

BACKSCATTER FOR ICE SHEET 2 GROWTH PHASE  
IN THE 1994 WINTER SEA ICE EXPERIMENT

DATA RELEASE VERSION 1.0

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This data set was taken during the CRREL/EX94 experiment. The data are polarimetric C-band radar measurements of a saline ice sheet grown in the outdoor Geophysical Research Facility at the Cold Regions Research and Engineering Lab. The radar and the experiment were described by Nghiem et al [1-3].

There are two types of data :

(1) Fully calibrated backscatter data are in file setxx.std, where xx is the incident angle. These data files also contain measurement-uncertainties.

For backscatter data, the file structure is

Header [1st line] :

Type for growth stages from 01 to 14 ;  
Time in hour from 0.0 hour of 19 January 1994  
HH, 10, hi for sigma<sub>HH</sub>, low value, and high value;  
HV, 10, hi for sigma<sub>HV</sub>, low value, and high value;  
W, 10, hi for sigma<sub>VV</sub>, low value, and high value;  
thk cm for ice thickness in cm  
xx deg for incident angle at xx degrees

- Data are in 12 columns corresponding to the header.

(2) original compressed magnitude and phase data.

For the original data, the data file structure is:

- File ttdhmm.ss, tt=tag, dd=day, hh=hour, mm.minute, ss.second  
the tag is t1-t9 for ice growth stage 01-09 and  
the tag is 10-14 for ice growth stage 11-14

Header line 1 : filename

- Header line 2: version of hardware control program

- Header line 3: operation mode

Header line 4: target type

- Header line 5: incidence, azimuth, 4 polarization tags, mode

- Header line 6: number of frequency samples, coherent averages

- Header line 7: Time tags of 4 polarization measurements

- Header line 8: Normalization factors of 4 polarizations

The rest is the original compressed magnitude and phase data

This data set is stored in 15 floppy disks. The data volume is 10 megabytes, approximately. The disk contents are :

- Disk 01 : this document, ation and calibrated data setxx.std
- Disk 02: data files t1ddhmm.ss
- Disk 03: data files t2ddhmm.ss
- Disk 04: data files t3ddhmm.ss
- Disk 05: data files t4ddhmm.ss
- Disk 06: data files t5ddhmm.ss

- Disk 07: data files t6ddhhmm.ss
- Disk 08: data files t7ddhhmm.ss
- Disk 09: data files t8ddhhmm.ss
- Disk 10: data files t9ddhhmm.ss
- Disk 11: data files 10ddhhmm.ss
- Disk 12: data files 11ddhhmm.ss
- Disk 13: data files 12ddhhmm.ss
- Disk 14: data files 13ddhhmm.ss
- Disk 15: data files 14ddhhmm.ss

The measured ice characteristic data corresponding to the backscatter data are :

Type	Time	Thick- cm	Ts [degree C]
01	16.80000	0.400	-8.6
02	20.84444	0.800	-7.9
03	22.18333	1.000	-9.3
04	25.51667	2.300	-10.-/
05	29.10000	3.000	-12.3
06	31.46667	4.000	-13.4
07	35.80000	5.000	-8.6
08	40.03334	5.400	-6.1
09	46.08333	5.800	-10.8
10	53.36666	7.100	-15.9
11	55.16667	8.000	-14.6
12	59.93333	9.000	-9.1
13	65.76666	9.500	-7.9
14	70.75000	9.700	-10.7

#### REFERENCES :

- [1] S. V. Nghiem, 'C-Rand Polarimetric Scatterometer: System, Operation, Sensitivity and Calibration,' Sea Ice Electromagnetics Workshop, September 14-16, 1993.
- [2] S.V. Nghiem, R. Kwok, S. H. Yueh, J. A. Kong, M. A. Tassoudji, and C. C. Hsu, 'Polarimetric Remote Sensing of Sea Ice,' Annual Technical Report, Jet Propulsion Laboratory, California Institute of Technology, 1994.
- [3] S. V. Nghiem, R. Kwok, S. H. Yueh, J. A. Kong, C.C. Hsu, and K. H. Ding, 'Variations in Polarimetric Backscatter of Saline Ice Grown under Diurns] Thermal Cycling Condition,' Progress in Electromagnetics Research Symposium, University of Washington, Seattle, Washington, July 24-28, 1995.

#### ACKNOWLEDGMENTS :

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set20.std

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Type Time  HH  Lo  hi  HV  Lo  hi  WV  Lo  hi  thk_lo  thk_hi  Time from 0.0 hour of 19 Jan 1994: 120 deg:
01 15.73333 -19.29 -20.13 -18.58 -31.14 -31.87 -30.51 -21.24 -23.72 -19.58 0.400
02 20.78333 -17.64 -17.88 -17.42 -23.53 -24.38 -22.99 -17.51 -18.45 -16.74 0.800
03 22.13333 -19.96 -21.36 -18.91 -25.90 -26.52 -25.36 -18.72 -19.42 -18.12 1.000
04 25.46667 -20.98 -22.73 -19.73 -29.22 -31.83 -27.60 -21.72 -22.83 -20.84 2.300
05 29.05000 -21.24 -21.73 -20.80 -31.00 -31.17 -30.83 -21.06 -21.93 -20.34 3.000
06 31.41667 21.30 -22.51 -20.30 -29.46 -31.94 -27.89 -21.24 -22.55 -20.24 4.000
07 35.75000 -21.03 -21.49 -20.61 -26.61 -28.68 -25.21 -20.45 -21.08 -19.91 5.000
08 39.98333 -19.93 -20.06 -19.80 -31.01 -31.73 -30.39 -21.62 -22.04 -21.24 5.400
09 45.03334 -20.08 -20.40 -19.79 -30.92 -31.83 -30.17 -20.77 -21.09 -20.47 5.800
10 53.31667 -22.22 -22.50 -21.96 -31.05 -31.77 -30.43 -22.81 -23.21 -22.45 7.100
11 55.11666 -23.09 -23.88 -22.41 -31.10 -32.09 -30.30 -21.86 -23.53 -20.66 8.000
12 59.88333 -21.37 -21.64 -21.12 -27.95 -29.24 -26.95 -21.32 -22.09 -20.67 9.000
13 65.70000 -18.93 -21.14 -17.47 -28.60 -30.20 -27.43 -18.34 -20.53 -16.89 9.500
14 70.70000 -16.94 -18.03 -16.06 -31.78 -32.41 -31.22 -17.56 -18.13 -17.06 9.700

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set25.std

1

Type	Time	HH lo hi	HV lo hi	VV lo hi	thk_cm	[Time from 0.0 hour of 19 Jan 1994]	[25 deg]				
01	16.80000	-19.71	-19.87	-19.55	-36.30	-37.34	-35.47	-20.18	-20.63	-19.77	0.400
02	20.84444	-19.00	-19.72	-18.38	-28.02	-29.02	-27.22	-18.68	-19.18	-18.23	0.800
03	22.18333	-20.08	-20.45	-19.74	-27.07	-29.53	-25.50	-19.36	-19.78	-18.98	1.000
04	25.51667	-22.08	-23.22	-21.18	-29.18	-30.38	-28.24	-21.97	-23.04	-21.11	2.300
05	29.10000	-23.41	-24.36	-22.62	-29.61	-31.32	-28.38	-22.11	-23.28	-21.19	3.000
06	31.46667	-23.73	-23.83	-23.53	-29.82	-31.17	-28.79	-23.52	-24.04	-23.06	4.000
07	35.80000	-22.56	-26.25	-29.5'2	-29.34	-31.35	-27.97	-21.04	-21.55	-20.58	5.000
08	40.03334	-22.42	-22.47	-20.57	-34.09	-34.20	-33.98	-21.51	-22.51	-20.70	5.400
09	46.08333	-22.12	-22.97	-21.40	-33.35	-33.74	-32.99	-22.43	-23.19	-21.79	5.800
10	53.35556	-22.91	-23.05	-22.78	-31.26	-32.22	-30.47	-22.48	-23.34	-21.77	7.100
11	55.15557	-24.09	-24.61	-23.52	-34.82	-34.90	-34.74	-22.39	-22.73	-22.07	8.000
12	59.93333	-23.21	-24.02	-22.52	-31.52	-34.87	-29.55	-23.16	-23.52	-22.84	9.000
13	55.75555	-20.74	-21.25	-20.29	-27.54	-28.11	-27.02	-19.27	-19.47	-19.08	9.500
14	70.75000	-18.96	-19.62	-18.38	-30.62	-30.82	-30.43	-19.76	-20.02	-19.52	9.700

set30.std

1

type	time	hi	lo	hi	WV	lo	hi	thk_cm	time	from	0.0	hour	of	19	Jan	1994	deg
01	16.85000	-19.94	-20.22	-19.67	-33.47	-34.77	-32.48	-18.76	-19.66	-18.02	0.400						
02	20.90000	-20.52	-22.20	-19.32	-26.56	-27.52	-25.77	-20.02	-20.34	-19.71	0.800						
03	22.23333	-20.67	-22.85	-19.23	-27.62	-29.61	-26.27	-20.27	-20.87	-19.75	1.000						
04	25.56667	-23.76	-24.38	-23.22	-27.28	-29.23	-25.94	-22.94	-25.76	-21.25	2.300						
05	29.16667	-25.86	-26.44	-25.35	-31.58	-35.25	-29.63	-23.14	-23.62	-22.71	3.000						
06	31.51667	-26.37	-28.84	-24.81	-31.38	-32.85	-30.29	-25.97	-27.58	-24.81	4.000						
07	35.86666	-23.77	-25.45	-22.57	-30.68	-31.51	-29.98	-21.53	-21.83	-21.26	5.000						
08	40.08333	-22.81	-23.11	-22.53	-31.56	-32.42	-30.84	-21.47	-22.79	-20.46	5.400						
09	46.23333	-24.63	-25.23	-24.10	-32.40	-33.59	-31.46	-24.29	-24.57	-24.03	5.800						
10	53.41667	-23.31	-23.59	-23.04	-31.66	-34.10	-30.11	-22.41	-23.83	-21.34	7.100						
11	55.21667	-25.46	-25.81	-25.13	-31.38	-31.63	-31.13	-23.06	-24.08	-22.22	8.000						
12	59.98333	-25.29	-25.60	-24.99	-32.73	-33.12	-32.38	-24.52	-25.90	-23.48	9.000						
13	65.81667	-22.79	-24.50	-21.56	-29.42	-29.92	-28.96	-20.53	-21.08	-20.05	9.500						
14	70.80833	-21.48	-23.29	-20.20	-34.24	-34.99	-33.59	-22.51	-23.10	-21.99	9.700						



Type	Time	HH lo hi	HV lo hi	VV lo hi	thk_cm	[Time from 0.0 hour of 19 Jan 1994]	[40 deg]
02	21.01667	-23.76	-24.79	-22.93	-33.17 -33.47	-32.89 -23.22	-25.82 -21.60
03	22.32500	-23.36	-24.55	-22.43	-32.16 -32.58	-31.79 -2.2.4:	-.22.39 -22.23
04	25.58333	-27.72	-28.72	-26.91	-37.07 -37.55	-35.55 -25.49	-26.13 -24.93
05	29.25557	-28.77	-29.11	-28.46	-34.38 -34.84	-33.95 -25.44	-26.14 -24.83
06	31.63333	-27.97	-28.58	-27.44	-34.84 -35.03	-34.55 -27.55	-28.87 -26.55
07	35.95557	-25.03	-25.40	-24.5?	-34.0? -36.09	-33.98 -23.01	-23.09 -22.93
08	40.21667	-24.49	-25.12	-23.95	-32.08 -32.7:	-31.52 -22.33	-22.64 -22.(?4
09	46.35000	-29.15	-31.91	-27.47	-38.88 -40.36	-37.77 -27.49	-28.51 -25.57
10	53.51666	-23.23	-23.72	-22.79	-33.59 -34.77	-32.55 -23.75	-24.08 -23.45
11	55.33333	-29.52	-30.24	-29.08	-35.18 -35.74	-34.59 -25.11	-26.41 -24.12
12	60.08333	-28.09	-28.93	-27.38	-36.50 -37.31	-35.82 -23.97	-24.05 -23.88
13	65.91666	-25.25	-26.46	-24.32	-35.75 -36.92	-35.16 -23.87	-24.55 -23.20
14	70.92778	-25.98	-27.49	-24.85	-34.70 -34.95	-34.47 -27.00	-27.27 -25.75

set45.std

1

Type	Time	HW lo	hi	HV lo	hi	VV lo	hi	thk_cm	[Time from 0.0 hour of 19 Jan 1994] [45 deg]			
02	21.08333	-25.14	-26.09	-24.36	-34.26	-35.44	-33.34	-24.55	-25.09	-24.07	0.800	
03	22.38333	-24.81	-27.17	-23.30	-34.29	-34.72	-33.91	-22.80	-22.90	-22.62	1.000	
04	25.73333	-27.23	-28.37	-25.31	-33.38	-33.91	-33.28	-24.81	-25.52	-24.14	2.300	
05	29.31667	-28.09	-29.94	-26.81	-32.82	-33.71	-32.09	-25.51	-27.42	-25.92	3.600	
06	31.68333	-27.10	-27.50	-25.74	-35.55	-36.06	-35.11	-26.42	-25.53	-25.22	4.800	
07	36.03334	-25.57	-25.71	-24.71	-35.99	-38.77	-35.74	-23.61	-25.41	-22.34	5.000	
08	43.25557	-24.90	-25.16	-24.57	-32.81	-34.23	-31.75	-23.44	-23.58	-23.20	5.400	
09	46.40001	-28.05	-30.39	-25.54	-35.27	-36.91	-34.08	-27.80	-28.21	-27.42	5.800	
10	53.55557	-23.32	-23.47	-23.19	-35.58	-36.21	-35.03	-25.22	-25.29	-25.15	7.100	
11	55.43333	-31.76	-32.23	-31.34	-39.47	-40.30	-38.78	-26.40	-25.97	-25.89	8.000	
12	60.18333	-28.01	-27.34	-26.99	-35.38	-37.22	-34.09	-23.25	-23.50	-23.92	9.000	
13	53.97222	-25.19	-25.97	-23.92	-35.43	-37.24	-35.75	-25.20	-25.31	-25.10	9.500	
14	70.98333	-25.60	-25.47	-24.87	-35.58	-37.25	-36.18	-25.38	-26.81	-26.00	9.700	



set50.std

1

Type	Time	HH	lo	hi	HV	lo	hi	VV	lo	hi	thk_cm	(Time from 0.0	hour	of	19	Jan	1994)	(50 deg)
02	21.14167	-26.18	-26.31	-26.05	-32.35	-33.71	-31.32	-24.81	-25.29	-24.38	0.800							
03	22.43333	-25.13	-26.13	-24.31	-31.94	-32.77	-31.24	-22.28	-23.08	-21.61	1.000							
05	29.36667	-27.23	-27.64	-26.85	-33.72	-36.16	-32.17	-27.34	-28.01	-26.75	3.000							
06	31.75000	-26.89	-27.48	-25.37	-32.59	-33.12	-32.11	-25.47	-25.25	-24.80	4.000							
07	36.08333	-26.59	-25.58	-26.49	-34.04	-34.90	-33.32	-23.30	-23.91	-22.75	5.000							
08	40.31667	-25.52	-26.64	-24.54	-35.21	-35.80	-34.69	-25.07	-25.58	-24.61	5.400							
09	46.45000	-25.91	-27.43	-24.78	-36.07	-37.52	-34.53	-27.22	-27.57	-26.90	5.800							
10	53.63333	-24.04	-24.50	-23.62	-36.68	-39.27	-35.07	-26.68	-27.64	-25.89	7.100							
11	55.48333	-31.79	-32.02	-31.57	-37.70	-38.55	-36.91	-27.35	-28.10	-25.72	8.000							
12	60.23333	-27.83	-29.92	-26.42	-35.56	-37.64	-34.16	-23.12	-24.23	-22.23	9.000							
13	66.03333	-25.35	-25.23	-24.52	-34.85	-35.77	-34.10	-25.34	-26.52	-24.41	9.500							
14	71.03333	-24.46	-27.11	-22.83	-35.20	-35.34	-35.05	-25.43	-25.25	-24.74	9.700							



EXAMPLE OF COMPRESSED MAGNITUDE AND PHASE DATA

1001210530

Version 1.0

DATA

10 THIN ICE

40, 0, 0, 1, 1, 1, I, DATA

401, 20

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