On the (non)stationarity of the AMV-AMOC relationship

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Abstract

In this study we investigate the stationarity of the AMOC-AMV relation in a multi-model set of CMIP6 pre-industrial multi-century integrations. A methodology is devised to identify different AMOC-AMV co-variability regimes relying on a change-point detection algorithm applied to the time-evolving AMOC-AMV cross-correlation. Based on this analysis, the AMOC- AMV relationship reveals sharp transitions between correlated (CR) and non-correlated regimes (NCR), with individual regimes lasting several decades and the transitions occurring in a comparatively shorter (O(10) years) time span. The detected CR/NCR alternation is associated with a consistent non-stationarity in the spectral features of the AMV and AMOC signals, with the transitions from CR to NCR occurring in concomitance with a substantial reduction of the spectral energy in the multi-decadal frequency range. The connection between the detected changes in the correlation regimes and the magnitude of the variability is also inspected. Using the same sliding-window approach adopted for the AMOC-AMV cross- correlation, the time-evolving standard deviation and lag-1 autocorrelation (σ(t) and α1(t), respectively) are diagnosed. A robust feature emerging from this analysis is the strong connection between the degree of AMOC-AMV coupling, as portrayed by the CR and NCR regimes, and the variability, as evaluated by σ(t) and α1(t) of AMV and AMOC. It is found that during CR phases, σ(t) and α1(t) tend to be higher, compared to NCR phases.

Keywords: Atlantic Multidecadal Variability, Atlantic Meridional Overturning Circulation

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