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Agenda Item: ATCM 6d, CEP 7a
Presented by: SCAR
Original: English
Submitted: 14 Apr 2023

SCAR updates on Antarctic Climate Change and the Environment

SCAR updates on Antarctic Climate Change and the Environment

Working Paper submitted by SCAR

Summary

In convening a special joint session on climate change, the ATCM and the CEP have a major opportunity to agree on effective and coordinated actions to limit the impacts of climate change in Antarctica, the Southern Ocean, and the rest of the planet. This issue requires immediate implementation of collaborative international responses to address critical research needs. The 18 recommendations from the 2022 ACCE Decadal Synopsis are summarized here within the overarching themes of: 1) research needs and coordination, 2) actions and policy proposals, and 3) outreach and communication. SCAR will continue to provide regular scientific updates to the ATCM and the CEP on Antarctic climate change and the environment, focused on the realised impacts of change in Antarctica, and information to support the Parties in taking action on mitigation and adaptation. We encourage the Parties to continue their efforts to implement all of the 2022 ACCE recommendations with urgency.

Summary of recommendations from the 2022 ACCE Decadal Synopsis report

The 2022 Antarctic Climate Change and the Environment (ACCE) Decadal Synopsis and Recommendations for Action¹ was delivered by SCAR to ATCM XLIV in response to a request from the Parties. The ACCE Decadal Synopsis was compiled based largely on the findings of the Intergovernmental Panel on Climate Change (IPCC)'s Sixth Assessment Reports (IPCC AR6, 2021 and 2022) and IPCC Special Report on Ocean and Cryosphere in a Changing Climate (SROCC, 2019), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Global Assessment Report (2019), and the International Cryosphere Climate Initiative's integrated report on the State of the Cryosphere (2021). ATCM XLIV WP30 *Antarctic Climate Change and the Environment: A Decadal Synopsis. Findings and Policy Recommendations* summarized the key findings of the report and provided a series of policy recommendations derived from these findings. ATCM XLIV WP31 *Antarctic Climate Change and the Environment: A Decadal Synopsis. Research Imperatives* provided additional recommendations on the most significant and urgent research required for the region.

The Parties agreed to convene a joint session of the CEP and the ATCM to consider the implementation of the ACCE recommendations at ATCM XLV. Following the proposed discussion themes for the joint session, key messages from these recommendations² are summarized here:

¹ Chown, S.L., Leihy, R.I., Naish, T.R., Brooks, C.M., Convey, P., Henley, B.J., Mackintosh, A.N., Phillips, L.M., Kennicutt, M.C. II & Grant, S.M. (Eds). 2022. Antarctic Climate Change and the Environment: A Decadal Synopsis and Recommendations for Action. SCAR, Cambridge, U.K. <https://scar.org/library/scar-publications/occasional-publications/5758-acce-decadal-synopsis/file>

² References in square brackets correspond to numbered policy recommendations [PR] and research recommendations [RR] in the 2022 ACCE Report.

1. Research needs and coordination

There is a critical need for improved understanding about the impacts of climate change on Antarctica and on the Earth System [RR1]. In particular, multinational, large-scale, well-resourced and coordinated research efforts must be focused on reducing uncertainty about the current and future mass change of the Antarctic Ice Sheet, including through the influence of rapidly changing atmospheric circulation and ocean currents [RR2, RR3], in response to anthropogenic warming. This is a globally urgent research priority that will require further support from National Antarctic Programmes, including novel observations to improve understanding of the key physical processes and improve projections [PR2]. The rate and magnitude of the contribution of the Antarctic Ice Sheet to future sea level rise must be determined with reduced uncertainty [RR4], and there must be effective communication of the global implications of sea level rise – what this means for mitigation pathways, as well as for adaptation to unavoidable impacts [PR3].

Within Antarctica and the Southern Ocean, it is important to identify and understand irreversible biological and physical thresholds, as well as extreme events [PR4; PR5]. The loss of Antarctic sea ice may be a key early-warning sign from Antarctica, and a trigger for feedbacks such as heat absorption accelerating surface warming, destabilization of ice shelves leading to the loss of Antarctica's ice sheets, weakening of global ocean circulation and associated reduction of ocean carbon storage, heat distribution, nutrient supply and productivity. Further understanding of these processes and their effects in both marine and terrestrial systems [RR5; RR6; RR7; RR8; RR9] is a priority in addressing their implications for ecosystems, biodiversity and ecosystem services [PR6; PR8].

2. Actions and policy proposals

Mitigation and adaptation actions to reduce impacts on Antarctic marine and terrestrial environments and ecosystems will require continued support for the research needed to deliver evidence-informed options, including through coordinated, international and transdisciplinary research efforts and long-term monitoring programmes [PR6]. Sea level rise, loss of sea ice, fast ice and ice shelves, the expansion of ice-free areas, and changes to temperature and precipitation including extreme weather events, will present new challenges for the management of areas of high human activity in Antarctica, particularly where infrastructure and other NAP assets are deployed [PR9]. Increased effort is needed to document terrestrial and marine biodiversity and to understand their vulnerability to the impacts of change and potential interactions with non-native species, further informed by long-term monitoring [RR7; RR9; PR8]. Strengthened biosecurity protocols and surveillance processes are also needed in anticipation of the growing ease of establishment of non-native species [PR7].

3. Outreach and communication

It is imperative that Antarctic Treaty Parties and observers to the Treaty should communicate to governments and to civil society the urgency of meeting and exceeding targets for the reduction of greenhouse gas emissions [PR1]. The need for resources to address research priorities must also be communicated with the same urgency [PR1], particularly where there is a critical need to understand global impacts [RR1; RR2; RR3; RR4; RR5; RR6] as well as impacts on Antarctic marine and terrestrial ecosystems and species [RR7; RR8; RR9].

Climate change and the environment – update on SCAR's main research activities

Research published in the short time that has passed since the publication of the ACCE Decadal Synopsis, is largely in line with the messages contained within it, noting record high global

ocean heat in 2022³ and record low Antarctic sea ice extent in 2023⁴. SCAR will continue to update the CEP on emerging research.

SCAR continues to prioritize the facilitation of international science coordination and the provision of evidence-based advice to the Antarctic Treaty System, with a central focus on global climate change and its impact on the Earth System. This commitment is reflected in SCAR's recent Strategic Plan 2023-2028 which highlights the urgency to respond to the climate crisis, primarily through its flagship Scientific Research Programmes (SRPs). AntClimNow (*Near-term Variability and Prediction of the Antarctic Climate System*), Ant-ICON (*Integrated Science to Inform Antarctic and Southern Ocean Conservation*) and INSTANT (*INStabilities and Thresholds in ANTarctica*) are addressing major questions on the impact of climate change on Antarctica's cryosphere and ecosystem and the role of Antarctica in global climate change. Many other SCAR subsidiary and affiliated science groups are also coordinating research on physical climate processes, understanding and predicting the impacts of change on biodiversity and ecosystems, and on human engagement with the Antarctic in the context of change (see ATCM XLIV IP81 *Mapping SCAR affiliated research to climate change related science needs identified by the CEP*).

SCAR has also provided information to this meeting on current research and new initiatives that will directly contribute to implementing the ACCE recommendations (Annex 1).

Future provision of SCAR advice on climate change

SCAR reiterates its commitment to provide regular advice to the CEP and the ATCM on the best available science representing current understanding of, and projections for, climate change and its impacts in Antarctica. As the impacts of climate change are increasingly felt in Antarctica, we anticipate that in addition to advice on future projections, SCAR's advice will focus on the realised impacts of climate change in Antarctica, the current status of Antarctic environments and ecosystems, and information to support the Parties in taking action on mitigation and adaptation. SCAR will work with partners, including the World Climate Research Programme (WCRP), to provide regular information on:

- Key indicators and trends of Antarctic and Southern Ocean climate and environment change and its impacts, extracted from global synthesis reports;
- Assessment and syntheses of the status of emerging science relevant to issues outlined in the ACCE recommendations, including progress against their implementation;
- Potential impacts on activities and interests relevant to the Treaty Parties.

We would welcome further feedback on the types of information that CEP Members and Antarctic Treaty Parties would find most useful to support understanding and to address science and information needs for the development of actions and policy proposals.

In addition to the provision of scientific information, it will also be important to consider how to provide regular assessments of progress against the recommendations and priority actions identified by the 2022 ACCE Decadal Synopsi and by the 2023 joint CEP/ATCM session on climate change.

³ Cheng, L., Abraham, J., Trenberth, K.E. *et al.* 2023. Another Year of Record Heat for the Oceans. *Adv. Atmos. Sci.* (2023). <https://doi.org/10.1007/s00376-023-2385-2>

⁴ Liu, J., Zhu, Z., Chen, D. 2023. Lowest Antarctic Sea Ice Record Broken for the Second Year in a Row. *Ocean-Land-Atmos. Res.* 2:Article 0007. <https://doi.org/10.34133/olar.0007>

Recommendations

SCAR encourages CEP Members and Antarctic Treaty Parties to:

- i) continue their efforts to implement the 2022 ACCE Decadal Synopsis recommendations with urgency, particularly in communicating internationally the critical importance of meeting and exceeding targets for the reduction of greenhouse gas emissions, and the need for resources to address research priorities to understand global impacts, as well as impacts on Antarctica;
- ii) continue to engage with the research community to deepen understanding of the key messages emerging from research as well as to determine what science and what types of information will best support the development of robust policies and actions;
- iii) consider how to provide regular assessments of progress against the recommendations and priority actions identified by the 2022 ACCE Decadal Synopsis and the 2023 joint CEP/ATCM session on climate change.

Annex 1: SCAR papers provided to ATCM XLV / CEP XXV with contributions to specific ACCE Decadal Synopsis recommendations.

SCAR papers to ATCM XLV / CEP XXV	Contribution to specific ACCE Decadal Synopsis recommendations
<p><i>Contribution of information to inform State of the Antarctic Environment Reporting (SAER): a potential new SCAR initiative (ATCM XLV WP018) – proposed framework for delivery of the best available science to inform policymakers on the state of the Antarctic environment, with a focus on drivers of change in Antarctica.</i></p>	<p>RR1 – integrated, international and targeted long-term monitoring programmes and observatories are among the most important efforts for reducing uncertainty and understanding the impacts of mitigation and adaptation responses.</p> <p>PR6 – research required to deliver evidence-informed options for mitigation and adaptation actions;</p> <p>PR7 – surveillance on the arrival and establishment of non-native species;</p> <p>PR8 – prioritize documenting terrestrial and marine biodiversity, long-term monitoring of change, and documenting the benefits of environmental management.</p>
<p><i>The Antarctic Nearshore and Terrestrial Observing System (ANTOS) (ATCM XLV WP049) – update on the delivery of a continent-wide environmental monitoring system.</i></p>	<p>PR6 – well-supported long-term monitoring of the physical and living environment;</p> <p>PR8 – long-term monitoring of change;</p> <p>RR1 – integrated, international and targeted long-term monitoring programmes and observatories are among the most important efforts for reducing uncertainty and understanding the impacts of mitigation and adaptation responses.</p>
<p><i>Understanding future sea-level change around Antarctica (ATCM XLV IP095) – risks that future sea-level rise represents for operations, coastal infrastructure and assets, heritage sites, specially protected and managed areas, and bioregions; and future research and actions to mitigate the risks through improved anticipation and effective adaptation.</i></p>	<p>RR4 – determine contribution of the Antarctic Ice Sheet to future sea-level rise, reduce uncertainties in projections of the rate and magnitude of that contribution, and effectively communicate the risks and impacts to stakeholders and users;</p> <p>PR3 – communicate the need for, and outcomes of, research on sea level in the Antarctic;</p> <p>PR9 – address new challenges for management of areas of high human activity, including where infrastructure and other NAP assets are deployed.</p>

<p><i>Marine Ecosystem Assessment for the Southern Ocean (MEASO) - Key Findings and Recommendations (ATCM XLV IP098)</i> – assessment of trends in Southern Ocean ecosystems, how species and ecosystems are currently being affected by climate change, how they are projected to be affected in the future, and priorities for research and management.</p>	<p>RR7 – establish which species, ecosystems and food webs are most vulnerable in the Southern Ocean, how they are likely to change and over what period;</p> <p>RR8 – determine how increases in harvesting in the context of climate change impacts will affect harvested, associated and dependent species, and Southern Ocean biogeochemical cycles;</p> <p>PR4 – research and expanded long-term monitoring to understand and address changes to the Southern Ocean and its ecosystems;</p> <p>PR8 – prioritize documenting terrestrial and marine biodiversity, and monitoring of change.</p>
<p><i>Update on the Southern Ocean contribution to the United Nations Decade of Ocean Science for Sustainable Development (ATCM XLV IP104)</i></p>	<p>PR1 – additional extensive research to resolve uncertainties about cryosphere change, its rate and its implications;</p> <p>RR1 – integrated, international and targeted long-term monitoring programmes and observatories;</p> <p>RR3 – understand how changes in atmospheric circulation drive changes in ocean currents around Antarctica;</p> <p>PR4 – research and expanded long-term monitoring to understand and address changes to the Southern Ocean and its ecosystems;</p> <p>PR6 – research required to deliver evidence-informed options for mitigation and adaptation actions.</p>