

Observations on the Changes in the Snout of Dakshin Gangotri Glacier, Antarctica

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Abstract

A small polar ice tongue, named Dakshin Gangotri Glacier during the Second Indian Expedition to Antarctica (1982-83), was studied with respect to any secular movement the glacier has undergone since 1983. Repeat mapping of the snout was carried out by EDM (electronic distance measuring unit) in 1986 and '87. Some interesting results obtained are compared to those obtained earlier.

Introduction

In the region of the Schirmacher hills, towards its southern periphery, the polar ice cap is exposed as a sloping ice sheet (Fig. 1), with the moraine-littered rocks of Schirmacher hills, exposed on the immediate northern side. The southern ice exposure is also characterised by a few glacier tongues extending right upto the major part of the moraine covered rocks. Such tongues, emanating from the polar ice, show secular oscillations in their frontal position and one such tongue named as Dakshin Gangotri Glacier (Kaul *et al*, 1985) has been selected for periodic monitoring to throw light on the minor and major adjustments the glacier makes, from time to time, to internal and external agents influencing its movement.

Dakshin Gangotri Glacier

The Glacier (70°45'S : 10°37'E) is located more or less in the central part of the Schirmacher hills and flows out in the form of a steep tongue, over-riding the moraines and the bed rock (Fig. 2). The outline of this glacier was monitored from a nearby, well established, survey station marked 'G' on the solid bed rock, initially in Jan., 1983. Since then the same station is being used for surveying the outline of glacier tongue and monitoring other pro-glacial features in the vicinity of the ice-tongue. The glacier is devoid of any supraglacial moraines, but a few intersecting crevasses, predominant in its frontal part, show some entrapped rock dust and boulders. Melt water flows into the proglacial



Fig. 1. Polar ice front at the southern periphery of Schirmacher hills



Fig. 2. Snout outline of Dakshin Gangotri glacier (February, 1986)

lake and some water emanates from ice-bedrock interface which too accumulates in this lake.

The glacier front was re-mapped in Feb., 1986 and the mapping was repeated in Feb., 1987, using the EDM (the electronic distance measuring unit) from the same station: G. The relative positions of the snout for the years 1983 (Jan.), 1986 (Feb.) and 1987 (Feb.) are given in Fig. 3.

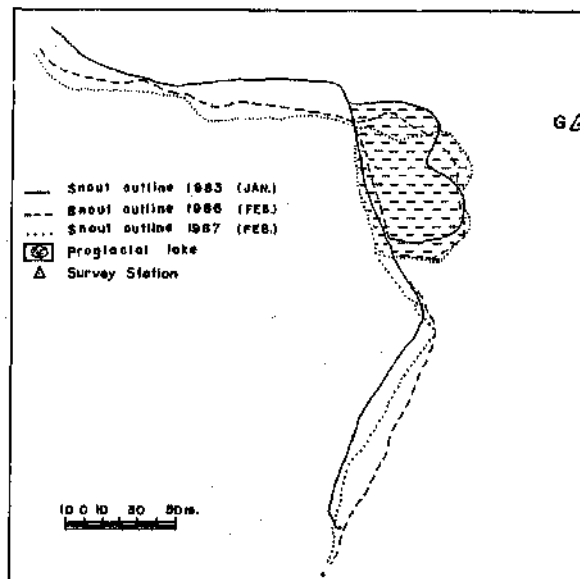


Fig. 3. Snout map of Dakshin Gangotri glacier, Schirmacher hills, Antarctica

Glacier Front

The glacier front is slightly concave, with a width of 130 m recorded in Feb., 1983 between two identified points. The width was reduced to 120 m, in 1987. Comparison of the relative position of the frontal outlines showed an advance of 4 m towards north-east in 1986, with respect to position of 1983; but in 1987, with respect to same position, it showed an average recession of 5.3 m. An average recession of 6.5 metres was recorded in a single year during 1986-87.

Northern Flank of Snout

The northern flank of the glacier is characterised by frequent calving down of the glacier ice in contrast to its southern flank. This flank showed an average recession of 12 m and 16.5 m, upto 1986 and 1987, respectively, when compared with the 1983 position. Calculations showed that this flank had vacated an area

of 2529 m² and 3809 m² during 1986 and 1987, respectively, when compared to 1983 outline (Table I). In the process it exposed polished bed-rock strewn with ground moraines. The comparison of 1986 and 1987 margin showed the area vacated to be 1280 m² and the average retreat to be 4.5 m.

Southern Flank of Snout

It was observed that in comparison to its 1983 position this flank showed a marked advance in 1986, averaging 13 m, whereas, compared to 1986 position this margin retreated about 6.8 m on average in 1987. In this flank, the glacier occupied 2186 m² more of area in 1986 with respect to 1983. In comparison, the glacier front vacated an area of 1388 m² in 1987, vis-a-vis its position in 1986.

Table I. Area fluctuations on the snout flanks

Year	Change in area (m ²) with respect to 1983			Change in area (m ²) with respect to 1986		
	S. Flank	N. Flank	Net	S. Flank	N. Flank	Net
1986	+ 2186	-2529	- 343	— — —		
1987	+ 765	-3809	-3044	-1388	-1280	- 2668

Proglacial Lake

A proglacial lake demarcated in 1983 (Kaul, et al., 1985) showed fluctuation on its margin during subsequent surveys. The fluctuations are due to change in the volume of melt water that drains from the Dakshin Gangotri glacier. Subsequently, this water further drains into a bigger lake immediately northwards.

The area of the proglacial lake, which depends upon the input, has changed during the past few years as shown in Table II.

Table II. Fluctuations in the area of the proglacial lake

Year	Area (m ²)	% change in area
1983	3150	
1986	2997	3.47
1987	3734	24.59

Conclusions

In the northern flank of the glacier, recession has been observed in 1986 and 1987, as compared to 1983. A marked advance in the southern flank and frontal position of the glacier is recorded in 1986 as compared to 1983. In 1987 recession has been recorded in all the sectors of the snout. Advance in southern

and frontal parts in 1986 is reflected in the decrease in the size of the proglacial lake in the same year. Retreat of 1987 has been reflected in the corresponding increase in the proglacial lake area.

It is suggested that these studies be extended to similar polar tongues in the southern periphery of the Schirmacher hills to collect more data for correlation with parameters related to such secular fluctuations.

Reference

- KAUL, M.K. CHAKRABORTY, S.K. AND RAINA, V.K. (1985): A note on the Snout of Dakshin Gangotri Glacier. *Sci. Rep. of Second Indian Expedition to Antarctica Tech. Publication No. 2*, Deptt. of Ocean Development, New Delhi.