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Application of Background Information Database in Drought Monitoring of Guangxi in 2010

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Abstract. In this paper, use Nanning city as an example to show application of Background information database in drought monitoring. A near-real time drought monitoring approach is developed using Terra-Moderate Resolution Imaging Spectoradiometer (MODIS) Normalized Difference Vegetation Index (NDVI) and Land Surface Temperature (LST) products. The approach is called Vegetation Temperature Condition Index (VTCI), which integrates land surface reflectance and thermal properties. VTCI is defined as the ratio of LST differences among pixels with a specific NDVI value in a sufficiently large study area; The ground-measured precipitation data from a study area covering Nanning in Guangxi, CHINA, are used to validate the drought monitoring approach. Taking the result of drought monitoring in background information of Nanning city, the area of farmland drought of Mild drought Moderate droughts Severe drought were 223607.2 Ha, 310596.9 Ha and 513.2 Ha.

Key words: Background Information Database, Drought Monitoring, MODIS, Guangxi

1 Introduction

Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. Drought is one of the major environmental disasters in China, whereas in recent years it have happened in mid and southern of china seriously, so it is very important to detect and monitor drought periodically at large scale for decision making. Droughts can be assessed with many kinds of indices but it is extremely difficult to quantitatively monitor and predict. Remote sensing is able to supply us with an update on crop condition over a large geographic area using a series of coarse resolution satellites and this technology has become the important means of drought monitoring. In the past decades, many

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methods using remote sensing information to monitor drought, such as Normalized difference vegetation index (NDVI), Vegetation Condition Index (VCI), Temperature Condition Index (TCI) and others. These indices have been developed and successfully used for monitoring drought and have the advantage in monitoring spatial and temporal variation of drought at regional, continental, and even at global scales due to their large and frequent coverage. At present, remote sensing methods for drought monitoring are mainly classified into four categories: Vegetation Index-based, Temperature-based, Vegetation and Temperature-based, and Cloud-based. The representative indices include Vegetation Supply Water Index (VSWI), Temperature/Vegetation Dryness Index (TVDI); Apparent Thermal Inertia Index (ATI), and Cloud Parameters Index (CPI). MODIS data is calibrated on orbit and it uses the complicated re-correcting technology to locate when it scans. Because of high-quality and effective monitoring, MODIS has become a widely used data source in drought monitoring. In this study, the vegetation temperature condition index(VTCI)model based on NDVI—LST feature space was applied to validating a series of drought disaster which occurred in Guangxi Province during the spring in 2010, and use Nanning city as an example to show application of Background information database in drought monitoring.

2 Materials and methods

2.1 Study area

Nanning is the capital of Guangxi autonomous region in southern China. Nanning is located in the southern part of Guangxi Zhuang Autonomous Region, 160 km from the border with Vietnam. It has an area of 22,293 square kilometers. The city is located on the north bank of the Yong River, the chief southern tributary of the Xi River, and lies some 30 km below the confluence of the Yu and the Zuo rivers. The Yong River (which later becomes the Yu River) affords a good route to Guangzhou and is navigable by shallow-draft junks and motor launches, even though it is obstructed by rapids and sandbanks. Nanning is situated in a hilly basin with elevations between 70 and 500 m above sea-level. Average temperature is 21.7°C. It is often windy or breezy and very rainy, with more than 1300 mm of precipitation annually. It is also frost-free for all but 3 or 4 days a year and never snows.

2.2 Data acquisition

In this study, MODIS images April, 8 in 2010 were required. According to remote sensing image interpretation target mark and image spectral characteristics, found remote sensing interpretation model of the background information of forest, shrub and grass, agricultural land, surface water, towns, roads from TM and ETM data from 1988 to 2008, using supervision, unsupervised, maximum classification of natural law to retrieve background information from simple to complex interpretation

of each classification. Meanwhile ,using human-computer interaction to refine the results. The output shp format data Vector file of disaggregated data edited in the GIS system, and get the background information on various types of remote sensing data each time(Fig. 1), then to map the agricultural land of Nanning City(Fig.2).

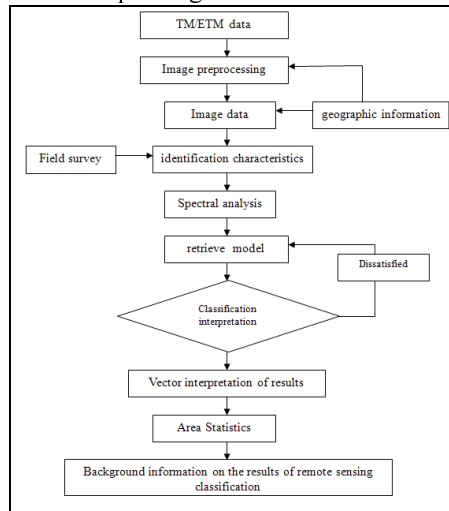


Fig. 1. The flow chart of background information of remote sensing classification

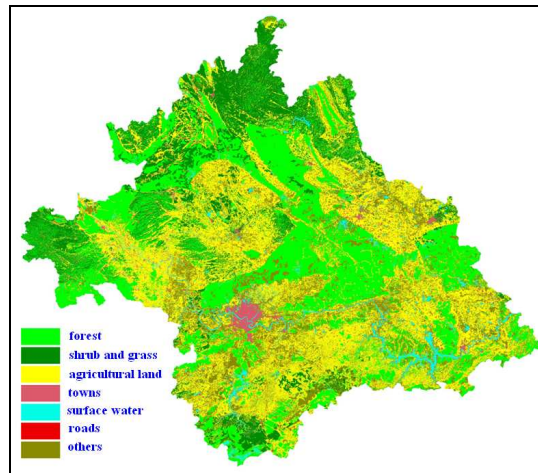


Fig. 2. Background information classes of Nanning City

2.3 Data processing

Land surface temperature derived from brightness temperatures and NDVI from MODIS data are used to calculate VTCI .The temporal-spatial distribution of drought

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

of 2010 in Nanning City in Guangxi was made by using the VTCI(Fig.3). Taking the result of drought monitoring in background information of Nanning city ,the distribution of arable land drought is made(Fig.4).

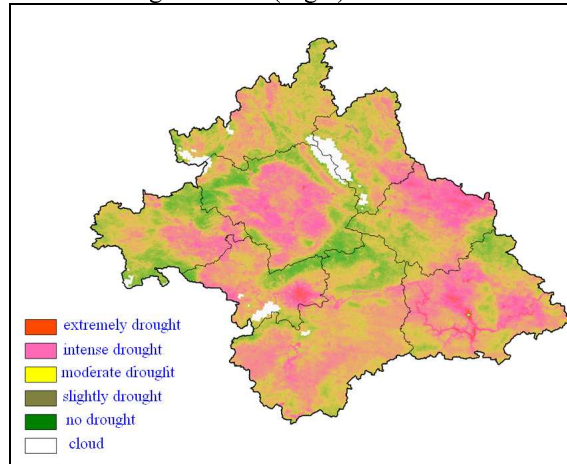


Fig. 3. Temporal-spatial distribution of drought of 2010 of Nanning City

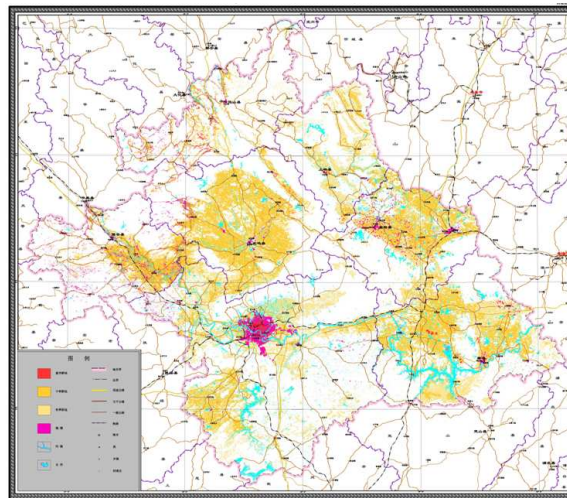


Fig. 4. Distribution of arable land drought

3 Discussion and conclusion

The result of drought monitoring in background information of Nanning city shows that the area of arable land drought of Mild drought Moderate droughts Severe drought were 223607.2 Ha ,3 10596.9 Ha and 513.2Ha(Table1).

Table 1. the area of arable land drought results(Ha)

	Slightly drought	Moderate drought	Intense drought
Binyang County	22957.2	52453.1	6.0
Heng County	34354.5	67289.3	501.4
Long'an County	17494.1	35137.4	0
Mashan County	23562.7	5611.5	0
Nanning area	66210.9	43871.8	0
Shanglin	31747.1	10546.8	0
Wuming County	27280.7	95687.0	5.8

The following conclusions can be reached on the basis of above analysis: Taking the result of drought monitoring in background information can provide more detailed surveillance. The background information can provide services to support decision-making for government departments. Based on the above study and analysis, some conclusions can be drawn as follows:

1. It is an effective way to use background information in drought monitoring to provide more detailed surveillance.
2. The information of drought monitoring can support disaster assessment for government .

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References

1. D. A. Wilhite and M. H. Glantz, "Understanding the drought phenomenon: the role of definitions," *Water International*, vol.10, no. 3, 111–120(1985)
2. R. Nemani, L. Pierce, S. Running, and S. Goward, "Developing satellite-derived estimates of surface moisture status," *Journal of Applied Meteorology*, vol.32,no.3, 548–557 (1993)
3. A. Volcani, A. Karnieli, and T. Svoray, "The use of remote sensing and GIS for spatio-temporal analysis of the physiological state of a semi-arid forest with respect to drought years," *Forest Ecology and Management*, vol. 215, no. 1–3, 239–250(2005)
4. T. Tadesse, J. F. Brown, and M. J. Hayes, "A new approach for predicting drought-related vegetation stress: integrating satellite, climate, and biophysical data over the U.S. central plains," *ISPRS Journal of Photogrammetry and Remote Sensing*, vol. 59, no.4, 244–253(2005)

5. P. R. Bajgiran, A. A. Darvishsefat, A. Khalili, and M. F. Makhdoum, "Using AVHRR-based vegetation indices for drought monitoring in the Northwest of Iran," *Journal of Arid Environments*, vol.72, no. 6, 1086–1096(2008)
6. A. T. Jeyaseelan and F. N. Kogan, "Evaluation of GVI based indices for drought early warning in India," in *Disaster Forewarning Diagnostic Methods and Management*, vol. 6412 of *Proceedings of SPIE*, 4120–4120(2006)
7. G. Marshall and X. Zhou, "Drought detection in semiarid regions using remote sensing of vegetation indices and drought indices," in *Proceedings of the International Geoscience and Remote Sensing Symposium (IGARSS '04)*, September 2004, vol. 3, 1555–1558(2004)
8. [8] L. Liu, D. Xiang, X. Dong, and Z. Zhou, "Improvement of the drought monitoring model based on the cloud parameters method and remote sensing data," in *Proceedings of the 1st International Workshop on Knowledge Discovery and Data Mining (WKDD '08)*, 293–296(2008)
9. W. Mo, Z. Wang, H. Sun, L. Ma, and L. He, "Remote Sensing Monitoring of Farmland Drought Based on Vegetation Supply Water Index," *Journal of Nanjing Institute of Meteorology*, vol.29, no.3, 396–401(2006)
10. C. Naira, L. Robert, M. Ramata, and T. Marouane, "Surface soil moisture status over the Mackenzie River Basin using a temperature/vegetation index," in *Proceedings of the International Geoscience and Remote Sensing Symposium (IGARSS '07)*, 2007, 1846–1848(2007)
11. [11] N. R. Patel, R. Anapashsha, S. Kumar, S. K. Saha, and V. K. Dadhwal, "Assessing potential of MODIS derived temperature/vegetation condition index (TVDI) to infer soil moisture status," *International Journal of Remote Sensing*, vol. 30, no. 1, 23–39(2008)
12. W. Li, S. Y. Mao, and W. Chen, "A new method of cloud detection in MODIS image," in *Proceedings of the 7th International Conference on Electronic Measurement and Instruments*, vol.7, 281–285(2005)
13. G. Cai, MODIS data based thermal inertia and land surface temperature modeling and their applications in determination of soil moisture and heat exchange, doctoral dissertation, M.S. thesis, Institute of remote sensing applications Chinese academy of sciences, 2006.10 *Advances in Artificial Intelligence*(2006)
14. L. Liu, D. Xiang, Z. Zhou, and X. Dong, "Analyses the modification functions of the drought monitoring model based on the cloud parameters method," in *Proceedings of the 1st International Congress on Image and Signal Processing (CISP '08)*, vol.4, 687–691(2008)
15. B. C. Reed, J. F. Brown, D. VanderZee, T. R. Loveland, J. W. Merchant, and D. O. Ohlen, "Measuring phenological variability from satellite imagery," *Journal of Vegetation Science*, vol.5, no. 5, 703–714(1994)
16. S. Hamel, M. Garel, M. Festa-Bianchet, J.-M. Gaillard, and S. D. Côté, "Spring Normalized Difference Vegetation Index (NDVI) predicts annual variation in timing of peak faecal crude protein in mountain ungulates," *Journal of Applied Ecology*, vol.46, no. 3, 582–589(2009)
17. J. T. Kerr and M. Ostrovsky, "From space to species: ecological applications for remote sensing," *Trends in Ecology & Evolution*, vol.18, no.6, 299–305(2003)

18. Y. Julien and J. A. Sobrino, "The Yearly Land Cover Dynamics (YLCD) method: an analysis of global vegetation from NDVI and LST parameters," *Remote Sensing of Environment*, vol. 113, no. 2, 329–334 (2009)
19. I. Sandholt, K. Rasmussen, and J. Andersen, "A simple interpretation of the surface temperature/vegetation index space for assessment of surface moisture status," *Remote Sensing of Environment*, vol. 79, no. 2-3, pp. 213–224 (2002)
20. S. Qi, C. Wang, and Z. Niu, "Evaluating soil moisture states in China using the temperature/vegetation dryness index (TVDI)," *Journal of Remote Sensing*, vol. 15, 420–427 (2003)
21. W. Li and D. Li, "The universal cloud detection algorithm of MODIS data," in *Geoinformatics 2006: Remotely Sensed Data and Information*, October 2006, vol. 6419 of *Proceedings of SPIE*, 4190 (2006)
22. C. Li and H. Li, "Study on winter wheat drought monitoring by TVDI in Hebei Province," in *Remote Sensing and Modeling of Ecosystems for Sustainability III*, San Diego, Calif, USA, August 2006, vol. 6298 of *Proceedings of SPIE*, 2981–2981 (2006)
23. C. Jin, Q. M. Qin, L. Zhu, P. Nan, and A. Ghulam, "TVDI based crop yield prediction model for stressed surfaces—a case study on Ningxia Huizu autonomous region of China," in *Proceedings of the International Geoscience and Remote Sensing Symposium (IGARSS '08)*, 4656–4658 (2008)