Experiments at the bed (planned and unplanned) suggest a thin layer of deforming fluidized material at the base, overlying rough bedrock. The sliding rate showed daily peaks related to peaks in ice melt, and longer-period peaks due to rainstorms or windstorms. Basal water pressure showed daily peaks related to water input, but did not necessarily rise at the times of storms and, in some cases, showed step-like drops at the end of these storms. No evidence was seen of "mini-surge" events or traveling waves of either sliding or water pressure. The Columbia Glacier results suggest that sliding is not a function of just driving stress and effective pressure; the amount (thickness and/or areal extent) of water, or possibly the rate of change of water input, will have to be considered.

OBSERVED VELOCITY FLUCTUATIONS ON A MAJOR ANTARCTIC ICE STREAM

(Abstract)

by

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Ice in the mouth of Ice Stream B, a large glacier in West Antarctica, has slowed by about 20% over a 10 year period. Recent measurements of velocity were made between 1983 and 1988 during the Siple Coast project (SCP) on a 100 km section of ice extending from the ice shelf just up-stream of Crary Ice Rise on to the ice plain of Ice Stream B (see Fig. 1). They are compared to three velocities measured during the Ross Ice Shelf Geophysical and Glaciological Survey (1973–75). Velocities in both surveys were measured using doppler satellite-tracking methods. The data are given in Table I. Measured strain-rates are used to define a linear strain field which allowed the recent velocities to be extrapolated to the position of the RIGGS measurements. The comparison is given in Table II. The deceleration is above measurement uncertainties, which were estimated at about ±50 m a^{-1} for the 90% confidence limit. This may be a response to regional thickening down-stream (MacAyeal and others, 1987) in the region around Crary Ice Rise. Other possible causes include a response to the stagnation of nearby Ice Stream C, changes in basal conditions, or external forcing.

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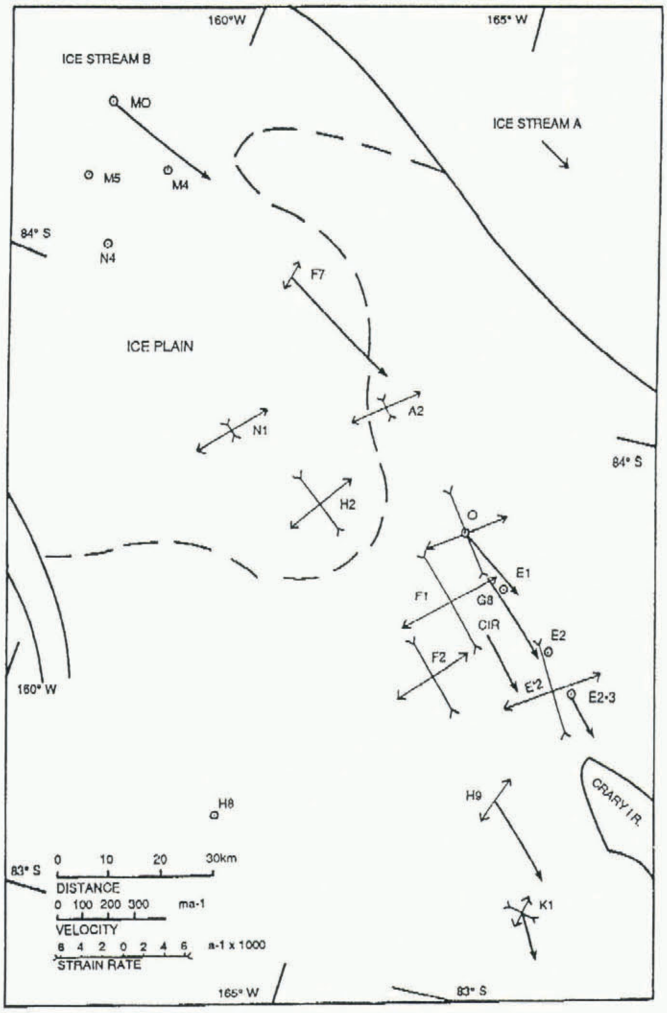

Fig. 1. Ice motion and deformation up-stream of Crary Ice Rise and on the ice plain of Ice Stream B. The thick continuous and broken lines show ice-stream boundaries (after Shabtaie and Bentley (1987) with modifications). Some of the data in Table I have been omitted for the sake of clarity.

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TABLE I. OBSERVED VELOCITY AND STRAIN-RATE DATA

Station	Lat.	Long.	Velocity Magnitude	Velocity Azimuth w.r.t. north	Principal strain-rates P1	Principal strain-rates P2	Rotation rate	Azimuth of P1 w.r.t. north
			$m\ a^{-1}$		$a^{-1} \times 1000$		rad/a × 1000	
RIGGS data								
F7	84°07′11″	162°03′52″	530	296	1.65	−0.22		12
G8	83°43′15″	166°31′15″	384	306	5.43	−4.96		50
H8	83°12′34″	163°28′37″			0.67	−0.43		115
H9	83°20′51″	167°25′27″	348	316	2.70	−0.28		22
SCP data								
CIR	83°37′14″	166°44′31″	245	318				
A2	83°57′29″	164°16′24″			3.79	−0.59	1.9	50.4
E1	83°42′25″	166°52′			5.27	−4.64	1.8	50.6
E2	83°36′38″	167°41′37″			5.49	−6.68	2.0	51.7
E2-3	83°33′09″	168°12′42″	172	319	9.09	−7.22	4.0	74.5
E-2	83°33′32″	167°52′18″			5.25	−4.34	0.5	60.0
F1	83°39′28″	165°58′18″			5.34	−5.13	−1.5	47.0
F2	83°32′03″	166°04′			4.13	−3.74	1.8	43.7
H2	83°46′09″	163°40′13″			4.15	−3.06	−0.3	36.6
K1	83°10′24″	168°09′10″	225	326	1.71	−1.23	−1.7	13.0
0	83°47′14″	166°01′28″	324	307	4.57	−4.09	1.8	53.3
M0	84°17′42″	158°13′27″	471	285	0.48	−0.20	0.5	171.0
M4	84°13′28″	159°29′32″			0.32	−0.17	0.4	158.0
M5	84°10′01″	158°15′49″			0.52	−0.23	1.4	186.0
N1	83°50′30″	161°56′00″			4.27	−0.54		43.9
N4	83°03′44″	159°01′17″			0.56	−0.22		35.1

TABLE II. COMPARISON OF RIGGS AND SCP VELOCITIES

Station name	Velocity	Azimuth	Station name	Distance from RIGGS station	Stations used for strain-rates	Velocity	Azimuth	Velocity	Azimuth
	$m\ a^{-1}$			km		$m\ a^{-1}$		$m\ a^{-1}$	
G8	384	130	0	10	0, E1, F1	281	128	−103	− 2
F7	530	136	0	59	0, H2, A2, N1, F7	409	113	−121	−13
F7	530	136	M0	48	M0, M4, M5, N4, F7	468	143	− 62	+ 7
H9	384	121	CIR	32	F1, E2, F2, E-2, H9	204	102	−144	−20
H9	348	121	K1	21	K1, H9, HB	210	115	−138	− 7