Geophysical Research Abstracts
Vol. 21, EGU2019-10010-1, 2019
EGU General Assembly 2019

On the vertical structure and generation mechanism of a deep anticyclonic vortex in the central Rockall Trough, northeast North Atlantic

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In the present study, the co-analysis of altimetry, fortuitous high-resolution ship-board wintertime Conductivity-Temperature-Depth and high-resolution Regional Oceanic Modelling System model output data sets brings new insights on a persistent, non-stationary, deep anticyclonic vortex in the Rockall Trough (RT), northeast North Atlantic (NA). The anticyclone is at times centred at approximately 55°N, 12°W. Long-term altimetry data, as noted in other studies, reveal the presence of the anticyclone at the aforementioned location. Our findings show that 1) the altimetry-defined anticyclone is an imprint of the warm and salty anticyclone's core at intermediate depths and 2) that the central RT anticyclone is locally formed, as a result of interactions between the current flowing poleward along the eastern RT slope and topography. The current, modulated by the background eddy field, generates large horizontal potential vorticity gradients due to frictional effects along the RT south-eastern slope. Intense negative vorticity filaments are formed, subsequently detaching from the slope, encapsulating Mediterranean Overflow Water (MOW) as they become unstable and grow into submesoscale anticyclonic vortices. These MOW-rich vortices are advected into the trough, consequently merging with the central RT anticyclone and sustaining it. We hint on the importance of the RT anticyclone on intermediate water masses distributions and modifications in the study region, as well as the anticyclone's impact on heat and salt budgets locally, and potentially, further afield across the subpolar northeast NA.