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On the dynamics of a deep anticylonic eddy in the Rockall Trough

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A new study has put into perspective the presence of a permanent deep anticyclonic eddy in the Rockall Trough (RT), west of Ireland. This eddy is located at a crossroad where different water masses meet and interact with each other. Using the terrain following coordinates ocean model ROMS (Regional Oceanic Modelling System) we study the generation and life cycle of the RT anticyclone.
We show that the main source of anticyclonic barotropic vorticity for the RT anticyclone is the divergence of eddy vorticity fluxes, and the main sinks are bottom stress and bottom pressure torque.
Eddy vorticity fluxes are mostly due to the advection of vorticity by anticyclonic submesoscale coherent vortices generated on the eastern RT slope. Interactions between the current flowing poleward on the eastern side of the RT and the continental slope induce anticyclonic vorticity generation in the bottom boundary layer. Detachment of the vorticity layer from the slope at specific locations induce centrifugal instability and formation of submesocale anticyclonic eddies. These eddies are then advected toward the center of the RT and merge with the RT anticyclone, continuously feeding it with anticyclonic vorticity.
The amplitude of the RT anticyclone is partly controlled by interactions with the topography, through bottom stress and bottom pressure torque, which acts as the main sinks of barotropic vorticity. The RT has a bowl shape, and the eddy is trapped close to its deepest part. The amplitude of the anticyclone is also controlled by centrifugal instability, which is triggered when the RT anticyclone becomes too intense.