Nonlinear evolution equations for nonlinear internal waves in the horizontal inhomogeneous ocean

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Two approaches to derive the generalized Korteweg de Vries equation for nonlinear internal waves in the ocean of smoothly variable depth and horizontally inhomogeneous hydrology are compared. The first approach is based on the asymptotic theory, and it results to the 2D Korteweg de Vries equation derived by Djordjevic and Redekopp in 1978. The second one uses the nonlinear ray theory, and it results to the 1D Korteweg de Vries equation along the ray coordinate, derived by Zhou and Grimshaw in 1989 and Pelinovsky et al in 1994. It is shown that the 2D Korteweg de Vries equation can be reduced to the 1D "ray" Korteweg de Vries equation confirming the validity of the energy flux conservation along the ray in smoothly inhomogeneous medium.