INT. J. REMOTE SENSING, 20 AUGUST, 2004,
VOL. 25, NO. 16, 3139–3159

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Estimation of interannual variation in productivity of global vegetation using NDVI data

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(*Received 25 June 2002; in final form 21 August 2003*)

Abstract. The interannual variation of global vegetation net primary production (NPP), which is crucial to understanding the role of terrestrial biosphere in the global carbon cycle, is still poorly understood. Currently, remote sensing emerges as a useful tool for estimating NPP through monitoring global vegetation distribution and growth. The objective of this study was to utilize the multi-year monthly Normalized Difference Vegetation Index (NDVI) dataset of 1987–1997 from the Advanced Very High Resolution Radiometer (AVHRR) to investigate the interannual variation in productivity of global vegetation due to climate variation, human activities, and environmental events. A decision tree algorithm based on simple metrics (minimum, maximum, mean and amplitude) was employed to classify the global vegetation from NDVI data and obtain the annual vegetation growth areas. Then, annual NPP was computed using the annual vegetation growth areas and the predefined NPP coefficients given in a 1990 Intergovernmental Panel on Climate Change (IPCC) report. The NPP exhibited a slightly increasing trend through the 11 years. However, interannual variations were observed to be mainly determined by variation in growth of tropical and temperate evergreen forests. These fluctuations were consistently correlated to El Niño/La Niña events. Although the interannual variation in primary productivity of global vegetation is expected to influence the atmospheric CO_2 concentration over the one-decade period, it is unlikely to have solely caused the anomalously low growth in 1992–1993. The adopted methodology enabled close examination of variability in vegetation growth at the biome scale as well as at global scale.

1. Introduction

Understanding the variation in atmospheric CO_2 concentration is crucial to explain and interpret climate changes. Since the commencement of the industrial revolution in the mid 19th century, the relatively stable atmospheric CO_2 concentration of 280 ppm dramatically increased to 367 ppm in 1999. The rate of

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International Journal of Remote Sensing
ISSN 0143-1161 print/ISSN 1366-5901 online
http://www.tandf.co.uk/journals
DOI: 10.1080/0143116032000160435