

Glacial retreat heralds climate change in Antarctica

A study of Brown Glacier on Heard Island has shown that the glacier is rapidly retreating, suggesting that local climatic conditions are continuing to change rather than stabilise.

The study, which commenced in November 2000, involved measuring the basic physical characteristics of Brown Glacier. During the 2003–04 Antarctic season the Heard Island glaciology team repeated these measurements to see what changes had occurred.

Our results showed that compared with 1950 (the earliest record from which physical boundaries of the glacier can be defined), the glacier has lost 38% of its volume and retreated 1.17 km at an average rate of 21 m per year. This retreat is attributed to an increase in average annual temperatures of about one degree Celsius. While this may sound trivial, a one degree change is a significant temperature increase considered as a yearly average.

Since 2000, Brown Glacier has retreated 60 m. But the greatest changes were noted using Global Positioning System surveying techniques to measure the ice surface elevation. The lower slopes of the glacier have lost as much as 11 m in thickness, while higher up (where it is colder and changes were expected to be minor), the surface has dropped by up to four metres. This translates to a loss of about 8 million cubic metres of ice a year, compared with the 50 year average of 3 million cubic metres a year.

Brown Glacier has been changing for the last 50 years, and the changes appear to be ongoing at an accelerated rate. This implies that climatic conditions are continuing to change, rather than stabilise. To understand these changes our team installed markers to measure the mass balance of the glacier over the summer season, and over the next few seasons. Three weather stations were temporarily installed at different altitudes to monitor the glacier's immediate response to temperature. Ice samples were collected from deep within crevasses to help determine the amount of annual ice accumulation, which is still the biggest unknown.

Because Heard Island is difficult to get to, and we can't always be there to measure how much ice is melting, we aim to predict melt rates based on data from a remotely operating weather station near the glacier, combined with energy balance models. The field measurements we made last summer will allow us to fine tune the equations that are used to make these calculations.

Other glaciers on the island also display marked changes with time. A comparison of the ice front of Stephenson Glacier (which terminates in a 113 m deep lagoon) using a high resolution satellite image taken in January 2003, showed a retreat of nearly 200 m; a dramatic change for a one year period.

The majority of glaciers are retreating worldwide, and Heard Island fills a gap in an otherwise vast expanse of ocean by providing a point where change in the climate of the Southern Ocean can be monitored. The lonely outpost of Heard Island is like a sentry, giving us advanced warning. And while the loss of glaciers on Heard Island would make a trivial contribution to world sea level rise, it heralds the progression of climate change south, towards the ice-covered Antarctic continent.

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The Heard Island glaciology team had an international flavour with Dr Martin Truffer (right), a Swiss national based in Alaska, and Ms Shavawn Donoghue (second from right), a Canadian PhD student based at the University of Tasmania. Aussies were Dr Doug Thost (left) co-ordinating the field program, field training officer Ms Heather Kirkpatrick (second from left) and expedition field leader Mr Robb Clifton (centre).



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