

# Progress Report : MOLI



Tadashi IMAI and MOLI Pre Project Team  
Research and Development Directorate, JAXA  
Jan. 20, 2022

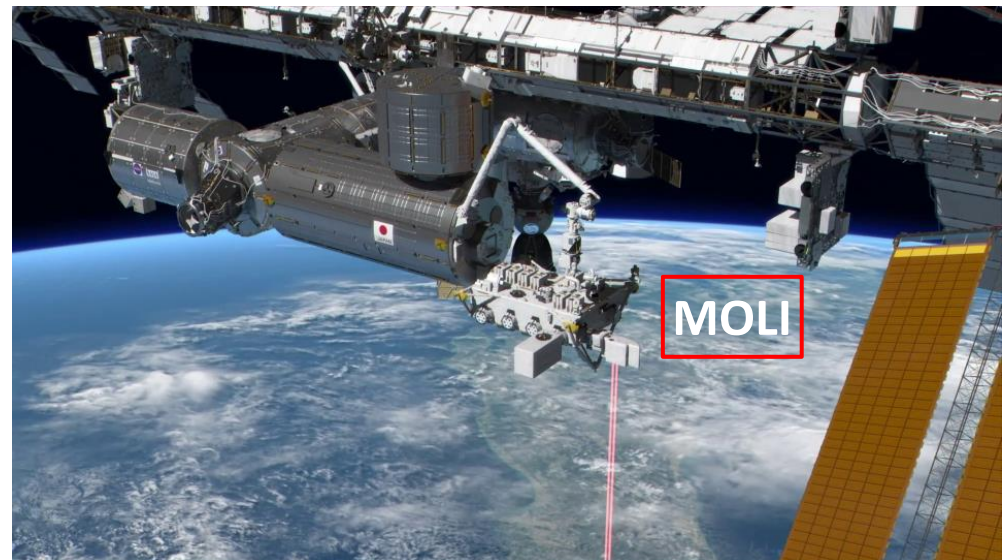
## MOLI (Multi-footprint Observation Lidar and Imager)

### • Objective

- To improve canopy height and above ground biomass estimation
- To improve 3D map (DTM)
- To Develop spaceborne lidar technology

### • Sensors

- LIDAR
  - ✓ multi footprint(2 footprint)
  - ✓ 1064nm(YAG), 2 beam
  - ✓ 20mJ each beam
  - ✓ Diameter of footprint: 25m
- Imager(Green, Red, NIR )
  - ✓ GSD:5m, swath : 1km



### • Platform

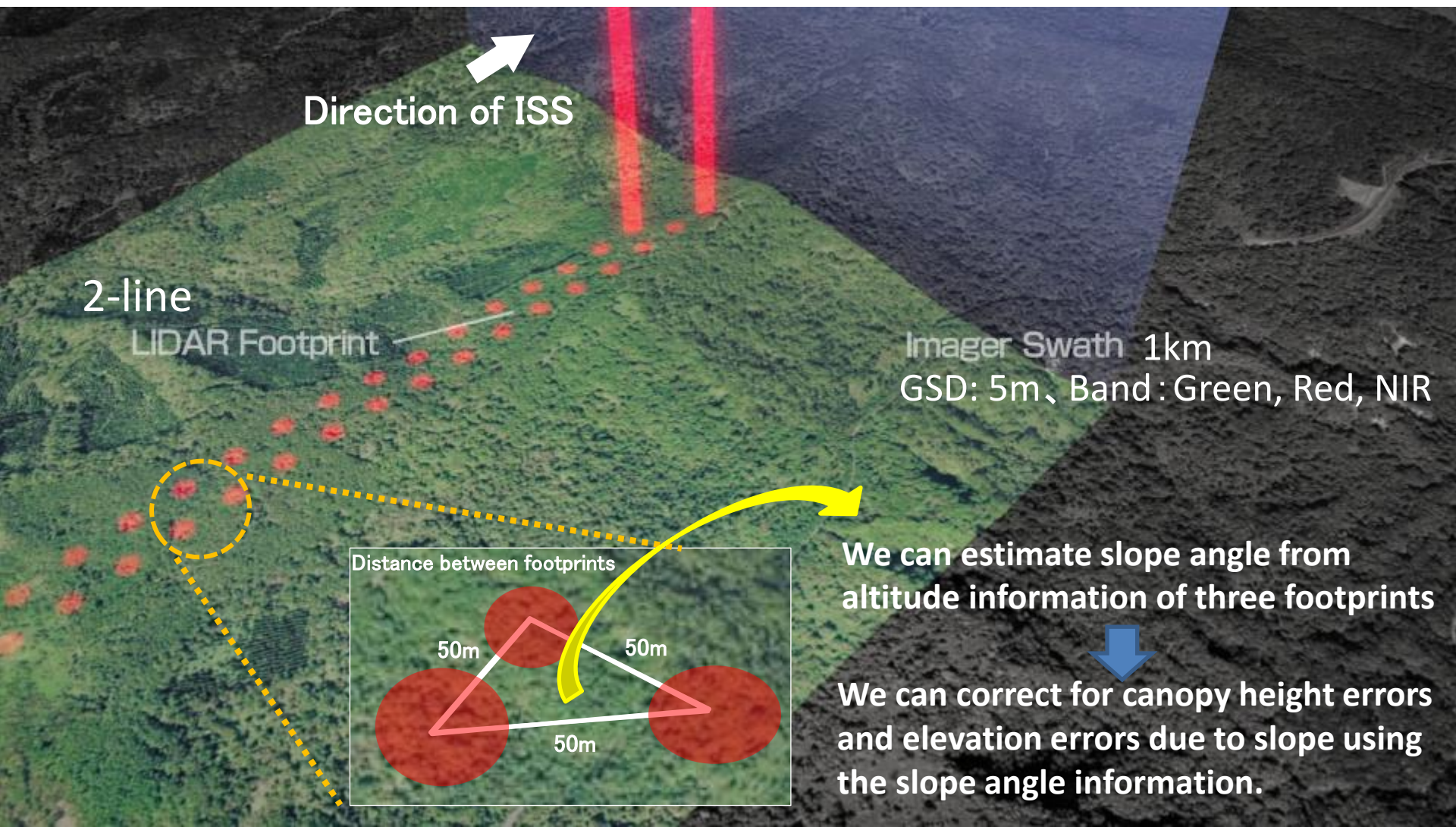
- Installed on ISS JEM-EF
- Orbit : Inclination : 51.6 deg, Non-sun-synchronous, Altitude: about 400 km



( Features of MOLI )

2-line Lidar observation

3-band Imager observes 1km swath including lidar footprint area



Direction of ISS

2-line

LIDAR Footprint

Imager Swath 1km

GSD: 5m、Band : Green, Red, NIR

Distance between footprints

50m

50m

50m

We can estimate slope angle from altitude information of three footprints



We can correct for canopy height errors and elevation errors due to slope using the slope angle information.

## MOLI Imager:

Spatial Resolution: 5m

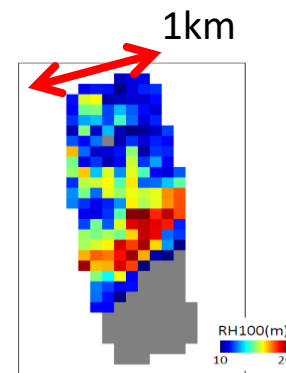
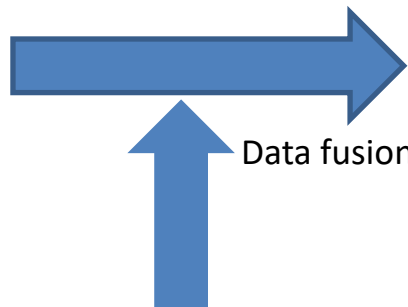
Swath: 1km

Band

Green: 520-600 nm

Red: 610-690 nm

NIR: 760-890 nm

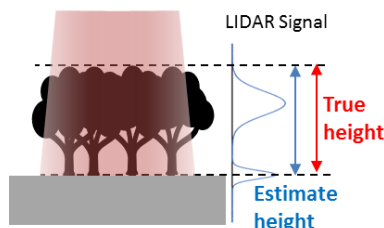


MOLI L3 product

40m resolution

Imager data

+



MOLI Lidar data (Canopy height)

Data fusion



Canopy height map

## Other imagers:

(e.g., Landsat-8)

Spatial Resolution: 30m

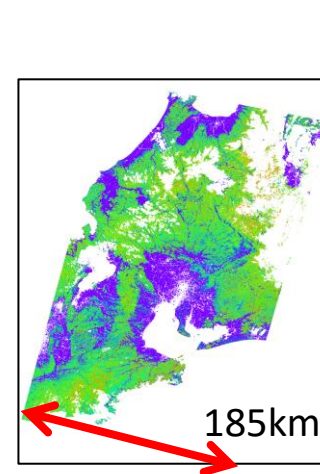
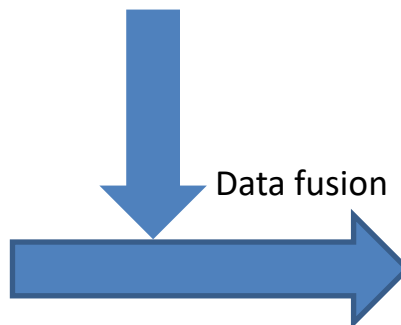
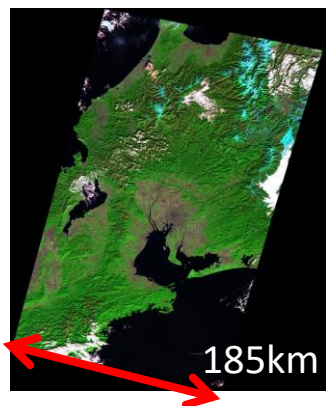
Swath: 185km

Band

BLUE: 450-515 nm

Green: 525-600 nm

Red: 630-680 nm



MOLI L4 product

about 100m resolution



Product level	Product category	Products	Remark
L1 (Standard)	Lidar footprint products	Waveforms( $\geq 500$ Msp/s)	including geolocation data Footprint Position Accuracy $\leq 15$ m
	Imager product (1km swath)	Image (Red, Green, NIR)	geometrically corrected
L2 (Standard)	Lidar footprint products	Ground heights	$\leq 3$ m(RMSE: Forest surface coverage is less than 95% and ground slope is less than 30 degrees.)
		Canopy heights	$\pm 3$ m(Canopy Height is under 15m) $\pm 20\%$ (Canopy Height is over 15m)
		Forest biomass	$\pm 25$ t/ha (Biomass density is under 100t/ha) $\pm 25\%$ (Biomass density is over 100t/ha)
L3 (Research)	Integrated products with Lidar and imager (1km swath)	Canopy heights	Target ○Canopy heights $\pm \sim 5$ m(Canopy Height is under 15m) $\pm \sim 40\%$ (Canopy Height is over 15m)
		Forest biomass	
L4 (Research)	Wall-to-Wall map products  (Integrated with GCOM-C/SGLI, SAR Data)	Canopy height map	○Forest biomass $\pm \sim 40$ t/ha (Biomass density is under 100t/ha) $\pm \sim 40\%$ (Biomass density is over 100t/ha)
		Forest biomass map	

※ Multi-footprint is expected to compensate each product up to 30 degrees of slope.

- 1. JAXA will develop MOLI, and it will be installed to ISS.**
- 2. MOLI will be able to provide high precision canopy height and forest biomass data, globally.**
- 3. We will also provide canopy height map and forest biomass map created by lidar data and imager data (e.g., SGLI, ALOS-2, 4, ALOS-3) fusion.**
- 4. Target launch is now JFY2024. MOLI Pre-Project Team has been established in last October.**