

Press release

Universität Hamburg

Abteilung Kommunikation und Marketing,

02/25/2025

<http://idw-online.de/en/news848044>

Research results, Scientific Publications
Environment / ecology, Geosciences, Oceanology / climate, Physics / astronomy
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Long-term costs of global warming: Weaker ocean circulation could cost trillions

A major motor for the global climate is beginning to falter: a massive system of ocean currents called the Atlantic Meridional Overturning Circulation (AMOC), which also includes the Gulf Stream. As a new study conducted by experts at the University of Hamburg's Cluster of Excellence for climate research CLICCS and the Max Planck Institute for Meteorology shows, a weaker AMOC could produce long-term costs amounting to several trillion euros by the year 2100.

The Atlantic Meridional Overturning Circulation (AMOC) transports warm water north from the Tropics and cold water back to the south, serving as a "radiator" for Europe's climate. Until recently, economic research has considered a weakening AMOC to be beneficial, as this would cool the Northern Hemisphere in periods of global warming. "But a weakening AMOC would further accelerate climate change", explains co-author and climate economist Felix Schaumann, Ph.D. candidate in Sustainability Economics at the University of Hamburg and the Max Planck Institute for Meteorology and coauthor of the study, which has just been released in the journal "Proceedings of the National Academy of Sciences."

What we already knew: when the Arctic ice melts, massive amounts of freshwater flow into the ocean. The seawater becomes diluted and less saline, a development that reduces its density and causes it to sink more slowly – and one that will likely slow the AMOC. Now, Schaumann and his colleague Eduardo Alastrué de Asenjo, from the Max Planck Institute for Meteorology and the Climate Modelling group of the University of Hamburg, have confirmed: as a result of this process, less CO₂ is transported from the surface ocean to the deep ocean. More CO₂ remains in the atmosphere, which accelerates global warming.

"Our findings indicate that previous studies on AMOC weakening most likely underestimated the economic impacts," says Schaumann. In global terms, the acceleration of climate change would produce more frequent and extreme weather events like heat waves, droughts and floods, leading to an increase in the social cost of carbon. This cost represents the damage caused by additional CO₂ emissions, and the increase in the social cost of carbon could offset the economic benefits of the cooling that accompanies a weaker AMOC.

The findings are based on a global climate model in combination with an economic model that estimates economic costs along different scenarios of CO₂ emissions. Using this approach, the experts created a first scenario based on the CO₂ development without any AMOC-related effects, and a second, which reflected various degrees of weakening. This allowed them to establish a direct connection between the strength of the AMOC and the amount of carbon the global ocean can take up.

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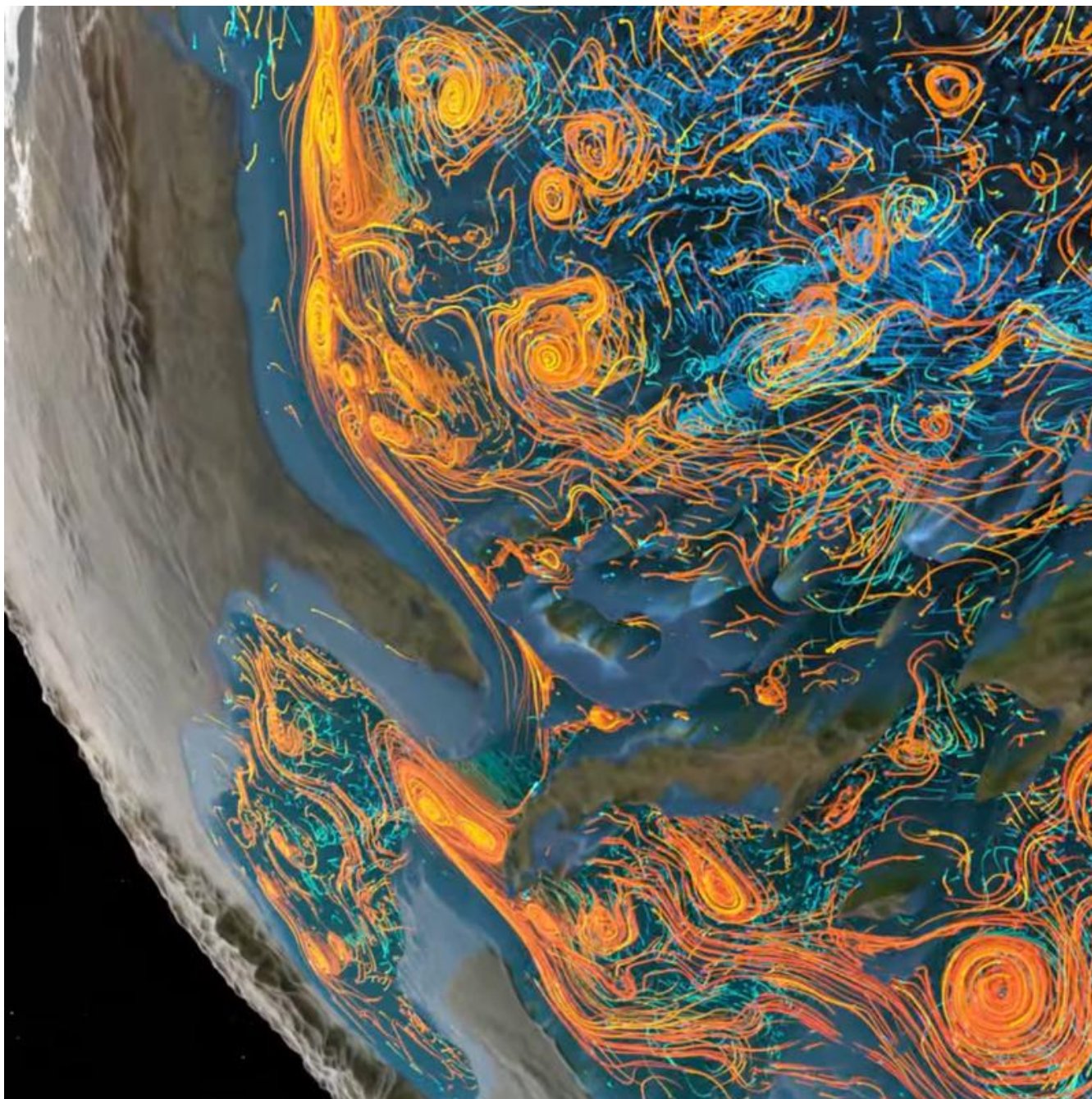
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Original publication:

Felix Schaumann, Eduardo Alastrué de Asenjo (2025): Weakening AMOC reduces ocean carbon uptake and increases the social cost of carbon. Proceedings of the National Academy of Sciences, DOI: [10.1073/pnas.2419543122](https://doi.org/10.1073/pnas.2419543122)
<https://www.pnas.org/doi/10.1073/pnas.2419543122>

URL for press release: <https://www.cliccs.uni-hamburg.de/> University of Hamburg's Cluster of Excellence for climate research CLICCS



Ocean currents transport tropical heat to Europe, while cold deep water flows back.
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