

CHANGE ASSESSMENT OF ALBEDO FOR THE DIFFERENT HUMANISTIC REGIONS

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1. INTRODUCTION

Albedo is defined as the ratio of all the reflected energy to all the incident energy. It has been shown that albedo is one of the most essential parameters on the radiation energy budget of land surface from analysis of the land-surface process^{[1][2]}, which has influence on the regional climate and even on the global climate. Thus the alteration of the albedo on earth may cause the fluctuation of climate. But it is not very clear about how and how much the albedo is changed in the spatial and temporal in the region. China is one of countries which greatly suffers from the negative influence of climate change and also greatly affects the climate with the rapid development of Chinese economic as reported in the fourth reports of Intergovernmental Panel on Climate Change (IPCC)^[3]. This paper 1) describes the changes of albedo during years from 2000 to 2008 for the different humanistic regions and 2) compares and assesses how the changes of landuse and regional environments affect the variations of albedo.

2. DATA AND STUDYING AREAS

We chose two administrative areas in China with the different humanistic characteristics as the studying area, one is Maduo County in the province of Qinghai and the other is Beijing district. The Maduo County is located at N34.5° - N35.5° , E96.5° - E99.5° on the Qinghai-Tibet Plateau and its average altitude is up to 4500m. The land cover types are mainly alpine grasslands, meadows, and wetlands in Maduo region where there are lesser human activities and the grasslands have been recovering gradually under the national environmental conservation policy since 2003. On the contrary, Beijing (N39.4° - N41.2° , E115.3° - E117.5°), one of the most developed political and economic international center, is mainly covered with the impervious surface such as buildings, roads and so on, where the area of urban is expanding year by year. Human activities in Beijing are far more than in Maduo.

The datasets of MODIS/Terra+Aqua Albedo 16-Day L3 Global 500m SIN Grid V005 (MCD43A3) and MODIS/Terra Vegetation Indices 16-Day L3 Global 500m SIN Grid V005 (MOD13A15) during 2000-2008 were collected from the Warehouse Inventory Search Tool (WIST). The monthly average atmospheric temperature data from 2000-2008 were collected from China Meteorological Data Sharing Service System. The field data of albedo

in the shortwave spectrum, optical depth and temperature were acquired in the field works, which was conducted on the grassland and wetlands in Maduo in August, 2009.

3. METHODOLOGY

The yearly and seasonal variations of albedo for two study areas were taken according to the following steps.

- (1) Multi-temporal black-sky and white-sky albedo images including 900 scenes from 2000 to 2008 were derived from MODIS MCD43A3 datasets. The images were re-projected and mosaiced by the batch processing based on the MODIS Re-projection Tools (MRT) and cygwin software.
- (2) The actual albedo images were derived from black-sky and white-sky albedos based on the albedo formula^[4] and 6S.
- (3) Statistics of albedos were calculated based on the whole administrative districts of Maduo County and Beijing respectively, where the lake surface are excluded not to used in the statistics. Moreover the multi-temporal variations of albedo for the different land cover types in two areas are analyzed as well.
- (4) The yearly and seasonal variations of albedos are investigated in two studying areas of Maduo and Beijing, respectively. We compare and assess their variations combined with the variation of meteorological temperatures and land cover types. .

4. RESULTS AND CONCLUSIONS

The preliminary results present as the followings.

4.1 Albedo in two studying areas

The results show that the average annual albedo for years 2000-2008 for Beijing is 0.121, which is lower than that of Maduo with the value of 0.227. The standard deviation is 0.001 for Beijing and 0.034 for Maduo.

4.2 Seasonally variations of albedo and temperature

Based on the average statistics of 9 years, the seasonal variation of albedo is significantly larger in Maduo than in Beijing (Fig.1). The seasonal variation of temperature shows inverse relationship with the albedo in Maduo.

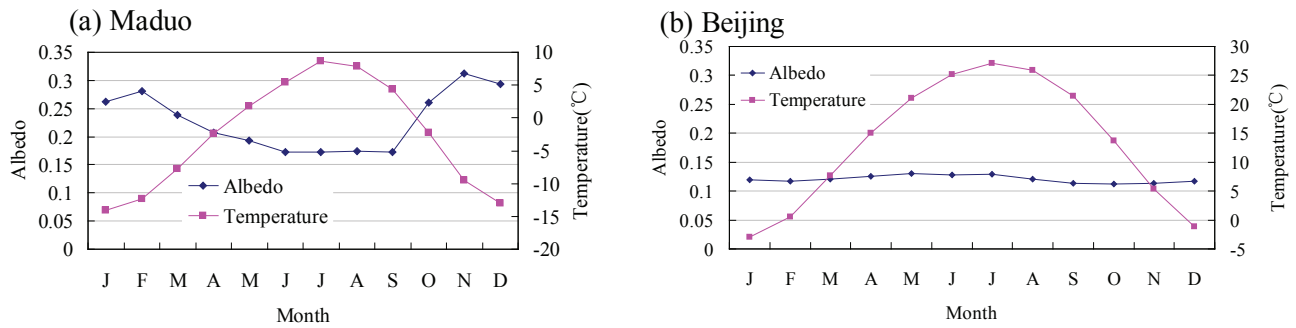


Fig.1. Seasonal variations of albedo and temperature in (a) Maduo and (b) Beijing.

There is no significant seasonal variation of albedo in Beijing (Fig.1(b)), that may be related with the human activities' disturbances in most of the built-up area. Whereas the significant seasonal variation characteristics of albedo in Maduo (Fig.1(a)) may be related with natural vegetations and lesser human activities' disturbances.

4.3 Yearly variations of albedo and temperature

The yearly variation of albedo in Maduo shows the increasing trends from 2000 to 2008, while the albedo variation in Beijing shows slightly decreasing trends (Fig.3). Furthermore, the value of albedo in Maduo is always higher than that in Beijing. The temperature and precipitation show slightly increased trend year by year in both areas (Fig.4-Fig.5). The different variation trends in Maduo and Beijing are related with the different land cover types. But as shown as in Fig.3 the yearly increase aptitude trend of Maduo albedo especially in the same winter season is larger than that of Beijing, which indicates that the effects decreasing the temperature in Maoduo should be larger than the effects increasing temperature in Beijing. The results maybe tell us that the main factors caused the global warming maybe is the emission of green house gases as reported by IPCC, not as reported by Brian ^[5] that the landuse change may be the main factor causing the global warming.

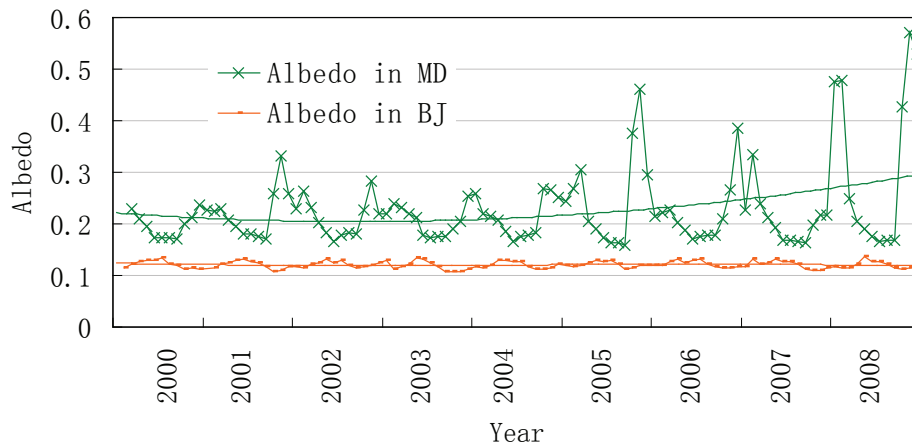


Fig.3 Year-to-year variations of albedo in Maduo (MD) and Beijing (BJ)

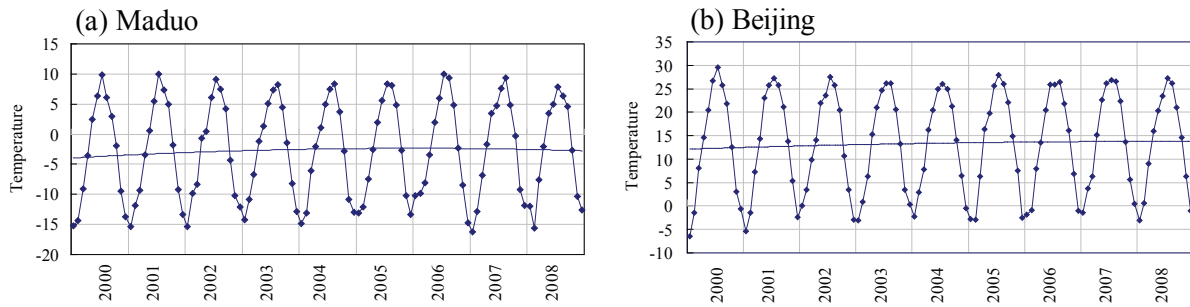


Fig.4 Yearly variations of temperature in Maduo (a) and Beijing (b)

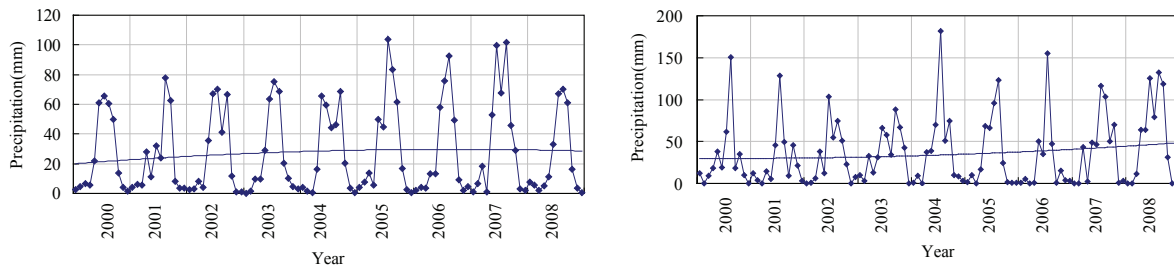


Fig.5 Yearly variations of precipitation in Maduo (a) and Beijing (b)

4.4 Conclusion and further works

Our research has shown the different albedo variation characteristics between the temperature and albedo in two different areas, which are the plateau area of lesser human activities and large city affected a lot by human activities. The interesting results, that albedo yearly change trend of Beijing is adverse to Maoduo from 2000 to 2008 while their temperature change trend is the same, imply us that the changes of albedo in the plateau of Maduo may play a positive effects in the process of global warming since it has been known that the urban area has increased the temperature. We need to take the further investigation for the vegetation and landcover changes of Maduo and Beijing. We will give more results and discussion in the full paper.

5. REFERENCES

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