

A.34 STUDIES WITH ICESAT-2

NOTICE: Amended June 2, 2020. This Amendment releases the final text for this program element. Notices of Intent are requested by September 30, 2020 and proposals are due October 30, 2020.

1. Overview

NASA solicits proposals for Earth science research using observations from the Ice, Cloud, and land Elevation Satellite-2 (ICESat-2), which was launched on September 15, 2018. The Advanced Topographic Laser Altimeter System (ATLAS) instrument on ICESat-2 is a photon-counting lidar with six beams and ICESat-2's near-polar orbit is optimized to enable characterization of elevation changes in Earth's polar ice. The mission also collects data globally, particularly to enable determination of vegetation height, but also to support research and applications in hydrology, oceanography, and atmospheric sciences.

This call for proposals is a successor to the ROSES 2019 "Studies with ICESat-2" opportunity and Principal Investigators (PI) of the proposals selected under this program have additional responsibilities as members of the ICESat-2 Science Team (I2ST). Section 4 lists the topics solicited.

2. Background

ICESat-2's single instrument, ATLAS, is a six-beam, photon-counting lidar operating at 10 kHz. ICESat-2 measures travel time of individual photons that are reflected off the Earth (atmosphere, surface, sub-surface), enabling retrieval of surface heights with a precision of a few centimeters. Each beam has a ground-footprint of ~15 meters in diameter, offset by 0.7 meters along-track. The six beams are organized into three pairs – a strong and a weak beam offset by 90 meters – separated from adjacent pairs by 3.3 kilometers. In addition to providing more observations than a single beam, the multibeam/pair configuration enables direct measurements of instantaneous cross-track surface slope, which is especially important for measuring seasonal and annual height changes of Greenland and Antarctica, as well as height changes of glaciers globally. With an orbital inclination of 92 degrees, ICESat-2 takes measurements up to a latitude of 88 degrees north and south. It has a 91-day repeat orbit for observations over the polar regions to enable seasonal measurements. Nearer the equator, off-pointing by the satellite is used to create a global map with tracks less than 4-km apart for global vegetation height assessments.

More information about ICESat-2 is available at: <https://icesat-2.gsfc.nasa.gov/>.

3. ICESat-2 Data Products and Cloud-based Resources

3.1 ICESat-2 Data Products

To facilitate research with ICESat-2, algorithms have been developed for routinely produced data products to support a range of users, from those requiring base telemetry through to modelers requiring gridded geophysical data.

More information is available at: <https://icesat-2.gsfc.nasa.gov/science/data-products>.

ICESat-2 data products are available from the NASA Distributed Active Archive Center (DAAC) at the National Snow and Ice Data Center (NSIDC) at: <http://nsidc.org/data/icesat-2/>.

3.2 Cloud-based Resources

ICESat-2's photon counting approach is a data-intensive observation technique that generates ~1 Terabyte (Tb) of data per day globally. While the individual data products are smaller, moving, processing and analyzing such volumes of data are challenging. Cloud-based computing may offer critical efficiencies to proposed investigations and should be considered.

NASA's Advanced Data Analytics Platform (ADAPT) (<https://www.nccs.nasa.gov/services/adapt>) will be made available to investigations selected under this element. ADAPT offers cloud storage and access to high-performance computing resources. To minimize data movement, ADAPT hosts all ICESat-2 data products, as well as related satellite and aircraft altimetry products, including data from the first ICESat (2003-2010) and Operation IceBridge (2009-2020). Proposers who would like to use ADAPT are encouraged to incorporate it in their proposed work plan.

4. Scope of Investigations

The scope for this call is to fund investigations that are complementary to, but not addressing the same specific science questions as, the proposals selected under the ROSES-2019 ICESat-2 opportunity. Under that announcement, 24 proposals were selected, covering the disciplines of cryospheric science, terrestrial ecology, atmospheric science, and ocean bathymetry. For a list of abstracts, see [the PDF file of titles and abstracts of selected proposals](#) that may be downloaded under the heading "selections" on [the NSPIRES page for the 2019 "Studies with ICESat-2" call for proposals](#).

ICESat-2 data must be a central and critical part of the proposed effort and a driver for the investigation; investigations should be studies that could not be carried out without ICESat-2. However, consideration of ICESat-2 data in the context of other satellite, airborne, and/or surface-based measurements is encouraged.

The specific topics solicited for this opportunity are listed below. Proposals that do not address these research topics will be considered non-responsive. NASA makes no commitment to select proposals in each of these topics.

- Investigations in non-polar physical oceanography, especially topography and waves that utilize the global sea surface height product (<https://nsidc.org/data/ATL12>).
- Investigations of cloud processes that utilize the global clouds, cloud properties, and lidar backscatter product (<https://nsidc.org/data/ATL09>).
- Investigations of local-to-regional scale ice sheet and ice shelf processes that utilize the unique capabilities of ICESat-2 to improve our understanding and assessment of the ice sheet mass balance, including ice sheet hydrology and ice shelf-ocean-sea ice interaction.
- Investigations of sea ice and oceanic processes in the Southern Ocean.

- Long-term monitoring of annual changes and variability of sea ice, ice sheets, and Alaskan glaciers using Operation IceBridge as the link between ICESat and ICESat-2.
- Investigations of ice sheet seasonal variability and its drivers in the context of improving projections.

5. Science Team Membership

In addition to their proposed research activities, PIs selected under this program have additional responsibilities as members of the ICESat-2 Science Team (I2ST). The ICESat-2 team will:

- Accelerate ICESat-2 science through the use of Open Science approaches
- Report to NASA Headquarters on the impacts to ICESat-2 science resulting from any issues with mission operations
- Provide guidance to the ICESat-2 Project Office at the NASA Goddard Space Flight Center for mission planning, as requested

All proposers must describe anticipated I2ST contributions and their approach to Open Science (see Section 7). For investigations focused on research outside of polar ice, proposals should describe specific plans to represent the mission to non-polar ice scientific communities and may include these activities in the proposal budget.

6. Meetings

There are two 3-day I2ST meetings each year in changing locations within the United States. One meeting is generally on the East Coast and one on the West Coast, but because of the pandemic could also be held virtually. It is expected at least some portion of these team meetings will be open, and other members of the PI's team will be welcome to attend and participate. Proposers should include support in the proposal budget for the PI and critical team members to attend these meetings.

7. Open Science

This program element requires proposers to implement Open Science (OS) approaches consistent with the recommendations of the report *Open Science by Design: Realizing a Vision for 21st Century Research* from the *National Academies of Science, Engineering and Medicine* (<https://www.nap.edu/catalog/25116/open-science-by-design-realizing-a-vision-for-21st-century>). Some key recommendations from the report that are particularly relevant to research using ICESat-2 include but are not limited to:

- Developing proposals using Findable-Accessible-Interoperable-Reusable (FAIR) principles
- Conducting research using tools compatible with open sharing
- Preparing data and tools for reproducibility
- Documenting approaches in electronic research notebooks
- Depositing research output in FAIR archives

Progress is accelerated to the maximum extent possible by sharing advances during the conduct of investigations, not just at the publication stage. This sharing:

- Includes scientific results and analytic approaches to ICESat-2 observations;
- Occurs within and across disciplines; and

- Happens openly and frequently via team meetings, contributions to open repositories, and other communications with colleagues.

NASA recognizes that fully-implementing OS approaches will be challenging and entail additional cost. However, NASA sees great benefit to these approaches for accelerating ICESat-2 research, and proposers are required to include Open Science and the costs for implementing it in their work and budget plans, respectively.

7.1 Open Source Software

Awards made under this program element must follow NASA's Earth Science Data Systems (ESDS) Open Source Software Policy (<https://earthdata.nasa.gov/earth-science-data-systems-program/policies/esds-open-source-policy>).

7.2 Data Policies

Proposals developing significant datasets must include in the data management plan a clear description of the dataset development, including delivery to the NASA DAAC at the National Snow and Ice Data Center (<https://nsidc.org/daac>), in compliance with NASA data standards (<https://earthdata.nasa.gov>).

8. Summary of Key Information

Expected program budget for first year of new awards	~\$1.5 M
Number of new awards pending adequate proposals of merit	7-10
Maximum duration of awards	3 years
Due date for Notice of Intent to propose	See Tables 2 and 3 of this ROSES NRA
Due date for proposals	See Tables 2 and 3 of this ROSES NRA
Planning date for start of investigation	May 2021
Page limit for the central Science/Technical/Management section of proposal	15 pp; see also Table 1 of ROSES
Relevance	This program is relevant to the Earth Science questions and goals in the NASA Science Plan. Proposals that are relevant to this program are, by definition, relevant to NASA.
General information and overview of this solicitation	See the ROSES Summary of Solicitation
General requirements for content of proposals	See A.1 Earth Science Research Overview and Section IV and Table 1 of the ROSES Summary of Solicitation
Detailed instructions for the submission of proposals	See https://nspires.nasaprs.com/tutorials/ and Section IV(b) of the ROSES Summary of Solicitation
Submission medium	Electronic proposal submission is required; no hard copy is required or permitted.

Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Web site for submission of proposal via Grants.gov	http://grants.gov/ (help desk available at support@grants.gov or (800) 518-4726)
Funding opportunity number for downloading an application package from Grants.gov	NNH20ZDA001N-ICESAT2
Point of contact concerning this program	<p>Thorsten Markus Earth Science Division Science Mission Directorate NASA Headquarters Washington, DC 20546 Telephone: (202) 358-3860 Email: thorsten.markus@nasa.gov</p>