Water depth of Lagoon San Rafael, Patagonia

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Abstract

The water depth of Lagoon San Rafael was measured using a fishing line in November 1985. The results of the measurements were compared with the nautical chart made by the Chilean Navy in 1983. The locations of the deepest area are different between these two charts due to the recent retreat of the terminus of San Rafael Glacier.

1. Introduction

As reported in our previous paper (Nakajima *et al.*, 1985), limnological observation at Lagoon San Rafael and Elefantes Fjord were made in November, 1983. However, at that time, our observations were made only in the upper 70 m layer of the Lagoon. Meanwhile, a nautical chart of Lagoon San Rafael was published by "Instituto Hidrográfico de la Armada de Chile" in 1983.

Recently, this glacier is showing rapid retreat as seen from the difference between Fig. 1 and Fig. 2. Our
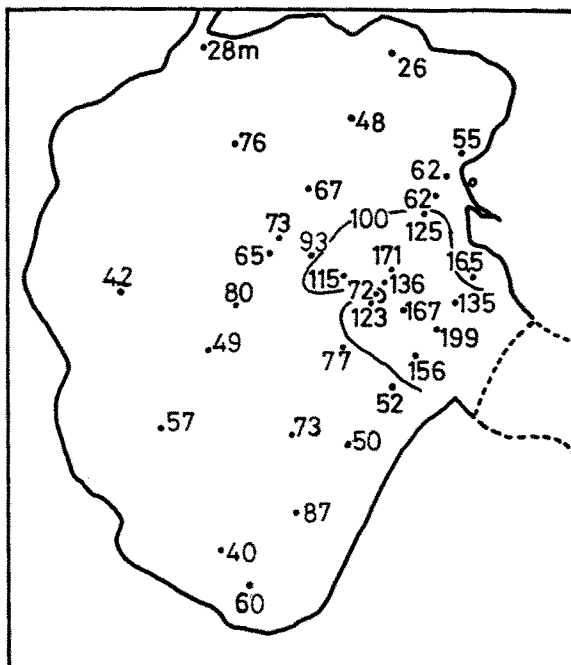

Fig. 1.   Map of Lagoon San Rafael, showing the water depth measured by us at 33 stations.
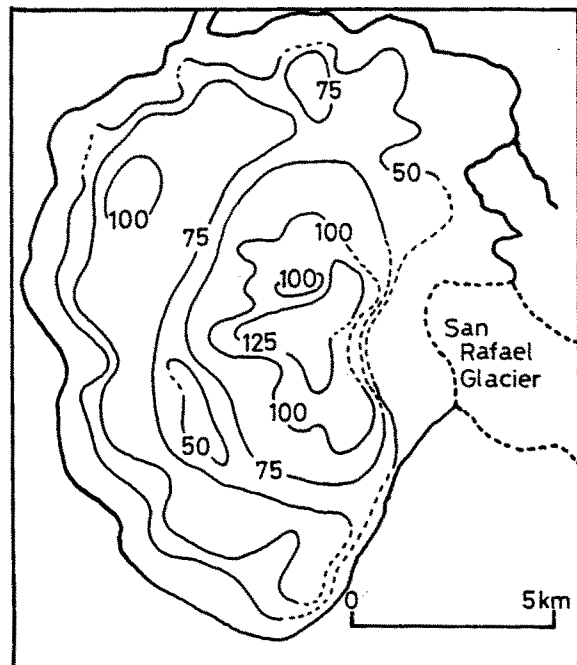

Fig. 2.   Same as Fig. 1. but published by "El Insituto Hidrografico de la Armada de Chile" in 1983.

measurements were made to see the depth change in this Lagoon. Observations of the water temperature and the meteorological conditions over the Lagoon were also made at the same station using same ship. Those results are reported in another article (Fujiyoshi et al., 1987) in this issue.

2. Method of measurements and results

Measurements of the water depth at various points in the Lagoon was made using a fishing line with scale counter. The times of the measurements and the weather conditions at those times are shown in the article "Cooling of water and the overlying air by melting ice at Lagoon San Rafael in northern Patagonia" (Fujiyoshi et al., 1987). The surface water moved irregularly under the influence of the surface winds, sea tides (amplitude is about 1.3 m) and the falling of the large ice blocks at the terminus of the glacier. So, the fishing line was sometimes not vertical due to the water movement. The real water depth may have the values between L and H, but it is difficult to know the real value, because the shapes of the fishing line in the water were unknown. Here

$$H = L(\text{length of the fishing line}) \times \sin\theta$$

θ : Angle between the direction of the fishing line and the vertical line near the water surface

Values of L, θ and H at various stations are shown in Table 1. At the stations 14, 15, 16, 18, 20, 22, 25 and 26, $\theta = 90°$ and the values of L and H are considered to be the real values of the depths. However, at the stations 3, 6, 8, 9, 10, 11 and 24, $\theta < 45°$ and the real depth values are unknown. At the other stations, real depth values are seemed to be approximately same as the values of H.

The distribution of the values of H are shown in Fig. 1. The maximum depth (199m) is seen near the glacier terminus. The fishing line was almost vertical there.

3. Discussion

As our measurements were done using fishing line, detailed contour lines are not drown in Fig. 2. However, the comparison between Fig. 1 and Fig. 2 shows that the area deeper than 100m was moving eastward from 1983 to 1985, and the maximum depth

Table 1. Water Depth of Lagoon San Rafael

Station	1.	2.	3.	4.	5.	6.
L (m)	30	76.5	88	27	55	119.5
θ (°)	69	82	29	72	62	34
H (m)	28	76	42	26	48	67

Station	7.	8.	9.	10.	11.	12.
L (m)	90	109.5	117	101.5	84.5	101
θ (°)	54	36	43	29	43	67
H (m)	73	65	80	49	57	93

Station	13.	14.	15.	16.	17.	18.
L (m)	128	5.5	62	62	130	171
θ (°)	64	90	90	90	74	90
H (m)	115	5.5	62	62	125	171

Station	19.	20.	21.	22.	23.	24.
L (m)	142	72	129	77	81	63
θ (°)	74	90	72	90	65	40
H (m)	136	72	123	77	73	40

Station	25.	26.	27.	28.	29.	30.
L (m)	167	16.5	139	203	165.5	57.5
θ (°)	90	90	76	80	70	66
H (m)	167	16.5	135	199	156	52

Station	31.	32.	33.
L (m)	52	92.5	62.5
θ (°)	74	69	74
H (m)	50	87	60

by our measuement (1985) is larger than that of the Chilean chart (Instituto Hidrográfico de la Armada de Chile, 1983). The terminus line seen in Fig. 2 are drawn using the aerial photographs taken in 1985. The difference between the positions of the terminus in 1983 and 1985 may be the main reason of the change of the distribution of the depth values. If more detailed depth values are obtained in future, interesting relation between the distribution of the depths and the water current in Lagoon San Rafael will be discussed.

References

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Resumen

Profundidad de la Laguna San Rafael, Patagonia

En Noviembre de 1985 se realizó sondeos en la
Laguna San Rafael mediante un hilo de pesca. Debido
a vientos de superficie, mareas y caída de témpanos el
hilo a veces se inclinaba, y las mediciones de profundi-
dad fueron corregidas proyectándose en una línea
vertical. Los resultados se muestran en la Fig. 1,
mientras que en la Fig. 2 se muestra la carta hidrográ-
fica publicada por el Instituto Hidrográfico de la
Armada en 1983. Al comparar ambas figuras se obser-
va que cerca del frente del glaciar las profundidades
de la Laguna han aumentado. Esto podría explicarse
por el rápido retroceso del frente del glaciar en el
último tiempo.