First ICESat-2 global data released: Ice, forests and more

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For the second straight year, NASA researchers endured low temperatures, biting winds, and high altitude to conduct another 88-South Traverse. The 470-mile expedition in one of the most barren landscapes on Earth provides the best means of assessment of the accuracy of data collected from space by the Ice Cloud and land Elevation Satellite-2 (ICESat-2).Credits: NASA's Goddard Space Flight Credit: Center/Ryan Fitzgibbons

More than a trillion new measurements of Earth's height—blanketing

everything from glaciers in Greenland, to mangrove forests in Florida, to sea ice surrounding Antarctica—are now available to the public. With millions more observations added each day, data from NASA's Ice, Cloud and land Elevation Satellite-2 is providing a precise global portrait of elevation and will allow scientists to track even the slightest changes in the planet's polar regions.

"The data from ICESat-2 are really blowing our minds, and I'm really excited to see what people with different perspectives will do with it," said Lori Magruder, a senior research scientist at the University of Texas, Austin, and the ICESat-2 science team lead.

The long-awaited ICESat-2 mission, launched in September 2018, continues the record of polar height data begun with the first ICESat satellite, which operated from 2003 to 2009. NASA's airborne Operation IceBridge project bridged the data gap between the two satellites. The new satellite provides far more measurements than its predecessor. ICESat took approximately 2 billion measurements in its lifetime, a figure ICESat-2 surpassed within its first week.

When ICESat orbited over a rift in Antarctica's Filchner-Ronne Ice Shelf in October 2008, for example, it recorded a handful of data points indicating a crevasse in the ice. When ICESat-2 passed over 10 years later, it collected hundreds of measurements tracing the sheer walls and jagged floor of the growing rift.

ICESat-2 is taking these measurements in a dense grid across the Arctic as well as Antarctica, recording each spot every season to track both seasonal and annual changes in ice.

ICESat-2's ability to measure heights beyond the poles is also impressing scientists—Magruder pointed to coastal areas, where in clear waters the satellite can detect the seafloor up to 100 feet (30 m) below the surface.

Over forests, the satellite not only detects the top of the canopy, but the forest floor below—which will allow researchers to calculate the mass of vegetation in a given area.

All this is being done with six laser beams from a satellite 310 miles (500 kilometers) in space, noted Tom Neumann, ICESat-2 project scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

"Getting the exact latitude, longitude, and elevation of where a photon bounced off Earth is hard—lots of things have to happen and go really, really well," he said. To make sure everything is working, the science team conducts a series of checks using data from airborne surveys, ground-based campaigns, even the satellite itself.

That includes scientists travelling to Antarctica, where they drove modified snow-groomers along an arc of the 88-degree-south latitude line, taking highly accurate elevation measurements to compare with the data collected by ICESat-2 in space. Magruder compared measurements taken in White Sands, New Mexico, with what the satellite was tracking. In its most recent Antarctic and Arctic campaigns, NASA's airborne Operation IceBridge flew specific routes designed to take measurements over the same ice, at close to or exactly the same time the satellite flew overhead.

ICESat-2 is designed to precisely measure the height of ice and track how it changes over time. Earth's melting glaciers cause sea levels to rise globally, and shrinking sea ice can change weather and climate patterns far from the planet's poles.

Small changes across vast areas like the Greenland ice sheet can have large consequences. ICESat-2 will be able to measure the shift in annual elevation across the ice sheet to within a fraction of an inch. To do this,

the satellite uses a laser altimeter—an instrument that times how long it takes light to travel to Earth's surface and back. With that time—along with the knowledge of where in space ICESat-2 is, and where on Earth the laser is pointing—computer programs create a height data point. The data is originally processed at NASA Goddard, then turned into advanced data products that researchers will be able to use to study elevations across the globe.

ICESat-2 data products are now available for free from the National Snow and Ice Data Center at https://nsidc.org/data/icesat-2.

More information: For more information, visit http://www.nasa.gov/content/goddard/icesat-2 or https://icesat-2.gsfc.nasa.gov/. For more information on the data products, visit: https://earthdata.nasa.gov/icesat-2-data

Provided by NASA's Goddard Space Flight Center

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