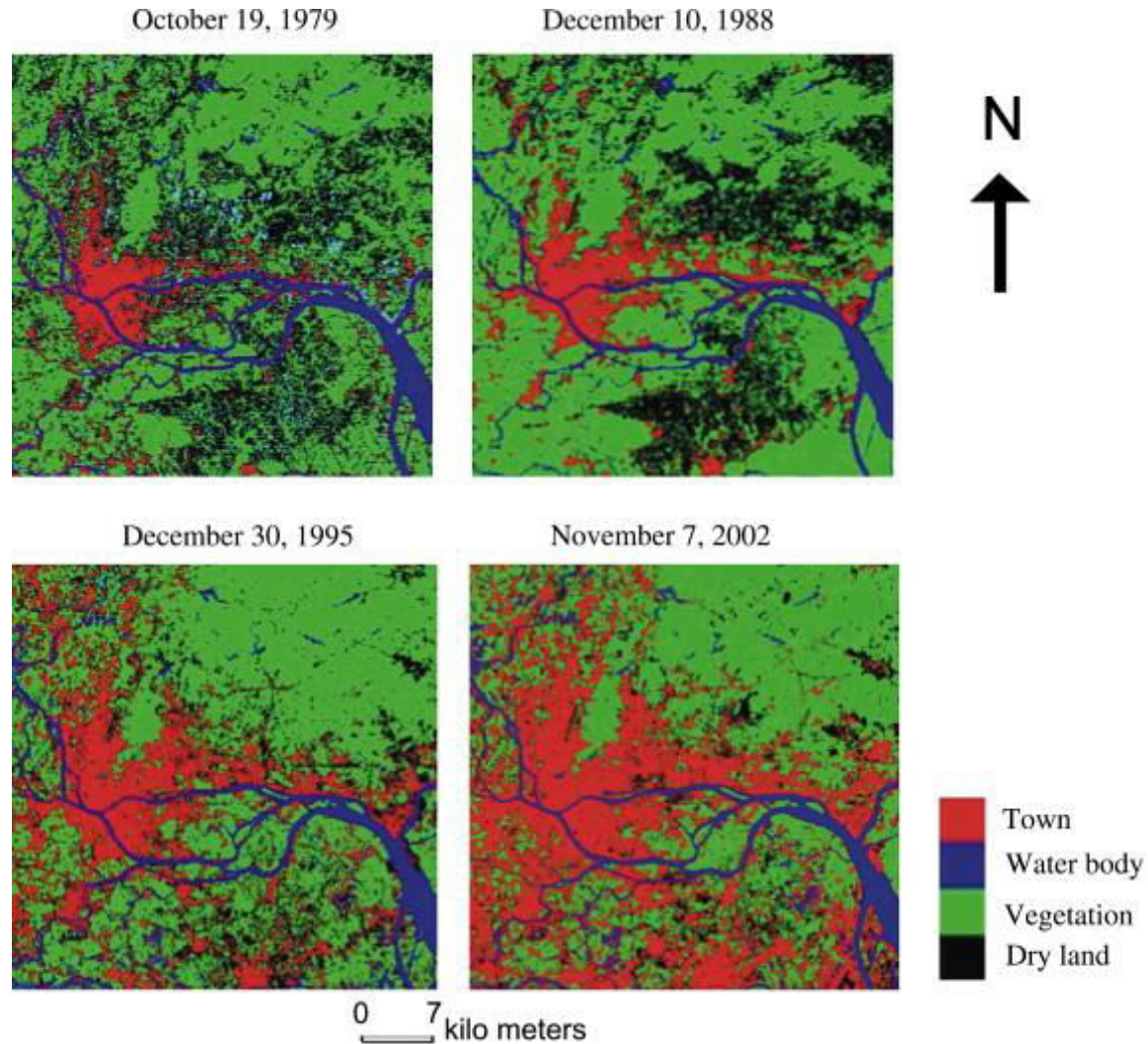
Map showing location of Guangzhou City in Mainland China



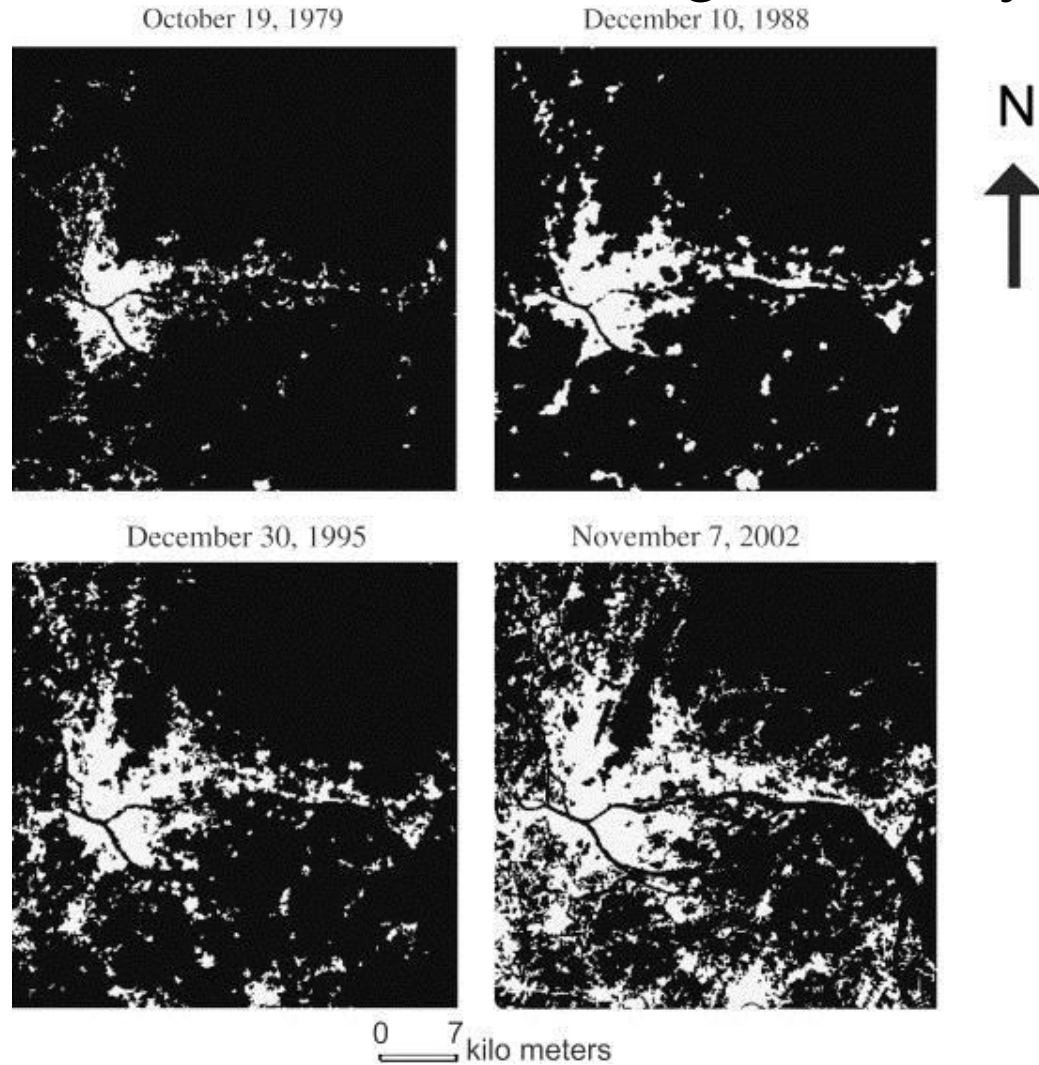
Data sources

- Multi Spectral Scanner (MSS) data acquired on October 19, 1979,
- Thematic Mapper (TM) data acquired on December 10, 1988,
- TM data acquired on December 30, 1995
- Enhanced Thematic Mapper (ETM) data acquired on November 7, 2002.
- The Guangzhou City map with a scale of 1:50,000 (1998 version) is an important reference.

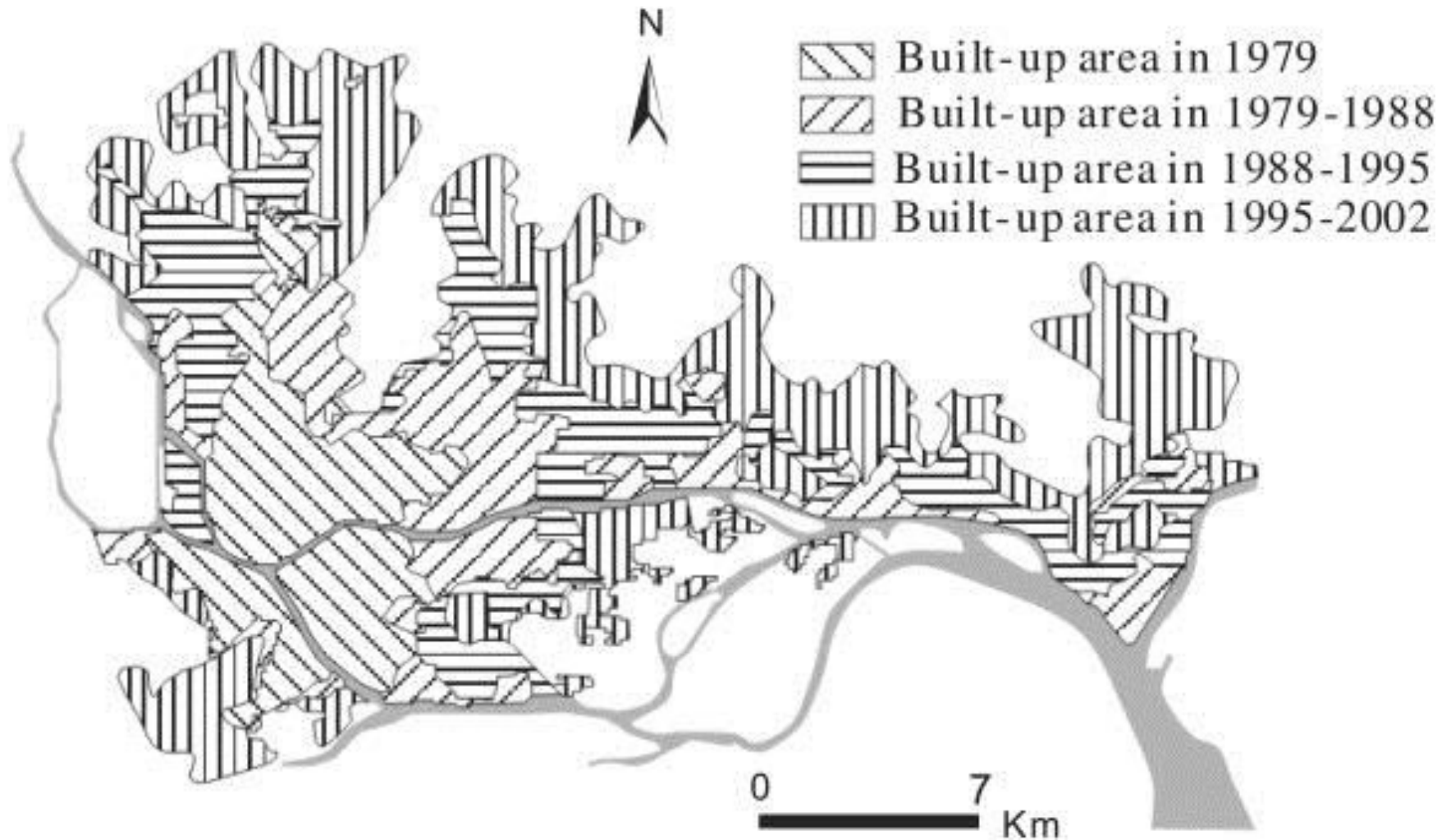
Diagram for classification of multi-temporal remote sensing images of Guangzhou City, China



Binary images showing distribution of urban land and non-urban land in Guangzhou City, China



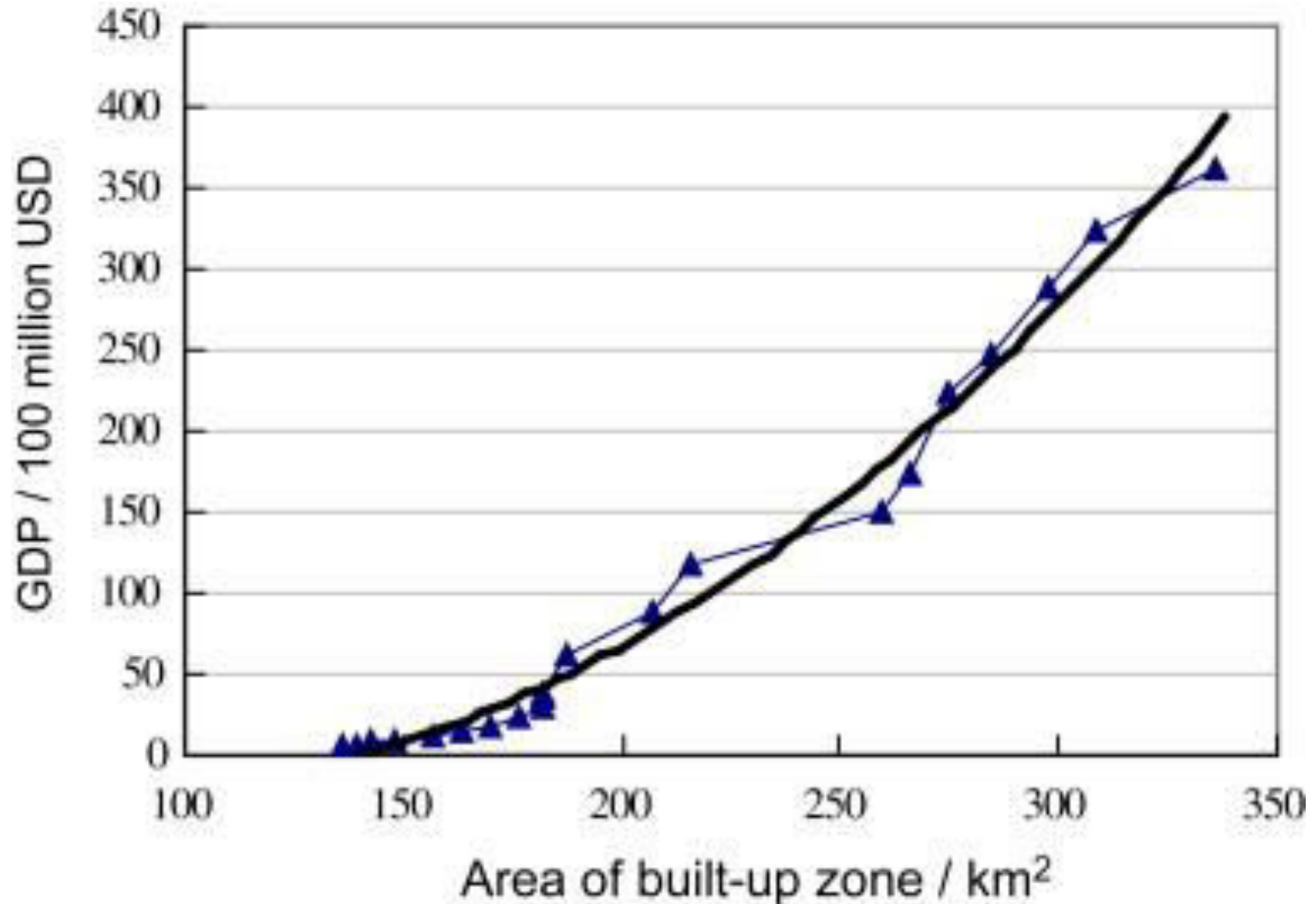
Topic diagram showing expansion of the built-up urban area of Guangzhou City, China from 1979 to 2002



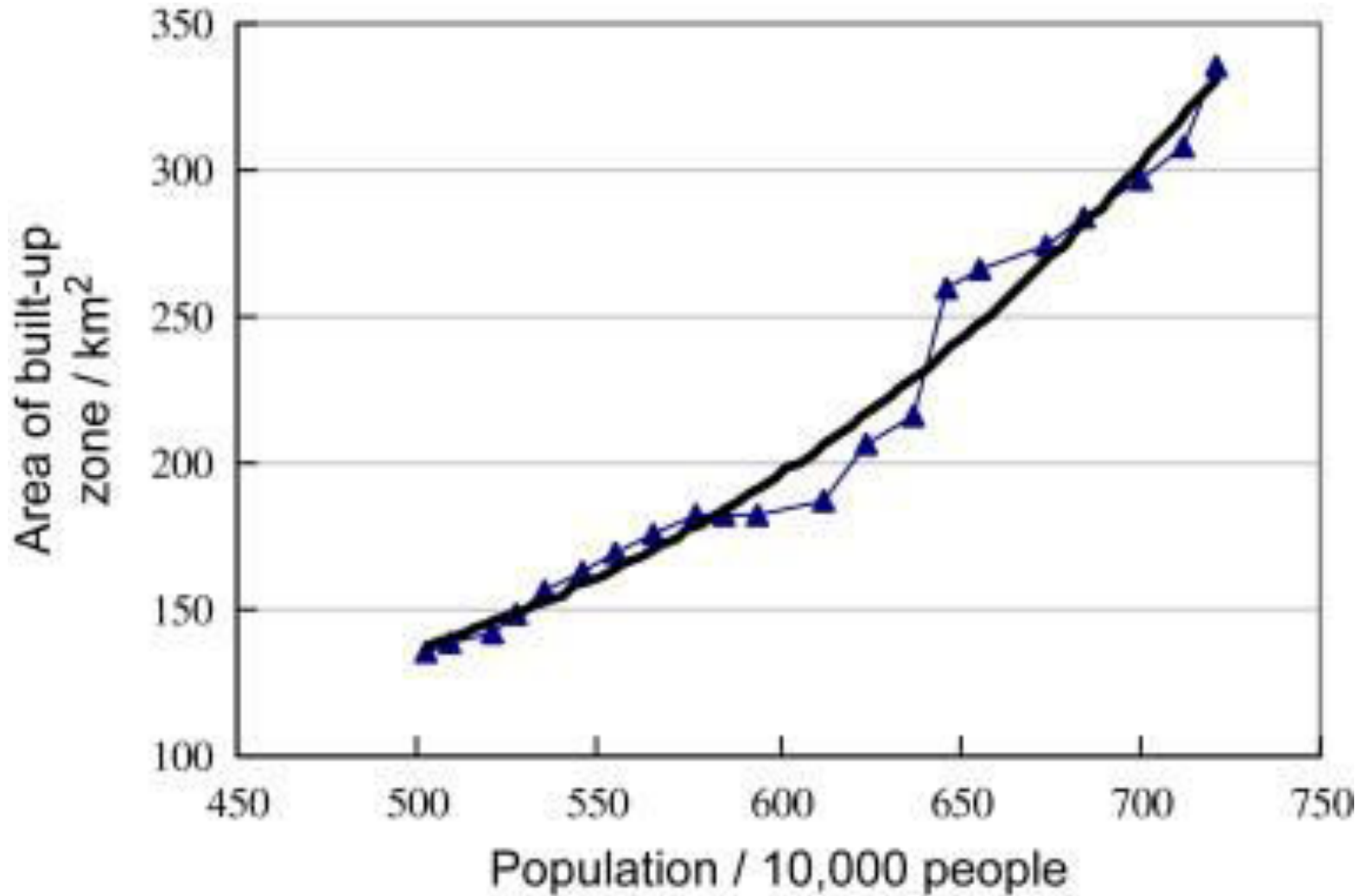
The built-up urban area , area expansion rate and change rate of Guangzhou City, China in four different periods

Year	1979	1988	1995	2002
Area(km ²)	71.9	152.4	236.3	397.4
Item	1979–1988	1988–1995	1995–2002	
Expansion				
area (km ²)	80.5	83.9	161.1	
Expansion				
percentage (%)	112.0	55.0	68.2	
Expansion rate				
(km ² a ⁻¹)	8.9	12.0	23.0	
Annual change				
rate (%)	12.4	7.9	9.7	

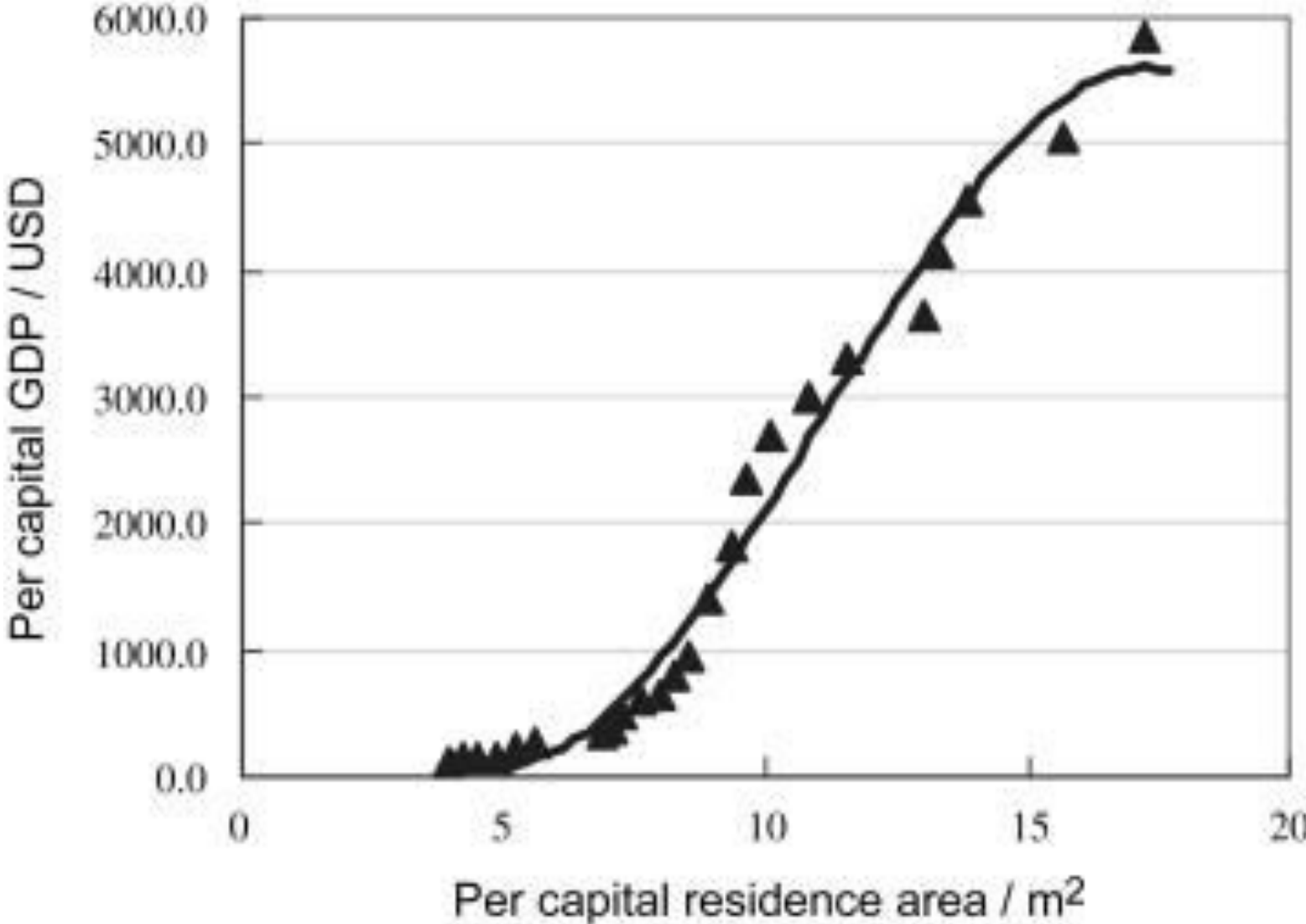
Correlation between **GDP** and **built-up urban area** for Guangzhou City, China



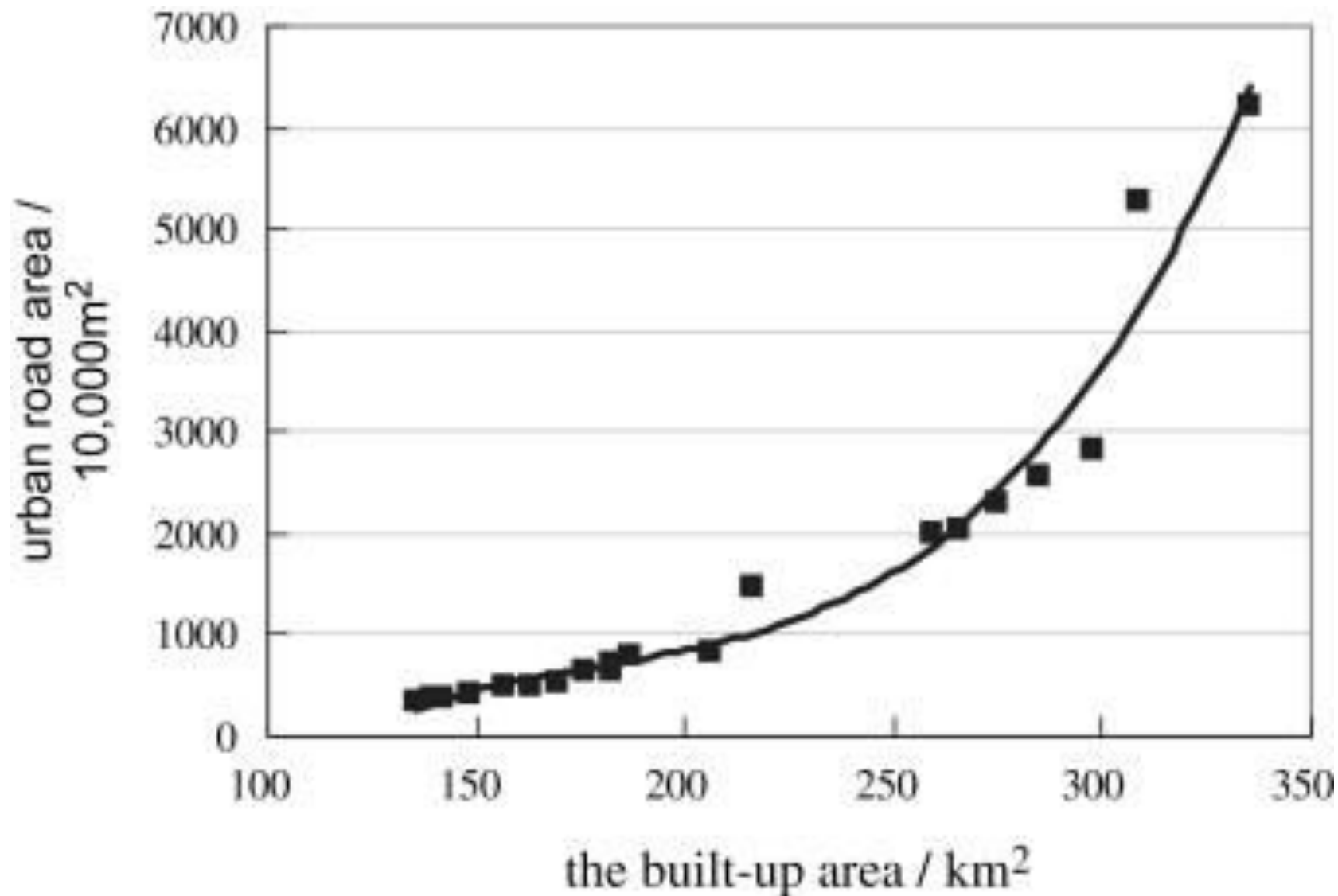
Correlation between total population and built-up urban area for Guangzhou City, China



Correlation between per capita GDP and per capita residence area for urban residents in Guangzhou City, China



Correlation between total area of **urban road** and **built-up urban area** for Guangzhou City, China.



Conclusions

- With the fast economic development, urban expansion of Guangzhou City, China is accelerated, as the built-up urban area achieves a net increase of 325.5 km² in the 23 years period between 1979 and 2002, and the built-up urban area in 2002 is increased by nearly 4.5 times of that in 1979, with an annual average increase of 14.2 km², and an annual change rate of 19.7%
- The model of urban expansion of Guangzhou City, China basically takes the form of radiation centered around the old downtown, consisting of layer-by-layer outward extension and extension along major traffic routes, which results in a spatial development pattern as characterized by three groups plus two routes; The rate of expansion is different in different periods, with the eastward urban expansion being the most remarkable in all stages

Conclusions

- Economic growth is the major driving force for expansion of the built-up urban area, population growth and resident income increase are the two most direct driving forces for urban land expansion, while city infrastructure construction, city planning and policy control to considerable extent the macroscopic pattern and development rate of urban expansion, natural geographic environment and topography constrains to a certain degree the spatial development of a city
- Dynamic monitoring of urban expansion, in terms of area, orientation and rate, by means of multi-temporal remote sensing images, is a highly efficient and feasible technique, which can provide scientific criteria for reasonable planning and decision-making for macroscopic management of a city.

Acknowledgements

- This research was partially supported by the Natural Science Foundation of Guangdong Province (No. 9151064004000004) and the Project of Guangzhou Development District (A Study of Eco-city of Guangzhou Development District, Luogang District in Guangzhou)

Thanks!