Extraction of Remote Sensing Information of LONGAN Under Support of "3S" Technology in Guangxi Province

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Abstract. This paper presents an automatic approach to planting areas extraction for mixed vegetation and hilly region, more cloud using moderate spatial resolution and high temporal resolution MODIS data around Guangxi province, south of China. The Maximum likelihood was used to extract the information of longan planting and their spatial distribution through the calculation of multiple-phase MODIS-NDVI in Guangxi and ten stylebook training regions of longan of being selected by GPS. Compared with the large and little regions of longan planting in monitoring image and the investigation of on the spot with GPS, the resolute shows that the longan planting information in remote sensing image are true. In this research, multiple-phase MODIS data were received during longan main growing season and preprocessed; NDVI temporal profiles of longan were generated; models for planting areas extraction were developed based on the analysis of temporal NDVI curves; and spatial distribution map of planting areas of longan in Guangxi in 2009 were created. The study suggests that it is possible to extract planting areas automatically from MODIS data for large areas.

Key words: Longan , 3S , MODIS , Information extraction

1   Introduction

The longan tree is handsome, erect, to 30 or 40 ft (9-12 m) in height and to 45 ft (14 m) in width, with rough-barked trunk to 2 1/2 ft (76.2 cm) thick and long, spreading, slightly drooping, heavily foliaged branches. The evergreen, alternate, paripinnate leaves have 4 to 10 opposite leaflets, elliptic, ovate-oblong or lanceolate, blunt-tipped; 4 to 8 in (10-20 cm) long and 1 3/8 to 2 in (3.5-5 cm) wide; leathery, wavy, glossy-green on the upper surface, minutely hairy and grayish-green beneath. New growth is wine-colored and showy. The pale-yellow, 5- to 6-petalled, hairy-stalked flowers,

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larger than those of the lychee, are borne in upright terminal panicles, male and female mingled. The fruits, in drooping clusters, are globose, 1/2 to 1 in (1.25-2.5 cm) in diameter, with thin, brittle, yellow-brown to light reddish-brown rind, more or less rough (pebbled), the protuberances much less prominent than those of the lychee. The flesh (aril) is mucilaginous, whitish, translucent, somewhat musky, sweet, but not as sweet as that of the lychee and with less "bouquet". The seed is round, jet-black, shining, with a circular white spot at the base, giving it the aspect of an eye.

Guangxi located in the area of low latitude (200-270) complicated geographic environment. Meteorological disaster such as frost injury, cold wave and drought could seriously affect LONGAN production, especially in 2008. The most continuously lower temperature, rainy and snowy, freeze injury weather took place from on Jan 12th to Feb 12thin the southern of China. The disaster occurs once in fifty years. LONGAN and other sub-tropic crops were suffered injury severity. However, due to the laggard monitoring method and monitoring means, disaster loss evaluation had not been exactitude evaluated till on Apr 1st , 2008. The exactly and quickly evaluating disaster losing have become a focus issue for government .Planting spatial distribution information is key factor in quickly disaster losing evaluation. In order to improve classification accuracy, some classification methods were studied by many experts in recently years. Vegetation index was proposed to classify plant types. Yang, J.G. thought that PVI could easily identify broadleaf forest and conifer forest, and the RVI difference was obvious in different coniferous forest species (Yuan,1999). Wang, Q.F. thought the characteristics of land-cover′s seasonal variability derived from remote sensing images can make some typical land cover easy to be distinguished (Wang,2006). Gong, P. thought that the TVI was used in the land cover classification could resolve the problem of Grassland and cropland and needle-leaf deciduous forest and broadleaf deciduous forest had similar phenological characteristics which were easy to be confused. The results show that the TVI includes more information and is more sensitive to land cover than NDVI, and MODIS data have their own advantages in the regional land cover mapping (Gong, 2006). With the development of satellite remote sensing technology, extraction of remote sensing information of LONGAN planting spatial distribution by using "3S" technology has become reality. Taking LONGAN planting of Guangxi Province as example, the article try to use MODIS data for extraction of remote sensing information of LONGAN planting spatial distribution. The objective is to make better use of "3S" technology to serve the society.

2   Materials and methods

2.1   Study area

This study area is located in Guangxi province, south of China. It's latitude is 20°54′ ～26° 23′ N and longitude is 104° 29′ ～112° 04′ E, total area is 236700.0 km2. It belongs to monsoon region of south subtropical zone and north tropical zone

without four clearly demarcated seasons of spring, summer, autumn and winter. The climate here is hot and humid in summer and warm and dry in winter.Data input to the method is assumed to be calibrated and navigated level 1B radiance data which offered by National Satellite Meteorological Center and DVBS of GuangXi Institute of Meteorology. The time segment of complete data is from 2002 to 2009. The MODIS data used to this method must be clear without cloud or little cloud images.

2.2   Extraction of remote sensing information method

Due to the relationship between vegetation indices calculated by different algorithms, reflectance of bands and field measurements of NDVI, NDVI was retrieve by using EOS/MODIS data. A NDVI retrieval model for study area can be established with this relationship. The specific flow chart of retrieval technique is shown as Fig. 1.

Based on the above flow chart of technique, detailed steps are described as follows:

• Inversing reflectance for EOS/MODIS imagery

The pre-processing included atmospheric correction, geometric correction, and orthographic correction. The purpose of atmospheric correction was to obtain accurate reflective characteristics of ground surface, followed by geometric correction which ground control points were chosen referencing to a topographic map of 1:250,000. The objective of atmospheric correction for EOS/MODIS data is to attain related parameters which can indicate the vegetation inherent properties of the region. Since the remotely sensed image was affected by reflective solar energy, solar elevation, zenith angle, the thickness of aerosol and the bidirectional scattering due to the mutual influence of ground environment factors, we should take into account both atmospheric and bidirectional scattering to obtain accurate ground reflectance. Because the parameters of atmospheric profile based on measurements data or standard atmospheric profile were not established in China, in this paper we adopted international standard parameters of atmospheric profile to correct EOS/MODIS image.

• Obtaining characteristic parameters of vegetation

Due to the chlorophyll and inner architecture of foliage, a special reflective spectrum of vegetation foliage was formed like intensive absorption in the red waveband and intensive reflection in the near infrared waveband. Normalized difference vegetation index (NDVI) is chosen to obtain the vegetation coverage information from the satellite images. This index combines the algorithms of EVI, DVI and DDVI together with high fidelity of indicating the vegetation on the ground. It is one significant indirect index of the growth and number of vegetation and has a linear correlation with the vegetation coverage density. The formula is shown as:

$$NDVI=(NIR-RED)/NIR+RED） \quad -1 \leqslant NDVI \leqslant 1. \tag{1}$$

In which NIR and RED represents the reflectivity of the vegetation coverage on the near-infrared band and red band respectively.

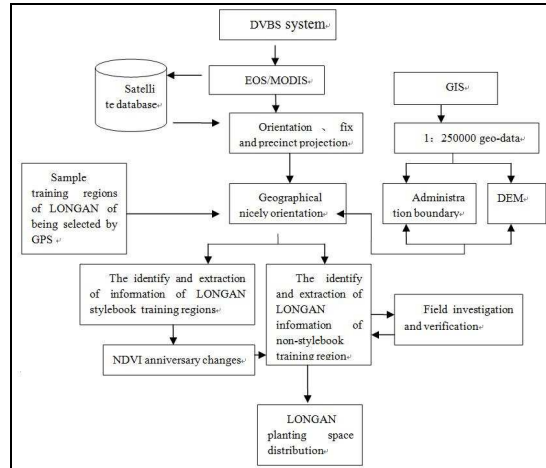4   Xin Yang1,2, , Chaohui Wu 1,2，Weiping Lu 1,2, Yuhong Li 1,2, Shiquan Zhong 1,2,

Fig. 1. The flow chart of the identify and extraction of LONGAN planting space distribution information based on EOS/MODIS data

From the equation we can see that the water area and roadway area and city or town area, theirs value of NDVI are below 0 or approach constant value in different seasons. But the land surface with cover foliage, NDVI ranges from 0.1 to 0.6. NDVI has been applied in many fields, such as land cover or change, vegetation and environment change, net primary productivity and the assessment of crop yield.

- Sample training regions of LONGAN of being selected by GPS

To the same foliage, its value of NDVI is various with its growth process. As result, the values of NDVI between foliages are diversity in different seasons. In order to mastery the spectrum characteristic of LONGAN and distinguish LONGAN from many kinds of foliages, some sample training regions of LONGAN (the area must be bigger than 7 ha^2) in different county of Guangxi were selected by GPS (the Global Positioning System).

- The identify and extraction of LONGAN planting information based on EOS/MODIS data.In the first place, the values of NDVI of sample training regions of LONGAN during the main growing seasons were calculated. As result, we could find the variety trend of curves of LONGAN in regions being consistent (Fig.2).
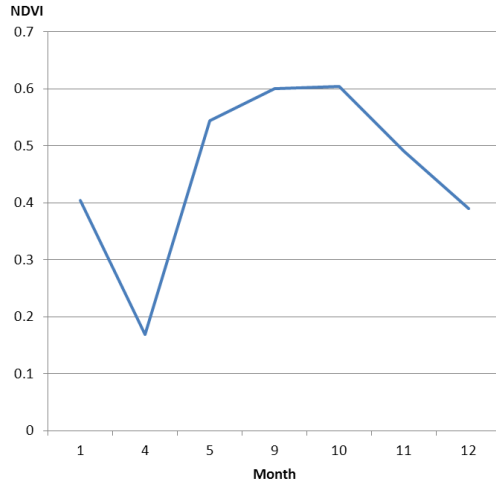
Fig. 2. The curse of NDVI of LONGAN in training regions

Corn and rice and soybean, theirs growth (from sowing to harvest) are general lasting 3 or 4 months. The south subtropical zone and north tropical zone forest growth lasting more than 12 months, but its value of NDVI anniversary approach constant. Consequently, the curves of NDVI variety in different foliages during the main growth seasons are difference. We can use the Maximum likelihood to extract the information of LONGAN planting and its spatial distribution through the calculation of multiple-phase MODIS-NDVI from different foliages in Guangxi province. The result shows that the information of LONGAN planting and its spatial distribution in 2009 were clearly in remote sensing imagine (Fig.3). The survey of field also showed that the information of LONGAN planting based on multiple-phase EOS/MODIS data was highly reliable and truth.
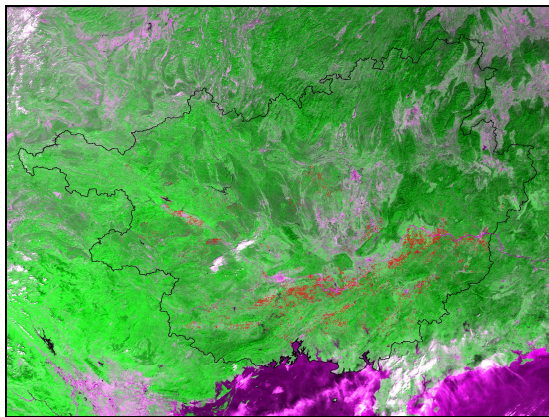
Legend: LONGAN   reservoir   other plant

Fig. 3. the imagine of LONGAN planting and its spatial distribution based on EOS/MODIS in Guangxi province

3   Discussion and conclusion

Based on the above study and analysis, some conclusions can be drawn as follows:
(1) It is first used for extraction of LONGAN planting spatial distribution information by using MODIS data.
(2)Method for extraction of LONGAN planting spatial distribution information by using MODIS data is given in this paper.
(3) Decomposition of Mixed pixel is a difficulty points in calculating area of LONGAN, so this paper does not calculate area of LONGAN.

Acknowledgments

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