EGU2020-614
https://doi.org/10.5194/egusphere-egu2020-614
EGU General Assembly 2020

Timescale-dependent AMOC-AMO relationship

Hyojeong Kim[1,2] and Soon-Il An[1,2]
[1]Yonsei University, Atmospheric Sciences, Seoul, Korea, Republic of (kimhj29@yonsei.ac.kr)
[2]Irreversible Climate Change Research Center, Seoul, Korea, Republic of

Previous studies showed that both AMOC and AMO work in different ways in interdecadal and multidecadal timescales. Although their relationship has also been covered in many studies, the possibility that overlapping between multiple timescales may have diluted their inherent relation has not been considered. To understand their physical relation correctly, it is necessary to consider interdecadal and multidecadal timescales, separately.

Here, we apply a band-pass filter to the AMO and AMOC indices obtained from a present-day climate simulation, to separate interdecadal and multidecadal variability. The results show that strong AMOC induces a warm phase of AMO by the northward heat transport in both timescales, but with a different time lag. This is because, in the interdecadal timescale, the southward propagation of AMOC anomaly gradually warms up the Atlantic basin from the high to low latitudes, resulting in a lag of seven years. As the delayed AMO peak provides negative feedback to AMOC by surface density modulation, the AMOC-AMO relationship can be described as an oscillatory system. On the other hand, AMOC in the multidecadal timescale matures at once in the entire basin, simultaneously warming the surface. The synchronous maturity of AMOC and AMO indicates that AMO-related density changes cannot account for the AMOC phase transition, and AMO remains a relatively passive component in their relationship. This study implies that overlooking timescale-dependency in physical processes may obscure our understanding of interactions between climate components.