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Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

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Microclimate of Antarctic till surfaces

Although a relatively small area of Antarctica is comprised of exposed bedrock and sediment, these surfaces produce a unique microclimate which has led to the development of shallow desert soils. The biological environment of these soils is particularly fragile because of the extreme thermal and hydrological conditions in which they develop. Surface microclimates control the flow of heat and water between the surface and the atmosphere and within the surface material. Mass budget estimates and soil development models for exposed rock in Antarctica therefore require understanding of the unique microclimatological conditions in which they operate.

Dr Andrew Oliphant, a visiting fellow at Gateway Antarctica from San Francisco State University, is currently working on characterising the microclimate of ice-cored till surfaces near the terminus of Taylor Glacier in the Dry Valleys region of Antarctica. This is based on a field experiment conducted in early summer during the onset of the melt period in collaboration with Dr Wendy Lawson from the UC Geography Department and Dr Richard Hindmarsh from the British Antarctic Survey. The measurements centred around fast response atmospheric instruments (sonic anemometer, thermometer and hygrometer) that were used to resolve surface-atmosphere transport of heat and water vapour by turbulent eddies. The water vapour flux was also estimated independently using weighing lyssimeters to measure the *in situ* mass changes of till/ice substrate, while temperature changes were monitored from 1.5 m above the surface to a depth of 40 cm within the till. Four different till sites were chosen for these measurements to represent a range of till/ice combinations.

The results show that prior to the period of daytime melting, a distinctive desert microclimate exists with relatively low sublimation rates of 0.69 mm dy^{-1} (on average) and high rates of heat transport within the ground. However, following the onset of melt, the available energy becomes predominantly used by sublimation, melt and evaporation (twice that of atmospheric or ground heat fluxes). The rates of the water fluxes were also found to be strongly controlled by environmental conditions, specifically cloud cover, turbulence strength and atmospheric humidity. Ground temperatures showed large diurnal ranges, especially near the surface and evident to a depth of 40 cm. However, as freeze-thaw cycles begin to dominate, energy used in the phase changes dampens the diurnal temperature oscillation and eventually prevents the surface from dropping below the freezing point. Comparing water fluxes between surfaces indicated that mixed till and ice surfaces produced more rapid mass wasting (140 % greater) than ice capped by till layers 10-20 cm thick. Compared with surrounding ice surfaces, the low albedo of exposed rock is primarily responsible for the unique thermal and hydrological regime observed. However, these results also suggest that microclimate regimes are likely to vary considerably within relatively small areas of exposed rock, such as the Dry Valleys region due to spatial variability in surface properties and near-surface atmospheric conditions.

The Dry Valleys, Antarctica.

- Photo: Christine Elliott.

Directors Note

Capacity Building

Over the past six months I have been involved in writing a new Capacity Building Strategy for the Scientific Committee on Antarctic Research (SCAR) to increase the number of people involved in Antarctic research in SCAR member countries. A draft of the document was recently discussed at the annual Royal Society meeting on Antarctic Science. It became increasingly obvious at this meeting that New Zealand has been doing more than its fair share of capacity building over the years. The sad part is, that many of our best graduates have left New Zealand to seek out opportunities abroad, as indicated by the number of Victoria University of Wellington graduates who are now involved in ANDRILL through the US program. This is good and bad, New Zealand graduates form a useful global network for international collaborations but we need to think more about investing in our own future and creating new research posts to increase our own Antarctic research capacity. One of the aims of the newly established University Antarctic Alliance is to lobby for more investment in Antarctic research. Let's hope that this alliance, which had its first meeting in July, can effectively speak on behalf of the New Zealand Antarctic research community and make a difference to future capacity building in New Zealand.

--Prof. Bryan Storey

...in Brief

MFAT Ross Dependency Scholarship

This scholarship is awarded annually to a PhD or Masters student to undertake research concerning a matter of importance to the understanding of Antarctica or the Southern Ocean. Applications are now being accepted, see www.anta.canterbury.ac.nz for details. The closing date for the $5000 scholarship is Friday 28th October.

Scholarship Recipient

Congratulations to GA PhD student **Briar Wait** for winning one of the prestigious Tertiary Education Commission's Top Achiever Doctoral Scholarships. Briar is studying the chemical extremes experienced by cyanobacterial life in Antarctic meltwater ponds jointly with NIWA and the University of Auckland.

SCAR Open Science Conference

The second SCAR Open Science Conference will be held in Hobart Tasmania, 12-14 July 2006, in conjunction with the XXIXth SCAR meeting. Further details are available from www.scar2006.org (SCAR/COMNAP conference website).

Dr Andrew Oliphant from San Francisco State University, USA, is visiting GA until December 2005. (See cover story).

Antarctic Season Opening Programme 1 – 9 October 2005

The Christchurch City Council and Antarctic Link Canterbury, a group which GA currently chairs, are sponsoring a week long programme of Antarctic-related events celebrating Christchurch's many links to Antarctica and the first flight of the 2005 season on 4 October. A full programme can be downloaded from www.antarctic-link.org.nz or visit the GA website. Two highlights from the programme are the two free public lectures. One, by Doug MacAyeal on "Titanic Icebergs of Antarctica" as part of the GA/NSF Summer Science Lecture Series on Friday 7 October at 7pm in room A1 at UC; the second, by Suruj Seunarine, UC Physics Department, on the neutrino research being done at South Pole Station, on Wednesday 5 October at 6pm at Christchurch Girls High School Auditorium. Phone 941-6877 for more details.

Antarctic Non-Native Species Workshop

Gateway Antarctica will host a workshop on non-native species in the Antarctic region in April 2006. Participation is by invitation only, but the workshop results will be made public in a proceedings publication and via a Working Paper which will be prepared for presentation at the June 2006 ATCM in Edinburgh. The workshop is being convened by Neil Gilbert, Maj de Poorter and Bryan Storey with support from Antarctica New Zealand.

Luke Copland

Dr Luke Copland is leaving Gateway Antarctica at the end of September to take up a new faculty position in the Department of Geography at the University of Ottawa, Canada. Luke has been a post-doctoral research fellow in Gateway Antarctica for the last two years, working on the McMurdo Ice Shelf project with Dr Wendy Lawson of the UC Geography Department. Luke will maintain his research links with Gateway Antarctica, and is hoping to return to the Antarctic next summer to work on the dynamics of the B-15 icebergs. We wish him well in all his future endeavours.

Dr Luke Copland appearing as tall as the Trans-Antarctic Mountains.

- Photo: Penny Clendon

GCAS

Our Graduate Certificate in Antarctic Studies (GCAS) course has once again attracted a strong field of applicants from throughout the world for the 2005-06 season. Of the 34 applicants, nine were from overseas, including four from Australia, two from Germany and one each from the Netherlands, USA, and Scotland. It was a tough choice to select the participants, only 17 this year due to logistical constraints arising from a reduction in the number of RNZAF flights to Antarctica this season. The course, which begins on 14 November, will be coordinated by Yvonne Cook, with Brian Stewart and Laurence Fearnley as field tutors.

GRID Christchurch UNEP

United Nations Environment Programme

Michelle Rogan-Finnemore and Alan Hemmings (GA Senior Fellow) participated in the First Global and Regional Scenarios Workshop of the Global Earth Outlook 4 (GEO-4), held in Bangkok, Thailand, from 12-16 September. GEO-4 is both a process and a publication which investigates the state of the global environment. Michelle and Alan joined Christian Lambrechts, from UNEP in Nairobi, to comprise the Antarctic component of the Polar Regional team. The GEO-4 publication is scheduled for completion in 2007 and will be a comprehensive summary of the state of the global environment.

UNEP is also currently reviewing the status of the GRID network of collaborating centres. The initial findings of the review will be presented in early October and any final decisions will be made by the end of 2005.

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