STUDY OF THERMAL ENVIRONMENT BASED ON REMOTE SENSING IN BEIJING-CAPITAL ZONE

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With the fast development of the global economy, the urbanization has been accelerated all over the world. The urbanization has brought about the benefit to the whole human society, but also resulted in the negative impact on the global eco-environment system. With the development of urbanization and population increasing, the nature vegetation and cultured land coverage turned in building land, impervious surface, and lots of liquid, solid, gas waste were pouring into environment, which have disturbed the mass and energy balance of eco-environment, however the urbanization is the trend and result of the society development, so the study of eco-environment change caused by urbanization in city is necessary.

Thermal environment is one of important factors for urban eco-environment. The objective of this research is to aid in the understanding of the spatial structure of thermal environment within Beijing-capital zone. Urban Heat Island (UHI) effect is one of the main factors influencing the weather, climate, and environment over the urban and its surrounding area. This understanding will help guide efforts to cool cities in order to increase human comfort, conserve energy and resources, and reduce air pollution in both of these states. Land Surface Temperature (LST) is an important parameter in characterizing surface energy balance and a key parameter in monitoring farming drought, and is of very significance in the studies of global change, meteorology, hydrology, ecology, agricultural, etc.

Beijing-capital zone, as one of three economy zones in the east of China, and Beijing, as the politics and culture center of China, it's necessary to study their eco-environmental Status. In the past 20 years, Beijing experienced significant change both in urban expand, population increase, economic development and eco-environment change. And for the 2008 Olympic Games held in Beijing, people from all over the world come to Beijing, so the government of China pays a lot of attention to the construction of ecological environment. So the study of eco-environmental is important, especially regional thermal environment.

RS (Remote Sensing) can provide multi-scaled, multi-temporal data in wide space scope, and the GIS (Geographic Information System) technique specializes in spatial analyses, which are the important tools for eco-environment study. Based on meteorological data, remote sensing data, including landsat TM/ETM, ASTER and Modis data for LST and other corresponding factor retrieval, the paper clarifies the spatial distribution, temporal development and change analysis of LST by thermal remote sensing retrieval technical assisted with field investigation and meteorological data in Beijing and Beijing-capital zone by different scale, analyzing reasons mainly accountable for it, last puts forward proposals concerning action program and principal measures to combat it.

Atmospheric transmittance and surface emissivity are the key steps for calculating LST. First, we use atmospheric radiation transfer model MODTRAN to modeling the correlationship between the vapor content and atmospheric transmittance, atmospheric path radiance, atmospheric downward radiance. Then, Surface emissivity is mainly affected by land cover, especially by vegetation coverage, so the algorithm is developed for estimating surface emissivity based on land cover. We use the landsat TM/ETM+, Aster retrieve the LST of Beijing region during 1992-2007, and Modis data combined Modis LST product retrieve the LST of capital zone at 1 km resolution by the split-window algorithm during 2000-2007. The data we retrieval from Modis L1B and the Modis LST product keep good similarity.

The spatial autocorrelation index Moran' I which is relevant with spatial location indicate that the distribution of thermal environment is spatial clustering of similar LST value. Based on the analysis of Moran scatter plot and spatial lag regression models，it put forward that the spatial statistical analysis could draw some reference value for analyzing spatial structure and pattern for UHI effect.

On the basis of LST calculation, by the method such overlay analysis, buffer analysis, et.al, the temporal and spatial distribution rules were studied. A lot of sections and routes profiles were selected to reveal the UHI spatial distribution characters. And the temporal analysis show that daytime UHI demonstrates distinctive seasonal variation, while the seasonal variation of nighttime UHI is much less. There is the trend that the UHI is getting quicker and stronger.

In order to find the driving factors of UHI, the relationship between urban Land Use/Cover Change and UHI spatial distribution are analyzed. The same work was done between vegetation cover, NDVI and UHI. The conclusion shows that the urban heat island mainly results from the difference of the surface thermal characteristics between urban and rural area, which can provide the theoretic basis for the urban-planning optimization and urban thermal environment control.

Key Words: land surface temperature, urban heat island, spatial statistical analysis, Moran index, remote sensing