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Multidecadal variability of the Meridional Overturning Circulation as an air-sea coupled mode

X. Zhu (1), J. Jungclaus (2), K. Fraedrich (1)

(1) University of Hamburg, Meteorological Institute, Bundesstr. 55, 20146 Hamburg, Germany, (2) Max-Planck Institute for Meteorology, Bundesstr. 53, 20146 Hamburg, Germany

The Meridional Overturning Circulation (MOC) in the coupled ECHAM5/MPIOM exhibits Multidecadal Variability (MDV) at about 60 years. The MDV damps out when the atmosphere-ocean coupling is partly or completely inhibited and therefore interpreted as a coupled mode. Further analyses show that the time scale is determined by ocean advection of temperature anomalies, which have consequences on the deep water formation and the strength of the MOC. The atmosphere is involved by directly spinning up or down the subpolar gyre and by influencing the intensity of the oceanic heat loss in the Labrador Sea Basin. The associated sea level pressure pattern transforms continuously between a NAO-like north-south dipole and an east-west dipole pattern, showing an imprint of the MOC-related sea surface temperature on the atmosphere. This MOC variability is likely related to the multidecadal variability in the North Pacific and over the Eurasia continent.