Nonlinear internal waves in the Gulf of Guinea: observations and modeling

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Nonlinear internal waves are known hazards to offshore operations. They have been observed at different locations around the world and have been studied for a long time in Southeast Asia. However in West Africa, they are less documented. This research presents original data of currentmeters in northeastern part of the Gulf of Guinea, in the vicinity of offshore oil platforms. Nonlinear internal waves were observed. Their characteristics were determined under the assumptions of the weakly nonlinear and non-hydrostatic Korteweg-de Vries equation. Their directions of propagation were studied to determine generation zones. The monthly distribution was shown to assess seasonal variability. Their main generation mechanism was the barotropic tides over the shelf break, but other processes were at work too. The seasonal variability due to the monsoon, river discharges also played a part in the nonlinear internal wave dynamics. Since several processes, of different time and space scales, are at work, interactions between them must be investigated. Thus, a two-layered numerical model was used to reproduce nonlinear internal waves. Sensitivity experiments were made, in order to investigate the balance between nonlinearities, Coriolis and non-hydrostatic dispersions. The impact of non-uniform bathymetry and the presence of another flow in addition to the tides were also tested.