Global surface warming accelerated during weak Atlantic overturning circulation

A collaborative study partly sponsored by the National Natural Science Foundation of China reveals the accelerated global surface warming during the phase of weak Atlantic meridional overturning circulation (AMOC), which is different from the traditional view of the warmer period coinciding with vigorous AMOC and colder periods with a weak AMOC. The work entitled "Global surface warming enhanced by weak Atlantic overturning circulation" was coauthored by Professor Chen XianYao (陈显尧) from the Key Laboratory of Physical Oceanography of Ocean University of China, and Professor Ka-Kit Tung from the University of Washington (UW), USA, and published in *Nature* (2018, 559:387—391, doi:10.1038/s41586-018-0320".

In the presence of top-of-atmosphere (TOA) radiative imbalance, earth's surface would have warmed much more rapidly were it not for the buffering role of the deeper oceans. This paper describes and quantifies one of the effective mechanisms for ocean heat sequestration and its variability: the AMOC that spans both hemispheres, responsible for sequestering about half of the excess heat globally during one of its phases. A picture of how AMOC varies through one complete cycle is given: After a relatively stable low phase 1975—1998, AMOC sped up rapidly, and then declined rapidly from the 2005 peak to present. During that stable low phase Atlantic did not sequester additional heat, and the TOA radiative imbalance manifested itself mainly at the surface as rapid global warming for 25 years. This concept of rapid surface warming during a period of low AMOC runs counter to the common perception based on preindustrial data, which becomes inapplicable when there is TOA forcing.

The result indicates that the leading indicators in subpolar Atlantic suggest the current decline is ending and AMOC may now enter into a similar minimum. Therefore, a period of rapid surface warming is expected and may last over two decades.

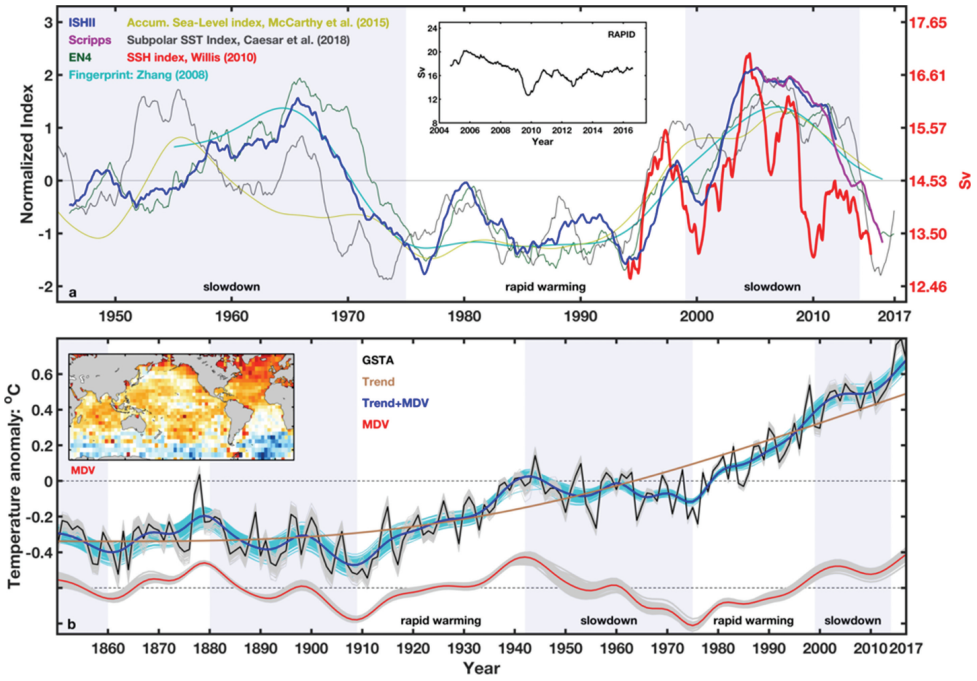

Figure The AMOC proxies and global mean surface temperature variability.