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The Atlantic Meridional Overturning Circulation: Scientific Information And Public Alert

EDITORIAL

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Climate change is currently a focus not only within the research community but also in the media and amongst the public; see e.g. the editorial of Hannachi and Hansson (2021) that highlights the evaluation of the credibility of scientific statements in relation to climate change. The climate has several compartments that exchange energy and materials via complex physical and biogeochemical processes. The ocean is one major compartment of the climate system, which currently acts as a sink of heat and anthropogenic carbon dioxide, thereby reducing global surface warming.

The Atlantic Meridional Overturning circulation (AMOC) is a component of a global ocean circulation pattern that exchanges waters between the surface- and deep-ocean, as well as between the major ocean basins (Ferreira et al, 2018; Cessi, 2019). The AMOC transports relatively warm waters in the upper ocean northward to the northern North Atlantic. In these high-latitude regions, the upper ocean waters of the AMOC become denser due to cooling, sink and feed a southward return flow in the deep ocean. The northward heat transport of the AMOC contributes to the warm ocean climate in the North Atlantic sector, where sea-ice free surface waters penetrate deep into the Arctic Ocean. This northward ocean heat transport also contributes to the relatively warm climate of northwestern Europe.

One of the main research questions that climate scientists are attempting to address concerns the future evolution of the AMOC. If the AMOC slows or shuts down, the climate in the Atlantic sector would be affected. Is this possible and what changes in climatic conditions could cause this? A seminal study by Henry Stommel (Stommel, 1961) examined a feedback between oceanic transport of salt and surface freshwater fluxes (referred to as Stommel's salt-advection feedback), which in theory could cause a shut-down of the AMOC followed by a major reorganization of the global ocean circulation. Stommel's study was essentially considered as a fluid-dynamical curiosity until the mid-eighties, when it was invoked to explain possible glacial-to-interglacial changes of the ocean circulation (Broecker at al., 1985; Walin, 1985). Influenced strongly by Stommel's original work, a possible weakening or even collapse of the AMOC in response to global warming has been discussed and studied in the scientific community for over three decades. A possible future collapse of the AMOC has also emerged frequently in public media and popular culture, often presented in dramatic terms with limited focus on the underlying observational and theoretical foundations that remain far from complete.

In the present Tellus issue letter, Roquet and Wunsch discuss the complex issue of a potential near-future weakening or a collapse of AMOC in light of available ocean observations. They also consider the often challenging role that scientists face in communication with the media and public, particularly when it comes to disclosing information on climate change and its impacts.

COMPETING INTERESTS

The authors have no competing interests to declare.

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