EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Sensors and Technology (3)

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ICESAT-2: THE NEXT-GENERATION SPACEBORNE LASER ALTIMETRY MISSION TO MEASURE CHANGES IN ICE SHEET ELEVATION, SEA ICE THICKNESS, AND VEGETATION HEIGHT

Abstract

The Ice, Cloud, and land Elevation Satellite-2 (ICESat-2) is currently in its Integration and Testing phase for a scheduled launch in 2018. ICESat-2 is a laser altimetry mission with technologies never before utilized in an Earth satellite mission. The primary science objectives are to measure changes in the elevation of the Greenland and Antarctic ice sheets to infer ice sheet mass balance, to measure the elevation of sea ice to calculate its thickness, and to measure the height of vegetation to estimate the amount of carbon stored. In addition, ICESat-2 will measure the height of the land, oceans, inland waters, as well as cloud characteristics on a global basis.

In contrast to analog lidars, as, for example, used on ICESat, ICESat-2 uses a low energy 532-nm laser in conjunction with single-photon sensitive detectors to measure range. ICESat had a single 1064 nm laser beam measuring 70-m footprints at 150 m along-track intervals. The usage of photomultiplier tubes and high-speed timers to measure the travel time of individual photons) reduces the energy needed to measure range at a given precision allowing us the use of a single laser with its beam split into six separate beams through a diffractive optical element. A very high pulse repetition frequency of 10 kHz, which translates to an along-track sampling interval of 0.7m on the ground, reduces the energy of individual transmitted pulses to minimize stress on laser components. In order to optimize the spatial resolution, the laser spot size on the ground for each beam is 17 m. This results in stringent alignment requirements and necessitates an active alignment system. To fully utilize this high resolution, the location of the laser spots needs to be known within 6.5. m, making the GPS receivers and star trackers (that are mounted on the optical bench rather than as more commonly on the spacecraft) an essential part of mission success. All these innovations (multiple beams, photon counting detectors, high repetition rate, small footprint size) will result in earth elevation data never before collected from space.

Geophysical algorithms that fully utilize the new technology are currently under development. All data will be publically available through the National Snow and Ice Date Center in Boulder, CO. The talk will give details about the concept and design of the mission and present example data and analysis methodologies.