Retrieving and Evaluating Water Vapor Content from MODIS Data by Neural Network

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Abstract—**An algorithm based on radiance transfer model (MODTRAN4) and a dynamic learning neural network for retrieving water vapor content from MODIS 1B data is developed in this paper. The MODTRAN4 are used to simulate the process of Sun-surface-sensor with different conditions. The dynamic learning neural network is used to estimate water vapor content. The analysis indicates that water vapor content can be accurately estimated from near-infrared channels of MODIS data by RM-NN. If the only one training and testing database for all conditions, the mean and the standard deviation of estimation error are about 0.05 gcm-2 and 0.078 gcm-2. The mean and the standard deviation of estimation error are about 0.04 gcm-2 and 0.059 gcm-2 by using different training and testing database for different atmosphere condition. Finally, the comparison of estimation results with ground measurement data at meteorological stations indicates that the RM-NN can be used to retrieve water vapor content from MODIS 1B data.**

Keywords-Remote Sensing, Neural Network, MODTRAN, MODIS, Water Vapor Content

1. Introduction

Water vapor content is important troposphere greenhouse gas, which is very import to energy balance and the global climate change studying (Manabe and Wetherald, 1967;

Kaufman and Gao) [1][2]. The near-infrared around 1 μm is very sensitive to water vapor content [3]. Kaufman and Gao (1992), Gao and Kaufman (2003), Sobrino et al (2003)[2][4][5] used ratios of water vapor absorbing channels at 0.905, 0.936, and 0.94 μm with atmospheric window channels at 0.865 and 1.24 μm to estimate water vapor content from Moderate Resolution Imaging Spectrometer (MODIS) data on the Earth Observing System (EOS)[6]. The ratios partially eliminate the effects of variation of surface reflectances with wavelengths and give approximately the atmospheric water vapor transmittances. This method is influenced by spectral reflectance of surface and mixed pixels. The overall water vapor error estimated by using ratios method is about ±13% [2][7], which need further improve the retrieval accuracy of water vapor content in many applications, like atmospheric correction in visible spectral remote sensing and land surface temperature retrieval in thermal remote sensing [8].