Study finds potential instability in Atlantic Ocean water circulation system

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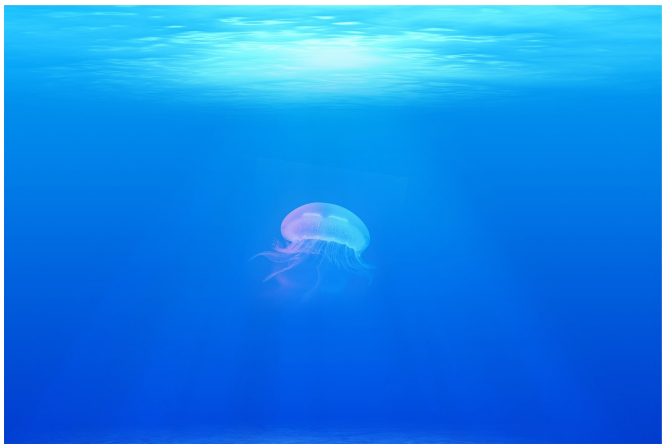

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One of the world's largest ocean circulation systems may not be as stable as today's weather models predict, according to a new study.

In fact, changes in the Atlantic Meridional Overturning Circulation (AMOC)—the same deep-water ocean current featured in the movie "The Day After Tomorrow"—could occur quite abruptly, in geologic terms, the study says. The research appears in the Jan. 4 online edition of the journal *Science Advances*.

"We show that the possibility of a collapsed AMOC under global warming is hugely underestimated," said Wei Liu, a postdoctoral associate in the Department of Geology and Geophysics at Yale University and lead author of the study. Liu began the research when he was a graduate student at the University of Wisconsin-Madison, and continued it at the Scripps Institution of Oceanography, prior to coming to Yale.

AMOC is responsible for carrying oceanic heat northward in the Atlantic Ocean. It consists of a lower limb of denser, colder water that flows south, and an upper limb of warm, salty water that flows north. The system is a major factor for regional climate change, affecting the Atlantic rim countries, especially those in Europe.

"In current models, AMOC is systematically biased to be in a stable regime," Liu said. "A bias-corrected model predicts a future AMOC collapse with prominent cooling over the northern North Atlantic and neighboring areas. This has enormous implications for regional and global climate change."

A collapse of the AMOC system, in Liu's model, would cool the Northern Atlantic Ocean, cause a spreading of Arctic sea ice, and move tropical Atlantic rain belts farther south.

While a calamity on the order of the fictional plot of "The Day After Tomorrow" is not indicated, the researchers said a significant weather change could happen quickly in the next few centuries.

"It's a very provocative idea," said study co-author Zhengyu Liu, professor of atmospheric and oceanic sciences, and of environmental studies at the University of Wisconsin-Madison Center for Climatic Research in the Nelson Institute. "For me it's a 180-degree turn because I had been thinking like everyone else."

The researchers stressed that their new model may require additional refinement, as well. They said detailed information about water salinity, ocean temperature, and melting ice—over a period of decades—is essential to the accuracy of AMOC models.

The researchers also noted the major impact that climate change itself has on AMOC patterns. Additional carbon dioxide, for example, warms the cold water of the North Atlantic. Such developments would have an impact on AMOC behavior, the researchers said.

More information: "Overlooked possibility of a collapsed Atlantic Meridional Overturning Circulation in warming climate," *Science Advances* 04 Jan 2017: Vol. 3, no. 1, e1601666. DOI: 10.1126/sciadv.1601666

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