

SPATIAL-TEMPORAL VARIATIONS OF PHOTOSYNTHETICALLY ACTIVE RADIATION BASED ON SATELLITE DATA IN HEIHE RIVER BASIN FROM 2000 TO 2008

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1. INTRODUCTION

Photosynthetically active radiation (PAR) is the solar radiation in the spectral region of 400-700nm and received at the terrestrial surface. It controls the variations of carbon sink rate in temporal and spatial scale, which is directly related to different terrestrial ecosystem models. Compared to the ground observations acquired from meteorological stations, satellite remotely sensed data can provide a more effective approach to estimate incident PAR at sufficient spatial and temporal resolutions. Algorithms that estimate incident PAR based on satellite remotely sensed data have become increasingly important and sensors aboard on different satellites have been widely used for PAR estimation (Eck and Dye, 1991; Pinker and Laszlo, 1992; Frouin and Pinker, 1995; Dye and Shibasaki, 1995; Liang et al., 2006)^[1-5]. However, few literatures analyse the spatial-temporal variations of estimated PAR. The aim to this paper is not only estimating the PAR based on remotely sensed data in Heihe River Basin from 2000 to 2008, but also significantly assessing the changes of spatial-temporal characteristics for estimated PAR.

2. METHOD AND MATERIALS

Based on the fact that cloud reflectivity is constant and the effect of cloud absorption is relatively small across the ultraviolet and PAR wavelength, (Eck and Dye, 1991) developed a method to estimate PAR using the ultraviolet radiance of TOMS (Total Ozone Mapping Spectrometer)^[1]. Compared to the PAR (visible) band, this method can preferably distinguish clouds at PAR region as a simple linear function of TOMS ultraviolet reflectance. In this paper, we reviewed an improved Eck and Dye model (Li et al., 2007) for calculating actual

PAR insolation using ultraviolet reflectance^[6]. In view of the fact that OMI (Ozone Monitoring Instrument) was launched on the EOS-Aura satellite in July 2004 and took the place of Earth Probe (EP) TOMS in 2006, 8-day mean ultraviolet reflectance data from TOMS (2000-2004) and OMI (2005-2008) was used to calculate 8-day composite incident PAR. The Heihe River Basin, which is the second largest inland river basin, is located at arid and semi-arid regions in northwest of China. The area of Heihe River Basin is approximately 130,000 km. There are three main topography units from south to north, and it comprises many different landscape types in Heihe River Basin. Hence, it is a good place for ecological, hydrological and other terrestrial processes research.

3. RESULTS

8-day composite and annual PAR were calculated using TOMS and OMI reflectance data in Heihe River Basin from 2000 to 2008. The results indicated that the changes of estimated PAR in Heihe River Basin were totally fluctuating over the past several years. Annual total PAR, which approximately ranged from 1600-2200MJ/km², increased from upstream to downstream and was basically associated with topography units in study area. Further, four representative sites with different landscape types in study area were selected for analyzing seasonal dynamics and interannual variations. On the four sites, the variations of 8-day composite PAR in one year was consistent and fluctuated due to instantaneous climate changes. Meanwhile, the discrepancies of total annual PAR between these study sites were unobvious from 2000 to 2004 but distinct in the 2005-2008 periods due to different data sources, which can demonstrated that remotely sensed data with higher resolutions can provide a better divisions of PAR with different landscape types.

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