Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

ACG34-P01 Room:Poster Time:May 1 18:15-19:30

An aerosol correction algorithm to improve the GOSAT TANSO-CAI NDVI product

KIKUCHI, Nobuhiro[1*] ; YOKOTA, Tatsuya[1]

[1]National Institute for Environmental Studies

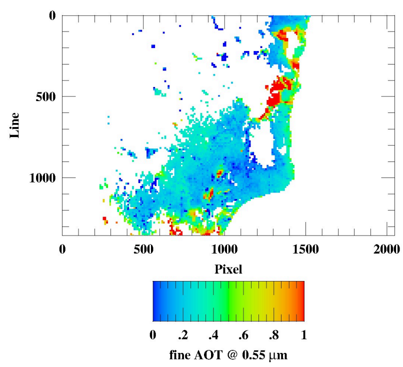
The Cloud and Aerosol Imager TANSO-CAI (CAI), onboard the Greenhouse gases Observing SATellite (GOSAT), is equipped with 4 spectral bands of 380, 674, 86,0 and 1600 nanometers (Band 1-4). The main purpose of CAI is to assist the Fourier Transform Spectrometer TANSO-FTS in retrieving accurately the column amount of carbon dioxide and methane by detecting and characterizing clouds and aerosols in FTS footprints. CAI is also designed to monitor the variation of global vegetation indices, and the CAI Normalized Difference Vegetation Index (NDVI) product has already been released.

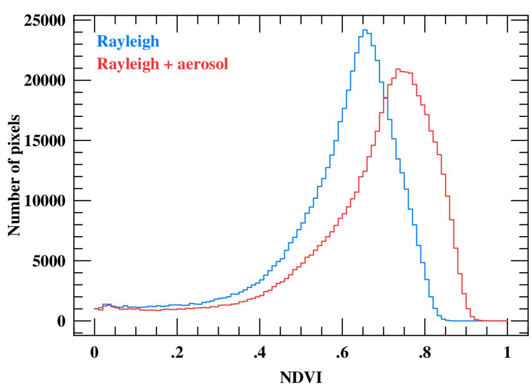
Since GOSAT is orbiting with a three-day recurrence, CAI observes the same location from the same direction once in every three days. Unlike the MODIS NDVI product, this makes it difficult to correct the effects of Bidirectional Reflection Distribution Function (BRDF) on the CAI NDVI product, but it has a potential capability to detect changes in vegetation with shorter time scale. In the current version, the CAI NDVI is calculated from 30 days composite of the minimum reflectance to minimize contamination of clouds and aerosols, and the effect of aerosols is not explicitly corrected. The goal of this study is to develop an aerosol correction algorithm that can be applied to the CAI NDVI.

Due to the relatively limited number of spectral bands of CAI, we take an approach slightly different from so-called the Kaufmann method or the minimum reflectance method in developing our aerosol correction algorithm. Since the number of observables is four, which are TOA reflectance at bands 1-4, the maximum number of retrieved parameters is also four. We choose optical thickness of fine mode aerosols and coarse mode aerosols, surface reflectance at band 3 and band 4 as retrieved parameters. We assumed that surface reflectance at band 1 and band 2 is expressed as a function of surface reflectance at band 3 and band4. The parameterization of band 1 and band 2 surface reflectance is done by utilizing the CAI minimum reflectance product. We do not expect that this parameterization is rigorously valid in pixel-wise. Therefore, we do not determine aerosol optical thickness for every pixel, but for 10x10 pixels (5x5 km in horizontal scale). Moreover, we do not use all TOA reflectance of 10x10=100 pixels, but select the darkest 10 pixels. Then, the number of observables is 40, and the number of retrieved parameters is 22, which can be determined by least-square fitting.

Left panel of the figure shows optical thickness of fine mode aerosol over souse-east part of Australia on October 20th, 2013. Currently, aerosol optical thickness is not retrieved for pixels with TOA reflectance greater than 0.2 at band 4. Right panel of the figure demonstrates the effect of aerosols on NDVI by comparing NDVI with and without aerosol correction. We can see that the frequency distribution of NDVI is shifted by about 0.1 as a result of aerosol correction, which is consistent with the result of Vermote et al. (2002).

Keywords: vegetation index, retrieval method, GOSAT





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Effects of water stresses due to climate change on production and dynamics of tree community in tropical rain forests

FUJII, Shinjiro[1*] ; SATO, Hisashi[2] ; KUMAGAI, Tomo'omi[1]

[1]Hydrospheric Atmospheric Research Center, Nagoya University, [2]Graduate School of Environmental Studies, Nagoya University

Recently, climate changes caused by the El Nino-Southern Oscillation have been reported to result in the widespread death of trees due to droughts in many parts of the world. Strong reductions in tree growth and litterfall production occurred during the record-hot 1997/98 El Nino. Tropical regions receive strong solar radiation, and tropical vegetation shows a strong feedback effect to carbon sequestration, water circulation, and climate formation. In addition, tropical forests are important ecosystems, and they act as a huge carbon sink because they accumulate 40-50% of land vegetation carbon of the Earth. In a biological community such as a tropical forest that consists of various species, response to changes in the physical environment depends on the operating functional group. A dynamic change in a particular functional group that plays a signi?cant role in the biological community may in?uence the structure and ecosystem functions of the tropical forests. The aim of this study is to predict the impact of drought on matter production and tree community dynamics in tropical rain forests by using a spatially explicit individual-based biogeochemical model developed for predicting vegetation dynamics in response to climate change at the global level, such as global warming (SEIB-DGVM). In the model simulation, applying stochastic rainfall model with the meteorological data, including the 1997/98 El Nino, of the tropical rain forests of Sumatra Island in Malaysia that were measured in 1997-2009, the rainfall experiments were performed by operating some parameters related to daily precipitation and frequency of rainfall events. Based on the experiment results, the turn of production with the amount of tree growth and death, and tree mortality dynamics in the tropical rain forests for 200 years were verified.

Keywords: drought, water stress, El Nino, tropical rain forests, matter production, SEIB-DGVM

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Modeling Interactions between Vegetation and Aeolian Processes

BANZRAGCH, Nandintsetseg[1*] ; SHINODA, Masato[1] ; SHAO, Yaping[2]

[1]Arid Land Research Center, Tottori University, [2]Institute for Geophysics and Meteorology

The sustainability of temperate grassland (TGs) ecosystems is determined by the feedbacks between climate, vegetation and human activities, in which Aeolian processes play a key role. Current existing dust models do not have sufficient capability in simulating vegetation growth and decay effects that play a major role in TG aeolian processes. In this study, we purposed to couple the DAYCENT, a vegetation-growth and nutrient-cycle model (the most prominent biogeochemical model), with QF2003, a wind-erosion model. The DAYCENT-QF2003 modeling system enables an examination of the feedbacks between grassland-grazing and aeolian processes. This approach is a completely new approach. First, we assessed the DAYCENT for its capability to provide estimations of vegetation dynamics under different grazing conditions in order to incorporate into the QF2003. DAYCENT was parameterized with the field experiment data (soil physical/chemical properties, vegetation and grazing) at the Bayan-Unjuul (BU) site in 2010-2012. BU is located in north of the most frequent dust outbreak region in Mongolia. Results showed that the DAYCENT could simulate realistically vegetation growth-decay, nutrient-cycle and the effect of grazing on grasslands, which are the factors controlling dust outbreaks in TGs. Then, the DAYCENT model was coupled into the QF2003 wind-erosion scheme. We conducted the numerical test of the coupled DAYCENT-QF2003 model to predict dust flux. With the initial results, we have demonstrated the potential of the DAYCENT-QF2003 coupled model. Therefore, the integrated DAYCENT-QF2003 modeling system will provide a useful tool for an early warning system and the future projection of dust events over dust source areas in TGs region.

Keywords: Temperate grassland, dust, vegetation, model