DETERMINATION OF THE CLOUD THRESHOLD FOR MODIS IMAGERY OVER TAIWAN REGION

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ABSRACT

Determination of a practical and accurate cloud threshold is a very crucial task for satellite imagery canopy monitoring over Taiwan, due to its often-high humidity and cloudy atmospheric characteristics. Overly cloud-masking would remove the bulk of useful pixels, while weak cloud masking would involve cloud mixed pixels, rendering inaccurate interpretation of the vegetation information. The main purpose of this study is to develop a suitable cloud threshold in order to derive more reliable vegetation mapping with satellites. A set of long-term visible and near infrared observations data of the MODIS sensors are used in this study to determine the cloud threshold, and the result is presented. In this paper, methods that can identify and remove cloud-contaminated pixels from multi-temporal observations are discussed.

INTRODUCTION

Every surface has unique characteristics of reflection or emission depending on its type as well as the environmental conditions. Remote sensing is the technology to identify and understand the surface or the environmental condition through this uniqueness of the reflection or emission. One of the very examples is photosynthetically active healthy green vegetation, which has its own spectral properties to the solar electric magnetic radiation, with very high absorption in the red region, and high reflectance in the near infrared region (D.M. Gates et al, 1965). But, in cloudy conditions the red reflectance tends to increase. On the basis of this particular spectral behavior, one can detect cloud-contaminated pixels by applying different steps of procedures (R.W. Saunders and K. T. Kriebel, 1988).

In this study we make an attempt to obtain most clear pixels and compute time series vegetation map over Taiwan. In order to get optimized surface vegetation map and to remove atmospherically contaminated pixels, most of the previous studies have employed the maximum-compositing procedures. For this work we plan to isolate the cloudy pixels based on the visible reflectance, and for this purpose we try to determine a threshold reflectance over Taiwan, based on which such pixels can be identified.

METHODOLOGY

In contrast to the healthy green vegetation, cloud can largely increase the reflectance of red band**.** Therefore visible reflectance can be used to define a cloud threshold. The methodology is to identify cloud-free individual pixels. For this clear sky images with maximum solar zenith angle and minimum view angle are selected and the red reflectance at cloud free pixels is determined. From a reflectance histogram of such pixels, a cloud free peak reflectance at the visible region is defined. This value is used as the reflectance threshold, and all pixels with visible reflectance above this threshold are assumed to be cloud-contaminated.

RESULTS

The primary results from a set of long-term visible and near infrared day time MODIS-Terra observations data are presented here. Figure 1 shows the red and NIR reflectance values for different target surfaces. It can be seen from Figure 1 that the reflectance of red wavelength at healthy vegetation, above ocean, and in cloudy regions are significantly different from each other. Over forest region the red reflectance is very less in contrast to the near infrared, but over cloudy region the reflectance at red and IR are almost identical.

Figure 2 demonstrates the behavior of red and NIR reflectance values of cloudy pixels. This figure is constructed using the values selected from 133 cloudy pixels during the period from November 2004 to July 2006**.** The visible reflectance values in these pixels can be used to define the threshold to remove the cloud effect from the images. Further analysis using a larger data set to quantify a threshold value is currently being carried out.

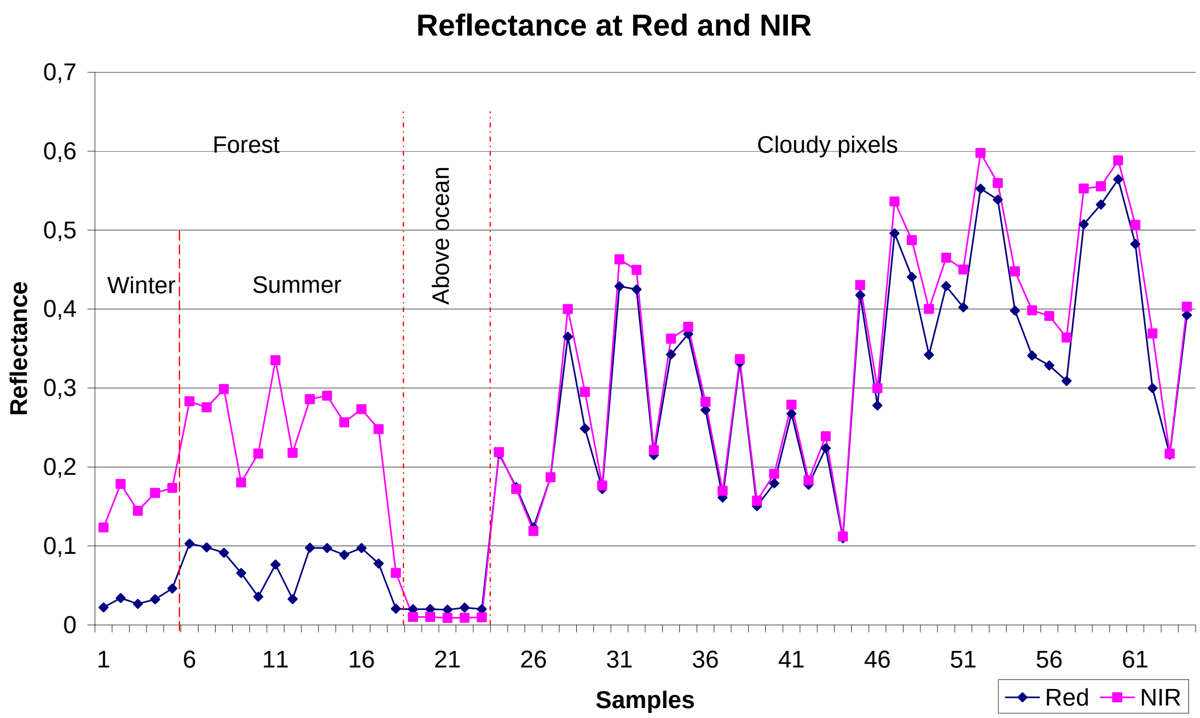

Figure 1. The red and NIR reflectance values for different target surfaces.

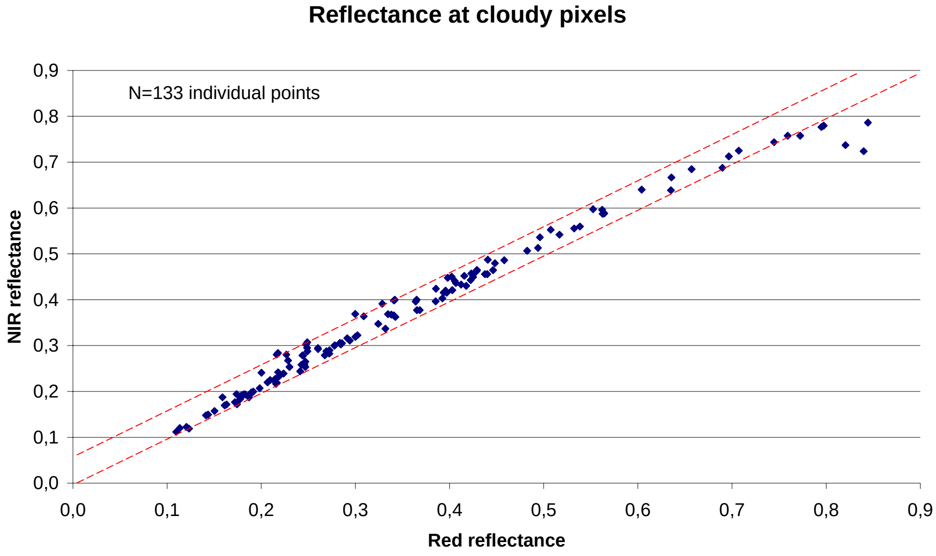

Figure 2. Red reflectance against NIR in cloudy pixels

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