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The influence of the Canary Current System on the seasonal variability of the Atlantic Meridional Overturning Circulation at 26°N from a high-resolution model

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Previous studies showed that the seasonal cycle of the Atlantic Meridional Overturning Circulation (AMOC) at 26.5°N predominantly arises from density variations at the Eastern boundary. Here, we present results from a high-resolution ocean model (STORM), where we find that the seasonal cycle of the AMOC has its origin in the seasonal variability of the Canary Current System, which in turn mainly originates from the seasonal variability of the trade winds.

In the model, the meridional transports at the eastern boundary of 26.5°N are characterized by the Canary Current System: the Canary Current flows southward at the surface, and the poleward undercurrent (PUC) flows northward beneath the Canary Current. The seasonal cycle of the Canary Current System is dominated by the seasonal variability of the PUC. At 26.5°N, the simulated PUC shows a minimum transport of 2.0 Sv in March, and a maximum transport of 4.1 Sv in September. The seasonal variability of the PUC has been linked in previous studies to upwelling at the African coast induced by the trade winds. In agreement with observations, we find a lag of 1-3 months between the seasonal cycle of the PUC and the wind stress curl at the eastern boundary of 26.5°N.

Integrated from the Eastern boundary to 17°W, the seasonal cycle of the Canary Current System corresponds to the seasonal cycle of the geostrophic upper mid ocean transport (T_{UMO}). As in the observations from the RAPID 26N array, the seasonal variability of the simulated AMOC is dominated by the seasonal cycle of T_{UMO}. In a basin-wide analysis, we also show that in the model the seasonal cycle in T_{UMO} forms at the eastern boundary and propagates westward, taking about 5 years to reach the western boundary.