Geophysical Research Abstracts
Vol. 18, EGU2016-9976, 2016
EGU General Assembly 2016

Cyclogeostrophic correction of the AVISO surface velocities for intense surface eddies and its application to the Mediterranean Sea.

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The recent progress in automated eddy detection algorithms enables to identify the positions of coherent structures and to follow their Lagrangian trajectories during several months. Several algorithms use the surface geostrophic velocities derived from the satellite altimetry to detect and quantify the dynamical parameters of the surface eddies. However, it is well know that for a given horizontal pressure field, the neglect of centrifugal accelerations results in an overestimation of the velocities in the cyclonic eddies and an underestimation in the anticyclonic eddies. This discrepancy is expected to be even more pronounced with the future altimetry products able to quantify the sea surface deviation at smaller scale.

The main goal of this study was to identify the range of parameters where the cyclogeostrophic correction is needed to quantify accurately the vortex Rossby number and the relative core vorticity of surface eddies. The impact of the eddy shape and its ellipticity on the cyclogeostrophic correction was investigated. The perturbative and iterative methods were both tested to provide a robust and optimized algorithm able to converge for a wide range of parameters. We found that a quintic interpolation of the initial geostrophic velocity on an higher resolution grid leads to a better estimation of the cyclogeostrophic corrections. This algorithm was tested on the 1/8° AVISO regional product available for the Mediterranean Sea. Errors up to 20% to 30% were accounted for few intense cyclonic and anticyclonic structures between the geostrophic velocities and the cyclogeostrophic fields.