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NASA's Wide-swath Mapping Laser Altimetry Capability and its Application to Cryospheric Sciences

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Complete mapping of the detailed topography of remote polar regions is an emerging remote sensing capability for the Cryospheric science community. NASA has developed a wide-swath large-area mapping capability, i.e. the GSFC-developed airborne sensor, LVIS (Land, Vegetation, and Ice Sensor), is a wide-swath, full-waveform laser altimeter system that produces large-area topographic maps with the highest levels of accuracy and precision. Recent data collections in support of NASA's Operation IceBridge over Antarctica and Greenland have demonstrated the unique and extraordinary mapping capability of the LVIS sensor. Operating efficiently from high altitudes, the vertical accuracy is sub-decimeter and the horizontal knowledge of individual footprint locations is approximately 1 meter. Areal coverage is accumulated at a rate of > 1,000 sq. km/hr and enhancements are underway to double this collection rate. With this new capability come new applications, new insights into surface processes, the ability to fully capture the spatial extent and variability of changes occurring in highly dynamic areas, and enhanced input into ice sheet models. One example is 7,000 sq. km collected over the Antarctic Peninsula in just 7 hours of mapping from 40,000 ft on the NASA DC-8 aircraft. The wide swath and dense coverage enabled by the LVIS sensor results in significant overlap with legacy ICESat data permitting statistically powerful comparisons and eliminates the need for interpolation or slope corrections. NASA is currently completing a version of the LVIS sensor for use in the Global Hawk UAV. Very long duration flights over remote areas will be possible with this sensor and it will be able to map 10,000's of sq. km in each flight. The goal of this program is to completely map the dynamic regions of Greenland and Antarctica to serve as a baseline for comparison with all past and future altimetric data sets. Examples maps and advanced data products and analysis techniques with be shown. The LVIS data are available from the NSIDC website (http://nsidc.org/data/icebridge/) and the LVIS website (https://lvis.gsfc.nasa.gov).