

The 2023 Aotearoa New Zealand Sea Ice Emergency Summit

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The record low Antarctic sea ice extent observed during 2023 prompted a group of Aotearoa New Zealand researchers to organize a “Sea Ice Emergency Summit” to provide information for the media and public. The key output from the summit was a public statement - the “2023 Aotearoa New Zealand Sea Ice Emergency Statement” - that called for a “dramatic reduction in greenhouse gas emissions now”. This was achieved through the ad hoc development of a rapid-response collaborative and communication process - as often required in emergency situations. This article reports on the motivation, process, science and initial impact of the summit.

Introduction

The recent trend of record low Antarctic sea ice extent (SIE) continued during 2023, but with unprecedentedly low extent that year (Cheng et al., 2024). This rapid change generated unease among many parts of the climate science community (e.g., Readfearn, 2023). The change was so sudden it challenged the normal timescales for science, in terms of how science is published and communicated to decision-makers and the public. A group of Aotearoa New Zealand-based researchers held a “Sea Ice Emergency Summit” in October 2023 that produced a public statement for immediate publication as well as a discussion at a live-streamed public forum in Wellington. Here we describe the precursors to the summit and statement, the data and science underpinning the effort, and the statement itself. Then we explain the components of the public statement and wider aspects that were not included but still discussed. Finally, we describe the immediate impact of the initiative.

The “2023 Aotearoa New Zealand Sea Ice Emergency Statement” was produced on the back of several other science-initiated communiqués. The Scientific Committee

on Antarctic Research (SCAR) Biology Christchurch Communique expressed alarm at changes in Antarctic species, populations and ecosystems (SCAR Biology, 2023) and was issued following the international SCAR Biology Symposium held in August 2023 in Christchurch, New Zealand. A subsequent statement from the Southern Ocean Observing System (SOOS) Symposium, held in August 2023 in Hobart, urged sustained and coordinated observations to inform our knowledge of changes in order to make evidence-based decisions (SOOS Symposium, 2023). Wider declarations were also being produced, for example the Helsinki Declaration on Climate Change and the Antarctic which summarised the views of the Consultative Parties to the Antarctic Treaty and the Members of the Committee for Environmental Protection in a statement of concern, and recommendations for action, regarding the Antarctica and the Southern Ocean and the climate emergency (Finland Ministry for Foreign Affairs, 2023).

A number of the authors of the present article were at the SOOS Symposium where the SOOS (2023) statement was developed. At the post-SOOS Symposium Scientific Steering Committee meeting there was a discussion around actions beyond the SOOS statement. Several of the contributing programmes had mandates for aspects of such responses but clearly the capacity to develop a statement quickly was limited simply by complexity and the inertia for spinning up action. There appeared to be an opportunity for an “agile” response to quickly raise public awareness of the geophysical changes.

The data record that provided the prime motivation for our initiative was the Antarctic sea ice extent record (Figure 1). We felt there was a need for an Aotearoa New Zealand-focused statement because (i) the sea ice extent was at unprecedented low levels for the satellite era and (ii) there

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would be some benefit to having a regionally/nationally focused statement.

One of the key aspects was timing. The entire process (outlined below) was developed in only a matter of weeks. This was driven by (i) the rapidity of the change of sea ice extent (and other metrics) and (ii) the approaching Antarctic field season that would see the lead proponents head to the field which would have resulted in a likely six-month delay in any public declaration. It did bring the process to within 10 days prior to the 2023 Aotearoa New Zealand general election which brought with it some challenges and risks around potential lack of media interest and also heightened sensitivities around perceptions of political motivation or lobbying. However, any impacts in this latter regard appeared minimal.

The Science

Both the peer and public discussion sessions (see below) involved a brief preamble on the science and the individual perspectives from the panel. This was the primary pathway for building scientific consensus within the process. The subsequent peer discussion then amplified and debated particular aspects of the changes to the Antarctic sea ice system.

The changes in Antarctic sea ice coverage as seen in the NSIDC (U.S. National Snow and Ice Data Centre) data are happening rapidly compared to normal science publication timescales, and it is difficult to find up-to-the-minute studies. Notably, Purich and Doddridge (2023) and Siegert et al. (2023) published data through to mid-2023 and Cheng et al. (2024) appeared after the summit. The wider discussion examined the likely causes of the changes in sea ice extent as well as explanations of the interactions and impacts of sea ice in different system components and processes: Southern Ocean ecology, CO₂ uptake, water mass formation, etc. Then, mainly driven by media questions, we discussed impacts of low sea ice extent on those systems and contextualised these studies in a future with less sea ice. Topics such as Antarctic bottom water and deoxygenation (Gunn et al., 2023; Schmidtke et al., 2017), the atmospheric response to Antarctic sea ice change (Ayres and Screen, 2019), ocean heat content trends (Cheng et al., 2024; Meehl et al., 2019), ecosystems (Fretwell et al., 2023), Earth-system-scale modelling of sea ice (Roach et al., 2020), carbon budgets (Crabeck et al., 2021; Gupta et al., 2020) and more, were discussed.

The Process

Activities were held over one day and evening. This included a peer science discussion and generation of the statement, a media conference, and a public event involving presentations from the participants, followed by a general discussion. The summit team was assembled in a matter of a week. One of the positives of the small Aotearoa New Zealand science system is that it is very interconnected. A wider group of colleagues from a range of disciplines was invited and around twelve were available. Many of those that were unavailable sent supportive comments. Despite the serendipitous nature

of the grouping, the team was diverse in terms of expertise, gender and career stage (Table 1).

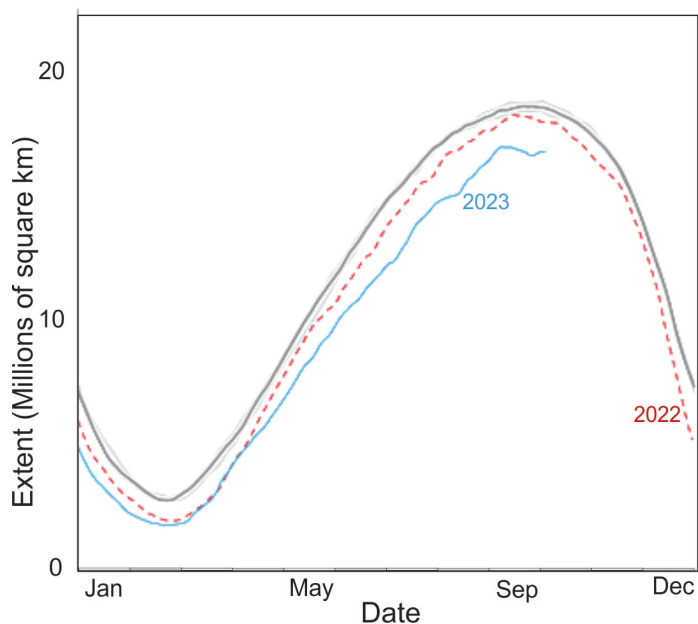


Figure 1: Antarctic sea ice extent (NSIDC - National Snow and Ice Data Centre) with blue line showing the 2023 track up until the time of the summit - 3rd October, 2023.

Participant	Speciality
Melissa Bowen	Ocean temperatures, currents and salinities
Ralph Chapman	Political economy of climate policy
Vonda Cummings	Marine ecology and ocean acidification
Sam Dean	Climate and sea ice prediction
Denise Fernandez	Oceanography of the Ross Sea
Liz Keller	The Carbon cycle and sea ice
Adrian McDonald	Atmospheric science and sea ice interactions
Andrew Pauling	Sea ice and implications for climate modelling
Wolfgang Rack	Remote sensing of sea ice
Natalie Robinson	Oceanography beneath sea ice
Craig Stevens	Ocean mixing
Vincent van Uitregt	Indigenous environmental policy and governance

Table 1: Panel specialities

An invitation to the public event also provided the option - primarily aimed at science peers - to listen and contribute to the peer discussion. The process was not heavily moderated which exposed the session to the risk of disruptive behaviour, either at the time or afterwards via social media. Although there was debate about the

implications of the statement, no disruption occurred.

The format of the statement was developed by a three-hour online session of peer discussion with the ability for the public and wider scientific peers to listen in and provide written comments. This culminated in the drafting of the statement (see below). Following an iterative refinement process, and with the help of the NZ Science Media Centre, the day moved to an on-line media conference attended by 13 media representatives and journalists. It was noted that the summit was being held in the lead-up to a general election and there were many demands on reporters' time. Later that same day, a hybrid online/in-person public session was held at the City Gallery auditorium in central Wellington. This format again included a science overview and then was open to audience questions both in-person and on-line. This was recorded and hosted online by the Royal Society Te Apārangi (Royal Society Te Apārangi, 2023).

Statement

- [1] **We have coordinated today's emergency summit on Antarctic sea ice and climate change in response to the alarmingly low sea ice extent, which is well outside the observed variability of the entire satellite record (44 years). This unprecedented Antarctic sea ice low has been driven by warming of the Southern Ocean and atmosphere.**
- [2] **This low in Antarctic sea ice area in 2023 has been accompanied by similar dramatic shifts in global averages of both air and sea surface temperatures, and some studies suggest there will be lasting changes in how the Southern Ocean behaves. And, we know that the Southern Ocean provides vital uptake of heat and CO₂. We still have much to learn about what can drive rapid changes to sea ice, oceans and the atmosphere.**
- [3] **Effects are becoming visible on a diverse range of life from algae through to penguins. The global nature of the ocean and atmosphere means impacts will be felt everywhere - this includes the waters and weather around Aotearoa New Zealand. We are one of the closest nations to Antarctica, and our climate is strongly influenced by the Southern Ocean.**
- [4] **Recent calls to action from the international science community, motivated by the changes around Antarctica, are especially relevant to Aotearoa.**
- [5] **As people who have studied the Antarctic and Southern Ocean system for decades, these recent changes are deeply alarming. This group calls for a dramatic reduction in greenhouse gas emissions now. It is not too late to keep the climate within liveable conditions, but policy action is needed urgently.**

Rationale and Wider Aspects for the Statement content

The statement comprises five short paragraphs. The opening [1] presents the reason for the statement and notes the situation is "unprecedented" but is also clear that sea ice is responding to ocean and atmosphere drivers. The next [2] paragraph emphasizes the potential for on-going change and the central role the Southern Ocean plays in the wider climate system. From this, the statement examines impacts [3] in a very high-level way, from damaged ecosystems through to weather and highlights Aotearoa New Zealand's proximity to the changing sea ice. This point is then made explicit in a single sentence [4], which notes that all the concern internationally is "especially relevant" to Aotearoa. Finally, [5] reflects the training, experience and investment in learning that have given us the ability to highlight the "deeply alarming" changes. It then explicitly calls for reduced greenhouse gas emissions along with the parallel message that it is not too late to see benefits from such action.

The initial draft statement had the rough structure seen above but was far less nuanced or detailed. For example, the initial text did not give enough weighting to atmospheric drivers. It was also initially drafted to end on an "economic" note, which while important, misses the diversity of perspectives and values that people hold. Our limited discussion on the human values underpinning emissions reflected the group's skills, and the decision to focus the message on sea ice trends. The statement only identified human-driven greenhouse gas emissions right at the end which reflects how all-pervasive the issue is that it was assumed a given in this context.

A component of the discussion focused on the inclusion, or not, of phrases like "tipping points" and "regime change" (e.g. Purich and Doddridge, 2023). The group were equivocal about the inclusion of such dramatic language, on balance believing that the situation is serious enough as it is. While several of the media questions focused on these points, ultimately, we decided against using these terms as we felt it is too early to tell, we lack information on the mechanisms behind different tipping points, and rapid changes do not always signal a major shift in system behaviour (Rudnick and Davis, 2003). Overall, we agreed there was sufficient impact already in the messaging without including such terms. A decision was also made to not focus on economic implications and leave this implicit in the text of paragraphs [3] and [5]. This was in part a reaction against the reduction of every facet of our Earth System to a monetary value.

In discussion within the peer group and amongst a wider group of colleagues before and after the Summit, there was emphasis on the care required to work within the evidence-base. It was noted, though, that a good deal of the impetus behind the statement and the effectiveness of the public session came from reference to the personal impacts the climate systems changes were having on the participants. Impacts included mental health, family and social dynamics as well as personal efforts to contribute to

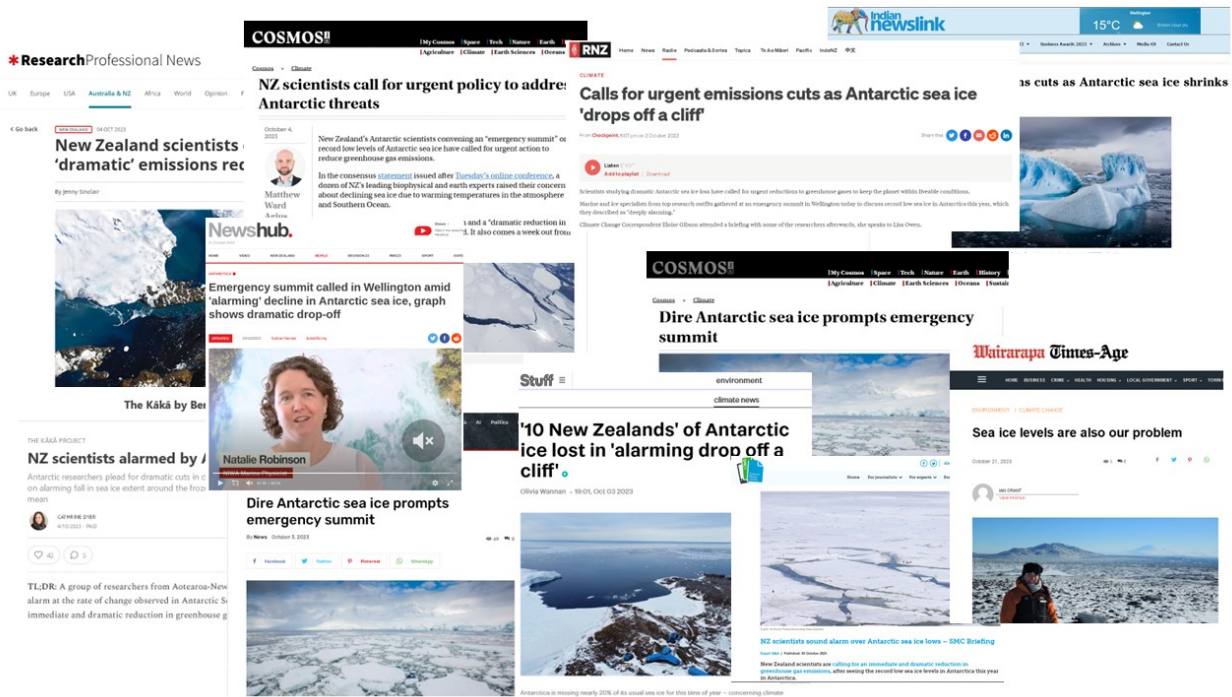


Figure 2: Collage of some of the media outcomes from the summit.

emissions reduction. This necessarily shifts the nature of the dialogue.

Clearly, at a global level there is a disconnect between our understanding of climate change and our willingness to reduce emissions (Lamb et al., 2020). There was discussion of the role of social science and Indigenous knowledge in addressing this disconnect, noting that these were not as well integrated into the Antarctic science community as would be ideal. There was explicit recognition that these aspects of knowledge-creation were important however, within the scope of the summit statement, developing these aspects on the day was not feasible given time and people constraints. These themes remains both an opportunity and responsibility for the climate science sector.

Impact

The rapid progress was in part possible because of the connectedness of the Aotearoa science community and the fact that most people on the panel and wider discussion group had previous interactions with one another. The impact was manifest in several ways. (i) The statement itself and the present synthesis will sit in the archived literature as a marker in the record of the times. (ii) The peer group met and collaborated in a different way from most existing models and we, as a group, are looking to follow-up on some of these ideas – specifically those around improved data availability, social science and Indigenous knowledge. (iii) Media produced a range of outputs reporting on the summit (Figure 2). (iv) The wider peer community was able to view a science process in action and potentially inform future related efforts. The apparently accelerating number of climate impacts (Ripple et al., 2023) means that there is a growing need for rapid-response science-informed thinking.

We had many positive comments come in from the public including a poem and more than one audience member saying they had been brought to tears. There was little negative comment. Media outputs included segments on news streaming and radio as well as various online news platforms. There was also international coverage with an interview with the US-based ACCU weather service as well as articles from the Australia-based Cosmos magazine (Agius, 2023). Notably, while the proximity to the election did not seem to reduce media interest, the initiative was not reflected in political debate in the run-up to the election.

In discussion with people in the media it was clear that the closing points made in the statement were effective. The public could see and hear that real - and knowledgeable - people were raising a very strong warning. It reiterated the consensus view that a dramatic reduction in greenhouse gas emissions is needed. It closed with the message that now is the time to act.

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