Achievement of CEReS Research Projects

Project 2

Subject:
Study on land surface – land cover, vegetation change of Eurasia continent

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Objective of the project:

The main purpose of this project is t o grasp the land surface change originating from vegetation structure change on lar ge area especially on Eurasia continent. This ac tivity will connect to clarify the carbon dioxide interchange between land and atmosphere.

On the above point of view , we have been de veloping a m onitoring m ethod using satellite optical sensors focus ed on the detection of 3D structure in formation of vegetation-c overed surface especially on forest area. 3D structure change of forest area means its biomass change.

Summary of Achievement

Main tar get of our res earch is biomass esti mation of fores t area using m ulti-angle spectru m observation f rom satellite. In or der to actualize it, the estimati on m odel related to bi- directional reflectance has been developed. Additionally, in-situ data collection method also developed.

For next generation Earth observation satellite se ries of JAXA/ GCOM-C1, our activity have set to develop several satellite products such as biomass, roughness index, shadow index, fAPAR, and so on.

Details of Achievement

Achievement 1: Multi-angle spectrum observation method development

1-1 Forest canopy BRF measurement using unmanned helicopter

Developed forest canopy BRF observation method using GPS and computer controlled unmanned helicopter with on-board spectroradiometer . Within 30 minutes, totally 26 spectrum data from different observation angle on principal and cross-principal plane can be observed. This system can observe same sensor-target geometry on different sun angle or time.

1-2 Rapid BRF measurement for large area using unmanned helicopter

Using on-board spectroradiometer equipped fixed 3 different angles, large area BRF measurement can be obtained. Combining 1-1 method and simulator described 3-1, BRF representing satellite IFOV can be estimated.

Achievement 2: Canopy structure measurement method development

2-1 Canopy surface measurement from the air

Using unmanned helicopter, on-board laser scanner departed from the canopy only 30 to 50m can detect precise structure of the canopy surface structure. The resolution of DSM generated from observed data is sprier to airborne laider.

2-2 Tree structure parameter measurement from the ground

Using the laser scanner equipped on robot-arm or other platform, tree structure parameter such as DBH, tree height, crown diameter has been developed.

Achievement 3: Bi-directional Reflectance Factor (BRF) simulator development

3-1 BRF simulator uses observed DSM and BRF

In order to calculate the realistic surface situation, generated DSM from helicopter observation data is used. For BEF mode based on linier mixing model also used observed spectrum. Developed simulator can reconstruct the BRF of existed forest.

Achievemnt 4: Vegetation physical parameter estimation

4-1 fAPAR estimation from satellite data

Using MODIS visual bands data, fAPAR estimation method has been developed. The estimation model has been developed from in-situ data of forest incoming, reflected, transmitted light.

Publications

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3) Junichi Susaki, Keitarou Hara, Koji Kajiwara and Yoshiaki Honda, "Robust Estimation of BRDF Model Parameters" , Remote Sensing of Environment, vol.89, pp.63-71, 2004
4) Koji Kajiwara, YoshiakiHonda, Akiko Ono,Yusaku Ono, Development of bidirectional refl ectance function for above-ground vegetation biomass estimation using SGLI sensor,Remote Sensing 2008, CDS322, 7106-26,2008
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