

Operation IceBridge: Using instrumented aircraft to bridge the observational gap between ICESat-1 and ICESat-2

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1. INTRODUCTION

In Spring 2009, the National Aeronautics and Space Administration's (NASA) began a series of instrumented aircraft missions over the Arctic and Antarctic to bridge the observational gap in satellite altimeter coverage following the end of data acquisition of ICESat-1 (Ice, Cloud and land Elevation Satellite) in October 2009, and its replacement, ICESat-2, scheduled for launch in 2015. The primary goal of Operation IceBridge is to use airborne laser altimetry to monitor rapidly changing areas of the ice sheets, glaciers and sea ice. The second goal is to use ice-penetrating radar to map the bedrock topography beneath the ice sheets. Data collected by Operation IceBridge will improve our modeling efforts and knowledge of the contribution of the Greenland and Antarctic ice sheets to sea level rise and contribute to our understanding of changes in the extent and thickness of the sea ice cover. The flights maintain altimetry time series over outlet glaciers started by NASA in the early 1990s, expand airborne altimeter coverage to new areas and add grids of ice-penetrating radar data to better resolve bedrock topography.

2. AIRBORNE PLATFORMS AND INSTRUMENT PAYLOAD

Operation IceBridge uses NASA's DC-8 and P-3 research aircraft as the main platforms for data acquisition over the Arctic and Antarctic. The DC-8 instrument payload includes two NASA laser altimeters, the Airborne Topographic Mapper (ATM) and the Land, Vegetation and Ice Sensor (LVIS); three radar systems from the University of Kansas Center for Remote Sensing of Ice Sheets (CReSIS), a Ku-band radar altimeter, the Snow Radar and the Multichannel Coherent Radar Depth Sounder (MCoRDS), a Sander Geophysics airborne

gravimeter and a high resolution stereographic camera. The P-3 carries the same instruments minus LVIS and with the addition of the CReSIS Accumulation Radar and an improved antenna array for MCoRDS.

In addition to the NASA field campaigns, Operation IceBridge contributes to National Science Foundation (NSF)-funded work in collaboration with the University of Alaska, Fairbanks and with the international ICECAP consortium through the University of Texas, Austin. In May and September 2009, the University of Alaska gathered laser altimetry data over the Southeast Alaskan glaciers. During the 2009/2010 austral summer, the international consortium of ICECAP teams collected data over ICESat ground tracks and outlet glaciers in East Antarctica while based out of McMurdo, Dumont d'Urville and Casey Stations. These collaborations with existing aircraft campaigns provide expanded spatial coverage to the Operation IceBridge effort.

3. ICEBRIDGE SCIENCE HIGHLIGHTS

Operation IceBridge achieved many milestones during the 2009 campaigns. In Greenland, both laser altimeters, ATM and LVIS, collected data over long (100's of km) ICESat tracks to ensure calibration with the GLAS altimeter. The CReSIS snow radar gathered snow depths on sea ice across a trans-Arctic transect. In Antarctica, Operation IceBridge completed extensive gridded surveys over Pine Island, Thwaites, Smith, Kohler and Crane Glaciers. The gravimeter survey of the Pine Island Ice Tongue was the first to spatially resolve the bathymetry beneath the tongue. Several landmark sea ice missions have been flown in the Weddell and Bellingshausen Seas, collecting the first airborne data in these areas.

4. DATA AVAILABILITY

Data collected during the Operation IceBridge campaigns will be made publicly available by the National Snow and Ice Data Center (NSIDC) in Boulder, CO. Currently, NSIDC and the Operation IceBridge Science Data Working Group are designing and implementing an archival and processing strategy that will enable rapid distribution and efficient use of Operation IceBridge data products by the science community. Check <http://nsidc.org/data/icebridge/index.html> for updates on the release of all data.

5. ADDITIONAL INFORMATION

For more information on Operation IceBridge, please follow the campaigns on the web at <http://www.nasa.gov/icebridge> or on Twitter at <http://twitter.com/IceBridge>.