

The potential of spaceborne LiDAR for precise forest resources observation

*Masato Hayashi¹, Nobuko Saigusa¹, Yoshiki Yamagata¹

1. National Institute for Environmental Studies

Satellite remote-sensing is suitable for a large scale observation of forests, and spaceborne light detection and ranging (LiDAR) is a novel sensor that can be used for accurate measurement. Spaceborne LiDAR is an active sensor to transmit laser pulses, and it records the changes in return laser energy intensity as a waveform, and the waveform contained information on the vertical structure of forests. The only spaceborne LiDAR so far has been the Ice Cloud and land Elevation Satellite (ICESat)/ Geoscience Laser Altimeter System (GLAS), operated by NASA from 2003 to 2009. Many previous studies have applied GLAS data to forest observation, and they mostly estimated two essential parameters of forest resources: canopy height and aboveground biomass. We also applied ICESat/GLAS spaceborne LiDAR data to three forested areas: Hokkaido Island in Japan (cool-temperate forest), Borneo Island (tropical forest), and Siberia (boreal forest). As a result, we revealed the distribution of canopy height and aboveground biomass in the study areas. Furthermore, we implemented the following: (1) quantitative estimates of canopy height change according to typhoon disturbance in Hokkaido, (2) estimation of yearly forest loss rate in Borneo, and (3) hot spots detection of forest change in Siberia. In this way, spaceborne LiDAR enables us to observe forest resources accurately at each footprint point. However, an analysis combined with the other imagery data should be needed for entirely forest monitoring, and the methodology has been studied in recent years. There are some plans of spaceborne LiDARs launched within a few years, and they will play an important role in global forest resources monitoring in the future.

Keywords: Canopy height, Forest biomass, Spaceborne LiDAR, ICESat/GLAS