



Supplement of

Investigation of post-depositional processing of nitrate in East Antarctic snow: isotopic constraints on photolytic loss, re-oxidation, and source inputs

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Supporting information includes two tables (Table S1 and Table S2), one figure (Fig. S1).

Table S1. Summary information for the seven snowpits presented in this study.

Snowpit	Location	Elevation, m	Distance from coast, km	Mean annual accumulation, kg m ⁻² a ⁻¹ 1)	Mean annual Temperature, °C 2)	Depth, cm	Sampling resolution, cm	Sampling date, YYMM
P1	71.13°S, 77.31°E	2037	200	172.0	-29.12	150	3.0	201212
P2	71.81°S, 77.89°E	2295	283	99.4	-32.87	200	5.0	201212
P3	73.40°S, 77.00°E	2545	462	90.7	-35.72	200	5.0	201212
P4	76.29°S, 77.03°E	2843	787	54.8	-41.28	200	2.0	201212
P5	77.91°S, 77.13°E	3154	968	33.3	-46.37	200	2.0	201212
P6	79.02°S, 76.98E	3738	1092	25.4	-53.13	200	2.5	201301
P7	80.42°S, 77.12°E	4093	1256	23.5	-58.50	300	2.5	201301

1) Mean annual snow accumulation rates are obtained from bamboo stick field measurements, updated to 2013 from Ding et al. (2011).

2) Mean annual temperatures are derived from 10m borehole temperatures and automatic weather station observations (Ding et al., 2010).

Table S2. Evaporative enrichment factors from the field experiment observations by Erbland et al. (2013) and modeled here following the theoretical approach of Frey et al. (2009). No $^{18}\epsilon$ data were reported by Erbland et al. (2013).

Temperature, °C	Field Experiment		Temperature, °C	Model	
	$^{15}\epsilon$, ‰	$^{18}\epsilon$, ‰		$^{15}\epsilon$, ‰	$^{18}\epsilon$, ‰
-10	-3.6±1.1	-	0	12.6	1.1
-20	-0.3±1.2	-	-13	13.2	1.0
-30	0.9±3.5	-	-33	14.2	0.8
			-53	15.3	0.7
			-73	16.8	0.6

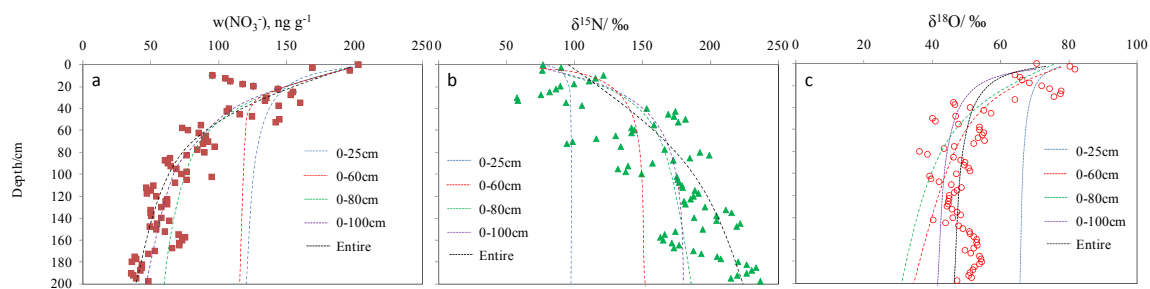


Fig. S1. Detailed profiles of $w(\text{NO}_3^-)$, $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ in different snow depth intervals (0-25cm, 0-60cm, 0-80cm, 0-100cm and 0-bottom) for snowpit P6. The dashed lines are the best fit regressions for the observed data, and asymptotic values are calculated for $w(\text{NO}_3^-)$, $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ by Eq. (6).

Snowpit P1

Depth, cm	w(NO ₃ ⁻), ng g ⁻¹	δ ¹⁵ N, ‰	δ ¹⁸ O, ‰
150.0	57.7	13.0	77.4
147.0	78.7	37.4	73.9
144.0	79.7	59.4	69.2
141.0	52.4	50.3	71.0
138.0	36.2	-5.8	78.2
135.0	42.4	0.2	75.0
132.0	41.5	13.9	71.6
129.0	43.4	24.8	85.2
126.0	44.8	24.1	89.5
123.0	60.1	23.6	82.3
120.0	74.9	19.1	78.0
117.0	84.4	12.2	75.4
114.0	81.6	10.1	73.4
111.0	81.6	11.6	73.4
108.0	72.5	15.6	77.8
105.0	59.6	23.9	85.3
102.0	46.2	23.6	85.4
99.0	38.1	25.6	85.1
96.0	33.8	33.7	83.8
93.0	31.9	38.9	83.0
90.0	31.4	43.1	78.5
87.0	34.8	46.2	78.4
84.0	30.0	47.3	75.6
81.0	28.1	47.7	73.8
78.0	26.7	50.6	74.1
75.0	27.1	48.8	71.1
72.0	28.1	45.5	70.4
69.0	30.0	41.7	70.9
66.0	33.8	10.0	69.5
63.0	37.9	7.4	68.1
60.0	42.9	4.8	66.7
57.0	46.2	11.2	82.8
54.0	50.1	-3.8	78.9
51.0	45.3	-8.4	77.9
48.0	36.7	-14.8	76.9
45.0	45.3	-10.5	77.0
42.0	43.9	11.0	96.3
39.0	51.0	23.4	102.4
36.0	47.7	26.3	102.0
33.0	46.5	28.3	101.7
30.0	44.8	30.1	105.3

27.0	43.4	31.5	104.3
24.0	40.0	32.4	101.6
21.0	37.6	32.5	100.0
18.0	35.7	33.8	98.9
15.0	31.7	30.2	95.0
12.0	27.6	27.1	91.7
9.0	28.1	28.8	90.8
6.0	37.2	27.0	85.3
3.0	97.1	31.8	72.8

Snowpit P2

Depth, cm	w(NO ₃ ⁻), ng g ⁻¹	δ ¹⁵ N, ‰	δ ¹⁸ O, ‰
5.0	74.5	-5.7	91.7
10.0	79.2	-3.7	92.2
15.0	54.1	25.5	90.0
20.0	47.6	20.9	90.3
25.0	52.1	-1.9	89.8
30.0	98.1	14.1	88.1
35.0	173.0	17.8	86.7
40.0	136.4	12.4	87.0
45.0	99.4	1.2	75.7
50.0	66.9	10.8	78.7
55.0	81.9	53.4	92.5
60.0	91.2	47.7	96.8
65.0	90.7	35.5	95.5
70.0	82.5	20.7	86.8
75.0	108.4	30.3	76.3
80.0	112.5	37.3	76.4
85.0	99.4	35.4	78.9
90.0	81.3	17.7	81.1
95.0	85.8	21.5	83.9
100.0	46.3	-12.1	74.0
105.0	49.8	-11.6	73.6
110.0	75.1	28.8	69.9
115.0	72.6	24.0	71.3
120.0	53.7	16.8	72.7
125.0	46.3	12.7	72.7
130.0	54.1	14.0	73.6
135.0	69.4	23.6	75.5
140.0	73.9	15.1	77.0
145.0	92.0	9.5	76.7
150.0	89.5	28.0	75.8
155.0	69.4	53.4	85.1
160.0	86.6	70.8	89.4
165.0	74.7	34.0	83.4
170.0	83.3	25.7	83.0
175.0	88.7	25.7	81.8
180.0	75.9	21.4	74.7
185.0	38.5	34.2	70.4
190.0	67.7	44.1	72.4
195.0	66.9	40.5	74.4
200.0	73.1	32.1	76.5

Snowpit P3

Depth, cm	w(NO ₃ ⁻), ng g ⁻¹	δ ¹⁵ N, ‰	δ ¹⁸ O, ‰
5.0	266.3	-2.2	79.0
10.0	95.7	31.6	97.7
15.0	105.5	39.9	104.0
20.0	102.3	34.9	107.0
25.0	117.1	23.4	76.8
30.0	108.4	24.7	110.2
35.0	86.6	9.8	97.1
40.0	149.1	15.9	95.8
45.0	95.3	35.6	85.2
50.0	95.3	37.6	90.0
55.0	109.0	27.6	95.0
60.0	112.1	20.3	94.7
65.0	112.9	16.1	100.9
70.0	115.8	16.1	104.3
75.0	101.4	25.4	107.9
80.0	87.0	24.0	111.2
85.0	59.5	11.3	104.7
90.0	62.8	10.3	105.6
95.0	92.4	23.6	89.2
100.0	107.6	23.1	64.1
105.0	79.4	24.6	83.0
110.0	63.6	26.0	84.1
115.0	65.2	24.4	81.0
120.0	81.3	22.0	94.7
125.0	71.8	20.2	87.7
130.0	63.2	15.0	52.5
135.0	68.1	17.2	81.5
140.0	80.9	12.6	83.9
145.0	82.9	11.8	75.9
150.0	76.3	16.5	72.4
155.0	86.8	27.7	70.8
160.0	97.7	33.0	66.6
165.0	64.0	22.4	70.7
170.0	65.0	3.4	70.1
175.0	66.1	15.0	57.8
180.0	76.3	20.8	65.9
185.0	75.1	20.3	58.3
190.0	64.0	25.7	69.3
195.0	61.1	24.9	70.6
200.0			

Snowpit P4

Depth, cm	w(NO ₃ ⁻), ng g ⁻¹	δ ¹⁵ N, ‰	δ ¹⁸ O, ‰
200.0	40.3	171.3	74.8
198.0	38.0	174.1	75.1
196.0	33.2	172.5	73.7
194.0	27.4	168.2	70.4
192.0	25.0	169.8	67.0
190.0	25.4	175.8	65.0
188.0	26.2	178.8	62.6
186.0	25.4	176.7	61.8
184.0	24.1	174.2	63.1
182.0	26.6	169.8	62.1
180.0	28.7	167.2	62.9
178.0	28.9	163.0	62.9
176.0	27.4	159.5	62.7
174.0	34.1	148.8	64.1
172.0	44.0	136.2	66.6
170.0	42.7	125.9	67.2
168.0	53.5	118.3	65.3
166.0	63.0	113.1	64.8
164.0	63.4	110.0	64.8
162.0	65.0	109.8	65.0
160.0	61.3	115.5	65.1
158.0	58.0	125.6	64.5
156.0	58.0	139.3	63.6
154.0	58.4	150.2	62.9
152.0	58.4	149.5	62.3
150.0	68.8	139.5	63.9
148.0	72.9	133.6	63.9
146.0	65.9	123.3	64.5
144.0	62.2	104.0	66.5
142.0	61.3	93.5	67.7
140.0	54.7	100.1	67.1
138.0	51.6	106.8	67.7
136.0	53.1	109.7	66.9
134.0	52.7	118.5	65.6
132.0	56.0	124.2	63.8
130.0	51.8	126.9	62.4
128.0	53.9	113.0	63.6
126.0	56.0	109.2	65.8
124.0	66.7	111.7	64.3
122.0	71.7	124.3	61.0
120.0	66.3	132.7	57.5

118.0	77.2	126.4	56.4
116.0	79.9	111.3	56.7
114.0	74.1	87.2	60.1
112.0	75.0	83.8	59.8
110.0	71.2	88.5	60.6
108.0	71.7	94.8	61.9
106.0	66.3	101.7	61.1
104.0	69.2	102.6	61.3
102.0	59.3	113.4	61.2
100.0	53.5	139.8	59.2
98.0	46.7	155.1	57.9
96.0	49.3	154.9	55.7
94.0	44.4	162.5	54.1
92.0	45.6	146.5	54.3
90.0	46.9	150.9	55.0
88.0	55.5	125.5	59.4
86.0	56.0	120.7	59.7
84.0	64.2	112.1	60.5
82.0	74.1	107.3	62.8
80.0	80.7	108.2	63.1
78.0	89.4	101.8	64.2
76.0	85.3	95.2	62.2
74.0	79.9	96.9	63.5
72.0	79.5	102.7	62.5
70.0	77.0	120.0	58.8
68.0	83.6	147.8	52.0
66.0	67.5	172.7	47.9
64.0	66.6	180.9	46.6
62.0	65.6	184.2	45.9
60.0	62.7	176.5	46.9
58.0	63.2	157.8	49.8
56.0	64.1	142.7	51.8
54.0	56.4	114.4	56.9
52.0	50.1	124.4	58.8
50.0	45.3	137.5	58.9
48.0	43.1	147.4	59.3
46.0	42.4	153.4	58.8
44.0	41.9	155.0	56.9
42.0	41.4	156.6	55.4
40.0	42.8	172.6	51.3
38.0	48.2	183.5	46.2
36.0	51.6		
34.0	46.7	158.3	52.3

32.0	37.5	166.4	53.3
30.0	34.6	168.7	51.0
28.0	31.7	168.2	48.9
26.0	33.6	168.2	48.5
24.0	33.6	166.5	47.0
22.0	37.0	163.5	47.3
20.0	37.0	160.8	45.8
18.0	51.1	135.6	49.4
16.0	52.0	116.4	49.2
14.0	51.1	116.8	48.1
12.0	49.1	118.6	48.9
10.0	69.9	123.8	59.6
8.0	70.9	101.3	67.2
6.0	131.9	75.0	59.3
4.0	124.7	47.8	68.4
2.0	151.3	15.5	75.6

Snowpit P5

Depth, cm	w(NO ₃ ⁻), ng g ⁻¹	δ ¹⁵ N, ‰	δ ¹⁸ O, ‰
200.0	20.4	209.6	73.8
198.0	21.3	212.6	67.3
196.0	23.0	223.0	65.1
194.0	24.7	230.2	64.5
192.0	25.7	214.2	59.8
190.0	26.2	225.9	62.6
188.0	25.7	221.7	62.3
186.0	24.7	182.8	54.7
184.0	22.8	230.5	67.1
182.0	20.4	216.5	64.1
180.0	22.3		
178.0	20.9	185.1	62.6
176.0	18.4	198.0	68.1
174.0	24.7	185.8	66.7
172.0	21.3	155.9	55.5
170.0	17.9	170.2	52.5
168.0	18.9	178.0	52.7
166.0	18.4	173.3	50.3
164.0	20.4	155.1	47.8
162.0	14.6		
160.0	18.4	242.5	71.4
158.0	21.8	239.9	71.0
156.0	23.3	202.2	63.5
154.0	21.3	195.0	61.0
152.0	22.3	207.7	58.7
150.0	20.9	237.4	55.0
148.0	27.2	239.2	48.1
146.0	27.2	274.6	49.3
144.0	27.2	280.4	48.2
142.0	24.7	248.6	56.4
140.0	21.8		
138.0	25.7	248.3	52.8
136.0	26.2	213.5	47.1
134.0	28.1	204.6	44.5
132.0	33.9	243.4	49.6
130.0	33.5	204.2	50.3
128.0	35.4	232.4	58.9
126.0	35.9	230.3	60.6
124.0	33.9		
122.0	37.8	247.0	52.3
120.0	38.8	236.9	51.2

118.0	40.2	227.7	52.0
116.0	38.8	210.6	54.8
114.0	37.8	201.3	57.1
112.0	36.4	198.3	59.8
110.0	34.9	196.7	58.9
108.0	33.5	190.0	58.0
106.0	31.0	200.0	60.2
104.0	28.1	203.2	59.3
102.0	32.0	199.7	55.5
100.0	32.5	227.2	53.7
98.0	34.4	231.5	51.9
96.0	35.4	236.8	50.7
94.0	33.9	239.5	50.9
92.0	31.0	242.7	50.1
90.0	30.1	246.1	49.9
88.0	30.1	238.9	50.6
86.0	28.6	225.5	52.7
84.0	27.6	228.5	53.1
82.0	27.2	238.7	49.3
80.0	29.1	235.6	47.1
78.0	30.5	228.5	49.1
76.0	26.2	235.1	49.8
74.0	24.7	236.1	48.8
72.0	26.7	220.8	50.1
70.0	19.4	250.1	52.0
68.0	20.4	237.2	52.0
66.0	18.9	186.7	43.9
64.0	22.3	197.4	43.2
62.0	25.2	211.8	48.2
60.0	35.9	221.8	50.1
58.0	36.4	228.0	47.2
56.0	50.4	201.4	46.8
54.0	53.3	188.3	44.0
52.0	53.8	190.6	44.2
50.0	56.2	193.1	47.7
48.0	65.4	193.0	50.0
46.0	61.1	193.5	49.4
44.0	56.7	192.0	49.1
42.0	52.4	190.9	47.9
40.0	50.9	188.5	46.3
38.0	53.8	170.3	45.6
36.0	58.7	162.9	43.7
34.0	66.9	156.9	42.7

32.0	67.4	146.7	45.8
30.0	72.5	130.8	49.0
28.0	77.6	123.3	49.8
26.0	75.1	124.2	49.7
24.0	69.0	126.1	50.0
22.0	54.7	142.4	51.1
20.0	72.5	158.8	46.9
18.0	89.3	138.2	44.3
16.0	111.6	125.5	45.6
14.0	118.2	125.2	45.9
12.0	109.6	127.9	45.2
10.0	118.7	48.0	72.8
8.0	144.7	58.8	82.2
6.0	134.0	64.7	82.0
4.0	134.0	65.7	79.1
2.0	175.1	51.9	72.7

Snowpit P6

Depth, cm	w(NO ₃), ng g ⁻¹	δ ¹⁵ N, ‰	δ ¹⁸ O, ‰
200.0	48.3	236.8	47.2
197.5	39.2	215.3	51.6
195.0	37.0	220.0	50.6
192.5	35.4	226.7	50.9
190.0	42.4	230.6	51.9
187.5	43.4	233.8	52.3
185.0	43.4	226.8	53.9
182.5	35.9	220.4	54.3
180.0	39.2	207.7	54.1
177.5	37.8	205.1	53.8
175.0	48.3	193.5	51.2
172.5	53.1	187.6	49.6
170.0	65.4	173.4	52.1
167.5	70.8	177.2	53.1
165.0	70.8	171.6	52.9
162.5	72.9	165.4	53.0
160.0	75.1	163.1	52.0
157.5	70.2	166.3	51.0
155.0	60.1	174.4	50.8
152.5	54.2	194.6	49.0
150.0	49.3	219.5	47.7
147.5	54.7	222.0	43.9
145.0	63.3	204.6	40.1
142.5	57.4	188.4	46.0
140.0	50.4	204.6	48.4
137.5	49.9	215.6	47.3
135.0	49.9	211.5	45.7
132.5	57.4	196.0	44.3
130.0	61.7	182.0	44.7
127.5	60.6	180.9	44.7
125.0	61.7	185.6	44.8
122.5	54.2	187.9	45.0
120.0	47.2	191.2	46.3
117.5	49.9	188.9	47.3
115.0	46.7	179.8	48.5
112.5	52.0	179.3	45.5
110.0	67.6	177.0	41.9
107.5	76.1	175.9	39.6
105.0	94.9	175.5	39.1
102.5	72.4	149.5	47.0
100.0	76.1	138.0	51.0

97.5	68.6	132.3	50.7
95.0	64.3	139.7	49.4
92.5	62.2	157.4	49.5
90.0	60.1	172.7	48.4
87.5	63.8	184.8	46.1
85.0	76.1	199.2	38.6
82.5	89.5	192.3	36.2
80.0	84.2	166.4	43.4
77.5	96.8	134.1	46.4
75.0	88.5	94.6	52.2
72.5	92.2	98.8	55.3
70.0	89.5	116.2	53.3
67.5	90.6	130.7	54.6
65.0	85.2	142.0	55.2
62.5	77.2	144.5	53.7
60.0	72.9	142.2	53.8
57.5	86.9	158.3	47.7
55.0	142.1	176.5	40.9
52.5	144.5	182.1	40.0
50.0	124.4	173.4	46.8
47.5	115.3	169.3	57.1
45.0	105.6	174.6	55.2
42.5	107.2	153.5	51.0
40.0	144.2	105.5	46.5
37.5	159.7	93.8	46.3
35.0	134.0	58.2	64.1
32.5	135.1	57.7	75.7
30.0	152.8	75.3	77.5
27.5	154.7	81.6	77.7
25.0	143.7	86.4	74.4
22.5	125.4	89.7	72.0
20.0	117.4	100.0	68.4
17.5	108.3	110.7	66.2
15.0	104.5	115.8	65.7
12.5	95.4	121.6	64.2
10.0			
7.5	196.2	76.2	81.9
5.0	168.9	90.0	80.2
2.5	202.6	76.8	70.5

Snowpit P7

Depth, cm	w(NO ₃ ⁻), ng g ⁻¹	δ ¹⁵ N, ‰	δ ¹⁸ O, ‰
300.0	15.6	312.6	64.6
297.5	16.1	329.7	59.5
295.0	16.5	334.5	61.2
292.5	16.1	338.2	61.2
290.0	15.1	341.3	60.5
287.5	16.4	331.5	61.0
285.0	15.5	318.9	64.1
282.5	14.0	301.6	65.6
280.0	12.9	309.1	67.1
277.5	13.4	297.5	63.4
275.0	13.9	305.8	66.8
272.5	13.3	296.0	66.1
270.0	13.0	312.5	64.0
267.5	13.4	315.2	64.5
265.0	13.8	319.0	63.5
262.5	15.4	328.1	61.0
260.0	13.9	322.1	54.5
257.5	15.3	326.9	53.1
255.0	15.5	332.6	53.8
252.5	15.5	338.6	52.3
250.0	15.5	352.6	51.5
247.5	14.8	354.8	51.4
245.0	14.0	347.0	54.1
242.5	13.1	328.7	56.2
240.0	12.4	313.9	56.5
237.5	11.3	316.1	59.1
235.0	11.6	306.9	59.4
232.5	11.2	295.2	59.1
230.0	13.0	329.3	57.2
227.5	13.7	333.7	54.6
225.0	13.5	361.1	49.7
222.5	13.4	361.1	49.1
220.0	13.5	348.5	50.1
217.5	12.8	333.5	52.7
215.0	11.6	328.4	54.6
212.5	12.4	318.0	56.3
210.0	11.1	308.3	56.9
207.5	11.2	296.7	57.6
205.0	10.6	309.8	55.7
202.5	11.9	322.8	53.7
200.0	13.3	344.9	51.0

197.5	12.5	368.2	57.4
195.0	12.6	341.2	52.2
192.5	10.9	334.5	55.8
190.0	14.0	311.0	55.3
187.5	10.4	307.6	55.4
185.0	11.1	300.4	57.9
182.5	9.6	297.9	61.0
180.0	9.9	299.6	61.2
177.5	9.1	283.2	61.3
175.0	9.4	283.8	59.8
172.5	10.4	291.9	57.1
170.0	10.1	305.4	56.2
167.5	12.6	311.2	53.9
165.0	10.3	315.8	51.4
162.5	12.6	343.0	47.9
160.0	14.9	337.4	47.8
157.5	11.6	393.8	45.7
155.0	12.3	370.9	47.3
152.5	14.0	342.8	49.5
150.0	13.2	332.9	50.4
147.5	12.0	397.4	44.0
145.0	14.9	402.6	42.5
142.5	12.6	397.3	44.4
140.0	10.7	365.0	47.2
137.5	11.6	353.2	50.1
135.0	11.3	370.8	50.1
132.5	10.6	354.2	52.2
130.0	11.7	325.5	57.1
127.5	12.7	331.8	53.8
125.0	11.2	324.2	51.3
122.5	10.8	329.3	50.7
120.0	12.3	351.1	47.3
117.5	12.0	343.6	46.1
115.0	13.5	333.8	45.7
112.5	9.1	344.8	45.6
110.0	10.2	347.1	43.3
107.5	10.8	352.2	41.4
105.0	9.9	361.6	42.1
102.5	9.6	366.9	42.5
100.0	8.9	339.4	43.6
97.5	7.9	332.4	43.7
95.0	8.1	322.8	44.0
92.5	7.9	337.2	40.9

90.0	9.6	338.7	39.8
87.5	9.5	335.6	41.0
85.0	14.0	398.5	30.1
82.5	13.4	396.5	31.3
80.0	13.1	366.0	34.0
77.5	14.6	361.5	36.4
75.0	15.4	394.9	35.5
72.5	18.3	394.2	31.2
70.0	17.9	370.6	34.7
67.5	17.7	388.8	37.3
65.0	19.4	374.0	36.0
62.5	20.5	362.9	35.9
60.0	19.8	367.3	35.8
57.5	27.4	374.5	35.7
55.0	30.4	436.5	35.4
52.5	29.2	460.8	33.3
50.0	23.1	453.0	30.5
47.5	21.5	420.9	30.2
45.0	22.7	430.9	21.4
42.5	27.4	437.0	16.8
40.0	23.7	436.2	18.1
37.5	22.6	402.2	23.6
35.0	20.6	388.6	27.5
32.5	19.0	355.4	34.7
30.0	18.4	347.9	34.9
27.5	39.6	282.0	38.4
25.0	42.3	265.1	40.4
22.5	37.6	259.5	42.6
20.0	32.5	272.3	41.2
17.5	65.8	269.6	32.6
15.0	66.5	293.6	33.2
12.5	67.0	287.8	30.5
10.0	123.3	189.1	63.0
7.5	158.9	185.6	57.6
5.0	319.2	129.8	84.0
2.5	373.8	111.0	74.9

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