Review of Atlantic Meridional Overturning Circulation (AMOC) Fingerprints from Models and Observations

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To describe the past variability of the AMOC, as well as to evaluate AMOC impacts, it is desirable to develop fingerprints, or characteristic signatures, associated with AMOC fluctuations. The fingerprints need to be quantities that can be derived from both climate models and observations. The identification of such fingerprints will contribute to the interpretation of AMOC changes and will improve assessments of the impacts of AMOC variability on ecosystems, carbon cycles and global climate. In addition, to reconstruct the past variability of the AMOC when no direct observations have been made, it will be necessary to develop proxies for the AMOC state estimate. In this review, I'll cover various AMOC fingerprints or characteristic signatures that have been identified in previous modeling and modern observational studies, such as the Atlantic sea surface temperature (SST), sea surface salinity (SSS), sea surface height (SSH), subsurface ocean temperature, subpolar gyre circulation, Gulf Stream, North Atlantic Current, and North Brazil Current, etc. The relevant paleo proxies for AMOC variations will also be discussed. Finally, the review will cover the current understanding of the linkage between AMOC variability and North Atlantic SST (NASST) variability, both from a diagnostic and mechanistic viewpoint. In particular, the multidecadal variations of NASST during the 20^{th} century have highly debated origins, i.e. some suggested that they are primly driven by changes in aerosols. In depth analyses show that there are important discrepancies between modeled aerosol-forced response and observations, casting considerable doubt on claiming aerosols as a prime driver for the observed multidecadal variations of NASST.