Interaction of two baroclinic vortices near a continental slope : horizontal merger and vertical breaking

Xavier Carton*[1], Jean N. Reinaud , Mathieu Morvan , Charly De Marez , and Pierre L'hegaret

[1]Université de Brest (UBO) – Université de Bretagne Occidentale [UBO] – France

Résumé

In a three layer quasi-geostrophic model, we study the interaction of two identical vortices (either two cyclones or two anticyclones) near a localized, parallel bottom slope. These vortices are initialized as circular potential vorticity distributions in the upper two layers only.
In the absence of the bottom topography, the two vortices merge when closer than about 3 radii. In the presence of a bottom slope, a single vortex drifts towards the slope (C) or away from it (AC) and can break vertically if close enough to the slope. This drift and this breaking are due to the formation of topographic vortices in the bottom layer ; these vortices induce a vertical velocity shear on the original vortex.
When two vortices are initialized near the slope, their merger is affected both by the cross-slope drift and by the vertical velocity shear. The competition between these effects is assessed in terms of time evolution of vorticity distribution, deformation field, generation of vorticity fronts, deformation and separation of the upper two vorticity patches, and of the transport of passive tracers. The presence of a bottom slope is favorable to the merger of vortices initially separated by more than 3 radii. But the efficiency of the merging process is reduced by the horizontal shear created by the topographic vortices. These vortices also create a vertical shear able to break the original vortices vertically, if close enough to the slope. The height and steepness of the bottom topography are varied to assess its effect on the various nonlinear regimes.

Mots-Clés: Mots, clés : stratified rotating flows, quasi, geostrophic model, bottom topography, horizontal vortex merger, vertical vortex breaking

*Intervenant