Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACG37-14 Room:106 Time:May 22 14:30-14:45

Studies on boreal forest in Alaska by satellite remote sensing and in-situ surveys

SUZUKI, Rikie[1*], Shin Nagai[1], Hideki Kobayashi[1], Taro Nakai[2], KIM, Yongwon[2]

[1]Research Institute for Global Change, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), [2]International Arctic Research Center (IARC), University of Alaska Fairbanks

Vegetation, a major component of the global ecosystem, drives the carbon cycle between the atmosphere and the land surface through photosynthesis and respiration. Since the carbon cycle dominates the concentration of atmospheric CO_2, the most essential greenhouse gas, the investigation of vegetation photosynthetic activity over extensive geographical regions is important for climate change studies. Moreover, because vegetation stores carbon as biomass, the monitoring of vegetation biomass is significant for the study of food and fuel resources in addition to the climate change study. Based on the use of satellite remote sensing and field surveys in boreal forests in Alaska, our study focuses on the two vegetation functions: photosynthetic activity (i.e., productivity) and the carbon stock as biomass. The studies introduced here were conducted under the framework of JAMSTEC-IARC Collaboration Study (JICS).

As for the study on the vegetation productivity of boreal forest Alaska, we conduct three investigations at Poker Flat Research Range (PFRR), University of Alaska Fairbanks.
(1) Observation of bidirectional reflectance distribution function (BRDF) of the black spruce forest. The reflected irradiance from the black spruce forest was measured from the top of 17m observation tower in PFRR by the spectroradiometer, being changed the viewing angle from 20 to 70 degrees in the principal plane and the orthogonal (cross) plane in July, 2010 (no-snow season) and March, 2011 (snow season). The BRDF in the principal plane in the no-snow season showed a kind of bowl-shape distribution and the back scatter was generally larger than the forward scatter. By contrast in the snow season, forward scatter was generally larger than the back scatter, that is, reverse of that of the no-snow season. This result can be applied to the 3D forest radiative transfer model for estimating the leaf area index (LAI), an index of photosynthetic potential, based on the satellite remote sensing data.
(2) Monitoring of the forest landscape seasonal change. We installed a fisheye-lens interval camera on the top of the 17m observation tower, and monitored the daily change of the forest landscape by taking photographs. Those photographs tell us that the seasonal change of the vegetation index derived from satellite observations is considerably influenced by the seasonal change of the forest floor vegetation. Such new understanding will be used for the determination of the growing (productive) season of the forest ecosystem by satellite remote sensing data.
(3) Survey of the forest gap. The forest gap was measured by LAI-2000 in autumn of 2011 in PFRR. We are developing the estimation algorithm of the forest LAI by using 3D forest radiative transfer model based on the forest gap data.

As for the study of the carbon stock of the boreal forest, an attempt to estimate the geographical distribution of the forest above-ground d biomass (FAGB) by ALOS-PALSAR has been carried out. The in-situ FAGBs at 29 forests in the south-north transect from Fairbanks to the Brooks Range along the Trans-Alaska Pipeline were measured in July 2007, and based on them, an estimation algorithm for FAGB by ALOS-PALSAR was developed. Consequently, it was revealed that the forest biomass distribute from 5 to 100 Mg/ha (dried matter) and showed south-large north-small gradient in the transect, while the terrain effect contaminates the FAGB estimation that should be reduced.

Keywords: black spruce forest, forest biomass, 3D forest radiative transfer model, leaf area index, BRDF