Geophysical Research Abstracts
Vol. 21, EGU2019-14002, 2019
EGU General Assembly 2019

Intense cyclogeostrophic mesoscale anticyclone: Ierapetra Eddy

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Mesoscale eddies, having a characteristic radius equal or larger than the local deformation radius, are generally considered to be geostrophic. Even if this is true for most of them, there are nevertheless few cases where the ageostrophic velocity components induced by the local curvature of the streamlines are not negligible. To investigate the full cyclogeostrophic balance of intense mesoscale eddies we optimized an iterative method which computes with the best accuracy the ageostrophic corrections to the geostrophic surface velocity of the AVISO/DUACS products. We found that these ageostrophic corrections are needed for most of the mesoscale anticyclones that have a geostrophic vortex Rossby number larger than $Ro > 0.1$. We apply this ageostrophic correction to fifteen years (2000-2015) of AVISO/DUACS geostrophic velocity fields, gridded at 1/8° for the Mediterranean Sea. The Ierapetra Eddies (IE) are, with the Alboran gyres, among the most intense anticyclones of the Mediterranean Sea. The IE vortex Rossby numbers experience a strong seasonal variability and could vary by a factor 4, from $Ro=0.07$ to $Ro=0.27$. Moreover, we found that after their formation, IEs could re-intensify and double their intensity in less than 4 months. The maximum values of the core vorticity might sometimes exhibit a negative potential vorticity core. Evidences on the eddy intensity from several oceanographic campaigns (VMADCP measurements) suggest that the mesoscale IEs are probably more intense than we even estimate. Finally, by means of a simplified rotating shallow-water model forced by a transient wind forcing, which mimic the seasonal Etesian winds, we provide the first dynamical explanation for the strong intensity of IEs and the re-intensification process both detected from remote sensing analysis.