Taking the pulse of a shrinking glacier

Scientists in Chile hike over plains of snow to recover valuable data.

Patricio Segura Ortiz

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PATAGONIA

F. Croxatto

The San Rafael Glacier is shrinking fast.

The Exploradores Glacier in southern Chile is riven with cracks that form vertical cliffs of luminescent blue and indigo ice. A constant sound of running water rises from the rivers snaking beneath the 20-kilometre-long frozen mass that sweeps down from Mount San Valentín. The scene is stunning. And it is also, slowly but surely, disappearing.

To understand why this is happening, scientists must measure the various processes that affect glaciers — not an easy task in this frozen wilderness. Installing and maintaining satellite or radio transmission stations to send back data from this remote region is considered too costly, so Chilean researchers must gather the valuable data in person.

Takane Matsumoto, a glaciologist at the Centre for Ecosystem Research in Patagonia (CIEP), based in Coyhaique, Chile, journeys once a year to the Northern Patagonian Ice Field to check on the health of the Exploradores glacier. He gathers information about temperature, precipitation, humidity and wind speed from monitoring stations that he and Chile's General Water Directorate have installed.

Matsumoto is trying to understand how weather conditions affect the rate at which the Exploradores Glacier melts, and how the water

released flows through and out of the bottom of the glacier. His work is part of a bigger puzzle that researchers around the world are trying to solve: how quickly are glaciers disappearing, and how will that affect local water resources.

“Since my student days, I have been interested in the water flow and melting process of glaciers in humid climates such as Patagonia,” says Matsumoto.

Rapid retreat

About 75% of the world’s freshwater reserves are locked up in glaciers and ice sheets. The Patagonian Ice Fields, covering about 14,000 square kilometres, are the world’s third-largest frozen landmass after the continental glaciers of Antarctica and Greenland. About 100 glaciers in Chile are being monitored, and Chile’s Centre for Scientific Studies (CECS) in Valdivia says that almost 90% are in retreat.

Earlier this year, glaciologist Neil Glasser of Aberystwyth University, UK, and colleagues estimated that since 1870 the Northern Patagonian Icefield has lost more than 100 cubic kilometres of ice, and that the Southern Patagonian Icefield had lost more than 500 cubic kilometres since 1650. In both case, the melt rate had speeded up considerably in recent decades[1].

The San Rafael Glacier, for example, about 55 kilometres southwest of Exploradores, has retreated 12 kilometres over the past 136 years, and is still shrinking. And earlier this month, scientists from the CECS released time-lapse photos showing that the Jorge Montt glacier in the Southern Patagonian Ice Field retreated by about one kilometre between February 2010 and January 2011.

Matsumoto's journey to the Exploradores Glacier — one of the most accessible of Chile's glaciers — involves a six-hour drive from Coyhaique to a small shelter about one kilometre from the glacier. Then follows an hour’s walk through evergreen forests and over the moraine of rubble at the foot of the glacier. Eventually, the sliding soil and rock gives way to the ice of the glacier itself.

Over the course of the day he downloads data from monitoring stations on to his laptop. One station records precipitation; another, lying in the glacier's outlet stream, known locally as the Deshielo River, records data about its melt water. The information about these "plains of snow", as the region’s original settlers called them, "will help to understand the dynamics of the glacier and, by extension, how it responds to climate change”, says Matsumoto.

Matsumoto will return next year – when he fears the Exploradores may have retreated further still.

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References

1. Glasser, N. *et al*. *Nature Geoscience* **4** 303–307 (2011).

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