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Air Temperature and Snow Depth on Yala Glacier of Langtang Valley, Nepal Himalayas

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Abstract

Observations of air temperature and snow depth were carried out for 9 months on Yala Glacier, Langtang Himal, Nepal Himalayas. Air temperature on Yala Glacier (5250 m a.s.l.) were about 7 ℃ lower than at Kyangchen (3920 m a.s.l.). The relationship between the snow depth on Yala Glacier and at Kyangchen could be expressed by a linear equation.

1. Introduction

The observations in this report were carried out as a part of the Glaciological Expedition of Nepal/ Langtang Project (Watanabe and Higuchi, 1987). The observation sites were situated in Langtang Valley, Nepal Himalayas. Air temperature and the snow depth on Yala Glacier are compared with the values at Kyangchen which have been reported by Takahashi *et al.* (1987).

2. Outline of the observations

Air temperature was observed from August 1, 1985 to April 16, 1986 and snow depth was observed from October 25, 1985 to March 7, 1986 on Yala Glacier in Langtang Valley, which is located about 60 km north of Kathmandu, the capital city of Nepal.The location of the observation sites is shown in Fig. 1. The observation site on Yala Glacier, called S5 in this report, is located at 5250 m, a.s.l. and the observation site at the Base House of the research work at Kyangchen is located at 3920 m a.s.l..

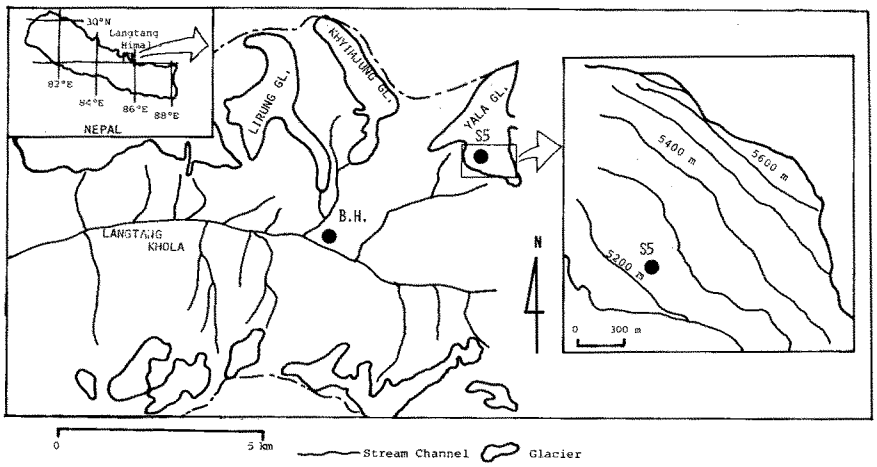

Fig. 1. Location of the observation sites in Langtang Valley.

Table 1. Daily mean temperature at 5250 m, a.s.l. (on Yala Glacier) and at 3920 m, a.s.l. (Base House, after Takahashi *et al.*, 1987). B.H. and S5 indicate Base House and Yala Glacier, respectively.

1985. 8			1985. 9			1985. 10		
Date	B.H. (°C)	S5 (°C)	Date	B.H. (°C)	S5 (°C)	Date	B.H. (°C)	S5 (°C)
1	9.5		1	9.1	5.4	1	5.2	−1.4
2	9.2	3.5	2	9.5	4.3	2	6.3	1.0
3	9.2	5.2	3	9.3	3.7	3	6.8	−0.3
4	9.4	3.1	4	7.9	2.3	4	6.5	−0.3
5	9.2	4.1	5	6.9	1.9	5	5.1	−1.1
6	9.2	2.9	6	7.6	3.7	6	4.8	−1.5
7	9.6	4.8	7	8.0	3.1	7	3.0	−0.2
8	9.4	5.7	8	8.3	2.5	8	2.7	−1.4
9	9.8	6.5	9	8.5	1.7	9	3.2	−3.0
10	9.5	3.3	10	7.7	1.9	10	2.3	−1.9
11	10.0	5.2	11	7.1	4.4	11	6.1	1.0
12	10.2	4.5	12	7.0	2.2	12	5.4	−0.2
13	10.7	3.3	13	7.6	3.7	13	7.1	−1.0
14	10.5	4.3	14	7.4	4.0	14	6.3	−3.8
15	10.4	4.4	15	7.5	2.1	15	6.0	−3.1
16	8.9	3.4	16	4.8	−0.1	16	4.9	
17	8.6	3.4	17	4.2	−0.1	17	2.4	
18	9.8	4.2	18	5.9	2.5	18	3.0	
19	9.0	2.5	19	5.8	0.5	19	2.8	
20	9.2	4.7	20	7.2	2.2	20	1.0	
21	9.4	3.6	21	7.7	4.9	21	0.7	
22	8.9	3.2	22	7.3	3.2	22	0.8	
23	8.3	3.1	23	6.6	2.1	23	1.4	
24	8.8	4.8	24	7.2	1.6	24	1.4	
25	9.1	3.8	25		0.4	25	1.0	−4.4
26	9.4	3.2	26		3.5	26	0.8	−4.0
27	9.0	3.1	27		2.2	27	1.3	−3.4
28	9.2	2.7	28		2.4	28	0.2	−2.5
29	9.5	3.3	29	5.0	0.3	29	1.6	0.6
30	9.1	5.5	30	5.4	−0.2	30	1.2	−0.5
31	9.4	3.9	m mean	7.2	2.4	31	0.2	−0.8
mean	9.4	4.0				mean	3.3	−1.5

A sensor for the measurement of air temperature was fixed at about 150 cm height above the snow surface on August 1, 1985. So, the measuring height of air temperature was not constant during the measuring period. Air temperatures were measured at intervals of 3 hours (0, 3, 6, 9, 12, 15, 18, 21 hr.), automatically. The daily mean temperatures reported here are the average value of these 8 times.

Snow depth was measured by an automatic recorder (Aburakawa, 1979) which sensor length was 200 cm. The length of the sensor above the snow surface was 173 cm on the first day of the observation period, October 25, 1985. So, the snow depth is the relative value on the assumption that the snow depth was 27 cm on October 25, 1985. The data in this report are the maximal values in a day which are marked continuously on recording chart. The data could not be obtained between December 7 and 18, 1985.

3. Results

3.1. Air temperature

Table 1 and Fig. 2 shows the daily mean temperatures at 5250 m, a.s.l. on Yala Glacier. The daily mean temperatures at the Base House (3920 m, a.s.l., Takahashi *et al.*, 1987) also are shown in Table 1 and Fig. 2. The difference of the temperature between these 2 places was larger in the winter season than in the summer season. The fluctuation of air temperature in the short period of about 10 days is lager at the glacier (S5) than at the Base House. This tendency is remarkable in the winter season.

Fig. 3 shows the relationship between the daily mean temperatures at the Base House (Takahashi *et al.*, 1987) and at the glacier. This relationship is linear and is able to be formulated as follows ;

$$T_{S5} = 1.11 \times T_{BH} - 6.75, \quad (1)$$

where T_{S5} is the daily mean temperature at the glacier (°C) and T_{BH} is the daily mean temperature at the Base House (°C).

Table 1.(2)

1985. 11

Date	B.H. (°C)	S5 (°C)
1	−0.4	−6.3
2	−0.6	−6.5
3	−0.8	−9.1
4	−1.1	−5.7
5	−1.2	−7.4
6	−1.6	−9.0
7	−1.3	−7.5
8	−0.8	−8.1
9	−1.7	−8.3
10	−1.2	−8.5
11	−1.4	−9.6
12	0.7	−5.0
13	0.7	−5.6
14	0.4	−6.4
15	1.3	−4.7
16	0.9	−5.6
17	1.3	−4.5
18	0.0	−5.0
19	−2.6	−8.2
20	−0.5	−3.9
21	1.1	−3.8
22	0.6	−5.8
23	1.7	−5.9
24	1.3	−5.7
25	−0.5	−7.8
26	−0.9	−10.1
27	−3.8	−9.5
28	−0.2	−8.7
29	0.8	−7.3
30	0.6	−7.6
mean	−0.3	−6.9

1985. 12

Date	B.H. (°C)	S5 (°C)
1	−0.5	−8.9
2	−2.4	−8.5
3	−1.4	−7.4
4	0.7	−6.9
5	0.9	−4.5
6	3.3	−3.4
7	0.8	−3.8
8	0.5	−7.1
9	−1.7	−10.2
10	−1.9	−11.1
11	−0.7	−10.9
12	0.3	−7.5
13	2.2	−7.7
14	2.6	−3.6
15	1.9	−5.0
16	1.0	−7.0
17	1.4	−6.5
18	1.1	−11.6
19	0.0	−11.9
20	−1.1	−2.7
21	0.3	−1.3
22	−0.3	−3.0
23	−1.5	−8.3
24	−3.8	−13.5
25	−5.2	−11.5
26	−5.9	−13.4
27	−6.3	−14.3
28	−6.6	−13.3
29	−3.2	−10.6
30	−3.9	−9.4
31	−1.2	−1.3
mean	−1.0	−7.9

1986. 1

Date	B.H. (°C)	S5 (°C)
1	−1.0	−7.9
2	−1.1	−9.5
3	−0.3	−7.0
4	−2.1	−11.8
5	−3.9	−10.4
6	−1.6	−6.3
7	−0.9	−7.0
8	−2.0	−7.6
9	−4.4	−12.0
10	−6.0	−13.0
11	−6.6	−11.3
12	−7.8	−15.0
13	−5.4	−12.5
14	−2.3	−8.2
15	−5.0	−10.8
16	−7.8	−13.6
17	−5.1	−13.6
18	−7.2	−13.3
19	−6.0	−11.7
20	−6.1	−11.5
21	−4.4	−10.0
22	−1.6	−8.9
23	−3.4	−11.2
24	−3.5	−8.7
25	−3.8	−11.2
26	−6.0	−13.4
27	−4.9	−11.7
28	−3.7	−11.0
29	−3.8	−12.7
30	−3.9	−14.2
31	−5.3	−14.3
mean	−4.1	−11.0

Table 1.(3)

1986. 2

Date	B.H. (°C)	S5 (°C)
1	−4.2	−13.7
2	−4.2	−11.1
3	−3.5	−9.1
4	−3.0	−12.3
5	−4.2	−12.9
6	−6.1	−12.3
7	−5.7	−13.4
8	−4.6	−10.8
9	−3.7	−9.6
10	−5.2	−12.0
11	−5.6	−12.1
12	−5.1	−11.3
13	−5.4	−11.8
14	−6.2	−13.1
15	−7.4	−14.7
16	−6.6	−11.7
17	−7.3	−13.5
18	−6.1	−11.8
19	−3.7	−10.9
20	−1.4	−6.8
21	−1.3	−8.1
22	−3.1	−10.6
23	−4.1	−10.3
24	−3.3	−11.3
25	−4.2	−11.2
26	−4.3	−11.7
27	−4.3	−12.7
28	−3.2	−11.8
mean	−4.5	−11.5

1986. 3

Date	B.H. (°C)	S5 (°C)
1	−3.2	−12.6
2	−5.5	−13.3
3	−3.2	−10.1
4	−3.2	−8.9
5	−3.7	−8.2
6	−3.8	−10.1
7	−3.6	−7.3
8	−2.7	−6.6
9	−1.7	−4.8
10	−0.9	−3.4
11	0.0	−5.9
12	−1.0	−9.7
13	−0.8	−9.2
14	0.1	−9.0
15	−2.7	−12.7
16	−2.3	−13.4
17	−1.3	−12.1
18	−2.5	−11.9
19	−1.9	−13.5
20	−1.7	−15.1
21	−0.3	−14.4
22	0.9	−11.6
23	0.3	−11.4
24	0.1	−13.3
25	0.3	−13.2
26	0.3	−9.4
27	4.9	−0.6
28	4.1	−4.7
29	3.1	−5.3
30	4.0	−6.7
31	1.7	−8.6
mean	−0.8	−9.6

1986. 4

Date	B.H. (°C)	S5 (°C)
1	0.0	−8.1
2	0.4	−8.2
3	−3.9	−11.7
4	−3.2	−9.7
5	−2.9	−9.2
6	−1.8	−9.9
7	−1.6	−9.2
8	0.8	−7.4
9	2.0	−6.6
10	2.9	−6.3
11	2.4	−6.5
12	3.1	−5.4
13	3.8	−4.2
14	4.2	−3.5
15	4.6	−3.5
16	5.5	−5.0
mean	1.0	−7.2

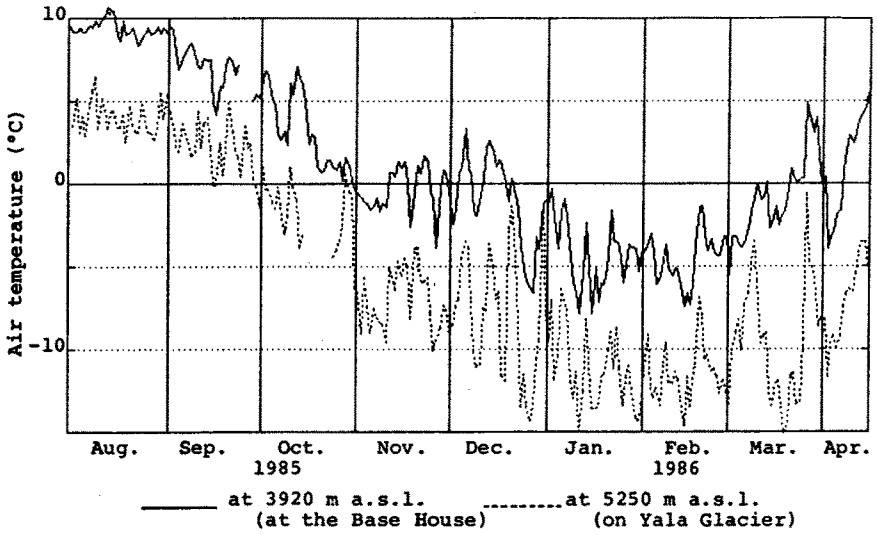

Fig. 2. Changes in daily mean air temperature at 5250 m, a.s.l. (on Yala Glacier) and at 3920 m, a.s.l.(Base House).

Table 2. Snow depth at 5250 m, a.s.l. (on Yala Glacier) and at 3920 m, a.s.l. (Base House; after Takahashi *et at.*, 1987). B.H. and S5 indicate Base House and Yala Glacier, respectively.

1985. 10

Date	B.H. (cm)	S5 (cm)
25	0.0	27.1
26	0.0	26.1
27	0.0	25.1
28	0.0	20.3
29	0.0	20.3
30	0.0	19.3
31	0.0	17.4

1985. 11

Date	B.H. (cm)	S5 (cm)
1	0.0	14.5
2	0.0	13.5
3	0.0	12.6
4	0.0	12.6
5	0.0	12.6
6	0.0	12.6
7	0.0	10.6
8	0.0	9.7
9	0.0	10.6
10	0.0	9.7
11	0.0	9.7
12	0.0	13.5
13	0.0	11.6
14	0.0	11.6
15	0.0	10.6
16	0.0	10.6
17	0.0	10.6
18	0.0	10.6
19	0.0	10.6
20	0.0	10.6
21	0.0	10.6
22	0.0	9.7
23	0.0	9.7
24	0.0	9.7
25	0.0	9.7
26	0.0	9.7
27	0.0	8.7
28	0.0	8.7
29	0.0	9.7
30	0.0	9.7

1985. 12

Date	B.H. (cm)	S5 (cm)
1	0.0	10.6
2	0.0	9.7
3	0.0	8.7
4	0.0	8.7
5	0.0	8.7
6	0.0	6.8
7	0.0	
8	0.0	
9	0.0	
10	0.0	
11	0.0	
12	0.0	
13	0.0	
14	0.0	
15	0.0	
16	0.0	
17	0.0	
18	0.0	
19	0.0	13.5
20	0.0	8.7
21	0.0	6.8
22	0.0	5.8
23	0.0	4.8
24	0.0	4.8
25	0.0	10.6
26	43.0	35.7
27	68.0	113.0
28	59.0	110.1
29	49.0	102.4
30	45.0	95.7
31	45.0	87.9

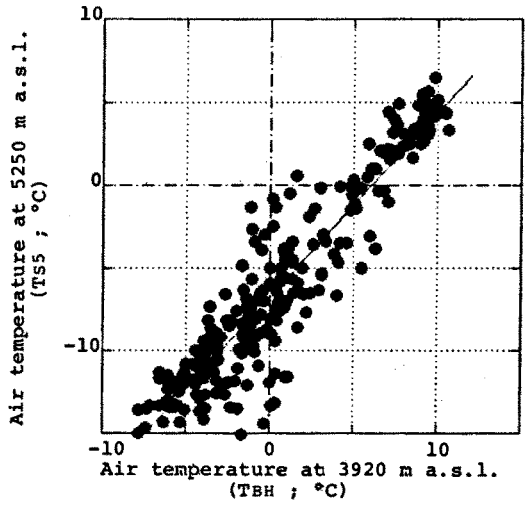

Fig. 3. Relationship of the daily mean air temperature at 5250 m, a.s.l. and at 3920 m, a.s.l..

3. 2. Snow Depth

Table 2 and Fig. 4 shows the snow depth at the glacier. Snow depth at the Base House (Takahashi *et al.*, 1987) is also shown in Table 2 and Fig. 4. The relationship of the snow depths at these 2 places is indicated in Fig. 5. This relationship is linear and is able to be formulated as follows ;

$$Hs_{S5} = 1.70 \times Hs_{BH} + 15.48, \quad (2)$$

where Hs_{S5} is the relative snow depth at the glacier (cm) and Hs_{BH} is snow depth at the Base House (cm).

Acknowledgment

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Table 2.(2)

1986. 1

Date	B.H. (cm)	S5 (cm)
1	42.0	86.0
2	42.0	84.1
3	41.0	82.1
4	40.0	82.1
5	40.0	80.2
6	37.0	77.3
7	34.0	75.4
8	34.0	74.4
9	32.0	73.4
10	32.0	70.5
11	32.0	69.6
12	32.0	68.6
13	32.0	66.7
14	28.0	65.7
15	28.0	64.7
16	26.0	65.7
17	25.0	63.8
18	25.0	63.8
19	25.0	64.7
20	25.0	61.8
21	25.0	62.8
22	25.0	60.9
23	25.0	59.9
24	24.0	58.9
25	24.0	58.9
26	26.0	58.9
27	26.0	58.9
28	24.0	58.9
29	27.0	66.7
30	26.0	70.5
31	26.0	70.5

1986. 2

Date	B.H. (cm)	S5 (cm)
1	26.0	67.6
2	26.0	67.6
3	25.0	67.6
4	25.0	67.6
5	24.0	66.7
6	24.0	67.6
7	24.0	64.7
8	23.0	64.7
9	21.0	64.7
10	77.0	92.8
11	68.0	116.9
12	59.0	112.1
13	58.0	108.2
14	67.0	111.1
15	65.0	120.8
16	60.0	110.1
17	56.0	108.2
18	56.0	107.2
19	53.0	105.3
20	49.0	104.3
21	49.0	103.4
22	46.0	102.4
23	44.0	101.4
24	43.0	99.5
25	42.0	98.6
26	41.0	97.6
27	40.0	95.7
28	40.0	94.7

1986. 3

Date	B.H. (cm)	S5 (cm)
1	36.0	91.8
2	35.0	92.8
3	36.0	89.9
4	34.0	87.9
5	39.0	101.4
6	31.0	95.7
7	28.0	94.6

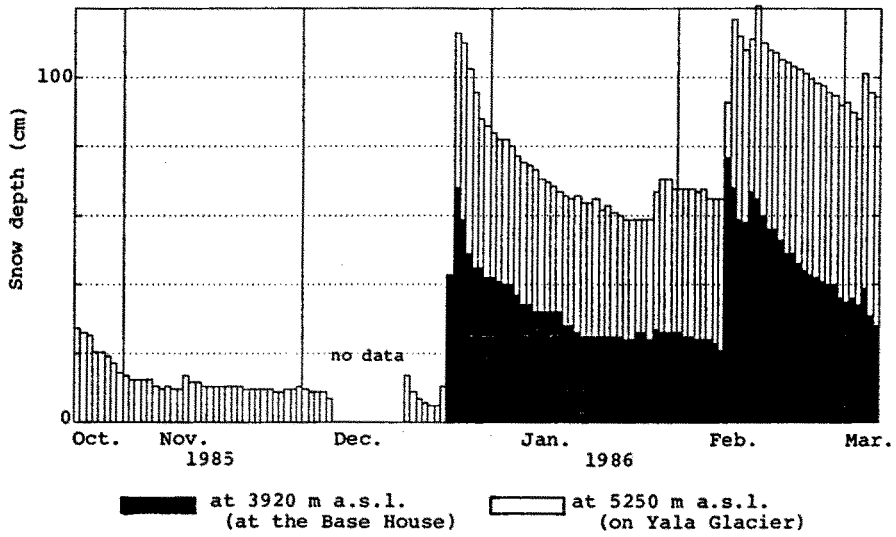

Fig. 4 Changes in snow depth at 5250 m, a.s.l. and at 3920 m, a. s.l..

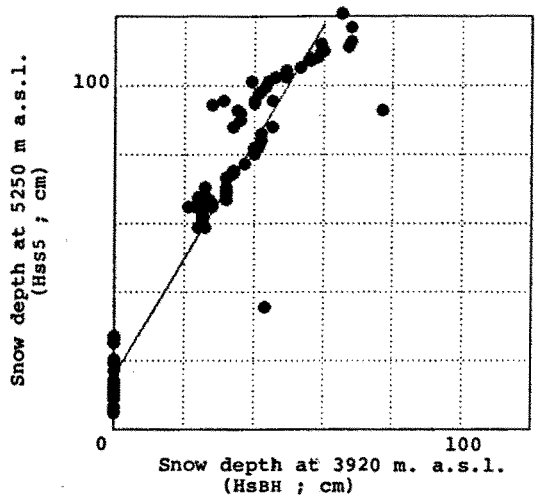

Fig. 5 Relationship of snow depth between at 5250 m, a.s.l. and at 3920 m, a.s.l..

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