DAO 기상자료와 구름 영향에 의한 MODIS 일차생산성 오차 분석

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Errors of MODIS Gross Primary Productivity (GPP) induced by using Data Assimilation Office meteorological data and cloudy effects

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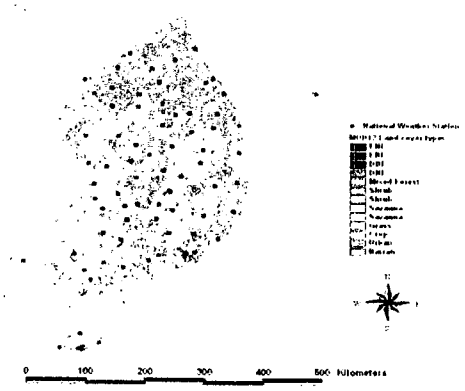
1. Introduction

MODIS (Moderate Resolution Imaging Spectroradiometer) GPP provides a useful tool for monitoring global vegetation production at 8-day interval and 1-km nadir spatial resolution since December, 1999. MODIS GPP algorithm adopts DAO (Data Assimilation Office) meteorological data and MODIS FPAR (Fraction of absorbed Photosynthetically Active Radiation) to calculate daily GPP. In this study, we tested uncertainties in MODIS GPP with respects to the coarse spatial resolution ($1.25^{o}\times1^{o}$) of DAO data, cloud-contamination of FPAR MODIS, and parameterization of the GPP algorithm in Korea (Republic of). In Korea, landscapes are highly fragmented by intensive land uses and forested area is about 65% of total Landcover. Most forests are distributed in topographically complex montane regions. By effect of monsoon period and subsequent typhoons, cloudy days are frequent from June to September.

2. Material and methods

2.1. Study area

Study region of this study was whole of South Korea. 25 km^2 around the National Weather Station was used to research. Because it was possible to use data at 72 National Weather Stations, total 1,800 km^2 area around the National Weather Stations (1,800 MODIS pixels) was used to study.



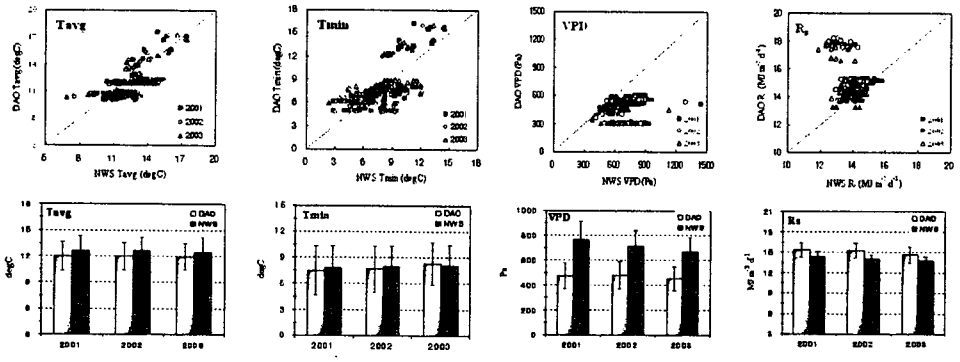
<Fig. 2-1> Study area of this study. Black dots represent National Weather Stations and background map is MODIS Landcover.

2.2. Description of MOD17 GPP algorithm

MODIS Gross Primary Productivity (GPP) product is the first regular, near-real-time data sets for repeated monitoring on vegetated land at 1-km resolution at an 8-day interval (Heinsch *et al.* 2003). MODIS GPPs are obtained by calculating in MOD17 GPP algorithm. But MOD17 GPP algorithm has uncertainties from inputs and algorithm. The uncertainties in DAO meteorological data, MOD15 FPAR/LAI, MOD12 Landcover, and parameterization of the algorithm would all influence MODIS GPP results (Zhao *et al.* 2005)

2.3. Improvement inputs

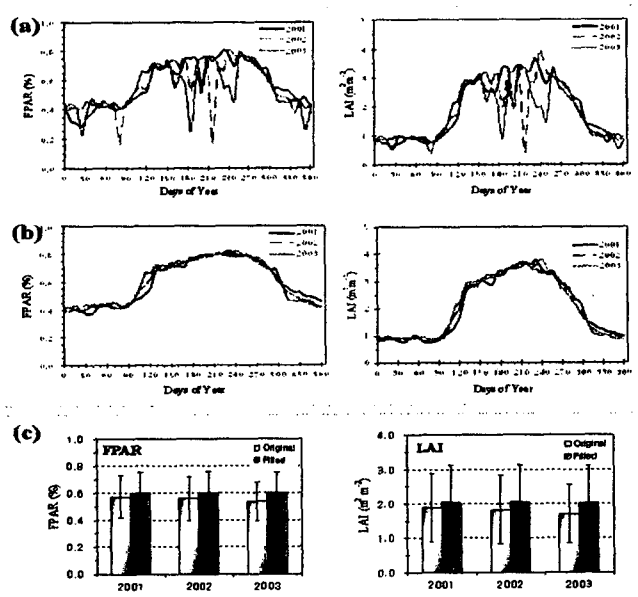
Since DAO meteorological data's spatial resolution is 1.25° in longitude and 1° latitude, it is sure that DAO is coarse resolution to apply in Korea. Compared with National Weather Station meteorological data, DAO data have some difference in daily average temperature, minimum temperature, vapor deficit pressure and short wave radiation.



<Fig. 2-2> Scatter plots of annual means of meteorological variables and daily mean values of meteorological variables between national weather station (NWS) and DAO data from 2001 to 2003

MOD15 FPAR/LAI products are influenced by cloudy effects. Therefore, it is necessary to eliminate cloud contaminated pixels. In this study, cloudy-correction algorithm was adopted in Kang *et al.*(2005)

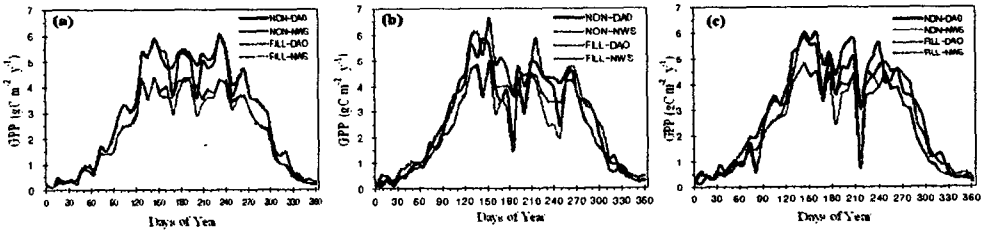
After cloudy correction, MODIS FPAR and LAI showed more reasonable seasonal patterns and higher average values from 2001 to 2003 in 1,800 MODIS pixels.



<Fig. 2-4> Time series of (a) original (b) cloud-corrected values and (c) daily mean values of original and cloud corrected (filled) images from 2001 to 2003

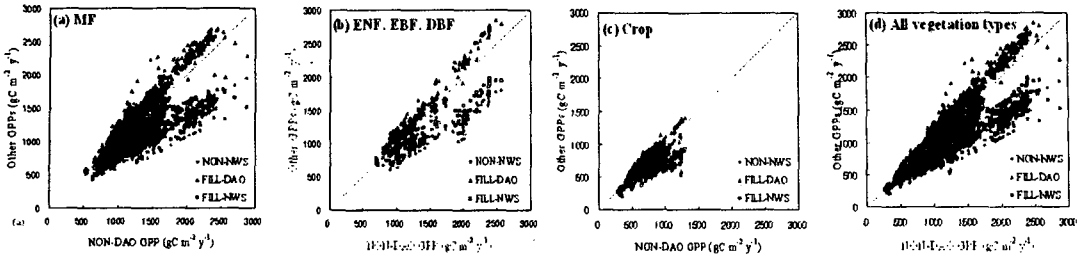
3. Results

Appling MOD17 GPP algorithm in 4 cases, seasonal GPP patterns were different from one another.

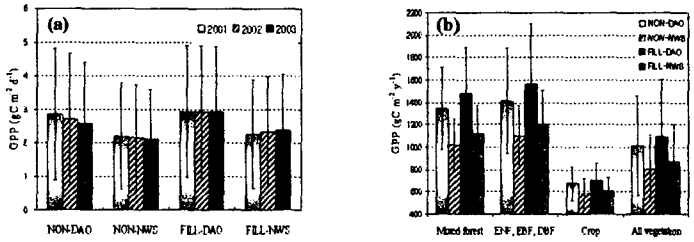


<Fig. 3-1> Time series of GPPs for mean GPP of all vegetation types (a) 2001, (b) 2002, and (c) 2003

In all case of GPPs, they had variations of GPP depending on vegetation landcover types.



<Fig. 3-2> Scatter plots between NON-DAO GPP and NON-NWS, FILL-DAO, and FILL-NWS GPP for different vegetation types.



<Fig. 3-3> (a) daily mean GPPs for all vegetation and (b) annual mean of GPPs for different vegetation types from 2001 to 2003.

References

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