

MOLI(Multi-footprint Observation Lidar and Imager) Mission for globally observing forest canopy height and forest structural characteristics from ISS(International Space Station)-JEM(Japanese Experimental Module)

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As well known, exchange of carbon between vegetation and the atmosphere is a vital function of the global carbon budget. However, the vegetation involves a contradictory effect in the exchange. One is carbon storage in forest biomass, which corresponds to a portion of 70-80% involved in residual terrestrial sink. The other is emission induced by land use change. This emission is estimated to be comparable to 10% of that given rise to total fossil fuel combustion and cement product. But, both are still not well quantified because of many uncertainties in spatial and temporal change yet. Most reason is difficult to accurately measure forest canopy height to estimate forest biomass, mostly above ground biomass (AGB), using only usual passive remote sensing technique. The other is that a backscattering signal of L-band SAR saturates and becomes insensitive over the biomass density of 100 Mg/ha, especially in tropical forest.

The Geoscience Laser Altimeter System (GLAS) on the Ice, Cloud and land Elevation Satellite (ICESat) had remarkably demonstrated higher potential that a laser altimetry was an excellent remote sensing not only for taking canopy height even in dense tropical forests but also for evaluating AGB by analyzing full waveforms. Therefore, a combination of the conventional remote sensing and the lidar on board satellite is significantly useful. For instance, recent studies approach a wall-to-wall mapping for distributions of the global canopy height, the forest biomass density and the carbon density.

A vegetation lidar and imager of MOLI(Multi-footprint Observation Lidar and Imager) mission onboard ISS-JEM presented here is a candidate of the first lidar mission in JAXA' s earth observation programs, which is planned to launch in 2021 just after a vegetation lidar of NASA/GEDI finished a two-year experiment. Both GEDI mission and MOLI mission should contribute to understanding the global environmental issue through more than three-year synergy effect. Another one-year operation will be expected if no system trouble happen. Multi footprint consisting of 2 footprints /shot with a footprint diameter of 25m are employed for self determination of slop angle & azimuth angle in order to reduce height errors induced by surface slope. A goal of the height error is less than 3m in RMSE. On the other hand, high resolution imager consists of RGB bands, a swath 500 m, a ground resolution of 5 m, respectively. The imager is adopted to provide information on tree crown size, height and field data for the conversion to AGB.

This paper describes an outline of MOLI mission and a mission requirement.

Keywords: Forest biomass, Canopy height, Lidar, Imager, ISS-JEM, Forest structure