UNIVERSITY OF HELSINKI

https://helda.helsinki.fi

Open Letter by Climate Scientists to the Nordic Council of Ministers

44 leading experts on ocean circulation; Rahmstorf, Stefan; Uotila, Petteri

2024-10-19

http://hdl.handle.net/10138/587175

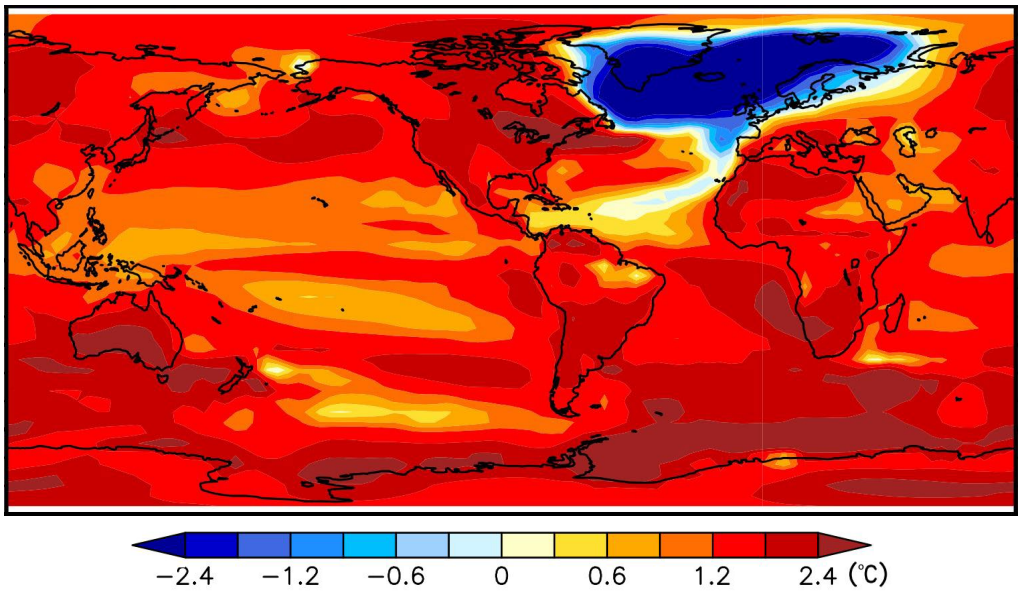
44 leading experts on ocean circulation, Rahmstorf, S & Uotila, P 2024, Open Letter by Climate Scientists to the Nordic Council of Ministers.

Downloaded from Helda, University of Helsinki institutional repository. https://helda.helsinki.fi
This is an electronic reprint of the original article.
This reprint may differ from the original in pagination and typographic detail.
Please cite the original version.

Open Letter by Climate Scientists to the Nordic Council of Ministers

Reykjavik, October 2024

We, the undersigned, are scientists working in the field of climate research and feel it is urgent to draw the attention of the Nordic Council of Ministers to the serious risk of a major ocean circulation change in the Atlantic. A string of scientific studies in the past few years suggests that this risk has so far been greatly underestimated. Such an ocean circulation change would have devastating and irreversible impacts especially for Nordic countries, but also for other parts of the world.



Annual mean temperature change in an idealised future CO2 doubling scenario in which the AMOC has fully collapsed. Source: Science[1].

Science increasingly confirms that the Arctic region is a "ground zero" for tipping point risks and climate regulation across the planet. In this region, the Greenland Ice Sheet, the Barents sea ice, the boreal permafrost systems, the subpolar gyre deep-water formation and the Atlantic Meridional Overturning Circulation (AMOC) are all vulnerable to major, interconnected nonlinear changes[2]. The AMOC, the dominant mechanism of northward heat transport in the North Atlantic, determines life conditions for all people in the Arctic region and beyond and is increasingly at risk of passing a tipping point.

Tipping point risks are real and can occur within the 1.5-2°C climate range of the Paris Agreement[3]. The world is currently heading well beyond this range (> 2.5°C). In the Synthesis report of the IPCC (2023) it is stated with high confidence that the likelihood of abrupt or

irreversible changes in the climate system will increase with the level of global warming, and similarly the probability of outcomes that may be considered low-likelihood but are associated with potentially very large adverse impacts increases[4]. The IPCC further specifies that *"risks associated with large-scale singular events or tipping points … transition to high risk between 1.5°C - 2.5°C"* of global warming.

A recent OECD report has concluded that *"the current scientific evidence unequivocally supports unprecedented, urgent and ambitious climate action to tackle the risks of climate system tipping points."* [5]

Regarding the risk of tipping the ocean circulation in the Atlantic, the IPCC concludes that *"there is medium confidence that the Atlantic Meridional Overturning Circulation will not collapse abruptly before 2100, but if it were to occur, it would very likely cause abrupt shifts in regional weather patterns, and large impacts on ecosystems and human activities."* [4]

Recent research since the last IPCC report does suggest that the IPCC has underestimated this risk and that the passing of this tipping point is a serious possibility already in the next few decades[6-9].

Despite significant research into the possibility and mechanisms of a collapse, the probability of such an occurrence remains highly uncertain. The purpose of this letter is to draw attention to the fact that only "medium confidence" in the AMOC not collapsing is not reassuring, and clearly leaves open the possibility of an AMOC collapse during this century. And there is even greater likelihood that a collapse is *triggered* this century but only fully plays out in the next.

Given the increasing evidence for a higher risk of an AMOC collapse, we believe it is of critical importance that Arctic tipping point risks, in particular the AMOC risk, are taken seriously in governance and policy. Even with a medium likelihood of occurrence, given that the outcome would be catastrophic and impacting the entire world for centuries to come, we believe more needs to be done to minimize this risk.

The impacts particularly on Nordic Countries would likely be catastrophic, including major cooling in the region while surrounding regions warm (Figure)[1]. This would be an enlargement and deepening of the 'cold blob' that already has developed over the subpolar Atlantic Ocean[10,11], and likely lead to unprecedented extreme weather. While the impacts on weather patterns, ecosystems and human activities warrant further study, they would potentially threaten the viability of agriculture in northwestern Europe[12].

Many further impacts are likely to be felt globally, including a shift in tropical rainfall belts, reduced oceanic carbon dioxide uptake (and thus faster atmospheric increase) as well as major additional sea-level rise particularly along the American Atlantic coast, and an upheaval of marine ecosystems and fisheries[13].

Recognizing that adaptation to such a severe climate catastrophe is not a viable option, we urge the Council of Nordic Ministers to (a) initiate an assessment of this significant risk to the Nordic countries and (b) take steps to minimize this risk as much as possible. This could involve leveraging the strong international standing of the Nordic countries to increase pressure for greater urgency and priority in the global effort to reduce emissions as quickly as possible, in order to stay close to the 1.5 °C target set by the Paris Agreement.

Sincerely, the signatories *(see next page)*

Open Letter by Climate Scientists to the Nordic Council of Ministers

Signatories (in alphabetical order)

Prof. Guðfinna Th Aðalgeirsdóttir, University of Iceland, Faculty of Earth Science

Prof. Nathan Bindoff, University of Tasmania, Australia

Dr. Halldór Björnsson, Icelandic Met Office, Iceland

Prof. Andreas Born, Bjerknes Centre for Climate Research and University of Bergen, Norway

Prof. Niklas Boers, Potsdam Institute for Climate Impact Research and Technical University of Munich, Germany

Dr. Rei Chemke, Weizmann Institute of Science, Israel

Dr. Lijing Cheng, Institute of Atmospheric Physics, Chinese Academy of Sciences

Prof. John Church, University of New South Wales, Australia

Dr. Femke de Jong, NIOZ Royal Netherlands Institute for Sea Research, Netherlands

Prof. Peter Ditlevsen, University of Copenhagen, x`

Prof. Sybren Drijfhout, University of Utrecht, Netherlands; University of Southampton, UK

Prof. Matthew England, University of New South Wales, Australia

Dr. Georg Feulner, Potsdam Institute for Climate Impact Research, Germany

Dr. Kikki Flesche Kleiven, Bjerknes Centre for Climate Research, Norway

Prof. Áslaug Geirsdóttir, University of Iceland, Faculty of Earth Science, Iceland

Dr. Sjoerd Groeskamp, NIOZ Royal Netherlands Institute for Sea Research, Netherlands

Prof. Steingrímur Jónsson, University of Akureyri and Marine and Freshwater Research Institute, Iceland

Prof. Caroline Katsman, Civil Engineering and Geosciences, Delft University of Technology, Netherlands

Dr. Torben Koenigk, Rossby Centre, Swedish Meteorological and Hydrological Institute, Sweden

Joseph Henry Lacasce, University of Oslo, Norway

Prof. Tim Lenton, University of Exeter, UK

Prof. Anders Levermann, Potsdam Institute for Climate Impact Research, Germany

Prof. Wei Liu, University of California Riverside, USA

Prof. Gerrit Lohmann, Alfred Wegener Institute, Germany

Prof. Michael Mann, University of Pennsylvania, USA

Dr. Gerard McCarthy, Maynooth University, Ireland

Dr. Elaine McDonagh, NORCE and Bjerknes Centre for Climate Research, Norway, and National Oceanography Centre, UK

Prof Trevor McDougall, University of New South Wales, Australia

Dr. Joonas Merikanto, Finnish Meteorological Institute, Finland

Prof. Sebastian Mernild, SDU Climate Cluster, University of Southern Denmark

Ulysses Ninnemann, Bjerknes Centre for Climate Research and University of Bergen, Norway

Prof. Stefan Rahmstorf, Potsdam Institute for Climate Impact Research, Germany

Prof. Markus Rex, Alfred Wegener Institute, Germany

Prof. Katherine Richardson, University of Copenhagen, Denmark

Prof. Johan Rockström, Potsdam Institute for Climate Impact Research, Germany

Dr Anastasia Romanou, NASA Goddard Institute for Space Studies, and Columbia University, USA

Associate Prof. Angel Ruiz-Angulo, University of Iceland, Faculty of Earth Science

Prof. Thomas Stocker, University of Bern, Switzerland

Dr. Didier Swingedouw, French National Center for Scientific Research (CNRS), France

Prof. David Thornalley, University College London, UK

Prof. Petteri Uotila, University of Helsinki, Finland

Prof. Yulia Yamineva, University of Eastern Finland, Finland

Dr. Chenyu Zhu, Institute of Atmospheric Physics, CAS, China

References

1 Liu, W., Xie, S.-P., Liu, Z. & Zhu, J. Overlooked possibility of a collapsed Atlantic Meridional Overturning Circulation in warming climate. *Science Advances*, 7 (2017). https://doi.org:10.1126/sciadv.1601666

2 Armstrong McKay, D. I. *et al.* Exceeding 1.5 degrees C global warming could trigger multiple climate tipping points. *Science* **377**, eabn7950 (2022). https://doi.org:10.1126/science.abn7950

3 Lenton, T. M., et al. The Global Tipping Points Report 2023. 479 (University of Exeter, Exeter, UK, 2023).

4 IPCC. Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. 184 (IPCC, Geneva, 2023).

5 OECD. Climate Tipping Points: Insights for Effective Policy Action. 89 (Paris, 2022).

6 van Westen, R. M., Kliphuis, M. A. & Dijkstra, H. A. Physics-based early warning signal shows that AMOC is on tipping course. *Science Advances* (2024). https://doi.org:10.1126/sciadv.adk1189

7 Boers, N. Observation-based early-warning signals for a collapse of the Atlantic Meridional Overturning Circulation. *Nature Clim. Change* **11**, 680-688 (2021). https://doi.org:10.1038/s41558-021-01097-4

8 Michel, S. L. L. *et al.* Early warning signal for a tipping point suggested by a millennial Atlantic Multidecadal Variability reconstruction. *Nat Commun* **13**, 5176 (2022). https://doi.org:10.1038/s41467-022-32704-3

9 Ditlevsen, P. & Ditlevsen, S. Warning of a forthcoming collapse of the Atlantic meridional overturning circulation *Nature* (2023). https://doi.org:10.1038/s41467-023-39810-w

10 Caesar, L., Rahmstorf, S., Robinson, A., Feulner, G. & Saba, V. Observed fingerprint of a weakening Atlantic Ocean overturning circulation. *Nature* **556**, 191-196 (2018). https://doi.org:10.1038/s41586-018-0006-5

11 Chemke, R., Zanna, L. & Polvani, L. M. Identifying a human signal in the North Atlantic warming hole. *Nature Communications* **11** (2020). https://doi.org:10.1038/s41467-020-15285-x

12 Benton, T. G. Running AMOC in the farming economy. *Nature Food* **1**, 22-23 (2020). https://doi.org:10.1038/s43016-019-0017-x

13 Rahmstorf, S. Is the Atlantic overturning circulation approaching a tipping point? *Oceanogr.* (2024). https://doi.org:/doi.org/10.5670/oceanog.2024.501