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Interannual variability of the Zapiola gyre: a potential vorticity flux perspective

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A new framework is proposed for analysing the interannual to decadal variability of barotropic circulations in ocean model outputs. This framework allows to examine the various contributions to the slow evolution of the low passed filtered barotropic vorticity averaged in an arbitrary volume. This approach being based on Ertel potential vorticity (PV) budgets, the contributions of surface forcings and bottom friction can be diagnosed without explicit knowledge of the actual forcing, diffusion and friction experienced by the model solution. The methodology is applied to study the origin of the interannual variability of the Zapiola gyre in a 50-year 1/4° global DRAKKAR hindcast simulation. The Zapiola Gyre is a mostly barotropic, intense anticyclonic circulation centered on the Zapiola Drift at 45°S in the Argentine basin and associated with a local minimum in eddy kinetic energy. The analysis reveals that the model solution is consistent with the classical view of the Zapiola Gyre : the barotropic circulation results from the equilibration of a turbulent PV flux (corresponding to a positive eddy mass flux above the Zapiola Drift) with a frictional PV flux in the bottom layers. The analysis also reveals the role of the various PV fluxes in driving the interannual variability of the Zapiola gyre.