



IceSked

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Newsletter of the Antarctic Research Centre
Victoria University of Wellington

A Word From the Director

As we look forward from the International Polar Year, the ARC prepares for a very busy Antarctic field season with six staff and three students participating in a range of projects including: site survey with the next ANDRILL project on the Ross Ice Shelf at Coulman High; glaciology and geology from the central Transantarctic Mountain camp at the Beardmore Glacier and sea-ice sampling in McMurdo Sound. I wish all a safe and productive summer of fieldwork. Tim Naish

Glacial Modelling

The Glacier Modelling Group within the ARC aims to identify the climatic drivers of Southern Hemisphere glacier fluctuations, past present and future. Our group has grown and numbers six staff (Andrew Mackintosh, Brian Anderson, Nick Golledge, Dan Zwart, Huw Horgan, Ruschle Dadic) and five students (Alice Doughty, Karen McKinnon, Stephen Stuart, Lawrence Kees, Jeremy Fyke). In addition, Heather Purdie (PhD) and Rebecca O'Donnell (MSc) recently submitted their theses. We are working on interwoven projects in the Southern Alps and Antarctica. In both places we are developing models but also collecting data to constrain them.

A summary of research progress follows: Brian and Andrew published a study of Brewster Glacier which revealed how sensitive New Zealand glaciers and meltwater runoff are to rising temperature. Andrew Mackintosh, Nick Golledge and US/Australian collaborators have a paper in review about the response of the East Antarctic Ice Sheet to climate forcing. Dan Zwart is also investigating the East Antarctic Ice Sheet using geological data and geophysical modelling. Nick Golledge has applied the Parallel Ice Sheet Model to both New Zealand and Antarctica. He has also visited Fairbanks, Alaska to work with model developer Ed Bueler, and is leading a field glaciology programme to Beardmore Glacier in December, with Wolfgang Rack (Canterbury University). Huw Horgan is investigating Antarctic ice dynamics, with a focus on ice shelves, grounding lines and streaming ice. Ruschle Dadic is researching the role of snow drift on alpine glaciers and will soon focus on the Southern Alps (when she gets back from Antarctica!).

Heather Purdie has published several papers about snow accumulation in the Southern Alps as part of her PhD in collaboration with Andrew Mackintosh, Brian Anderson, Nancy Bertler, Joel Baker (SGEES), and Wendy Lawson (Canterbury). Lawrence Kees has been measuring snow accumulation with Ground Penetrating Radar, in collaboration with Brian and Uwe Morgenstern (GNS Science). Steve Stuart has improved

our knowledge of Southern Alps precipitation using weather station data, in collaboration with Sam Dean (NIWA) and Andrew. Karen McKinnon is modelling the Tasman Glacier and is currently examining how bed topography influences glacier response, with Brian and Andrew. Rebecca O'Donnell has been simulating former Tasmanian glaciations in collaboration with Andrew, Nick Golledge and Alun Hubbard (University of Wales). Alice Doughty has attended the prestigious European modelling summer school at Karthaus, Italy, and has recently co-authored papers in *Nature* and *Nature Geoscience* with her American colleagues (Denton, Schaefer, Kaplan, Putnam). Jeremy Fyke is simulating the Greenland and Antarctic ice sheets and is close to PhD completion. *Andrew Mackintosh.*



New modelling staff Dr Ruschle Dadic and Dr Huw Horgan assisting MSc student Lawrence Kees at Mt Cook

Jeremy Fyke PhD

Jeremy initially contacted Andrew Mackintosh from University of Victoria, in British Columbia, with an interest in carrying out a PhD in coupled climate/ice sheet modelling. That was back in 2007 and it is a good time to reflect now that he has nearly finished. Jeremy has worked hard to couple David Pollard's ice sheet model to the UVIC Earth Systems model, with the support of Professor Andrew Weaver (Canada), David Pollard (Penn State University), Lionel Carter and myself. Several excellent papers have resulted and we hope to keep Jeremy involved in the future. He has made a significant contribution to the Antarctic Research Centre modelling programme, and his work is relevant to the forthcoming IPCC AR5 assessment.

Andrew Mackintosh



Ice Core Drill Testing at NEEM, Greenland

During the latter part of July and most of August Alex Pyne and Darcy Mandeno assisted by Tanner Kuhl (from Ice Core and Drilling Services, University of Wisconsin) carried out commissioning and testing of the recently completed VUW ice core drilling system at the NEEM (North Greenland Eemian Ice Drilling) deep ice core drilling site in Northwest Greenland.

Over the course of the four weeks at NEEM we were kept busy assembling the mast and drill systems, tuning the mast hydraulics, testing electrical controls, preparing a drilling trench before finally and tentatively drilling our first core on the 6th of August. Improving our technique with successive drilling runs, we reached the maximum core length of 2.1 metres (drill design maximum) at around 20 metres driller's depth. During the course of these initial tests two main issues with our core barrel were identified, concerning chips transfer from core barrel to the chips chamber and core barrel run-out eccentricity.

Further testing was successfully completed using the Hans Tausen chips chamber and core barrel (kindly on loan from our NEEM hosts) which was mounted to the remaining kiwi

drill system. This allowed us to ensure that the mast, winch, anti-torque and pressure tube and drill motor were tested for the RICE project at Roosevelt Island. The testing has also clearly shown what post-commissioning works and modifications are required with our dry drilling core barrel to achieve efficient and consistent core recovery for our version of the "Hans Tausen" electro mechanical ice core drill.

During the course of our stay, the project NEEM achieved a major milestone when they reached the ice sheet basement at a little over 2500 metres depth, recovering basal ice and sediment including a 50 mm long pebble in the last ice core. Many of the NEEM personnel, whose collective ice core experience could be measured in multiples of decades, offered some fantastic advice and tips and effectively granted us an "access all areas" pass to their facilities and knowledge. Although our appreciation is equal to all, our special thanks goes to Dorthe Dahl-Jensen and the Centre for Ice and Climate team of Copenhagen University for allowing us the opportunity to test the drill at NEEM.

Darcy Mandeno

Ice core drill mast base and winch are moved from the assembly workshop on the Piston Bully Palfinger, guided by Darcy Mandeno, while Sivirr drives to the drilling position.



Supporting the Antarctic Research Centre

The Endowed Development Funds Appeal supports emerging research and young students to undertake research in Antarctica. You can help contribute in supporting the Endowed Development Fund either through a monthly automatic payment or leaving a legacy through a gift in your will; an excellent way to take part without impacting on your financial needs.

For support options please refer to: http://www.victoria.ac.nz/antarctic/about/Endowments_Donations/development-fund.aspx

All donations are made through the Victoria University Foundation, a registered charity and are therefore eligible for a charitable gift taxation rebate.

For further information on how you can provide philanthropic support to the Antarctic Research Centre, please contact our Director, Prof. Tim Naish. Email: timothy.naish@vuw.ac.nz or Diana Meads, Fundraising Manager, Victoria University of Wellington Foundation. Ph: 0800 VIC GIFT (0800 842 4438), Email: diana.meads@vuw.ac.nz

Wind Blown Dust

Cliff Atkins, Brent Alloway and MSc Student Jane Chewings are heading to Antarctica this season to study windblown (aeolian) sediment on sea ice in McMurdo Sound as part of the FRST funded ANDRILL programme. During the ANDRILL SMS drilling project in 2007 a pilot study showed that the distribution of windblown sediment on the annual sea ice is highly variable but can reach 25 tonnes /km² annually. This represents a significant contribution of sediment directly to the sea floor when the ice melts. Furthermore, recent research suggests that the sediment may also be the source of iron (Fe) that triggers large phytoplankton blooms in the Ross Sea each spring. These blooms are recognised as major productivity events that contribute large volumes of biogenic sediment to the sea floor. The team will spend a month sampling snow from the surface of the sea ice along the western side of McMurdo Sound from Granite Harbour to New Harbour. These samples will be used to quantify the aeolian sediment and Fe flux in McMurdo Sound. *Cliff Atkins*

ANDRILL Coulman High Project Site Survey

This summer, a mixed group of scientists, students and operational staff from the US and New Zealand will be conducting a site survey at Coulman High. The site, approximately 150 km from Scott Base, east of Cape Crozier, near the edge of the Ross Ice Shelf is potentially the next ANDRILL drill site. Site survey operations include oceanographic measurements (with NIWA and Woods Hole Oceanographic Institute), testing an ROV (with Moss Landing Marine Laboratories), gravity coring seafloor sediments (with GNS), seismic surveying (with University of California Santa Barbara), gravity surveying (with University of Otago), and operational tests of the Hot Water Drill and other equipment. Tamsin Falconer will be acting as Field Coordinator for the first part of the field season. Richard Levy (GNS Science) will be the lead NZ scientist. ARC MSc student, Sanne Maas will work with the oceanographic and sediment coring activities. *Tamsin Falconer*



Alex Pyne and Darcy Mandeno work on RICE drill head in NEEM engineering workshop.

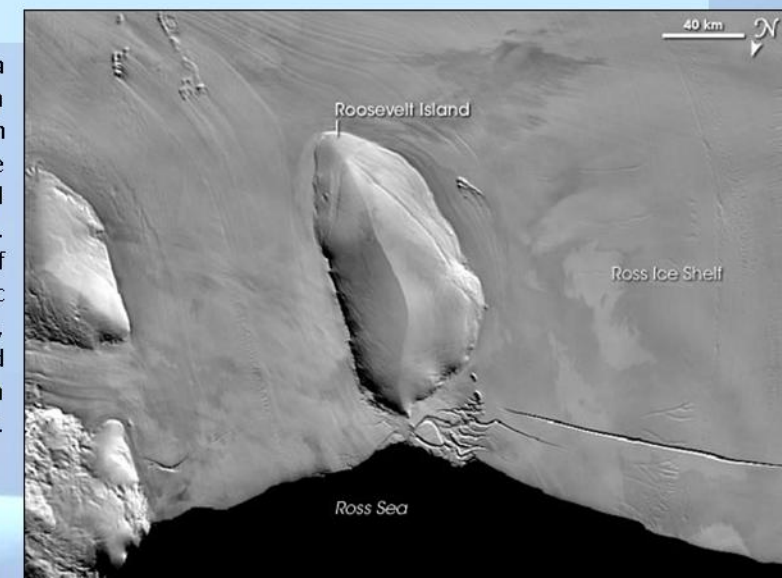
Beardmore Glacier Dynamics

In early December Nick Golledge will lead a team (K001-BI) of four including Wolfgang Rack and Oliver Marsh (Gateway Antarctica) into the American-led CTAM deep field logistics hub, located on the edge of the East Antarctic plateau near the head of the Beardmore Glacier. From there they will move to isolated camps, both on the Ross Ice Shelf and the Beardmore itself. Their aims are to better characterise glacier dynamics at the transition from glacier to ice shelf (grounding line) using a variety of geophysical techniques, such as ice-penetrating radar, kinematic GPS survey, and time-lapse photogrammetry. Subsequently these data, together with remotely-sensed (satellite) data, will be used to constrain numerical ice sheet models of the Beardmore Glacier that will help gauge the sensitivity of Trans-Antarctic Mountain glaciers to forcing perturbations. *Nick Golledge*

A second team, K001-BR, is a nimble, lightweight operation comprising Tim Naish, Gary Wilson (Otago) and Richard Levy (GNS Science), that will deploy for 3 weeks into the Beardmore Glacier to describe and sample glacial marine rock outcrops in and around the Cloudmaker. While the age of the sediments is uncertain, they are important as they potentially hold a record of the margin of the East Antarctic Ice Sheet when the earth was warmer-than-present in the Miocene or Early Pliocene. These rocks are likely to be the same age as sediments recovered by the ANDRILL Program in McMurdo Sound. *Tim Naish*

Roosevelt Island

Roosevelt Island Climate Evolution (RICE) Project, led by Nancy Bertler, is a seven nation collaboration aiming to retrieve a 750 metre deep ice core from the margin of the Ross Ice Shelf in Antarctica. The project will a) provide a high resolution climate record for the Ross Sea region during abrupt climate change, and b) evaluate the stability of the Ross Ice Shelf in a warming world to help constrain estimates of future Antarctic contributions to sea level rise. During the upcoming field season, the RICE team will deploy 27 tonnes of equipment to the site for next year's drilling operation, install an automatic weather station, and sample an array of 4 metre deep snow pits. In addition, the US team led by Howard Conway will be conducting additional ground penetrating radar surveys and install devices to measure mass balance. In total, a team of 7 staff and 2 students will deploy to Roosevelt Island this year. *Nancy Bertler*



OTHER ACTIVITIES

Ocean Drilling Activities

In our last issue of IceSked, ARC-researcher Rob McKay reported on the recent IODP expedition to the Wilkes Land margin of Antarctica. IODP is the most recent manifestation of a 40 year international effort in scientific ocean floor drilling, which is one of the longest running, most successful international science programmes ever. The current programme is due to finish at the end of 2012 and the international community is developing a science plan for another 10 years of scientific drilling. Peter Barrett has been participating on the Scientific Plan Writing Committee. This group have completed a draft of the future science plan which has been circulated for community comment. Tim Naish is serving on a US National Academies committee which is reviewing the accomplishment of scientific ocean drilling and will make recommendations on the new science plan to the National Science Board. *Tim Naish*

Colin Bull (1928–2010)



Colin Bull in his study surrounded by polar books taken by Peter Barrett during a visit in 2009.

Colin was Senior Lecturer in Physics at VUW 1956-61 and leader of the 2nd VUW Antarctic Expedition in 1958-59. By dint of personality, vision and administrative style he had a lasting influence on Antarctic research at VUW, and glaciology world-wide, through to his role as Professor and later Dean at The Ohio State University (1965-1986). He retired and became an Emeritus Professor and Polar Bibliophile living with artist and wife Gillian, on Bainbridge Island, near Seattle. In his career he attracted and inspired a number of staff and graduate students, including pioneering glacial geologist John Mercer, glaciologists Ian Whillans and Lonnie Thompson, and VUW's Peter Barrett. He also attracted VUW's first Antarctic student (with Barrie McKelvey) and geologist Peter Webb to become Chairman of Geology at OSU for many years. Colin died (September 7) on the first night of a cruise whilst taking Gillian to past research areas around coastal Alaska. *Peter Barrett*



Tim Naish (far left) and members of the US Scientific Ocean Drilling National Academies Committee, in front of the RV Joides Resolution docked in Victoria, Canada.



*Prof. David Bibby, Pro Vice-Chancellor & Dean of Science,
Prof. Lionel Carter, Marine Geologist,
Prof Neil Quigley, Deputy Vice-Chancellor (Research).*

Inaugural Lecture

An inaugural professorial lecture was delivered by Lionel Carter on 14th September, 2010. Entitled "*Between Pole and Equator: the New Zealand ocean in a changing world.*" The lecture explored the effects of Antarctic and tropical climate drivers on the New Zealand ocean, both now and in the past, and their interaction with major plate boundary processes such as earthquakes and volcanic eruptions which result from New Zealand's plate boundary setting. The studies presented in the first half of the lecture can help identify and resolve environmental problems associated with the present phase of climate change. This was the theme of the second part, which looked at problems associated with potential catastrophic ice loss from Antarctica and disruption of the submarine telecommunications network that underpins international data transfer and communications as well as the internet. *Lionel Carter*



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