Atlantic Meridional Overturning Circulation is stable under global warming

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Many new studies have been published supporting the hypothesis that the Atlantic Meridional Overturning Circulation (AMOC) is experiencing a slowdown. These studies are based on proxies, climate model predictions, or a combination of both. The latest work (1) is only based on predictions. The AMOC is allegedly slowing down at an increased rate because of the Arctic ice melting as predicted by climate models. Recent satellite information for the Arctic shows a shrinking sea ice and warming temperatures since 1978. Scattered prior information dating back to the mid-1800s shows the shrinking of Arctic sea ice possibly started in the mid-1800s with superimposed strong interannual and multidecadal oscillations, consistent with the Arctic temperature pattern (2–4). The recent shrinking of sea ice and warming for the Arctic should therefore be separated from the long-term shrinking and warming and the natural multidecadal oscillations.

Natural variability is globally well known (5, 6), and it should not be a novelty to have this variability also in the Arctic, as in the many interconnected climate patterns of atmosphere and oceans, and the AMOC. As better explained in ref. 7, recent satellite and in situ observations, coupled with tide gauge data, suggest an oscillatory behavior of the AMOC over the last 150 y more than an accelerating reduction of strength with oscillations becoming more and more frequent as claimed in ref. 1.

Direct estimations of the AMOC demonstrate no critical slowdown over the past two decades (7–10). The three time series of Fig. 1 are the AMOC S-A (satellite sea surface height plus ARGO), based on satellite sea surface height and ARGO temperature, salinity, and velocity from profiling buoys; the AMOC SSH (satellite sea surface height only) only, based on satellite sea surface height; and the AMOC MSL (tide gauge mean sea level), based on the detrended time series of mean sea level measured by tide gauges of The Battery (New York, NY) and Brest. Data from 1856 to present show that the AMOC MSL has marginally reduced. However, since 1910 in the same dataset, the AMOC MSL has marginally increased. Since 1993, the AMOC SSH has increased. Since 2002, the AMOC S-A, the AMOC MSL, and the AMOC SSH have reduced. Significant variability is affecting the AMOC. As there is no sign of increasing weakening of the AMOC during the last few decades, but only overall stability with substantial seasonal, interannual, and multidecadal variability, the climate model predictions in ref. 1 appear unrealistic.

As direct measurements are available for the strength of the AMOC as well as the many other climate parameters describing states of the atmosphere or the oceans, often strongly interconnected, climate models should be built through validation vs. those measurements and include all of the relevant natural forcings in addition to the anthropogenic carbon dioxide emission. Not accounting for natural variability and neglecting validation vs. direct measurements, the climate models fail to represent the recent past climate patterns and should not be applied to predict near-future evolutions.

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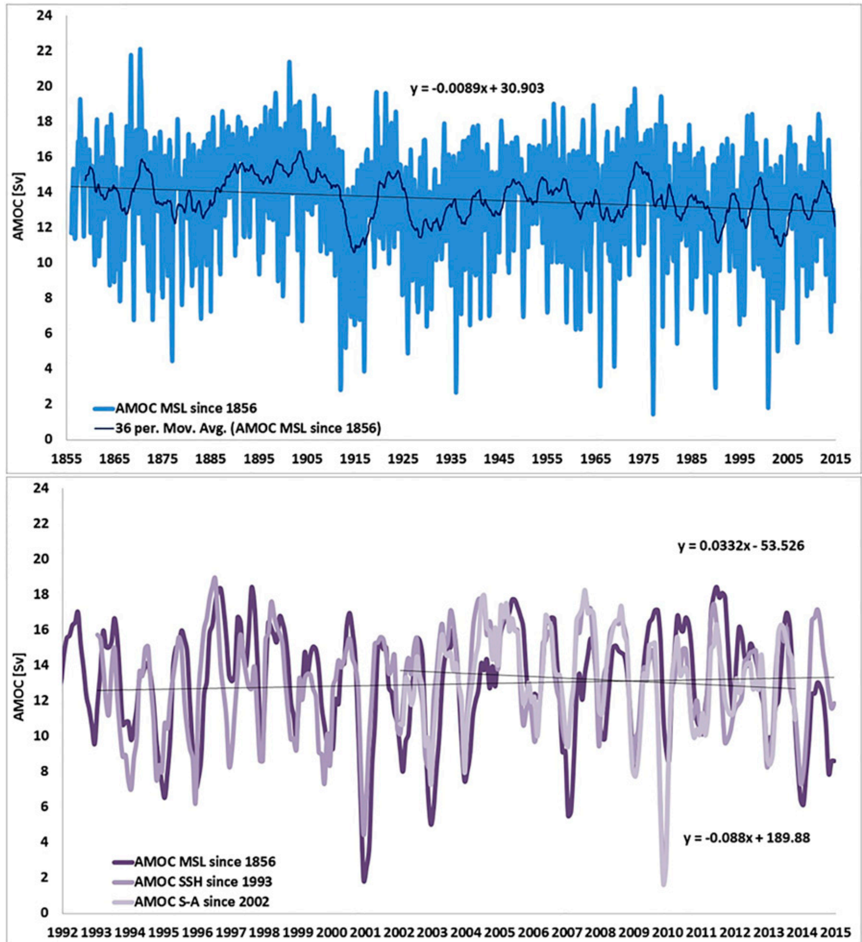

Fig. 1. Time series of the AMOC MSL since 1856 (*Top*) and AMOC S-A, AMOC SSH, and AMOC MSL since 1993 (*Bottom*). The computation of the AMOC S-A and AMOC SSH is described in refs. 8–10. Better details of the computation of the AMOC MSL are provided in ref. 7. Data from ref. 7.

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