

Glaciological Studies in Schirmacher Hills and on Ice Shelf during XIV Antarctica Expedition

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Abstract

The glaciological program included observations on fluctuations in shelf ice, movement of Dakshin Gangotri glacier snout and monitoring of icebergs in Antarctic waters. Variations in the accumulation and ablation pattern over shelf ice during 1995 austral summer and near steady state of the glacier snout were seen.

Introduction

The shelf ice level represents a dynamic surface reflecting net accumulation and ablation of snow drift and precipitated snow. Glaciers and dislodged volume of Antarctic shelf edge ice, contribute to icebergs of varying dimensions which float free in the waters of the Southern Ocean. This pattern of changes in shelf ice and ice cap movements in part of Central Dronning Maud Land (coastal areas of Lazarev sea) are being monitored for over a decade by the Geological Survey of India.

Fluctuation of Shelf Ice Studies

In the shelf region snow accumulation takes place primarily due to deposition of drift snow and its subsequent change to firm takes place due to variation in temperature. In order to measure the rate of accumulation/ablation and to unravel any pattern of cyclic nature, the study of shelf ice was initiated in 1983 during the 11 Indian Antarctica Expedition and has been continued till date.

The task involves measurement of exposed height of 9 stakes fixed at an interval of 50 m in a rectangular pattern. During XIV expedition only 8 of the original 9 stakes could be measured due to the loss of stake No.7. The stakes were measured during Jan. 1995 and March 1995 (Table 1). When the readings are compared to those taken during Feb. 1994, a net average accumulation of

Table 1 — Stake no. and exposed height of stake (in cm) taken on 21.1.95 and 1.3.95 as compared to that of February, 1994

Stake No.	1	2	3	4	5	6	8	9
Date								
21.1.95	75.0	82.0	95.0	87.0	81.0	78.0	85.0	81.5
01.3.95	77.5	85.9	91.3	80.2	84.0	76.9	87.5	84.6
Feb.'94	122.0	110.0	127.0	141.0	116.0	124.0	118.0	116.0

34 cm is inferred in the eight stakes with a maximum value of 60.8 cm and minimum of 24.1 cm (Fig. 1). When the January data is compared with the data obtained in March 1995, six stakes show ablation and two stakes show accumulation. Accumulation probably represents piling up of snow due to drift. Calculation based on the eight stakes indicates a net ablation of 0.5 cm. In the DG shelf, accumulation was found to be restricted to the austral winter and ablation to austral Summer, which is in accordance with observations made by earlier workers.

Dakshin Gangotri Glacier Snout Movement

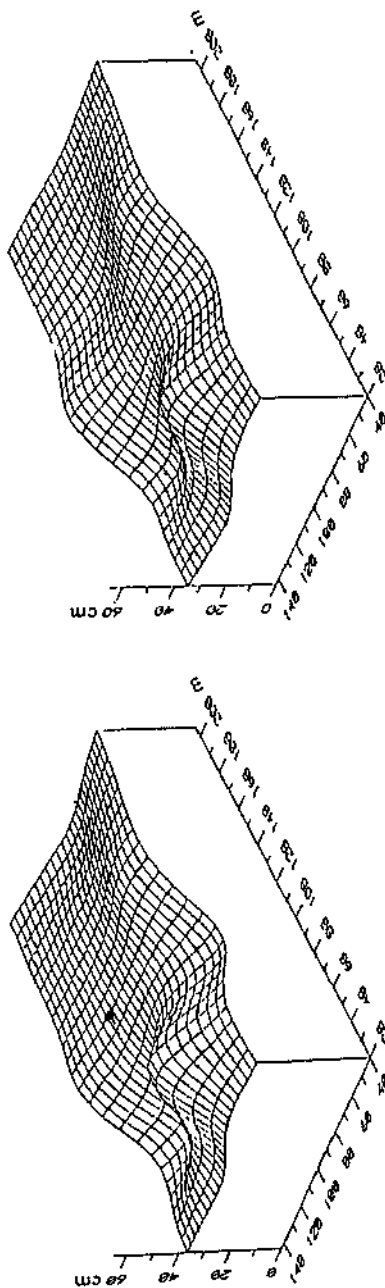
The polar ice sheet of Antarctica is considered to be in a dynamic state. To study the dynamic behaviour of Dakshin Gangotri glacier descending from the polar ice sheet, the snout is being regularly surveyed using Electronic Distance Measurement Device during each expedition. The configuration of snout thus obtained is compared with those obtained during the past expeditions to find out the advance or retreat in the different parts of snout. Fig.2 depicts the outlines of this year (1995) and when compared with that of year 1983, an average retreat of 4 m is observed.

Iceberg Monitoring in Antarctic Waters

This study, in the Indian Ocean Sector of Southern Ocean, started in response to the decision of International Iceberg Monitoring Programme initiated by the Polar Research Institute, Norway. The aim of the study is to maintain a statistical record of size, shape and number of icebergs encountered in the seas of southern hemisphere. The implication of this study is to work out their genesis, flow pattern, morphology and distribution pattern.

During the XIV Indian Antarctic Expedition, on way to Antarctica, the first iceberg was sighted on 7.1.95 at 57° 44'S: 28°28'E. In the return journey the last iceberg was noticed on 10.3.95 at 56° 57'S: 23° 15'E. Dimension of icebergs recorded varied from 10 to 1000 m with the large sized iceberg concentrated near to the Antarctic shelf. Modal size of the icebergs falls within 50 to 200 m.

**SHELF ICE SURFACE IN 1995 SUMMER
WITH 1994 SUMMER AS BASE
[D.G. SHELF]**



JANUARY 1995 MARCH 1995

Fig.1: Shelf ice surface in 1995 Austral Summer (1994 summer as base)

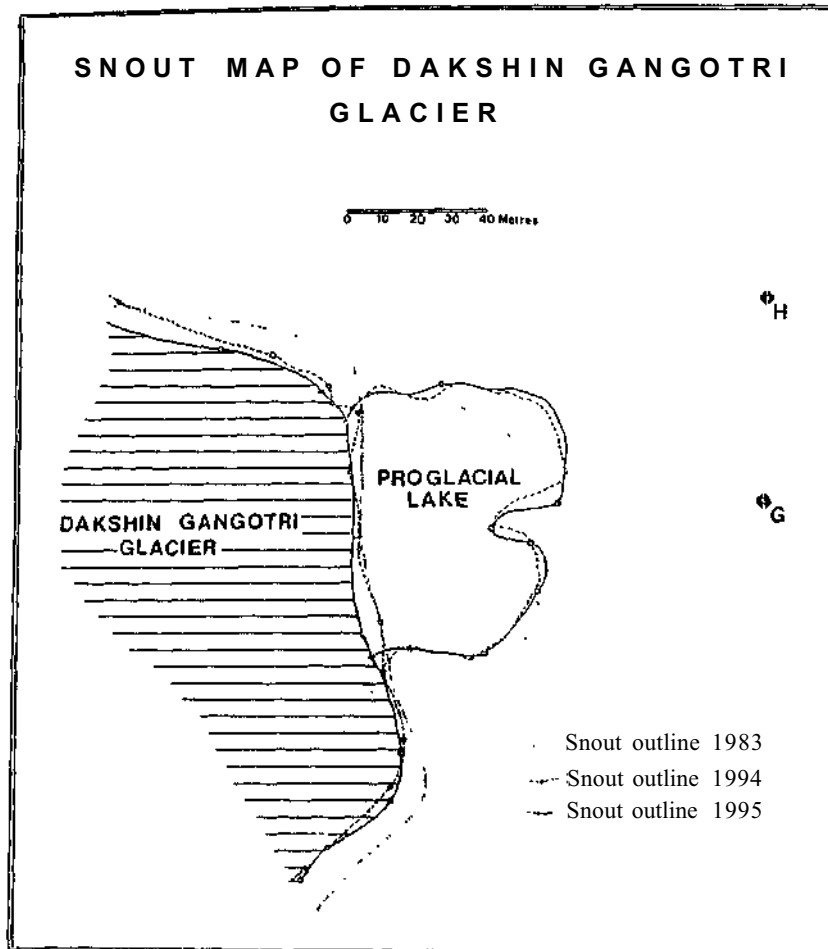


Fig.2: Snout Map of Dakshin Gangotri glacier

Corroded, tilted and pyramidal icebergs were mostly observed away from the shelf regions and tabular ones near to the shelf. The distribution of icebergs studied in the southern Indian Ocean during the outward and inward journey is depicted in Figure 3 and summarised in Table 2.

Conclusions

From the recorded data on fluctuations of shelf ice, a 34 cm net accumulation during the period Feb. 1994 and March 1995 was noted, whereas the Jan.

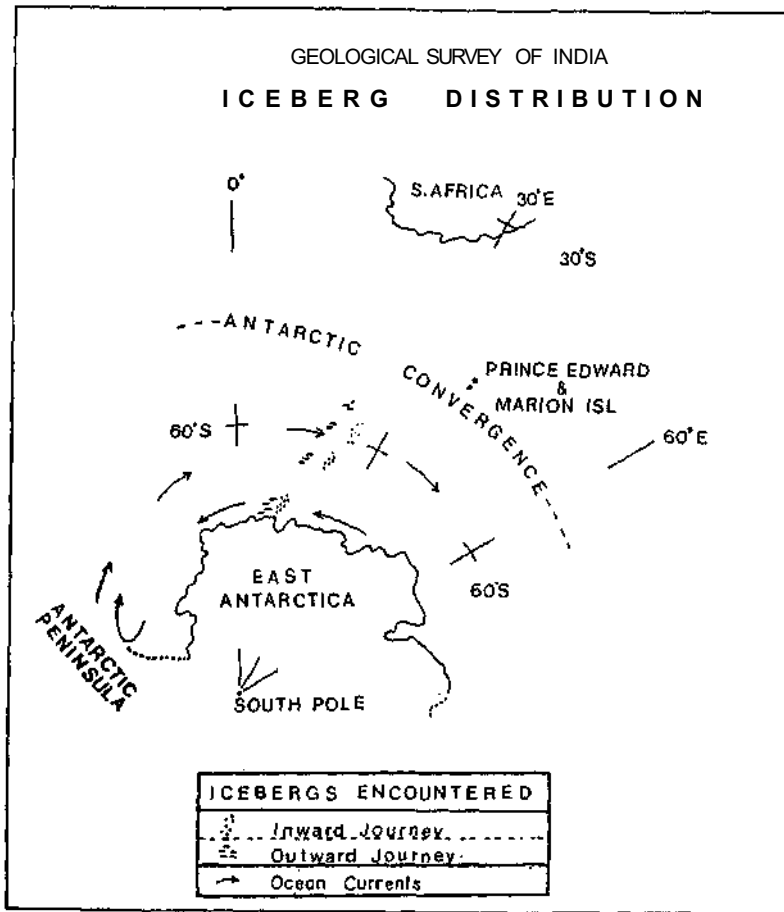


Fig.3: Iceberg distribution in Southern Ocean

1995 to Mar. 1995 a net ablation of about 0.5 cm was detected. An average retreat of 4 m since 1983 is observed in the snout of Dakshin Gangotri glacier. Distribution of icebergs along with their size and morphology during inward and outward journeys show bimodal distribution, which is related to coastal Antarctic currents.

Acknowledgement

Thanks are due to the members of the Survey of India for surveying the Dakshin Gangotri glacier snout area during 1995 austral summer.

Table 2 —Record of icebergs monitored onboard MV "Polar Bird", during XIV Antarctic Expedition

Date	Latitude	Longitude	Size Range	Total No.	Morphology
7.1.95	57°44'S	28°28'E	10-50	12	Tabular with vertical fractures
	60°05'	25°E	50 - 200	20	Pyramidal, tilted, composite.
			200 - 500	3	
8.1.95	62°S'	22°E	10-50	3	Tabular with vertical fractures, Pyramidal.
	65°45'S	18°30'E	50 - 200	16	
9.1.95	67°51'S	14°23'E	10-50	3	Tabular with corrodea tips, vertical fractures composite, pyramidal.
	68°15'S	14°15'E	50 - 200	7	
6.3.95	70°S	12°E	200 - 500	20	Tabular
7.3.95	69°16'S	12°19'E	200 - 500	8	Tabular, corroded, tilted.
	67°S	15°E			
8.3.95	64°S	18°E	200 - 500	3	Tabular, tilted, composite, corroded.
9.3.95	61°31'S	22°18'E	50 - 200	13	Tabular with vertical fractures. Tilted, composite, corroded.
	60°49'S	21°46'E			
10.3.95	57°15'S	23°E	50 - 200	7	Tabular with vertical fractures lilted, corroded.
	56°57'S	23°15'E	>1000	1	