URBAN STORAGE HEAT FLUX ESTIMATION USING ASTER REMOTE SENSING DATA

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1. INTRODUCTION

As one of urban eco-environmental contents, urban heat island is very significant. Nowadays, the temperature in urban is higher than the surrounding natural terrain, as the result of vegetation cover declining and impervious surface increasing, coupled with the influence of anthropogenic heat discharge. In recent years, it is possible to study the urban heat island and its formation mechanism, owing to the rapid development of quantitative remote sensing technology. The earth surface parameters can be retrieved from thermal infrared remote sensing data, supplemented by meteorological data of ground-based observations, so the formation mechanism of urban heat island can be analyzed quantitatively. Urban storage heat flux is an important parameter of heat-island formation mechanism analysis; therefore, its precise estimate is of great significance for the urban heat environment monitoring and improvement and regulation of the living environment.

2. METHODOLOGY AND PROCESSING PROCEDURE

Urban storage heat flux is the major participant of "land - air" boundary layer energy migration. It enables the urban surface energy balance equation to explain the process of urban surface.

$$\Delta Q_s = R_n + A - H - LE$$

where $\Delta Q_s$ is the storage heat flux, $R_n$ is the net radiation, $A$ is the anthropogenic heat discharge, $H$ is the sensible heat flux, $LE$ is the latent heat flux.

$R_n, A, H, LE$ can be defined by ASTER remote sensing data and meteorological data of ground-based observations, which means $\Delta Q_s$ was estimated by urban surface energy balance equation promptly.
In this paper, the typical large city (Beijing, China) and the medium-sized city (Changsha, Hunan, China) were chosen as the research object, from the perspective of different urban size, different regions and different seasons to explore remote sensing estimation methods of the urban storage heat flux and to analyze the relationship between urban storage heat flux estimation, urban size, seasons and other factors.

First, ASTER remote sensing data of Beijing on August 31 and January 7, 2004 and ASTER remote sensing data of Changsha on September 2, 2004 were collected. And meteorological data of ground-based observations as ancillary data which with synchronous observation time of remote sensing data were acquired. Visible band and near infrared band of ASTER remote sensing data were used to retrieve surface albedo, then thermal infrared remote sensing data were used to retrieve surface temperature.

Second, based on quantitative retrieval of ASTER remote sensing data, with the combination of urban surface meteorological observation data, the net radiation, sensible heat flux, latent heat flux had been retrieved quantitatively and the changing characteristics of the energy flux in summer and winter had been analyzed comparatively.

Finally, urban surface energy balance equation was used to estimate urban storage heat flux and to acquire heat storage volume and its changes in winter and summer, then to make analysis and comparisons for urban storage heat flux with different quantity step and different geographic.

3. SCHEMATIC DIAGRAM OF PARTIAL RESULTS

a, Retrieval of albedo                      b, Retrieval of surface emissivity
4. CONCLUSION

The results showed that urban heat island intensity in winter is higher than that in summer, and there is seasonal variation of urban storage heat flux; furthermore, anthropogenic heat discharge, such as residents heating and cooling and factory energy consumption were the important reasons of how the urban heat island heat formatted. The urban storage heat flux and anthropogenic heat discharge of heat were of close relationship, such as anthropogenic heat discharge in northern winter was the direct cause of elevated thermal reserves. The use of remote sensing methods could estimate these parameters, so as to provide a reference for the formation of the mechanism of urban heat island.

5. REFERENCES