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Remote sensing of Antarctic sea ice thickness applying airborne laser scanner

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The annual cycle of sea ice formation and decay plays a major role in driving the global ocean circulation, however, little is known about the large scale Antarctic sea ice thickness distribution. Only with the recent advent of sophisticated space-borne sensors can this key question be sufficiently addressed on a global scale. To validate these measurements field campaigns provide the necessary ground truth basis.

During the Australian led Sea Ice Physics and Ecosystem eXperiment SIPEX to the East Antarctic in September/October 2007 we used a helicopter-borne laser scanner in the pack ice zone to estimate sea ice thickness from range measurements. The laser scanner produces an across flight-track scan pattern of approximately 450 m at a flying height of 450 m. In combination with data from an inertial movement unit we can deduce the surface elevation / sea ice freeboard from laser range estimates. From these freeboard estimates sea ice thickness can be computed applying a so-called "K-factor". This factor is determined by in-situ observations of sea ice and snow cover properties on ice floes.

In this paper we present surface elevation / sea ice freeboard estimates of East Antarctic fast ice near the Dalton Iceberg Tongue and compare them with ICESat freeboard estimates acquired only a few weeks later. Since we expect limited temporal change in the fast ice region we use this study to prepare for large scale statistical analysis of measurements over the pack ice region.