SIMULATING WATER MIXING IN A BAROTROPIC ESTUARY: THE EFFECT OF VERTICAL DISCRETIZATION

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Mixing between estuarine and coastal waters is strongly dependent on the processes that occur in the vertical direction. This applies both for stratified and homogeneous estuaries. In homogeneous estuaries important recirculation flows in the vertical plane can arise, in regions with strong batimetry gradients, produced by the combined action of inertia and friction. On the Platform close to the inlet this structures can trap estuarine water during the ebb period, releasing it to the interior again during the flood. Those processes influence the exchange between estuarine and coastal waters.

In order to obtain an accurate simulation of these three-dimensional features, adequate discretizations for the vertical direction must be sought. Traditionally, numerical models have a fixed vertical discretization, with Cartesian, sigma, isopycnic or any other type of vertical co-ordinate. In that case, choosing between vertical discretizations would be a primary and definitive step since it would mean choosing between different models. In this paper an alternative approach is proposed, using a three-dimensional primitive equation model that uses a generic discretization for the vertical direction. In this way different vertical discretizations can be tested using the same model.

The model is applied in Sado estuary (Portugal) to investigate the influence of vertical discretization on the simulation of three-dimensional flows in well-mixed estuaries. Calibrated model results are used to identify regions of intense mixing inside the estuary and on the inlet. The impact of different vertical discretizations upon the presence, size and intensity of those regions is investigated. With the generic discretization technique the same code is used for every run, irrespective of the discretization. This isolates the effects of vertical discretization enabling a reliable comparison of model results.