

## Crop Drought Monitoring Using MODIS Data in Poyang Lake Watershed

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### Abstract:

Drought is one of the major environmental disasters in north 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 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.

NDVI (Normalized Difference Vegetation Index) has been widely used to monitor moisture-related vegetation condition. It presents as  $(\rho_{\text{NIR}} - \rho_{\text{RED}}) / (\rho_{\text{NIR}} + \rho_{\text{RED}})$ , where  $\rho_{\text{RED}}$  is the radiance (in reflectance units) of a red channel near 0.66  $\mu\text{m}$ , and  $\rho_{\text{NIR}}$  the radiance (in reflectance units) of a near-IR channel around 0.86  $\mu\text{m}$ . The two channels used in NDVI sense through different depths of vegetation canopies. The near-IR channel can see roughly eight leaf layers, while the red channel sees only one leaf layer or less because of the strong chlorophyll absorption near 0.67  $\mu\text{m}$ . NDVI is known to be saturated when applied to images over areas having leaf area index of 3 or greater. Numerous other vegetation indices with varying complexity have been developed using the same set of near-IR and red channels during the past decade. These indices do not have nearly the same popularity as that of NDVI.

Water is one of the most common limitations that cause drought. Remote sensing of vegetation water content has important applications in agriculture and forestry. Besides the thermal region of the electromagnetic spectrum (8–14  $\mu\text{m}$ ), two spectral regions have been found to be useful for the detection of plant water content: the near-infrared region (near-IR, 0.7–1.3  $\mu\text{m}$ ) and the shortwave infrared region (SWIR, 1.3–2.5  $\mu\text{m}$ ). The Normalized Difference Water Index (NDWI) that uses near-IR and SWIR channel has been developed which is sensitive to vegetation, soil moisture and leaf water content. The index was calculated in addition to the Normalized Difference Vegetation Index (NDVI) and to better understand the relationship between vegetation vigor and moisture availability.

NMDI (Normalized Multi-band Drought Index) is a drought index most recently proposed using multiple NIR and SWIR channels. Similar to NDWI and NDVI, this newly designed index uses the NIR channel centered at 860 nm as the reference. This index uses the difference between two liquid water absorption bands (1640 nm and 2130 nm), as the soil and vegetation water sensitive band. Strong differences between two water absorption bands in response to

soil and leaf water content give this combination great potential to estimate water content for both soil and vegetations.

In this study, the analysis was conducted on the combining information from visible, near infrared, and short wave infrared channels (1640 nm and 2130 nm) to improve sensitivity to drought severity. Using the NMDI (Normalized Multi-band Drought Index ) that had a stronger response to summer drought conditions than a simple difference between NDVI and NDWI, and is therefore a more sensitive indicator of drought in Poyang Lake Watershed. With the support of land use map and soil humidity of crop for the growing season, we build a simple model of the study area for crop drought monitoring. The results of August 2007 show that the large scale temporal and spatial characteristics of drought in Poyang Lake Watershed can be effectively detected by this way. Based on this method, we have developed a operational crop drought monitoring system for Jiangxi province land areas.

**Keywords:** Crop Drought; NDVI; NDWI;NMDI; Monitoring

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