

Temporal and Spatial Change of Albedo in Beijing-Tianjin Area of China

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1. INTRODUCTION

Land surface albedo is a key parameter representing the outgoing solar flux fractions reflected by earth surface ^[1]. It is widely used as an input parameter for numerical radiation budget models, the hydrological cycle and climate modeling studies. Urban's high albedo changes the original land surface radiation balance, high thermal diffusivity insulates the ground, and thus it represents a dry, heat surface in the heat and moisture fluxes. Thus urban cover has great influences on global ecological cycle and land surface albedo.

Land surface albedo is primarily altered with temporal and spatial variation. Land cover type, moisture, roughness, and solar angle are its main influence factors. Over urban surface, the temporal and spatial variation has strong relationship with human activities. In terms of the studying area (Beijing-Tianjin urban area) in this paper, during about 20 years, land cover type has converted from farmland or wasteland to urban with high radiation features, which directly increase the area of impermeable stratum on the surface. Correspondingly, other parameters such as moisture, roughness are also changed. Therefore, not only the alteration of surface albedo is reasonable, but also can the albedo results reveal exactly how some typical ground objects such as vegetation coverage, lands, large constructions etc. are modified.

2. STUDY REGION

In this paper, the research of albedo is focused on Beijing-Tianjin urban area of China as a typical densely inhabited district. Since the 1990's of last century, great changes, such as extended urban areas, large-scale artificial construction of traffic networks and buildings, environmental afforestation etc, have taken place in this region, mainly because of rapid economic growth, especially preparation for 2008 Olympic Games. According to statistics, the area of Beijing urban was 420 km² in 1990, which has grown up to 774 km² in 2008, and the growth rate of urban expansion is 84.3%, while the expansion rate of Tianjin urban is 79.7% from 256 km² in 1990 to 460 km² in 2008 ^[2]. It is a trend that Beijing-Tianjin area would be extended to one city in the future.

3. METHOD

The MODIS albedo products MCD43A3 in addition to 27 scenes ETM images from February 2000 to November 2008 are collected in this study. MCD43A3 combines registered, multirate, multiband, atmospherically corrected surface reflectance data ^[3] from the MODIS and MISR instruments to fit a Bidirectional Reflectance Distribution Function (BRDF) in seven spectral bands at a 500 m spatial resolution on a 8-day cycle and its reliability has been verified previously ^[4]. We integrate the seven

spectral bands products to broad-band albedo using the exiting algorithms, which is a linear equation based on the hypothesis of linear relationship between single-band albedo and broad band albedo, taking percentage of reflected spectral flux to input spectral flux as model coefficient. Furthermore, ETM data in autumn of 2000, 2004, and 2008, used for albedo inversion are utilized, relying on the analysis of isotropic land surface, and empirical relation between top of atmospheric (TOA) apparent reflectance and land surface albedo^[5]. Finally, the ETM image are resized to 500m resolution and normalized with MODIS broad-band albedo. Comparing the albedo results acquired from MODIS products, ETM inversion result and normalized outcome, respectively, we analyze the error sources for reference to albedo inversion with median and high resolution satellite data.

4. CONCLUSION

According to the analysis results, most parts of Beijing-Tianjin urban area present high value of surface albedo, but the value is lower around pent acyclic region in Beijing for its increasing vegetation cover. There is an obvious high albedo value band along the zone from Beijing to Tianjin, where wastelands have converted to highway. Albedo around Tianjin Olympic center demonstrates high for its game venue and lower vegetation coverage. Moreover, the normalized consequences are within a reasonable error range over most regions, in spite of some mixed pixels, for example, urban inhabited district mixed by buildings, roads and green vegetation etc. Thus, the albedo data affected by mixed pixels should be improved in order to accurately assess the radiation energy of land surface.

4. REFERENCES

- [1] IPCC, 2007. Language Portals.
- [2] <http://zhidao.baidu.com/question/22500107.html?si=1>
<http://zhidao.baidu.com/question/64191945.html?fr=qrl&fr2=query>
Google Earth.
- [3] Schaaf, C.B.,F.Gao, A.H.Strahler, W.Lucht, X.Li et al.(2002).First operational BRDF, albedo nadir reflectance products from MODIS. Remote Sensing of Environment
- [4] Ziti Jiao. The Use of MODIS BRDF/Albedo Products to Recover Land Surface Properties. Doctoral Dissertation. Beijing normal university, 2008
- [5] GH ULAM Abdwwasit, Qin Qiming. Acta Scientiarum Naturalium Universitatis Pekinensis On Line, Vol.1, No.4, Dec.30, 200