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Wave - current interactions

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The problem of wave interaction with current is still a big challenge in physical oceanography. In spite of numerous numbers of papers devoting to the analysis of the phenomenon some very strong effects are still waiting for its clear description. One of the problems here is the Benjamin-Feir instability in the presence of variable current. Modulation instability is one of the most ubiquitous types of instabilities in nature. In modern nonlinear physics, it is considered as a basic process that classifies the qualitative behavior of modulated waves ("envelope waves") and may initialize the formation of stable entities such as envelope solitons. We theoretically describe the explosion instability of waves on the adverse blocking current and corresponding frequency downshifting. Waves can be blocked only partly and overpass the opposite current barrier at the lower side band resonance frequency. Theoretical results are compared with available experiments.