Geophysical Research Abstracts, Vol. 9, 05884, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05884

The Swath Imaging Multi-polarization Photon-counting Lidar (SIMPL): An innovative laser altimeter for mapping ice, water, land and forest cover

D. Harding (1), J. Abshire (1), P. Dabney (1), **T. Scambos** (2), A. Seas (1), C. Shuman (1) and X. Sun (1)

(1) NASA Goddard Space Flight Center, Maryland, USA, (2) National Snow and Ice Data Colorado, USA (david.j.harding@nasa.gov, / Phone: +1 301-614-6503)

The Swath Imaging Multi-polarization Photon-counting Lidar (SIMPL) is an airborne prototype in development to demonstrate laser altimetry measurement methods and components that enable efficient, high-resolution, swath mapping of topography and surface properties from space. This instrument development is sponsored by the NASA Earth Science and Technology Office Instrument Incubator Program, which in 2004 requested proposals for advanced topographic mapping instruments capable of providing precise elevation and imagery data for detailed monitoring of ice sheet, sea ice and glacier change. Although currently emphasizing these polar-region cryosphere objectives, the SIMPL approach is also applicable in other scientific applications including changes in land topography, forest height and structure, and inland water and snow cover height and extent. In our approach accurate (cm-level) ranging is achieved with only $\sim$10's of detected photons by (1) transmitting short ($\sim$1 nsec), low-power (1 ?J), high-rep rate (300 kHz) laser pulses, (2) illuminating small footprints ($\sim$10 m) thus limiting pulse broadening due to surface relief, (3) precisely timing (0.1 nsec) the detection of single photons per pulse, (4) applying time-space correlation of transmit pulses and receive photons, and (5) accumulating surface return photons from successive pulses. Because of the efficiency of this approach, multiple, adjacent, along-track profiles distributed cross-track can be measured simultaneously, forming an elevation image with 10 m spatial resolution. The depolarization ratio of the surface return will also be mapped by utilizing filters to measure the backscatter energy with polarization parallel and perpendicular to the laser transmit pulse. The SIMPL prototype is designed to operate at 1064 and 532 nm wavelengths. Laboratory measurements we

have performed of range-resolved, laser retro-reflection at these two wavelengths documents that the depolarization ratio can be used to differentiate surface types, including water, snow and ice based on differences in their wavelength-dependent scattering properties. A one-beam, breadboard version of SIMPL is planned for airborne testing and validation of the measurement approach in Greenland as a part of the NASA Arctic'07 mission, scheduled for April and May of this year. In early 2008, a four-beam version of the SIMPL prototype will be completed, tested, and available for airborne missions conducted as a part of the International Polar Year.