Analysis of Vegetation Coverage Change Characteristics in Chongqing Based on MODIS-NDVI Data

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Abstract: In order to study the characteristics of vegetation cover change in Chongqing, MODIS-NDVI is used as data source. In this paper, the change of vegetation coverage in Chongqing from 2000 to 2011 was analyzed by mean value method and difference method from year, spring, summer, autumn and winter respectively. The results showed that the change of vegetation cover was larger than that of the western region on the annual scale. On the seasonal scale, the vegetation in the spring was in the middle with a high and low trend. The higher vegetation area was distributed in the summer area, and the lower area of vegetation was concentrated in the western part of the study area. Vegetation in autumn showed a flaky distribution in space. Winter vegetation to the Yangtze River as the boundary, the south cover is slightly higher than the north.

1. Introduction

Vegetation is associated with soil, atmosphere and moisture in the ecosystem. It reflects changes in certain components of the natural system, which help to study global changes. Human activities directly or indirectly lead to damage to vegetation, resulting in deterioration of the ecological environment and global environmental changes, such as the proportion of soil erosion, atmospheric carbon dioxide content increased, global warming. These changes directly affect the survival and reproduction of mankind. NDVI is one of the important indicators of the ecological environment. It plays a very important role in measuring the ecological environment, especially agriculture that is closely related to people's life, such as the estimation of crop production, the classification of vegetation and the valuation of crop economy market. It also provides services for the relevant parts indirectly.

Domestic and foreign scholars have done a lot of research on vegetation. Myneni et al. have shown that in the past 20 years, the northern hemisphere, high latitudes of vegetation activities showed a significant increase in the trend [ⁱ]. Schultz et al. Confirmed that the temperature rise in 20 years, leading to climate warming, northern hemisphere high latitudes of vegetation in advance of the trend of green [⁲]. Wang et al. results show that the North American grassland climate NDVI and spring and
summer cumulative precipitation was proportional relationship \(^3\). Letter et al. used a year of data to study the changes in vegetation cover in the Loess Plateau \(^4\). Scholar Park Shi-long, Fang Jingyun et al. studied the change of vegetation in China and its response to climate \(^5\)-\(^6\). Li Dengke analyzed the vegetation change and its relationship with climate in Wuqi County, Shaanxi Province with a whole year data \(^7\). Song Yi et al. analyzed the vegetation change and its relationship with climate in northwest China based on SPOT VEGETATION data \(^8\). In this paper, the NDVI products of MODIS data from 2000 to 2011 were used to study the vegetation distribution characteristics and the variation law of Chongqing from time and space.

2. Study area
Chongqing is located in the eastern part of Sichuan, in the south of Shaanxi, east of Hubei, Hunan, and south of Guizhou. The northwestern part of the northwest and the central part is mainly hilly and mountainous, and the slope area is larger. The terrain is reduced from north to south to the Yangtze River valley, and the area is subtropical and humid. Monsoon climate. The study area is subtropical humid monsoon climate. Its annual average temperature is around 18 \(^\circ\)C and the annual rainfall is 1000-1400 mm.

3. Data and Methods

3.1. Data description
The vegetation coverage data from the MODIS13A3 level provided by the NASA Earth Observation System (EOS) are 1 km and the time resolution is 1 month. The data selection time is 2000 - 2011 as the research scope.

3.2. Methods - Linear Trend Analysis
(1) Mean method: Utilize ArcGIS's grid calculation to find the NDVI average of all the pixels in the study area.

(2) Difference method: the use of different time image difference to represent the NDVI changes. Define the time series:

\[
\Delta NDVI = NDVI_i - NDVI_{i-1}
\]

In the formula, \(i\) represents the average NDVI value for a certain period. \(\Delta NDVI\) represents the difference between the \(i\)-th and \(i-1\) periods NDVI.

4. Analysis of vegetation coverage change.
In this paper, the characteristics of vegetation coverage change in Chongqing from 2000 to 2011 were analyzed from the aspects of year, spring, summer, autumn and winter scale, using mean method and difference method.

4.1. Analysis of vegetation change at annual scale
Based on the NDVI data of the study area from 2000 to 2011, the spatial distribution of the average vegetation change in the study area was obtained by using the difference method. The NDVI range of the study area was between 0-0.84 and the maximum was 0.84 A value of 0. The vegetation cover on the whole shows that the eastern part of the study area is superior to the western region. The area with high vegetation cover is concentrated in the urban area of the northeast of Chongqing, the Wuxi area and most of the north of the Yangtze River. The relatively small areas of vegetation cover are distributed in the areas of Tongnan, Hechuan, Tongliang and Yongchuan in the western part of the study area, which the vegetation coverage in the main urban area of Chongqing is the lowest area of the whole study area.
4.2. Analysis of vegetation change in spring
On the whole, the change of vegetation coverage in the study area was high in the middle and the trend was low. The area with the highest vegetation cover is concentrated in the areas of Fuling District, Wulong County, Fengdu County, Shizhu County, Nanchuan City and Wansheng District. The vegetation cover is relatively small in Wushan County and Jiangjin City. The coverage of the city is the lowest. Vegetation changes in Chongqing NDVI range in 0-0.69 and the maximum value of 0.69.

4.3. Analysis of vegetation change in summer
The highest NDVI in the spring area is 0.30, which is in the range of 0-0.99. The highest vegetation NDVI in Chongqing is distributed in Chengkou County, Wuxi County, Wushan County, in the Shizhu County, Fengdu County, Wulong County from southeast to southwest into the strip distribution and The lowest change in vegetation cover is located in the urban area of Chongqing. In the study area, the areas with high vegetation cover change were striped, and the areas with low change were in mass in the western main city.

4.4. Analysis of vegetation change in autumn
From the perspective of distribution, the change of vegetation cover in the study area is quite different in autumn, and the change space of planting cover in autumn is shown in a flaky distribution. The overall performance is the increasing trend from southwest to northeast. The range of vegetation changes in NDVI was between 0 and 0.89, and the vegetation coverage changes were highest in chengkou county, wuxi county and the Yangtze river annex area. Vegetation is slightly lower in the north of the Yangtze River and the main city is the lowest coverage area.

4.5. Analysis of vegetation change in winter
The change of vegetation in winter is similar to that of autumn vegetation. The area of vegetation NDVI is 0-0.83, and the main urban area north of the Yangtze river is the area with the lowest vegetation coverage. NDVI is not the most extensive, but it is widely distributed in areas with high coverage. As the main urban area of chongqing is affected by human activities and the vegetation coverage is the lowest.

5. Conclusions and discussion
In this paper, the change of vegetation coverage in Chongqing from 2000 to 2011 was analyzed by mean value method and difference method from year, spring, summer, autumn and winter respectively. The main conclusions are as follows: The change of vegetation cover on the whole scale shows that the eastern part of the study area is better than the western region. Vegetation cover is higher in the area concentrated in the northeast of Chongqing city, Wuxi area and the Yangtze River to the north of most of the region. The change of vegetation coverage in the spring area was in the middle and the trend was low, and the coverage of the urban area in Chongqing was the lowest. In the summer, the areas with high vegetation cover change were striped, and the areas with low change were in mass in the western main city. The vegetation cover in autumn was spatially distributed. The winter vegetation is characterized by the Yangtze River as the boundary and the south cover is slightly higher than the north.

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