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Anomalous Wind-Stress and Heat Surface Fluxes and their Relationship with the Intergyre-gyre in the North-Atlantic

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Numerical experiments using a regional version of ORCA 0.5 showed that winter wind-stress and heat surface fluxes anomalies, both associated with the North Atlantic Oscillation (NAO), induced different dynamics in the North-Atlantic. While the first created an intergyre-gyre anomalous circulation, i.e., an acceleration of the sub-tropical gyre and a decelaration of the sub-polar gyre, the heat surface fluxes anomalies accelerated both gyres. The intergyre-gyre anomalous circulation had a response in phase with the anomalous wind-stress forcing, but it almost vanished within 1 year. On the other hand, the acceleration of the sub-polar gyre induced by the heat surface fluxes anomalies reached its peak with a delay of 1 to 2 years, with maximum amplitudes that are about half of those obtained with the wind-stress forcing. The Meridional Overturning Circulation (MOC) had also an in phase response with the wind-stress, decaying quickly with time, and a delayed response with the heat surface fluxes anomalies that reached its peak within 1 to 2 years after the anomalous forcing is applied. The mixed layer depth experienced some variability associated only with the heat surface fluxes, but, differently from the other variables, that response was in phase with the anomalous forcing and it vanished after 1 year.