IceSked

Issue 38: June 2022

Newsletter of Te Puna Pātiotio—Antarctic Research Centre
Te Herenga Waka—Victoria University of Wellington

A word from our Director

Future sea-level rise from Antarctic melt still remains a challenge to accurately predict, but there are also unknowns relating to regional change resulting from our tectonically active landscape. In this issue, we place a spotlight on recent outcomes from the NZ SeaRise programme, which was designed to narrow down these uncertainties. We are now able to provide sea-level projections for all of Aotearoa, under a range of different future emission pathways – helping to inform decision makers on improving coastal resilience to sea-level rise over coming decades.

Rob McKay

Sea level is rising faster than we thought

On 2 May 2022 the NZ SeaRise: Te Tai Pari O Aotearoa programme released location specific sea-level rise projections out to the year 2300 for every 2 km of the coast of Aotearoa New Zealand. These projections can be accessed through a new online tool at https://www.searise.nz/maps developed by Takiwā, a data management and analytics platform. For the first time, New Zealanders can see how much and how fast sea level will rise along 'their own' stretch of coast.

Climate change and warming temperatures are causing sea level to rise, on average, by 3.5 mm per year. However, local sea-level rise around the coast of Aotearoa is also affected by up and down movements of our land. In areas that are going down (subsiding) the annual rate of sea-level rise can double. We have connected this vertical land movement (VLM) data with climate driven sea-level rise to provide locally relevant sea-level projections.

"We know that global sea-level rise of 25-30 cm by 2060 is unavoidable regardless of our future emissions pathway. But what may be a real surprise to people is that for many of our most populated regions, such as Auckland and Wellington, this unavoidable rise is happening faster than we thought. Vertical land movements mean that these changes in sea level may happen 20 to 30 years sooner than previously expected," said project co-leader Richard Levy.

"For many parts of New Zealand's coast 30 cm of sea-level rise is a threshold for extreme flooding, above which the 100-year coastal storm becomes an annual event."

Sea-level rise can be kept to a minimum by enacting policies to meet Paris Agreement targets to limit global warming by 2100 to between 1.5 to 2°C.

"To be forewarned is to be forearmed, and this new science gives us the time and opportunity to put in place equitable and effective adaptation measures, that will limit the impact of unavoidable sea-level rise for the people of Aotearoa," said project co-leader Tim Naish.

Sea-level rise projections for Auckland/Coromandel region

NZ SeaRise is a five-year research programme funded by the Ministry for Business, Innovation and Employment Endeavour Fund. It brings together 30 local and international experts from Te Herenga Waka—Victoria University of Wellington, GNS Science, NIWA, University of Otago and the Antarctic Science Platform to improve projections of sea-level rise in Aotearoa New Zealand.

On the Ice

The 2021/22 season for all south-bound Antarcticians started two weeks earlier due to Antarctica New Zealand's managed isolation requirement in Methven in a bid to keep Antarctic bases COVID-19 free. The ARC had three teams head to the Ice.

The ARC's first all-women research team in Antarctica

Te Herenga Waka—Victoria University of Wellington have been sending staff and students to the Ice since 1957, but 2021 saw our first all-women team head south. Team leader, Alanna Alevropoulos-Borrill, who is in the final stages of completing her PhD in glaciology, was joined by fellow PhD student Francesca Baldacchino and ARC research fellow, Alexandra Gossart. The team collected data as part of a four-year project exploring the flow dynamics of the Ross Ice Shelf.

The Ross Ice Shelf plays a key role in limiting ice loss from Antarctica so it's important to understand how sensitive the shelf is to changes in climate. While satellites can measure the velocity of the ice shelf, the data is sparse during winter and direct ground measurements are required for continuous records. Continuous velocity measurements over the ice shelf will help the team to understand how the ice shelf is responding to current climate and how this could change in the future. The data collected will therefore help predict future ice loss and how much the Ross Sea catchment will contribute to sea-level rise. Collapse of the entire catchment has the potential to raise global sea levels by about 12 metres.

Francesca Baldacchino, Alexandra Gossart and Alanna Alevropoulos-Borrill in Antarctica

The research team visited six locations on the Ross Ice Shelf as part of a Rutherford Discovery Fellowship and Antarctic Science Platform funded project led by the ARC's Nick Golledge. At two sites, GPS units have been collecting ice flow data since January 2020. This data was downloaded for use in the computer models, while instruments were installed at the other four sites.

It's a far cry from 1970, when Rosemary Askin, the first female Victoria University student to undertake her own research programme in Antarctica, required her supervisor, Peter Barrett, to push hard to get her on the expedition. The US Navy refused to fly Rosemary into the field without her father's permission!

Much has changed since Rosemary's days — over the past two decades, the ARC field teams have achieved a 50/50 split between male and female students going to the Ice.

Back in NZ

Nature lover to a geology career

After completing an MSc at the ARC in 2017, Olya Albot decided to take a break from academia and began working as an environmental geologist for an engineering company. Through this work, she was exposed to planning and adaptation for climate change impacts and realised this is the topic she would love to explore further through PhD studies. In 2021, Olya was awarded a VUW Scholarship to work with the MBIE-funded NZ SeaRise programme under the supervision of Richard Levy.

"Since I was a child, I have always loved the outdoors. My love for the natural environment evolved into a pursuit of a career in geology and environmental sciences and this PhD has enabled me to pursue my passion", said Olya.

Olya's PhD project investigates the carbon sequestration potential of Aotearoa's saltmarshes and their resilience to the future impacts of sea-level rise.

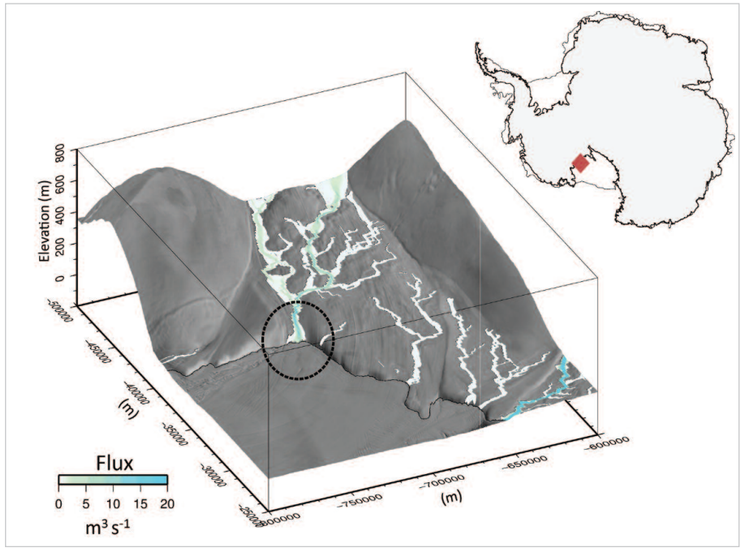
"Our coastal wetlands are key to mitigating future impacts of climate change as they sequester and store large quantities of atmospheric carbon in their soils. Coastal wetlands could therefore play an important role in Aotearoa's journey towards a zero-carbon future and present a unique opportunity as nature-based solutions for climate change adaptation. However, very little is known about Aotearoa's coastal wetlands. Many of them have been drained without any clear understanding of the impact on wildlife or carbon sequestration and what the implications will be for such land with sea-level rise. The remaining wetlands are under pressure from surrounding land use and rising sea levels."

Olya believes that this project has the potential to provide the data and direction needed for establishing a blue carbon credit scheme in Aotearoa and inform land-use and coastal adaptation planning. She has received additional funding for her research from the Department of Conservation and a Government funded Envirolink grant.

Olya Albot collecting saltmarsh cores, Rangaunu Harbour, New Zealand

Beneath Antarctica's ice sheets, liquid water flows

The liquid water that flows beneath Antarctica's ice sheets fills sub-ice lakes, allows the overriding ice to slide, and eventually drains into the ocean. Despite the cold surface temperatures, water is possible thanks to heat from the Earth, heat from ice deformation, and the insulation provided by the blanketing ice sheets. However, in spite of the significance of sub-ice water, its quantity and distribution remain poorly known due to the scarcity of direct observations.



Kamb Ice Stream study site (ellipse). Modelled subglacial water flux (ie Brocq *et al.*, 2009) overlain on MODIS Mosaic of Antarctica (MOA, Harran *et al.*, 2005). Black line shows the grounding zone transition between the West Antarctic Ice Sheet and the Ross Ice Shelf

The 2021/2022 season saw the Antarctic Science Platform's Antarctic Ice Dynamics project drill into a sub-ice river approximately 1000 km from Scott Base. The camp of 22 was led by the ARC's Huw Horgan. The team included NIWA oceanographers, the Icefin team from Georgia Tech and Cornell University, along with students and staff from the University of Otago and Victoria University of Wellington. Using the ARC's hot water drill, the team melted through 500 metres of ice to access a spectacular sub-ice channel 240 metres high and hundreds of metres deep. This channel represents an estuarine-type situation where sub-ice shelf river water draining from beneath the ice sheets mixes with ocean water circulating under the Ross Ice Shelf. Over two weeks of borehole access to this unique environment allowed a range of observations to be made. The ARC's Gavin Dunbar and VUW student Linda Balfoort acquired multiple short cores from the riverbed. Craig Stevens and Craig Stewart (NIWA) collected a vast amount of oceanographic data, and the Icefin remotely operated vehicle imaged the river environment away from the borehole.

The project's sub-ice river access owes huge thanks to ARC's Science Drilling Office, led by Darcy Mandeno, and the commitment of Antarctica New Zealand. With more sub ice-shelf access to come, the ARC and the Antarctic Science Platform look forward to making more significant insights into the past, present, and future of Antarctica's ice sheets.

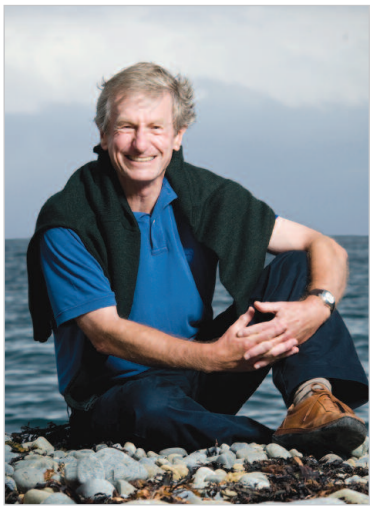
Discovering the depths of Discovery Deep

This past field season, ARC PhD student Matt Tankersley, ventured onto the Ross Ice Shelf for a six-week seismic and gravity survey as part of a University of Otago led event. The team consisted of Andrew Gorman, Hamish Bowman and Will Oliver (University of Otago), with Jenny Black (GNS Science). After a week of safety inductions and equipment preparations at Scott Base, they flew 150 km to the south of Ross Island, over Minna Bluff, and arrived at their field site, Discovery Deep. Discovery Deep lies beneath the NW corner of the Ross Ice Shelf and is named for containing the ice shelf's deepest known seafloor depths at up to 1400 metres below sea level.

The primary goal of the season was to image the sediments in this deep bathymetric depression and determine if it is a suitable target for future sediment drilling operations. Using a hot water drill, the team conducted a 30 km long active-source seismic survey. They imaged seafloor depths ranging from 1200-1450 metres below sea level, crevasses in the bottom of the ice shelf, and up to 200 metres of dipping and folded strata beneath the seafloor.

Matt Tankersley, Discovery Deep, Antarctica

Lionel Carter wins Francis P. Shepard Medal



Lionel Carter, Island Bay, Wellington

ARC Emeritus Professor, Lionel Carter, has been awarded the Francis P. Shepard Medal for Marine Geology in recognition of his "Excellence in Marine Geology."

The Medal commemorates the professional life of American geologist Francis Parker Shepard, whom in many eyes is regarded as the father of Marine Geology. His publications extended from 1927 to 1984 during which period he observed, measured, and sampled the ocean floor — a research effort that redefined basic concepts of how the ocean functioned. Those changes were captured in the book, Submarine Geology, published in 1948 and first on the subject. Against such a backdrop it is a tremendous honour for Lionel to receive this award.

The first Medal was awarded in 1967 by the Society of Sedimentary Geology which although based in the USA, has a strong international outlook. The list of past awardees reads like a who's who of Marine Geology and includes researchers from Europe, North America and Oceania. In 2002, the medal went to Emeritus Professor James Kennett of the University of California who is also a VUW graduate and long-term friend and benefactor to the ARC. There are now two New Zealanders on the roll of honour.

When asked about his presence on the list, Lionel replied,

"There is no doubt in my mind that I have been very fortunate to work with some exceptional and generous researchers from New Zealand and overseas. Those collaborations, together with institutional support, have been made possible by the remarkable nature of our vast marine environment. Under international law New Zealand has some level of jurisdiction over nearly 6 million square kilometres of ocean. Because of its size and location, in encompasses a wide range of natural phenomena that include an active tectonic plate boundary, tropical to polar climate and ocean waters, the largest ocean current namely the Antarctic Circumpolar Current, and the highly active Taupo Volcanic Zone. In essence, it is one of nature's great dynamic laboratories that provides insights into how our planet ticks. Who wouldn't want to research here?"

John Nankervis's generous bequest

The ARC is very grateful to the late John "Nank" Nankervis (1946-2022) who bequeathed a cash gift to the Victoria University of Wellington Foundation for research into Antarctic geology, tectonics and geophysics. The gift has been added to the ARC Endowed Development Fund to provide support for future Antarctic research.

Over a 50-year climbing career, John made a tremendous contribution to mountaineering both in Aotearoa and around the world. Those contributions included ascents of all New Zealand's 3000 m peaks, 50 of which were first ascents in the Southern Alps. He climbed extensively in South America, and his first expedition to the Himalayas was in 1981. He also climbed in Africa, Antarctica, Australia, Canada, China, Pakistan, Kyrgyzstan and Europe during his many expeditions.

John was President of New Zealand Alpine Club, and lead author of many submissions on National Park management plans and proposals. He served three terms on the Tongariro-Taupo Conservation Board, ten years on the New Zealand Conservation Authority, a decade as New Zealand delegate to the International Federation for Climbing and Mountaineering (UIAA), and many other roles. In 2010, he was made a member of the New Zealand Order of Merit for services to mountaineering.

John Nankervis checking the aerial photos after the descent of Mt Morning, Antarctica, during VUWAE 21, 1976 (Photo: Harry Keys)

In the summer of 1976, John was a field assistant on a Victoria University of Wellington Antarctic Expedition (VUWAE 21) with Field Leader, and friend, John "Harry" Keys, who said,

"Nanks' experience on the upper Taylor Glacier was reassuring as we crossed through a crevasse field and our trip from Mt Morning via Mt Discovery summit to its base was a real highlight. His wicked sense of humour certainly came out that summer! He is much missed by many."

John was a supporter of the ARC Endowed Development Fund since its inception in 2004, and most recently attended the ARC's S.T. Lee Lecture in Antarctic Studies in April 2021.