APPENDIX A

Ice Core Chemistry

Station ITP8 RECOVERY & ITP32 DEPLOYMENT
Lat 80 19.4 N
Lon 151 45.7 W
Date 03-Oct-09
Time GMT 02:00 Oct 4th {time when ITP finished and turned on - we were on the ice about 3hrs before this...}

Weather: Air temp (-6 degC) bright sunny day!! Blue sky with some low clouds. Looks like weather could roll in from the south - it did over the course of the ice visit...
Floe: *Get info from Alice's sheets ....*

CORE 1 T & S Core
153cm
Get info from Alice's sheets ....

CORE 2 Chemistry Core
35cm away from Core 1 hole (35cm mid point to mid point)
Sampled at irregular intervals in 20cm sections and stored in gas tight tedlar bags for determination of DIC/TALK, 13C-DIC, 18O, del13C-TOC, & salinity

Depth Sampled	Bag #	Photos	Sampling Notes	
5-25cm	10	486		*** vacuum pump was broken(frozen?) so used syringe for HS removal for all core sections - worked pretty well....*
40-60cm	13	to		
70-90cm	12	498	piece 1 = 96cm	
116-126cm	9	499 to	(20-40cm in piece 2)	
bottom 20	3	516	piece 2 = 71cm	*great brine channels in piece 2 !!*

Core 2 **Thickness** 155 cm
Core 2 **Freeboard** 4 cm

Ice Sampling	Depth of Sample	Bag #	13C-POC	DIC/TALK	13C-DIC	13C-TOC	18O	Bacteria*	salinity	sal (ppt)	cond(mS/cm)	cond(mS/cm)**	temp (cond)
Core Section 1	5-25cm	10		x	xx	x	x	x	x	0.3	0.692	0.596	17.7
Core Section 2	40-60cm	13		x	xx		x						
Core Section 3	70-90cm	12		x	xx		x	x	x	2.6	4.801	3.532	18.2
Core Section 4	116-126cm	9		x	xx	x	x	x	x	2.2	4.093	3.532	17.8
Core Section 5	bottom 20	3		x	xx	x	x	x	x	2	3.711	3.222	18.1

Melting Notes *(melted at room temp in dark - under plastic bag)*
leaking out of seam... Lots of water but gas samples suspect - looks only to leak when pressure applied....
bag leaking! Hole in seam - no TOC, no sal, other samples suspect ...
not enough sample for TOC

** Added to Bill Li's samples*
*** 2nd cond reading on Alice's probe*

Station ITP 33
Lat 77 59.7 N
Lon 149 14.5 W
Date 06-Oct-09
Time 15:20 LOCAL

Weather: Air temp (-4.5 degC), Overcast
Floe: Multi-year "chunk" of ice - Alice characterized it as a "small floe" ~ 30m x 40m at most. Mostly first yr ice around floe and some cake sized multi-year chunks... Weird to see such a thick floe surrounded by very very thin ice ...

SITE 1

SNOW PIT *Get info from Kazu...*

CORE 1 T & S Core
Get info from Alice's sheets ....

Thickness 315 cm
Freeboard [redacted] cm *Get info from Alice's sheets ....*
Snow Depth 11 cm

PUMPING **P 1 & 2** 10L of water pumped from the CORE 1 bore hole at a depth of ~130cm from surface

	Depth of Sample	Bag #	13C-POC	DIC/TALK	13C-DIC	13C-TOC	18O	salinity	Filtered Volume (mL) - 1	Filtered Volume (mL) - 2
PUMP 1	130cm	1	xx	x	xx		xx	x		
PUMP 2	130cm	2	x	x	xx		xx	x		

confirm...

Station ITP 35
Lat 77 04.476 N
Lon 135 25.785 W
Date 07-Oct-09
Time 12 noon LOCAL

Weather: Air temp (-18 degC), SUNNY!!!
Floe: LARGE floe of multi year ice for multi-buoy site with some big ridges and some leads & pools where 1st year ice has formed (yippee!!)

SITE 1 **MultiYr SITE** *Cores @ Kazu's First Snow Pit*

SNOW PIT *Get info from Kazu...*

CORE 1 T & S Core
Core right next to Kazu's snow pit - snow removed before coring.
Get info from Alice's sheets ....

Thickness	315	cm	
Freeboard		cm	*Get info from Alice's sheets ....*
Snow Depth		cm	

CORE 2 Chem Core
20cm from T&S Core (to the right of snow pit)

Thickness	375	cm	
Freeboard	65	cm	w slush ... Lots of slush in core hole
Snow Depth		cm	*Kazu?*

Core Section	Depth Sampled	Bag #	Photos	Sampling Notes
28-54 cm	28 - 54cm	10		Piece 1: took chunk between two natural breaks; 1st piece 76cm with 4cm hard snow on top; natural break at 27-28cm, with another break and big void at 52-56cm ; had to re-vacuum bag .. Might have been because of cold temps? Maybe I shouldn't have re-vacuumed it ...
22-42cm	98-118cm	1		Piece 2: 101cm long, 21cm soft top, 49-78cm rotten!!, break at 49cm
81-101cm	157-177cm	20		
9-29cm	186-206cm	7		Piece 3: 98cm long, lots of slush came up on top. Breaks at 9cm, 35cm & 74cm. Below 35cm very rotten! Lots of big voids etc...
49-74cm	226-251cm	5		BIG void on either side of this chunk - so I took the whole thing ..
27-47cm	302-322cm	6		Piece 4: 79cm, 0-47cm granular and rotten, 47-79 big loose chunks? Look like they are pices fit together - but each piece is pretty soid (not really rotten like stuff above) maybe newer ice rafted below?? Piece in bag 6 might actually be real bottom? So took the bottom 20cm and then all the bottom chunks..
47-79cm	bottom chunks	2		

Ice Sampling	Depth Sampled	Bag #	13C-POC	DIC/TALK	13C-DIC	13C-TOC	18O	Bacteria*	salinity	sal (ppt)	cond(mS/cm)	cond(mS/cm)**	temp (cond)	Vol Filtered (L)	**Melting Notes** *(melted at room temp in dark - under plastic bag)*
Core Section 1	28 - 54cm	10		x	xx					0.0	0.0667	0.0577	17.9		NO 18O, Bac or TOC - not enough vol
Core Section 2	98-118cm	1		x	xx	xx	x	x	x	0.3	0.554	0.482	18.1		
Core Section 3	157-177cm	20		x	xx	xx	x	x	x	0.5	0.922	0.798	17.9		
Core Section 4	186-206cm	7		x	xx	xx	x	x	x	1.4	2.735	2.361	17.8		
Core Section 5	226-251cm	5		x	xx	xx	x	x	x	1.2	2.309	2.006	18.1		
Core Section 6	302-322cm	6		x	xx		x	x	x	3.1	5.71	4.94	17.9		NO TOC, not enough vol
Core Section 7	bottom chunks	2		x	xx	xx	x	x	x	3.8	6.82	5.86	17.5		

** Added to Bill Li's samples* *** 2nd cond reading on Alice's probe*

SITE 2 **FirstYr SITE** *Cores @ Kazu's Snow Pit*

SNOW PIT *Get info from Kazu...*

CORE 3 T & S Core
Core right next to Kazu's snow pit - snow removed before coring.
Get info from Alice's sheets ....

Thickness		cm	
Freeboard		cm	*Get info from Alice's sheets ....*
Snow Depth		cm	

CORE 4 Chem Core
Right next to T & S core - cleared snow first and then cored

SNOW upper 3cm loose snow — *saved and melted for 18O*
lower 7cm hard pack snow — *saved and melted for 18O*

SNOW	18O	Bacteria*
upper snow la	xx	x
lower hard pa	xx	x

Thickness	88	cm	
Freeboard	18	cm	
Snow Depth		cm	*Kazu?*

Core Section	Depth Sampled	Bag #	Photos	Sampling Notes
0-21cm	0-21cm	21		Piece 1: 79cm long - sampled whole core in 3 pieces. Slush layer at 21cm. Core looks to have uniform consistancy - 1st yr ice!!
21-46cm	21-46cm	22		
46-79cm	46-79cm	23		

Ice Sampling	Depth Sampled	Bag #	13C-POC	DIC/TALK	13C-DIC	13C-TOC	18O	Bacteria*	salinity	sal (ppt)	cond(mS/cm)	cond(mS/cm)**	temp (cond)	Vol Filtered (L)	**Melting Notes** *(melted at room temp in dark - under plastic bag)*
Core Section 1	0-21cm	21		x	xx	xx	x	x	x	3.2	5.9	5.1	17.7		
Core Section 2	21-46cm	22		x	xx	xx	x	x	x	3.7	6.75	5.88	18.2		spigot NOT closed tightly - gas measurments suspect. Found mid-melting (~half melted) and closed.
Core Section 3	46-79cm	23		x	xx	xx	x	x	x	4.1	7.46	6.48	18.1		small leak in bag when pressure applied (once HS removed) ... Might be ok? I don't think it was leaking without the applied pressure.

** Added to Bill Li's samples* *** 2nd cond reading on Alice's probe*

CORE 5 POC Core 1
right next to core 4 & 6

Thickness 84 cm
Freeboard 13.5 cm
Snow Depth [redacted] cm *Kazu?*

Core Section	Depth Sampled	Bag #	Photos	Sampling Notes
0-88cm	0-88cm	1		Piece 1: 88cm long - sampled whole core in plastic bag for POC.

Ice Sampling	Depth Sampled	Bag #	13C-POC	DIC/TALK	13C-DIC	13C-TOC	18O	Bacteria*	salinity	sal (ppt)	cond(mS/cm)	cond(mS/cm)**	temp (cond)	Vol Filtered (L)	Melting Notes *(melted at room temp in dark - under plastic bag)*
Core Section 1	0-88cm	1	xx											3.665	black flecks in filters

** Added to Bill Li's samples* *** 2nd cond reading on Alice's probe*

CORE 6 POC Core 2
right next to core 4 & 5

Thickness 87 cm
Freeboard 11 cm
Snow Depth [redacted] cm *Kazu?*

Core Section	Depth Sampled	Bag #	Photos	Sampling Notes
0-80cm	0-80cm	2		Piece 1: 80cm long - sampled whole core in plastic bag for POC.

Ice Sampling	Depth Sampled	Bag #	13C-POC	DIC/TALK	13C-DIC	13C-TOC	18O	Bacteria*	salinity	sal (ppt)	cond(mS/cm)	cond(mS/cm)**	temp (cond)	Vol Filtered (L)	Melting Notes *(melted at room temp in dark - under plastic bag)*
Core Section 1	0-80cm	2	xx						x					3.69	black flecks in filters

** Added to Bill Li's samples* *** 2nd cond reading on Alice's probe*

PUMPING Tried to pump at Site 1 & Site 2 but pump was frozen. Abandonned pumping...

SITE 3 Multi-Buoy Site

CORE 7 Mi-Sun's Core
Core taken from MBB Site ~312m East of snow transect lines (Sites 1 & 2)
sampled bottom 3cm for incubation expariment on ship
Total Thickness = 152cm

Station Zodiac Station (CB15/17)
Lat 76 32.336 N
Lon 139 58.827 W
Date 08-Oct-09
Time 11:00 LOCAL

Weather: Air Temp (-13.2 degC) foggy, light snow fall. Cleared up as we went along and sun came out just as we got off water.
Floe: FRC left ship into a big lead. First year ice formed on sides and broken up by ship, lots of the edge ice was pushed underneith itself from the ship and the ship's wash covered the ice that we could sample. Unfortunatlye this meant that the frost flowers close to the edge were washed away - but the grey ice could still be sampled.

Water Temp: -1.2 degC
Ice Surface Temp: -2.0 degC
Air Temp: -13.2 degC

SITE 1

Sampled from side of Zodiac 76 32.336 N, 139 58.827W
*** DIC & POC samples cut out of side of floe with a saw, Core pieces cored using the 4" corer*

POC-1 7cm thick grey ice, sliced & broken out of side of floe with saw; filled a plastic bag to melt and filter.
POC-2 6.5 cm thick grey ice, discontinuity at 2.5cm between layers (flatter, horizontal oriented grains on top and vertical granular grains below)

DIC-1 6.5 cm thick, 3cm to change in layers (like POC section) L3
DIC-2 7cm thick, at 3.5cm texture change L4(L1)*

Removed headspace from all bags back in lab (immediatly after getting back from zodiac)
* L4 bag leaked (no vacuum) so samples switched to bag L1 in lab

Salinity 355mL sample taken from surface water/ice interface

Core 1 6cm DIC Core Bag 17
Core 2 + 3 4cm + 4cm Density Core Bag 14

SITE 2

Sampled from side of Zodiac 76 32.357N, 139 58.692W (about 20m away from site 1)
*** DIC & POC samples cut out of side of floe with a saw, Core pieces cored using the 4" corer*

Core 4 + 5 + 6 6.5cm + 3 cm + 7.5cm 3cm core gave to Mi-Sun, melted rest for DIC Bag 15

DIC-3 7cm piece + 8cm piece L5

POC-3 8cm thick grey ice, sliced & broken out of side of floe with saw; filled a plastic bag to melt and filter.

CTD soaking at 1m starting 11:43am
not enough time - had to abort at 11:51am

	Ice Sampling	Thickness	Bag #	13C-POC	DIC/TALK	13C-DIC	13C-TOC	18O	Bacteria*	salinity	sal (ppt)	cond(mS/cm)	cond(mS/cm)**	temp (cond)	Vol Filtered (L)	**Melting Notes** *(melted at room temp in dark - under plastic bag)*
SITE 1	POC-1	7cm	1	x											3.65	POC1 &2 combined in cubetainer before filtering. Filters bright orange in colour - expect some contamination from rust on saw.
SITE 1	POC-2	6.5cm	2	x											2.72	POC1 &2 combined in cubetainer before filtering. Filters bright orange in colour - expect some contamination from rust on saw.
SITE 1	DIC-1	6.5cm	L3		xxxx	xx	xx	x	x	x	13.0	21.62	18.81	18.2		DIC: dups sampled in ground glass stopperd BOD bottles - 1%HS, dups sampled in amber bottles - no HS
SITE 1	DIC-2	7cm	L1		xxxx	xx	xx	x	x	x	12.8	21.27	18.56	18.3		DIC: dups sampled in ground glass stopperd BOD bottles - 1%HS, dups sampled in amber bottles - no HS
SITE 1	Core 1	6cm	S17			xx				x	13.4	22.15	19.27	18.2		only enough volume for 2x 13C-DIC & sal
SITE 1	Core 2 + 3	4 + 4cm	S14													[VOLUMES for density] Piece 1: 3.4cm x 3.7cm x 4.1cm Piece 2: 3.8cm, 3.9cm, 3.9cm
SITE 2	Core 4 + 6	6.5cm + 7 cm	S15		x	xx		x	x	x	12.3	20.54	17.86	18.2		no TOC, not enough vol
SITE 2	DIC-3	7cm + 8cm	L5		xxxxxxx	xx	xx	x	x	x	12.1	20.15	17.54	18.2		DIC: dups sampled in ground glass stopperd BOD bottles - 1%HS one set at begining, and one set at end (after other things sampled), trips sampled in amber bottles - no HS
SITE 2	POC-3	8cm	3	xx											5.72	

** Added to Bill Li's samples* *** 2nd cond reading on Alice's probe*

NOTES: Oct 7th Cores, not melted by 1am Oct 9th - eek! - put in nut fridge overnight to keep cold. POC cores not melted either and put in NH4 fridge overnight. Still NOT melted in am. Moved POC cores to boardroom and covered with black garbage bags (its warm in there!) moved DIC cores to zoop lab. Sampling started for Oct 7&8 cores at 2:30pm Oct 9th (not all melted by then but enough were to start) and continued sampling until 8:30pm. L3, L4, L5 and Zodiac POC left in NH4 fridge overnight (again!) until they could be processed Oct 10th. L3, L4, L5 processed at 9am Oct 10th, and POC melts processed at 18:56 Oct 10. Site 2(POC1) = POC3: leaked from 1st bag into 2nd bag. Lots of condensation around outside of 2nd bag but didn't look like 2nd bag itself was leaking. Site 1, POC 1 & 2 combined to make one sample. No leaks noticed from either POC1 or POC2 bags but lots of condensation (?) in bag holding both samples (POC-1 & POC-2). Decided to include this water in the sample as well - just in case - was about 1.5L...

TOC samples - overnight in fridge, put in freezer (-20deg) at 1130am Oct 10
Bac samples - overnight in fridge, processed at 3pm Oct 10

Station ITP 34
Lat 74 35.0 N
Lon 134 45.5 W
Date 10-Oct-09
Time 12:45 LOCAL

Weather: WINDY!! Blowing 25knts gusting 35knts!! Though after we got on the floe the sun came out and the winds calmed a bit - beautiful day on the ice!!
Floe: LARGE floe of multi year with lots of hummocks & ridges! Looks like whipped cream peaks from the sky :)

CORE 1 T & S Core **** T&S core melts sub-sampled for del18O determination to test ice age profile (30samples)**

Get info from Alice's sheets ....

Thickness cm
Freeboard cm
Snow Depth cm

CORE 2 POC Core
54cm (center to center) from T & S core. Cored & bagged right away for POC melts on board ship. Tripple bagged once on ship and melted in dark at room temp.

Thickness 295 cm (glen measured 2nd time as 299)
Freeboard 38.5 cm with slush (Glen measured second time as 37)

Melt BAGS
Bag 1 40cm + 21cm + 52cm (Core 1 broken into chunks and came out of hole in a few pieces)
Bag 2 47cm + 57cm
Bag 3 42.5cm + 34.8cm FULL core came out - had to cut in half to fit in bag!!!

POC Core	Thickness	Bag #	13C-POC	l Filtered (L)	Vol Filtered (L) - 2	Melting Notes *(melted at room temp in dark - under plastic bag)*
Piece 1	113	1	xx			leaked into 2nd and 3rd bags
Piece 2	104	2	xx			only small leak into bag 3 (condensation?) leaked into bag 2
Piece 3	77.3	3	xx			1st bag leaked into bag 2 but no water or moisture in 3rd bag

PUMPING **P 1 & 2** 10L of water pumped from the CORE 2 bore hole at a depth of ~110cm from surface

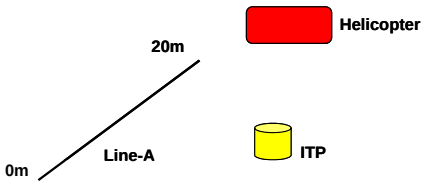
	Depth of Sample	Bag #	13C-POC	DIC/TALK	13C-DIC	13C-TOC	18O	salinity	Vol Filtered (L)
PUMP 1	110 cm	2	x	x	xx		x	x	6.3
PUMP 2	110 cm	1	x	x	xx		x	x	6.285

**NOTE: 30uL HgCL2 added to 13C-DIC's for PUMP 2*

APPENDIX B

EM & Snow Sampling

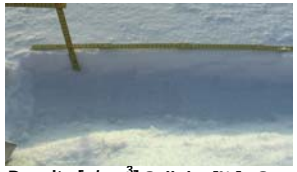
Date	06-Oct-09		
Time (UTC)			
Station no.			
Ice station no.	ITP		
Location Lat			
Location Lon			
Air temperature (deg C)	-4.7		
Length of profile (m)	20		
Spacing along profile, m	2		
Mean ice thickness, m	3.87	#DIV/0!	
Std. Dev., m	0.27	#DIV/0!	
Mean snow depth, m	#DIV/0!		
St. dev, m	#DIV/0!		
Comments (duration of s			



		icethick, m	freeboard, m	Draft, m
	ave	3.23	3.16	3.60
11	std	0.34	0.34	#DIV/0!

Position, m		app cond-V [mS/m]	app cond-H [mS/m]	Het ice/snow [m]	puddle [m]	Total thickness Std model (Tateyama & al., 2006)	Ice thickness Std model	Total thickness 1-D model (Eicken & al., 2001)	Ice thickness 1-D model	Total thickness empexp (Haas, 1997, 3.16e)	Ice thickness empexp	icethick, m measured	freeboard, m	Draft, m	ice+snow	Gap	Comment
Line-A	**0**	121	196	0.115	3.6	3.43	3.32	2.30	2.18	2.50	2.38						
	2	117	178	0.05	3.7	3.50	3.45	2.47	2.42	2.68	2.63						
	4	101	150	0.025	4.0	3.78	3.75	2.78	2.75	3.05	3.02	3.6	0.5		3.625		
	6	90	134	0.025	4.3	4.00	3.98	3.00	2.98	3.33	3.31						
	8	89	130	0.06	4.4	4.02	3.96	3.07	3.01	3.41	3.35						
	10	85	130	0.03	4.5	4.11	4.08	3.07	3.04	3.41	3.38						
	12	83	127	0.055	4.5	4.16	4.11	3.12	3.06	3.48	3.43						
	14	81	132	0.08	4.6	4.21	4.13	3.04	2.96	3.37	3.29						
	16	85	131	0.035	4.5	4.11	4.08	3.05	3.02	3.39	3.36						
	18	87	129	0.15	4.4	4.07	3.92	3.09	2.94	3.44	3.29						
	20	93	128	0.15	4.2	3.94	3.79	3.10	2.95	3.46	3.31						

Station	ITP-LineA-20m
Date	Oct 6/09
Start time	15:29
End time	
Air temp [degC]	-4.6
Surface temp [degC]	-4.5
Snow temp [degC]	



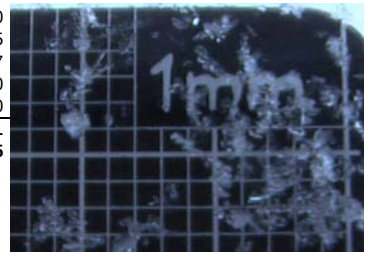
11.5cm

		Bottom	Top	Density [g/cm^3]	Salinity [‰]	Sample No.
10	-4.5					
7	-4.5	8.0	11.0	16.1	0	1
4	-4.7	5.0	8.0	31.0	0	2
1	-4.5	2.0	5.0	30.4	0	3
0	-4.5	0.0	3.0	32.0	0	4
-5						
-10						
-15						
-25						
-35						
-40						
-50						
-60						
-70						
-80						
-90						
-100						
-110						
-120						
-130						
-140						
-150						
-160						

Snow depth [cm]		Density [g/cm^3]				1	2	3	AVE	STD	Salinity [‰]
0	12.0	8-11	15	30.2	48.3	15	15.2	18.1	16.1	1.7	0.0
10	12.0	5-8	31.3	62.1	93.1	31.3	30.8	31	31.0	0.3	0.0
20	11.5	2-5	32.6	62.9	91.2	32.6	30.3	28.3	30.4	2.2	0.0
30	11.5	0-3	33.3	65.3	96	33.3	32	30.7	32.0	1.3	0.0
40	10.5										
50	10.0										
60	10.0										
70	9.5										
80	9.7										
90	10.0										
100	10.0										
AVE	10.61										
STD	0.95										

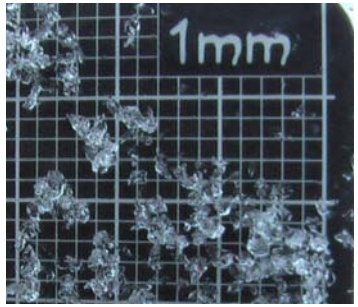
Crystal

8-11 1.5-2.5mm New



7.5-8 crust

0-7.5 0.5-1mm wind pack(compacted)



Station	**ITP-LineA-20m**
Date	**Oct 6/09**
Start time	**15:56**
End time	
Air temp [degC]	**-4.7**
Surface temp [degC]	**-4.4**

15cm

Snow temp [degC]	**Bottom**	**Top**	**Density [g/cm^3]**	**Sample No.**
12	**-4.4**	**12.0**	**15.0**	**26.6** -
9	**-4.2**	**9.0**	**12.0**	**25.7** -
6	**-4.1**	**6.0**	**9.0**	**27.6** -
3	**-3.9**	**3.0**	**6.0**	**33.0** -
0	**-3.8**	**0.0**	**3.0**	**32.7** -
-5				
-10				
-15				
-25				
-35				
-40				
-50				
-60				
-70				
-80				
-90				
-100				
-110				
-120				
-130				
-140				
-150				
-160				

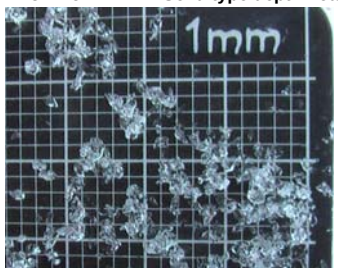
Density [g/cm^3]				**1**	**2**	**3**	**AVE**	**STD**
12-15	22	50.2	75.2	**22**	**28.2**	**25**	**26.6**	**3.1**
9-12	26.3	51.8	77.2	**26.3**	**25.5**	**25.4**	**25.7**	**0.5**
6-9	27.9	54.5	82.9	**27.9**	**26.6**	**28.4**	**27.6**	**0.9**
3-6	33.5	66.1	98.9	**33.5**	**32.6**	**32.8**	**33.0**	**0.5**
0-3	31.3	64.6	98.2	**31.3**	**33.3**	**33.6**	**32.7**	**1.3**

Crystal

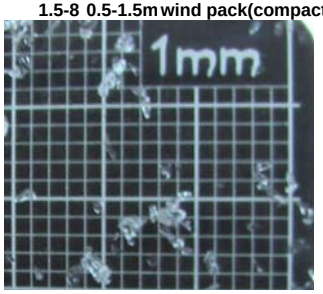
*** Top layer should be new snow, but there is no new snow due to Helicopter downwash**

14.5-15 **Crust**

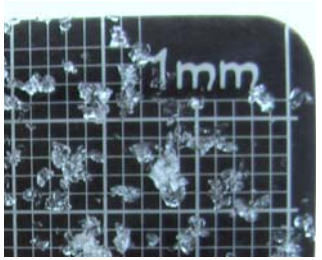
8-14.5 **1mm** **Solid type depth hoar**



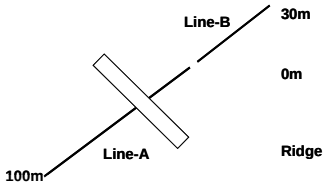
1.5-8 **0.5-1.5m** **wind pack(compacted)**



0-1.5 **1.5-2mm** **Depth hoar**



Date	07-Oct-09
Time (UTC)	
Station no.	
Ice station no.	Multibuoy
Location Lat	
Location Lon	
Air temperature (deg C)	-18
Length of profile (m)	130
Spacing along profile, m	########
Mean ice thickness, m	3.43 1.44
Std. Dev., m	1.74 0.63
Mean snow depth, m	#DIV/0!
St. dev, m	#DIV/0!
Comments (duration of s	

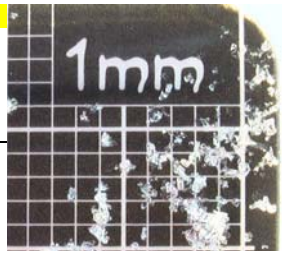


		icethick, m	freeboard, m	Draft, m
	ave	#NUM!	#NUM!	#DIV/0!
36	std	#NUM!	#NUM!	#DIV/0!

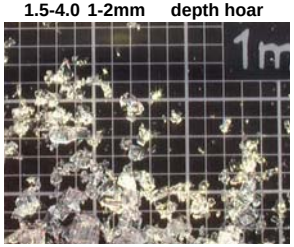
Position, m		app cond-V [mS/m]	app cond-H [mS/m]	het ice/snow [m]	puddle [m]	Total thickness Std model (Tateyama & al., 2006)	Ice thickness Std model	Total thickness 1-D model (Eicken & al., 2001)	Ice thickness 1-D model	Total thickness empexp (Haas, 1997, 3.16e)	Ice thickness empexp	icethick, m measured	freeboard, m	Draft, m	ice+snow	Gap	Comment
Line-A	0	96	147		4.2	3.87	3.87	2.82	2.82		3.10	3.10				0	
	4	64	109		5.2	4.70	4.70	3.47	3.47		4.00	4.00					
	8	50	91		5.7	5.25	5.25	3.98	3.98		5.03	5.03					
	12	43	79		6.1	5.61	5.61	4.51	4.51	#NUM!		#NUM!					
	16	45	64		6.0	5.50	5.50	5.91	5.91	#NUM!		#NUM!					
	20	43	72		6.1	5.61	5.61	4.97	4.97	#NUM!		#NUM!					
	24	43	71		6.1	5.61	5.61	5.06	5.06	#NUM!		#NUM!					
	28	48	65		5.8	5.34	5.34	5.75	5.75	#NUM!		#NUM!					
	32	45	70		6.0	5.50	5.50	5.15	5.15	#NUM!		#NUM!					
	34	44	75		6.0	5.55	5.55	4.75	4.75	#NUM!		#NUM!					
	36	42	66		6.1	5.67	5.67	5.60	5.60	#NUM!		#NUM!					
	38	38	58		6.3	5.93	5.93	8.68	8.68	#NUM!		#NUM!					ridge
	40	38	64		6.3	5.93	5.93	5.91	5.91	#NUM!		#NUM!					ridge
	42	41	80		6.2	5.73	5.73	4.46	4.46		8.47	8.47					ridge
	44	86	148		4.4	4.09	4.09	2.81	2.81		3.08	3.08					ridge
	46	274	204		1.4	1.96	1.96	2.23	2.23		2.43	2.43					
	48	357	315		0.7	1.50	1.50	1.56	1.56		1.73	1.73					
	50	476	440		-0.1	1.01	1.01	1.09	1.09		1.26	1.26					
	52	143	514		3.1	3.12	3.12	0.88	0.88		1.06	1.06					
	54	108	279		3.9	3.65	3.65	1.74	1.74		1.91	1.91					
	56	332	310		0.9	1.63	1.63	1.59	1.59		1.75	1.75					
	58	247	209		1.7	2.14	2.14	2.19	2.19		2.38	2.38					
	60	131	238		3.4	3.28	3.28	1.99	1.99		2.16	2.16					
	64	101	181		4.0	3.78	3.78	2.44	2.44		2.65	2.65					
	68	114	249		3.7	3.54	3.54	1.91	1.91		2.09	2.09					
	70	160	255		2.8	2.92	2.92	1.88	1.88		2.05	2.05					
	72	247	48		1.7	2.14	2.14	#NUM!	#NUM!	#NUM!		#NUM!					
	74	332	384		0.9	1.63	1.63	1.28	1.28		1.45	1.45					
	76	319	539		1.0	1.70	1.70	0.82	0.82		1.00	1.00					
	78	260	212		1.5	2.05	2.05	2.17	2.17		2.36	2.36					
	80	199	437		2.3	2.52	2.52	1.10	1.10		1.27	1.27					
	84	175	284		2.6	2.75	2.75	1.72	1.72		1.88	1.88					
	88	192	261		2.4	2.59	2.59	1.84	1.84		2.01	2.01					
	92	237	453		1.8	2.21	2.21	1.05	1.05		1.22	1.22					
	95	397	226		0.4	1.32	1.32	2.07	2.07		2.25	2.25					
	96	494	136		-0.2	0.95	0.95	2.97	2.97		3.29	3.29					
	98	507	193		-0.3	0.90	0.90	2.33	2.33		2.53	2.53					
	100	450	581		0.0	1.10	1.10	0.72	0.72		0.90	0.90					
Line-B	0	159	253		2.9	2.93	2.93	1.89	1.89		2.06	2.06				0	
	2	308	207		1.1	1.76	1.76	2.21	2.21		2.40	2.40					
	6	514	452		-0.4	0.88	0.88	1.06	1.06		1.23	1.23					
	10	399	423		0.3	1.31	1.31	1.15	1.15		1.31	1.31					
	14	410	507		0.3	1.26	1.26	0.90	0.90		1.07	1.07					
	18	536	371		-0.5	0.81	0.81	1.33	1.33		1.49	1.49					
	22	415	376		0.2	1.24	1.24	1.31	1.31		1.48	1.48					
	26	374	507		0.5	1.42	1.42	0.90	0.90		1.07	1.07					
	30	388	454		0.4	1.36	1.36	1.05	1.05		1.22	1.22					

Station	**multibuoy-LineA-0m**					
Date	**Oct 7/09**					
Start time	**12:30**					
End time						
Air temp [degC]	**-15.6**					
Surface temp [degC]	**-15.3**	**7.5cm**				
Snow temp [degC]						
7	**-14.6**					
5	**-8.8**	**Bottom**	**Top**	**Density [g/cm^3]**	**Salinity [‰]**	**Sample No.**
3	**-7**	**4.5**	**7.5**	**12.9**	**0**	**1**
1	**-7.3**	**1.5**	**4.5**	**23.9**	**0**	**2**
0	**-6.6**	**0.0**	**3.0**	**26.0**	**0**	**3**
-5						
-10						
-15						
-25						
-35						
-40						
-50						
-60						
-70						
-80						
-90						
-100						
-110						
-120						
-130						
-140						
-150						
-160						

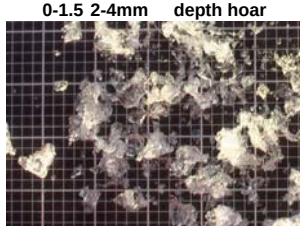
Snow depth [cm]		**Density [g/cm^3]**				**1**	**2**	**3**	**AVE**	**STD**	**Salinity [‰]**
0	7.0	**4.5-7.5**	13	25.3	38.6	**13**	**12.3**	**13.3**	**12.9**	**0.5**	**0.0**
10	6.5	**1.5-4.5**	23	47.1	71.6	**23**	**24.1**	**24.5**	**23.9**	**0.8**	**0.0**
20	6.5	**0-3**	26.3	51.5	78	**26.3**	**25.2**	**26.5**	**26.0**	**0.7**	**0**
30	6.5	**Crystal**									
40	6.5	**4.0-7.5**	**0.5-1.5mm**	**New**							
50	7.5										
60	8.0										
70	8.0										
80	8.0										
90	8.5										
100	8.0										
AVE	**7.36**										
STD	**0.78**										



1.5-4.0 1-2mm depth hoar

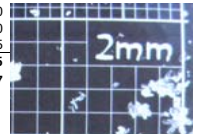


0-1.5 2-4mm depth hoar



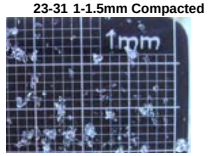
Station	**multibuoy-LineA-26m**					
Date	**Oct 7/09**					
Start time	**13:18**					
End time						
Air temp [degC]	**-15.8**					
Surface temp [degC]	**-14.7**	**36.5cm**				
Snow temp [degC]						
36	**-15.7**					
33	**-12.4**					
30	**-10.4**					
27	**-7.2**					
24	**-6.2**					
21	**-5.4**					
18	**-4.5**	**Bottom**	**Top**	**Density [g/cm^3]**	**Salinity [‰]**	**Sample No.**
15	**-3.8**	**33.5**	**36.5**	**10.5**	**0**	**4**
12	**-3.5**	**25.0**	**28.0**	**25.2**	**0**	**5**
9	**-3.4**	**18.0**	**21.0**	**31.6**	**0**	**6**
6	**-2.9**	**12.0**	**15.0**	**29.0**	**0**	**7**
3	**-2.7**	**3.0**	**6.0**	**33.6**	**0**	**8**
0	**-2.4**	**0.0**	**3.0**	**33.6**	**0**	**9**
-5						
-10						
-15						
-25						
-35						
-40						
-50						
-60						
-70						
-80						
-90						
-100						
-110						
-120						
-130						
-140						
-150						
-160						

Snow depth [cm]		**Density [g/cm^3]**				**1**	**2**	**3**	**AVE**	**STD**	**Salinity [‰]**
0	36.0	**33.5-36.5**	9.2	20	31.4	**9.2**	**10.8**	**11.4**	**10.5**	**1.1**	**0.0**
10	35.0	**25-28**	23.7	48.5	75.7	**23.7**	**24.8**	**27.2**	**25.2**	**1.8**	**0.0**
20	35.0	**18-21**	32.8	64.2	94.9	**32.8**	**31.4**	**30.7**	**31.6**	**1.1**	**0.0**
30	36.0	**12-15**	27.5	56.6	87	**27.5**	**29.1**	**30.4**	**29.0**	**1.5**	**0.0**
40	37.0	**3-6**	32	64.3	100.7	**32**	**32.3**	**36.4**	**33.6**	**2.5**	**0.0**
50	36.0	**0-3**	35.9	68.9	100.9	**35.9**	**33**	**32**	**33.6**	**2.0**	**0.0**
60	36.5	**Crystal**									
70	38.5	**32-36.5 1-3mm New**									
80	39.0										
90	39.0										
100	39.5										
AVE	**37.05**										
STD	**1.67**										

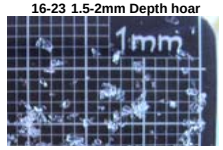


31.5-32 Crust

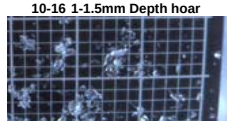
23-31 1-1.5mm Compacted



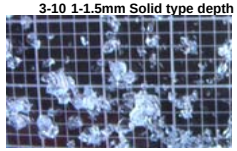
16-23 1.5-2mm Depth hoar



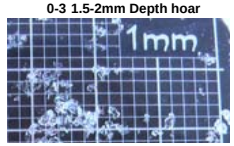
10-16 1-1.5mm Depth hoar



3-10 1-1.5mm Solid type depth hoar



0-3 1.5-2mm Depth hoar

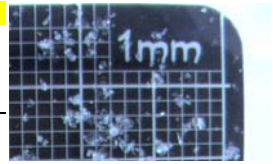


Station	multibuoy-LineB-22m
Date	Oct 7/09
Start time	16:06
End time	
Air temp [degC]	-18
Surface temp [degC]	-17.8 32cm
Snow temp [degC]	

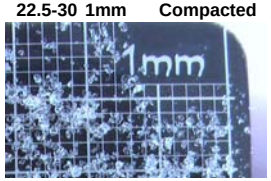
30	-13.2
27	-11.8
24	-10.7
21	-9.1
18	-6.7
15	-5.3
12	-5.8
9	-4.1
6	-3.1
3	-2.7
0	-2.1
-5	
-10	
-15	
-25	
-35	
-40	
-50	
-60	
-70	
-80	
-90	
-100	
-110	
-120	
-130	
-140	
-150	
-160	

Bottom	Top	Density [g/cm^3]	Salinity [‰]	Sample No.
25.0	29.0	38.3	0	10
18.0	21.0	23.9	0	11
7.0	10.0	22.4	0	12
0.0	3.0	37.8	0	13

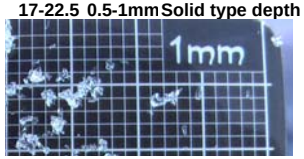
Snow depth [cm]		Density [g/cm^3]				1	2	3	AVE	STD	Salinity [‰]
0	20.0	25-29	36.8	76.2	114.8	36.8	39.4	38.6	38.3	1.3	0.0
10	21.0	18-21	24.6	46.9	71.8	24.6	22.3	24.9	23.9	1.4	0.0
20	21.5	7-10	22.5	44	67.2	22.5	21.5	23.2	22.4	0.9	0.0
30	30.0	0-3	34.6	73.4	113.3	34.6	38.8	39.9	37.8	2.8	4.9
40	31.0	Crystal									
50	31.5	30-32	1-5mm	New							
60	32.0										
70	32.5										
80	32.5										
90	31.0										
100	31.5										
AVE	28.59										
STD	5.04										



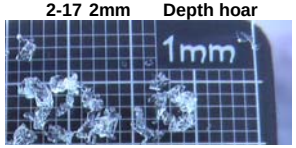
22.5-30 1mm Compacted



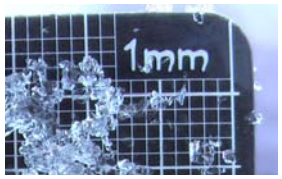
17-22.5 0.5-1mm Solid type depth hoar



2-17 2mm Depth hoar



0-2 1.5-2mm Wet



APPENDIX C

Ice Thickness

APPENDIX D

On-Board Observations