



A reality? “Giant underwater curtains” in the Antarctic and Legal issues potentially raised during its early phase

Session 46 on Consensus-building based on best available science


























































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**ATS Resilience
under
Anthropocene**

August 2024	Africa	Western Europe and others	Asia-Pacific	Eastern Europe	Latin America and Caribbean
<div>Consultative Parties</div> <div>(29)</div>	<div>South Africa</div> 	<div>Australia</div>  <div>Belgium</div>  <div>France</div>  <div>New Zealand</div>  <div>Norway</div>  <div>UK</div>  <div>USA</div>  <div>Germany</div>  <div>Italy</div>  <div>Spain</div>  <div>Sweden</div>  <div>Finland</div>  <div>Netherlands</div> 	<div>Japan</div>  <div>India</div>  <div>China</div>  <div>Korea, Republic of</div> 	<div>Russian Federation</div>  <div>Poland</div>  <div>Bulgaria</div>  <div>Ukraine</div>  <div>Czechia</div> 	<div>Argentina</div>  <div>Chile</div>  <div>Brazil</div>  <div>Uruguay</div>  <div>Peru</div>  <div>Ecuador</div> 
		<div>Denmark</div>  <div>Austria</div>  <div>Greece</div>  <div>Canada</div>  <div>Switzerland</div>  <div>Monaco</div>  <div>Portugal</div>  <div>Iceland</div>  <div>San Marino</div> 	<div>PapuaNG</div>  <div>Korea (DPRK)</div>  <div>Türkiye</div>  <div>Malaysia</div>  <div>Pakistan</div>  <div>Kazakhstan</div>  <div>Mongolia</div>  <div>Saudi Arabia</div> 	<div>Romania</div>  <div>Hungary</div>  <div>Slovakia</div>  <div>Estonia</div>  <div>Belarus</div>  <div>Slovenia</div> 	<div>Cuba</div>  <div>Colombia</div>  <div>Guatemala</div>  <div>Venezuela</div>  <div>Costa Rica</div> 

1. Basics on the Antarctic underwater curtain (still fancy) idea

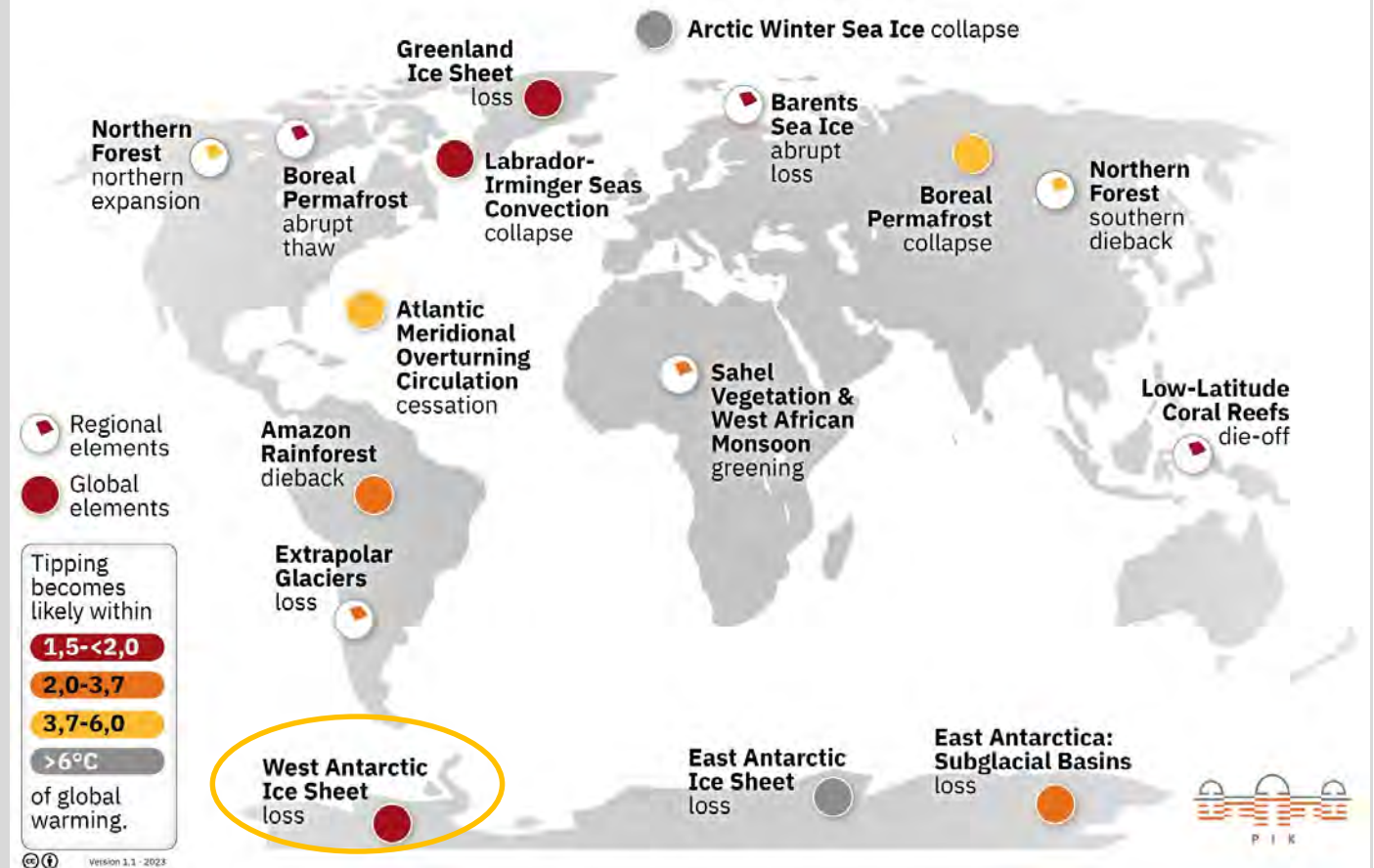
Figure designed at PIK (under cc-by licence), based on Armstrong McKay et al., Science (2022).

Tipping point argument

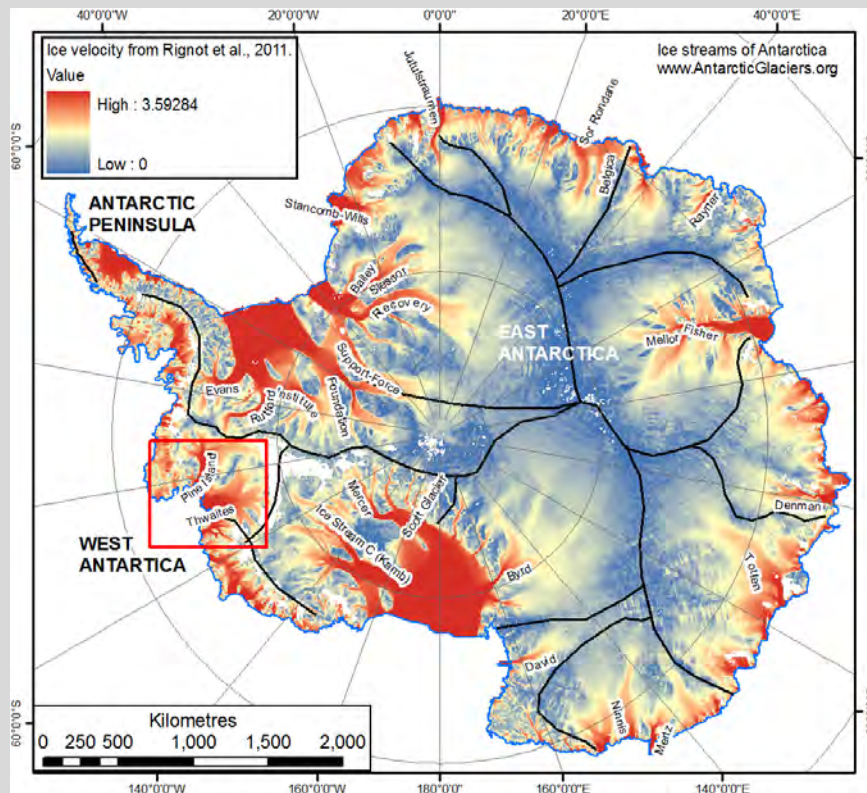
- West Antarctic Ice Sheet
- Urgency in the discussion

Geoengineering or not?

- Different from Solar Radiation Management and Carbon Capture & Removal techniques.
- Underwater curtain idea does not directly address climate change but **global sea-level rise**.



1. Basics on the Antarctic underwater curtain (still fancy) idea



Localised intervention in the Amundsen Sea area, West Antarctica

Keefer et al., PNAS nexus (2023).

Proposed areas of the curtains

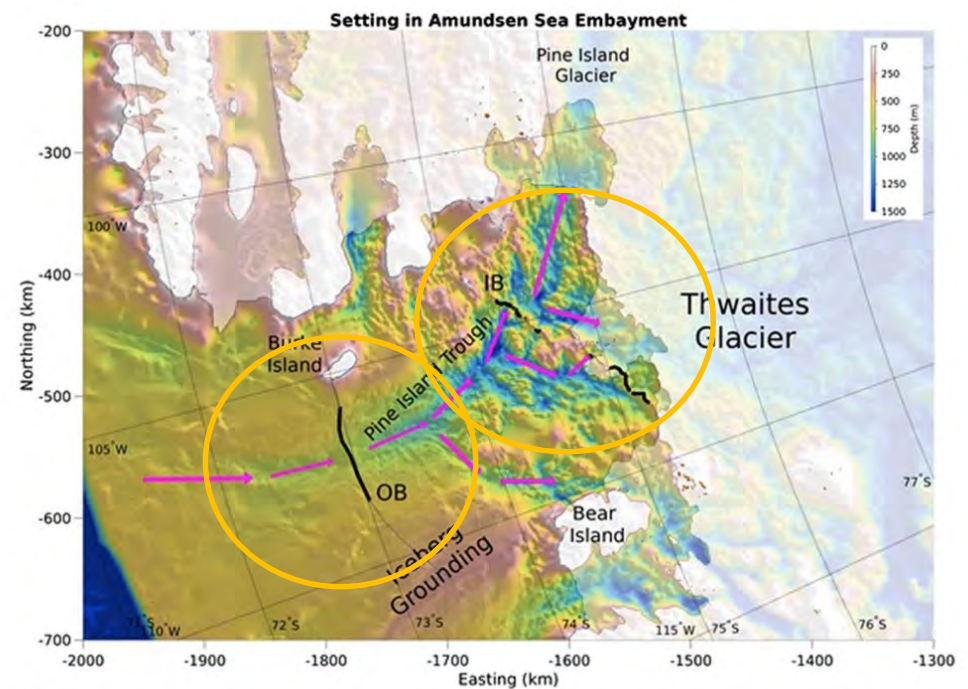
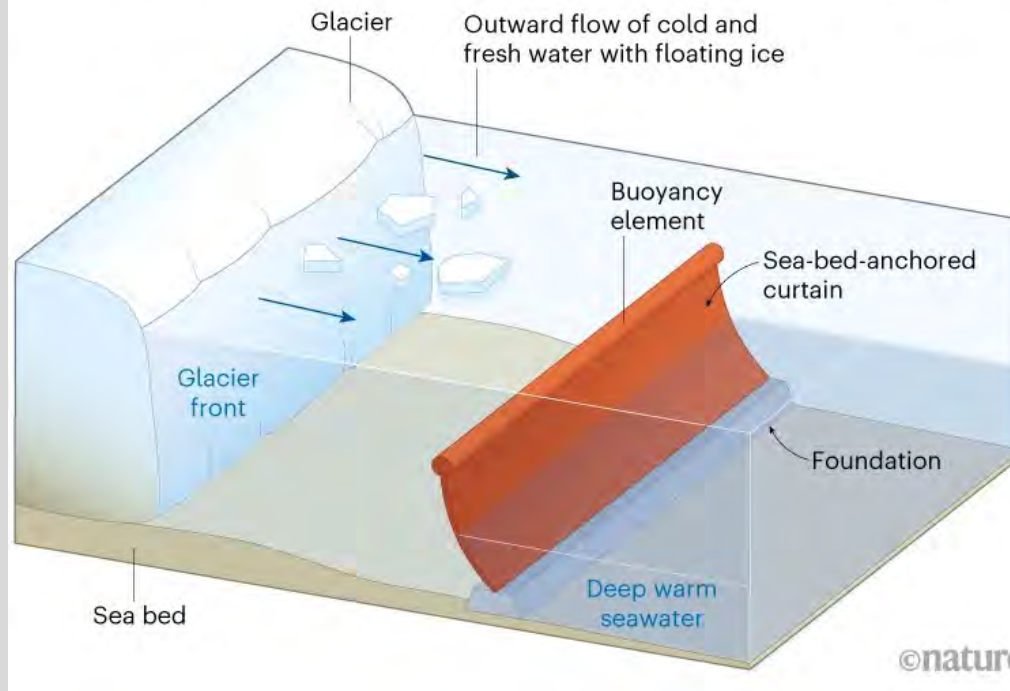


Fig. 1. Bathymetric setting in the Amundsen Sea Embayment. Map shows hill-shaded bathymetry from BedMachine Antarctica (19) with white lines for the grounding line and ice front. Thick black lines show possible Outer Bay (OB) and Inner Bay (IB) routes under consideration. Arrows show ingress routes of warm deep waters. Typical iceberg paths cross the stranding location north of Bear Island (20).

1. Basics on the Antarctic underwater curtain (still fancy) idea

CURTAIN CALL

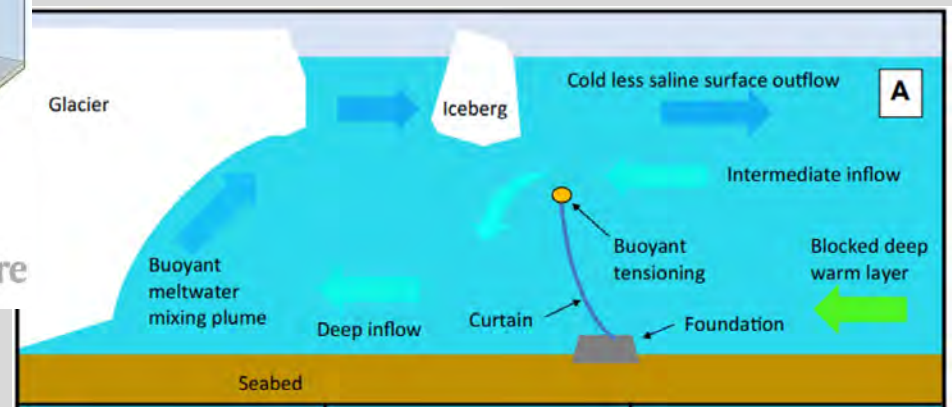
Fixing a curtain to the sea bed might prevent glaciers from being bathed in warm seawater, but it might also prevent the movement of nutrients and marine organisms.



Keefe et al. 2023/ Nature 2024:

“install a curtain that is 80 kilometres long, at a depth of 600 metres” “to prevent warm water from lapping at the base of the ice shelves” so as to slow down the ice sheet sliding into the ocean”

Curtains are made from natural fibres and are assembled in Punta Arenas, Chile, and towed to Amundsen Sea area where the curtains are lowered to the seabed.



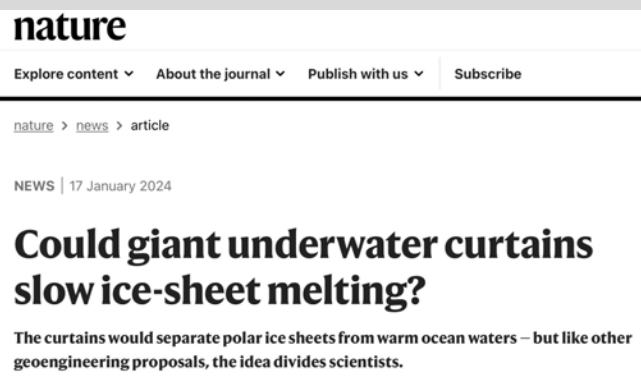
- Glaciological, physical oceanographical, and ecosystem **effectiveness and risks** still to be studied further.
- Engineering and financial **feasibility** also needs to be assessed.

2. Why is this fancy idea attracting attention now?



New York Times Jan. 6, 2024

Nature, Jan.17, 2024



- **Huge infrastructures** generally tend to attract peoples' attention anywhere in the world!
- Engineering idea that will **save the world** from inevitable global sea-level rise
- Certain **urgency** to act! Proceed before too late.

May 2024 White Paper by Moore, et al.
Recommends concrete scientific, technological, social and political debates on the idea in US National Academy of Sciences and SCAR



May 2024 ATCM ASOC IP 142

For the first time in ATCM history, the glacial geoengineering applied in the Antarctica is explicitly mentioned in ATCM official papers.



ASOC: "these projects are subject to the rigorous environmental impact assessment process required under the Protocol."

2. Why is this fancy idea attracting attention now?

“Ice-sheet conservation intervention as saving the world” argument

- ✓ **Nature, 2024**: “West Antarctic ice-sheet – which contains enough ice to **raise the global sea level roughly five metres** if melted – is projected to see unavoidable and widespread increases in ice loss **over the course of this century**”.
- ✓ **Moore, 2021**: Such sea-level rise will have serious consequences, loss of coastal land has been **costed US\$50 trillion/year**, while coastal defences to prevent that loss will **cost about US\$50 billion/year**. Whereas **Nature, 2024** estimates underwater curtain projects will cost US\$40-80 billion, plus US\$1-2 billion/year for maintenance.
- ✓ **Nature Sustainability, 2023**: In **vulnerable small island states coastal areas**, by 2050, 15,000Km²/year will be flooded, and by 2100, 1.45 million people will be displaced.
- ✓ **White Paper, 2024**: The **Global South** must also be engaged in the discussion on ice-sheet conservation



3. Small scale field tests in the Antarctic ?

Before full-fledged engineering to be applied in the Antarctica, the idea proposes some field testing to be done.

White Paper, 2024: As to research already being done in the Antarctic: *“basic research on paleoclimate, ice-sheet mechanics, and remote-sensing exploration. Peer-reviewed research, with numerical models for alternative interventions” “ways to adapt natural mechanisms that affect ice streams and glacier stability”.*

Moore, 2023: Research required for the idea: *“modeling of coupled oceanographic and ice dynamic response to deployment of curtains and analysis of fluid structural interactions, oscillation modes, and potential instabilities” “small-scale pilot demonstration projects” “field testing results on materials selection and manufacturing methods”.*

Corbett & Parson, 2022: Distinction or relationship between basic research and research for Ice-Conservation Intervention (ICI): *“Improved modeling and observations on glacier retreat would serve established cryosphere research agendas and [ICI] proposals alike. It may take a decade or more for research to develop and assess ice-sheet stabilization proposals to diverge from research in cryosphere science. During that period, a program by some states to explore [ICI] could readily coexist with or complement a broader research agenda set by SCAR [and others]”. However, “ICI research would be more strategic and mission-oriented than basic cryosphere science, and the two aims would diverge if early explorations showed promise and larger interventions were contemplated. Yet it is very likely that early research programs can be designed to advance both aims.”*



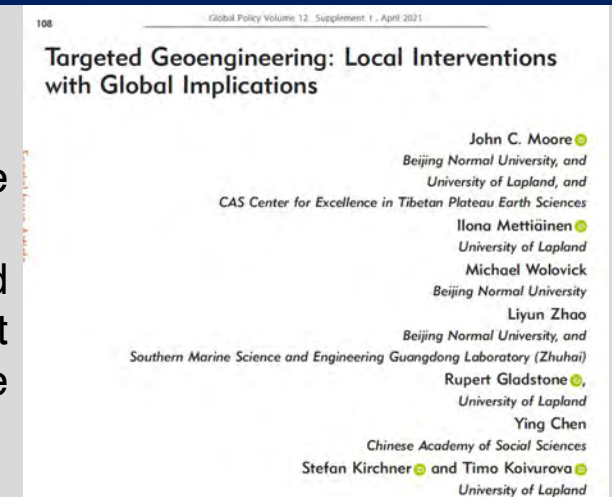
(1) “Field testing” which actually involve introducing the (small scale) curtains and other research, studies and modelling before such field testing can be distinguishable; (2) Such field testing would commence not in the Antarctic but in Northern states including Greenland.

3. Small scale field tests in the Antarctic ?

Some worrisome statements from proponents

Moore et al, 2021 Global Policy, pp.114-115.

- Since the purpose of ICI is to conserve the Antarctic ice-sheet, the idea is in accordance with the Antarctic Treaty. → **Why?**
- In the application of precautionary approach under the Madrid Protocol, a precedent from Russian Vostock subglacial drilling project can be a guide: when scientific benefits counted more than the environmental risk, it can proceed. → **Good precedent?**



Ecology Law Quarterly, Vol. 49, Issue 1 (2022), 77-136.

Radical Climate Adaptation in Antarctica

Charles R. Corbett* & Edward A. Parson**

Corbett & Parson, 2022 Ecology Law Quarterly, p.131

- Avoid raising the issue at all, and proponents can proceed with the project as conventional cryosphere and ocean science research, and then separately use the data for the ICI purposes. → **Secrecy promoted?**

- Under the information-sharing obligations under ATS, not much coordination is required between teams doing fieldwork and modelling for ICI. → **Really?**

3. Small scale field tests in the Antarctic ?

Foundational governance principle relating to Antarctic science:

➤ Transparency and Peer-Review

- Information exchange obligations under Antarctic Treaty Arts. 3 and 7(5) are the institutional linchpin to ensure all other substantive obligations, including peaceful use, non-militarization, etc. The information so exchanged is peer-reviewed in the inspection and in the ATCM; and as a consequence of such review, any necessary measures would be taken (AT Arts. 7(3), 9 and 10). **There is no place for secrecy in the Antarctic Treaty System!**
 - Under Madrid Protocol (Art.8 and Annex I), the prior environmental impact assessment and its reviews are conducted for all activities including scientific activities. Such reviews involve advice from CEP and SCAR (Art.10), and comments from fellow Antarctic scientists. **Exercise of accountability in good faith is the Rule of the Antarctic Players.**
 - Under Art. 3 (2) of Annex I, in the EIA, the “purpose” of the activity must be provided. **An intentional disguise of the purpose of field tests would raise doubts as to good faith compliance with treaty obligations.**
- ##### ➤ A purpose of an activity can be objectively ascertained:
- 2014 ICJ Whaling in the Antarctic case judgment

4. Fundamental governance challenges into the future

(Local=Antarctica) and (Global=The Earth) Governance relationship reconsidered

- ✓ **Certainty of sacrifice locally**
cf. Antarctica becoming the tool
- ✓ **Governance system specially suited for the locality**
- ✓ **Decision today on the Antarctic will affect the 100 years future of the Earth.**



- **Uncertain benefits globally**
- **Governance system suited for global issues**
- **The century future of the Earth will depend on the decision today on the Antarctic.**

(up to today) Mutual avoidance + partial adjustments



McGee (2019)

- ✓ Different nature of the activity
- ✓ Limits of Antarctic exceptionalism
- ✓ Governance pressures similar to Antarctic mineral resources

(future) Superior-subordinate?
Conflictual? Integration?

Flamm & Shibata (accepted, 2024)

- ✓ Authority
- ✓ Sovereignty
- ✓ Security

Reference

- **Corbett and Parson (2022)**. Radical Climate Adaptation in Antarctica. Ecology Law Quarterly, 49-1.
- **Flamm and Shibata (2024, forthcoming)**. “Ice-Sheet Conservation” and International Discord: Governing (Potential) Glacial Geoengineering in Antarctica. International Affairs.
- **Gertner (2024)**. Can 500 million dollars save this glacier? A bold engineering project might show a way to slow sea-level rise. The New York Times, [January 6, 2024](#).
- **Keefer, Wolovick and Moore (2023)**. Feasibility of ice sheet conservation using seabed anchored curtain. PNAS Nexus 2023-2.
- **MacAyeal, ...Moore (2024)**. Glacial Climate Intervention: A Research Vision, [Online](#).
- **McGee (2021)**. Frozen Eden Lost? Exploring discourses of geoengineering in Antarctica. Anthropocene Antarctica, Routledge.
- **Moore, et al (2021)**. Targeted Geoengineering: Local Interventions with Global Implications. Global Policy, 12.
- **Shibata (2015)**. Japan and 100 Years of Antarctic Legal Order. The Yearbook of Polar Law, 7.
- **Vousdoukas et al (2023)**. Small Island Developing States under threat by rising seas even in a 1.5 C warming world. Nature Sustainability, 6.
- **Wolovick and Moore (2018)**. Stopping the flood: could we use targeted geoengineering to mitigate sea level rise? The Cryosphere, 12.
- **You (2024)**. Could giant underwater curtains slow ice-sheet melting? Nature, [January 17, 2024](#).

Looking towards 2026 ATCM in Japan

Thank you for listening, and
look forward to welcoming you in **Hiroshima ATCM in May 2026**



**Photo : January 2017
Adelie penguins at
Japanese penguin
research field,
Mizukukuriura,
East Antarctica**