

GEDI

Global Ecosystem Dynamics Investigation

Specifications

Platform: ISS

Bands: single band, IR at 1064 nm

Spatial Resolution:

25 meter footprint diameter, with 60m spacing along track and 600m across track.

GEDI covers latitudes between 51.6° N and 51.6° S

Temporal Resolution:

On average, GEDI revisits the same area every 2 to 3 months. The revisit time varies with the varying orbit of the ISS.

Temporal Extent: 2019 - present.

LIDAR vs other sensors

- **Active vs. passive sensors:** Unlike passive sensors (e.g., cameras), LIDAR emits its own light, allowing it to penetrate dense canopies and work independently of sunlight
- **Unsaturated measurements:** LIDAR accurately measures dense forests without signal loss, a challenge for passive optical and short wavelength radar systems
- **Direct height and structure data:** LIDAR directly measures forest height and vertical structure, allowing comparison with field data, something unique in satellite remote sensing

Overview

- Collaboration between **NASA** and **University of Maryland**
- Spaceborne **LIDAR**: an active sensor that emits beams of light and measures the time it takes for the reflected light to return, allowing us to create detailed 3D measurements of Earth's surface, including any object on it
- **GPS** system for position and **star trackers** for orientation
- **Full-Waveform LIDAR**: unlike discrete return LIDAR, which captures only a few points, full-waveform technology records the entire distribution of returned light energy. This provides a more comprehensive view of the surface, giving detailed insight into the 3D structure of forests and other surface features (figure 1)
- **3 NIR** (near infrared) **lasers** with **4 beams** (2 full power lasers and 1 split into 2 beams) (figure 2), which fire at 242 pulses per second (with each light pulse 14 ns long)
- Measurements are collected along two axes, **along-track** (spacing between consecutive LIDAR pulses in the direction of the satellite's path) and **across-track** (spacing between beams perpendicular to the satellite's flight path)
- **Free data**

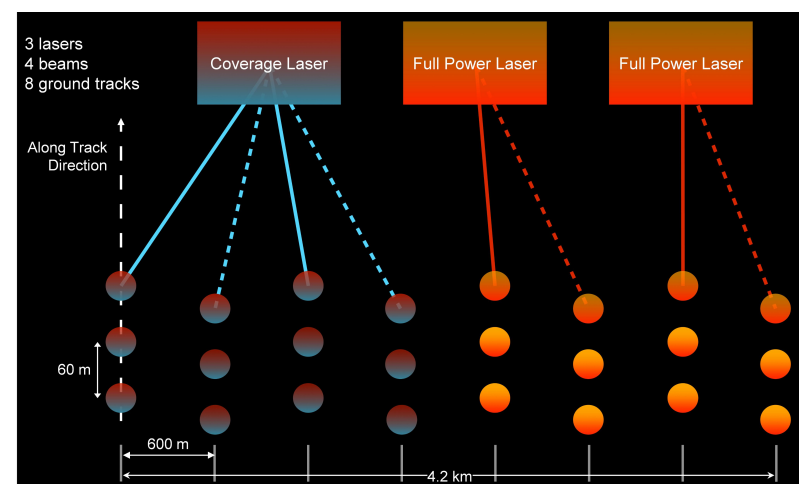


Fig. 2

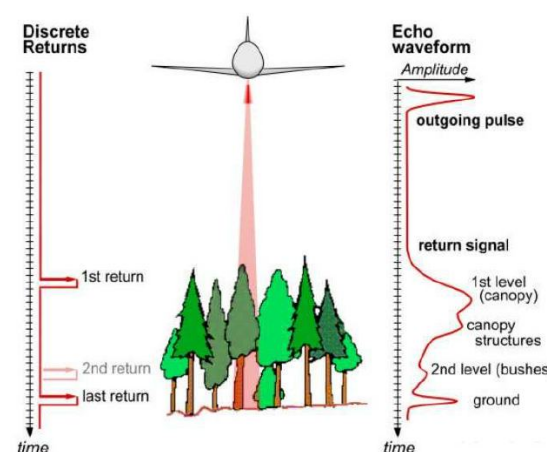


Fig. 1

Applications

- **Primary Application:** observation of forest biomass and carbon fluxes by quantifying the vertical distribution of vegetation by recording the amount of laser energy reflected by plant material (stems, branches, and leaves) at different heights above the ground. Four types of structure information can be extracted: surface topography, canopy height, canopy cover, and vertical structure
- **Additional Applications:** water resource management, weather prediction, forest management, and geomorphometry

Resources:

<https://www.earthdata.nasa.gov/sensors/gedi>

<https://gedi.umd.edu/instrument/instrument-overview/>