AIRBORNE LASER ALTIMETRY OVER THE CENTRAL WEST ANTARCTIC ICE SHEET

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The portion of the West Antarctic ice sheet (WAIS) encompassing the ice divide separating the Pine Island and Ross Embayments and ice stream D within the Ross Embayment is a particular focus for WAIS research. Proposed activities include both deep ice coring and shallow coring traverses near the divide as well as a seismological traverses of the ice stream onset. Here we report on results of the laser altimetry component of a 100,000 line-km aerogeophysical survey (on a 5.3 km grid) collected by the Support Office for Aerogeophysical Research (SOAR) covering ice stream D from the ice divide to the grounding line (Figure 1).

This survey utilized a 16 uJ (total energy) pulsed laser (23 nsec pulse at 1064 nm) with a 1.8 to 3.5 m footprint (for a typical flight elevations of 500-1000 m). The average range from the aircraft to the ice surface was determined every eight to nine meters along the flight path by summing the travel-times for 64 laser returns. These averaged laser ranges were ultimately projected to a position on the ice surface using aircraft attitude information from an on-board laser gyroscope. The aircraft position was determined kinematically using differential carrier phase GPS observations made at one-second intervals with multiple receivers. Surface elevations determined with this system have single-season uncorrected mean deviations for observations made at points of intersecting flight paths ranging from 0.13 to 0.39 meters. These mean deviations are reduced to 0.07 m to 0.28 m after correcting profiles for a linear drift in the vertical position of the aircraft (Table 1).

These new surface elevation data provide a calibration surface for space-based altimetry measurements and are a benchmark for future ice sheet volume change detection. Augmented by satellite imagery, these data also should be sufficient for resolving the position of the topographic ice divide and boundaries of ice stream initiation with the sub-kilometer precision necessary for modeling WAIS dynamics.

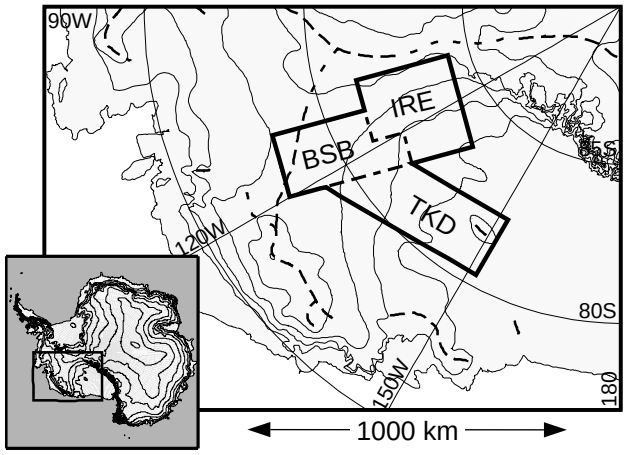

Figure 1: Coverage of CASERTZ/IRE, SOAR/BSB and SOAR/TKD aerogeophysical surveys conducted in West Antarctica.

Table 1: Summary of laser altimetry statistics.

Season	Survey	Line km	Deviation[1] post(pre) leveling
1991/92	IRE[2]	25k	0.37 m
1992/93	IRE[2]	25k	0.09 m
1994/95	BSB	18k	0.07 (0.13) m
1994/96	BSB	26k	0.13 (0.22) m
	TKD	24k	0.10 (0.19) m
1996/97	TKD[3]	33k	0.28 (0.39) m

[1] RMS of half the observation discrepancy at the "crossover" locations.
[2] from [Blankenship et al., 1999]
[3] including a region with ice motion exceeding 1 m/day

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