BYTES

THE NEWSLETTER OF THE NATIONAL MODELLING HUB

An update from the National Modelling Hub in Wellington, a multi-institute partnership supporting the Antarctic Science Platform and NZ Searise programmes
December '23 Edition

In a nutshell...

Welcome to another edition of the Modelling Hub's newsletter, and the last of 2023! In this issue, we cover the exciting collaborations and connections between the Hub and the broader research community. Read on to learn about the ongoing work of Hub researchers on ice sheet modelling, what it's like to visit the Hub as a researcher, and who will be joining us next year.

Enjoy the evolving landscape of climate science, as well as relevant modelling community updates, in each edition of BYTES.

Issue 3

Newsletter Resumes March 2024

We hope you have enjoyed reading each issue of BYTES this year. We'll be taking a break over the summer months and will send out our next issue in March, 2024, full of the latest updates and insights into the science and research of the Modelling Hub. Meri Kirihimete!

Ice Sheet Modelling, Latest Developments

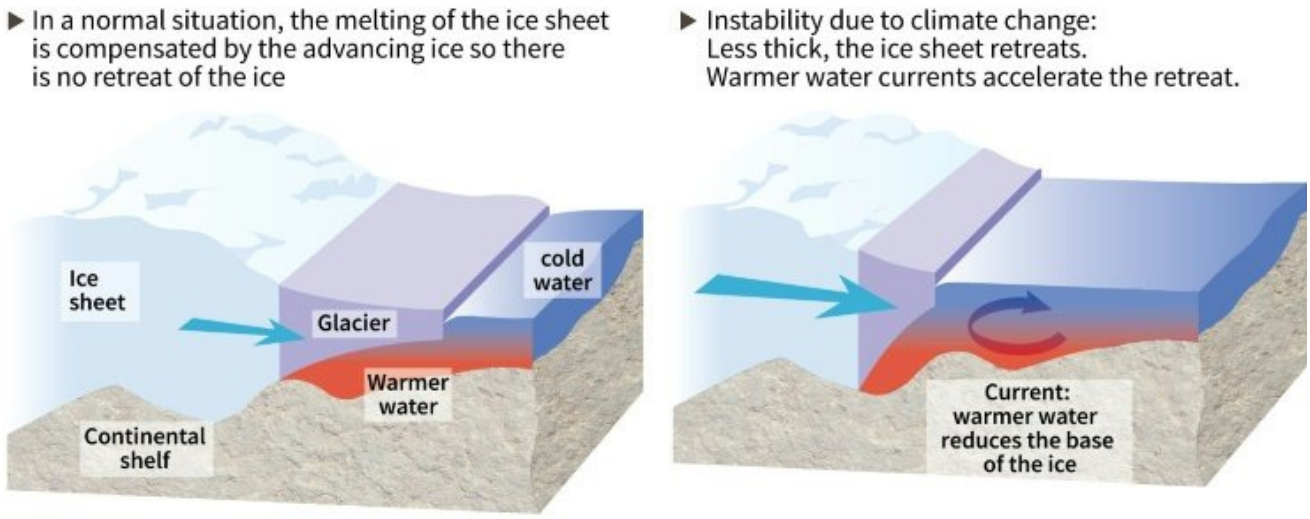
Hub researchers Nick Golledge and Dan Lowry, alongside international collaborators outside the Hub, recently published their findings on the vulnerability of Antarctic glaciers and their estimated contributions to sea-level rise. What makes this project important is its scale. With 13 groups spread across the world, this large-scale collaboration effectively combined their separate models to come up with the most accurate results. It's an ensemble modelling project, on a global level.

The project falls under the ISMIP6 umbrella, or the Ice Sheet Model Intercomparison for CMIP6, a substantial community effort of ice, ocean, and atmosphere modellers all examining how glaciers may contribute to sea level rise over the next century.

This is a prime area to apply computational modelling. By combining the many models of global climate and ice flow from different lab groups, the resulting ensemble of model simulations can provide a more well-constrained estimate of sea level rise, that captures a wide range of uncertainties related to the forcings and model physics used.

Although many of the processes controlling ice flow are reasonably well understood, modelling them can be a challenge. The rate of flow and resulting melt isn't straightforward to calculate because every glacier basin is different. They vary in how much snow is falling and the conditions of the ice and rock below. So, Dan and Nick look at specific glaciers, analysing their distinct behaviours separately.

> "You can slice and dice them [models] in many different ways, so you can get more information out of them. The more simulations you have in an ensemble, the more statistically robust your findings can be."
>
> DAN LOWRY



A demonstration of how glaciers contribute to sea level rise, from the European Union for Geosciences.

Understanding how these glaciers may contribute to sea-level rise means understanding their vulnerability to changes in basal melt (the melting that occurs where the ice floats on the ocean). The relationship is simple: the warmer the water, the faster the melting occurs. However, the degree to which this affects each particular glacier varies based on parameters such as the thickness of the ice and the depth of the bedrock it rests on. The team found several key glaciers in both West and East Antarctica to be highly sensitive to basal melt.

Next, Dan and Nick will work with other Hub members, Stefan, Mario, and Alanna, to develop additional models which can help examine the interaction between the ocean and the ice sheet in more detail. By incorporating new information about the ocean into the ice-sheet models, uncertainties can be further reduced. The group will also extend the simulation even further into the future, looking at how the atmosphere, ocean and ice sheet all change over the next two centuries.

How do glaciers contribute to sea level rise?

Glaciers are called “rivers of ice” for a reason. The ice they consist of slowly flows, and when it’s near warmer water, it melts. If this happens at a large scale, and the ice sheet can’t compensate for the melting, it can contribute to sea level rise.

WHAT'S THE GREATEST BENEFIT OF VISITING?

"Knowing what other people in the modelling community in New Zealand are working on. What they're thinking about doing [and] things we could potentially collaborate on."

ANDREW PAULING, UNIVERSITY OF OTAGO

Visiting the Hub

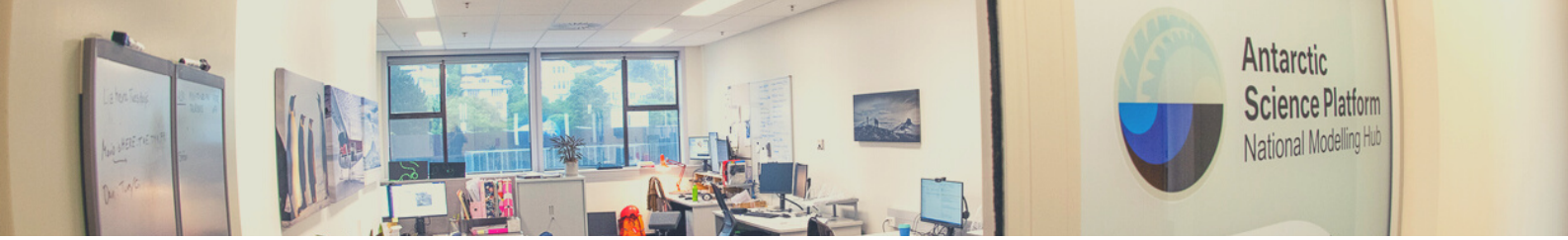
The Hub recently had the pleasure of hosting Andrew Pauling, a research fellow from the University of Otago's Physics Department. After sharing his expertise at the recent Sea Ice Emergency Summit in Wellington, he visited the Hub for a couple of days, engaging in a valuable exchange of ideas and experiences.

Andrew relies on the same underlying models as many of the Hub researchers, allowing them to exchange helpful tips and tricks for how they work with these standardised models. Their conversations extended even beyond current projects, and into future work. Being in the same place enabled beneficial exchanges on future career opportunities, new ideas, and potential collaborations down the road.

Andrew finds these discussions essential to long-term growth and planning. Research isn't done in isolation. Building and maintaining research relationships like these give rise to opportunities. In fact, that's one of Andrew's strategies in landing grants in time. By meeting people beforehand, brainstorming ideas, and developing these connections, researchers sow the seeds for future projects.

The Hub has an **open invitation** for researchers to visit, in order to enable more connections and exchanges like these.

If you're interested in visiting the Hub, please get in touch with us.



Welcoming our Newest Researcher: Peter Siew

The Hub welcomes a new member to the team, Peter Siew. Peter, currently a Postdoc at Columbia University, will be joining the Hub in 2024, bringing his expertise in machine learning applications in Arctic sea ice modelling to the Antarctic-focused work of the Hub. He is joining through the NZ SeaRise programme, and is set to spearhead a new project in collaboration with the Centre for Data Science and AI (CDSAI) at VUW.

Peter's future work will involve using machine learning methods to project Antarctic ice melting and sea level rise in the future. The goal is twofold: achieving Antarctic ice sheet predictions with minimal uncertainty and unravelling the underlying physical processes. Machine learning approaches are especially useful here because they are able to extract complex relationships. They can work along with climate models to reconstruct observational data in the past, especially in the polar regions where sea ice and land ice data were missing before the satellite era. Understanding the past climate is helpful in projecting future changes.

By bridging the gap between the Arctic and Antarctic regions, Peter is shaping his research to meet his ultimate goal of becoming a cryosphere scientist: “I’ve worked on sea ice before and in the future I will work on the ice sheet which can help me to become an expert in the cryosphere.”

The Hub welcomes Peter and looks forward to him joining the team next year.

“In the future I would like to be a polar scientist... Focusing on the cryosphere.”

PETER SIEW

NATIONAL MODELLING HUB

RESEARCH TEAM

ALENA MALYARENKO

Ice Shelf cavities, Ross ice sheet, The Terra Nova Bay Polynya

ALANNA ALEVROPOULOS-BORRILL

Ice sheet modelling, Ice-ocean interaction

ALEX GOSSART

Surface mass balance processes, Ross Sea, Terra Novay Bay

DAN LOWRY

Ice sheet dynamics, Ice shelf-ocean interactions, surface mass balance

LIZ KELLER

Carbon cycle dynamics, changes in Antarctica on global climate

MARIO KRAPP

Statistical modelling, dynamical systems, complexity

STEFAN JENDERSIE

Ocean circulation around Antarctica, ice shelves, polar oceanography

NICK GOLLEDGE

Glaciology, climate change, numerical modelling of Earth systems

ABOUT THE HUB

The National Modelling Hub was set up as a partnership between NIWA, VUW and GNS, funded by the Antarctic Science Platform (ASP). Now, the Hub incorporates researchers from VUW, GNS Science and University of Canterbury, all of whom are funded through a range of research programmes. The work of the Hub is coordinated by Nick Golledge and Liz Keller, Co-Chairs of the ASP Modelling and Future Projections Working Group.

The Hub has eight active PhD students: Béatrice Désy, Frank MacKenzie, Huiling Zou, Ihanshu Rane, Nikhil Hale, Prasad Shelke, Vincent Charnay, and Yaowen Zheng.

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