

Interactive comment on “Benjamin–Feir instability of waves in the presence of current” by I. V. Shugan et al.

Anonymous Referee #1

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The paper is devoted to a basic problem of evolution of water waves under effects of weak nonlinearity and inhomogeneous currents. Authors develop an asymptotic approach for the problem that contains two small parameters: wave steepness, responsible for nonlinearity, and a ratio of wavelength to the inhomogeneity scale, that accounts for the effect of current. Additionally, they incorporate the simplest models of wave dissipation and breaking in order to describe wave transformation near the so-called blockage point. Authors present results of simulations of their asymptotic model and discuss consistency of these results with previous experimental and theoretical findings. Thus, the paper covers a wide range of physical problems, mathematical approaches, applications and can find its readers easily.

In the reviewer opinion, the paper requires a revision before its publication. Any two-

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parametric asymptotic procedure requires a special care when discussing limits of validity of the procedure for a particular physical problem. Authors ignore or withhold a number of important issues on relevance of their asymptotic approach. Particular remarks are given below

1. Reviewer does not agree that "the model is free from the narrowband approximation for surface waves and relatively weak adverse current" (lines 4-5). The frequency (or wavenumber) detuning of their three-modes model has an order ε . Thus, we have a sort of narrow band approximation. The strength of the current should be consistent with the problem scaling when effects of nonlinearity and inhomogeneity are of the same order of magnitude and, thus, cannot be free from the approximation;

2. Authors develop their asymptotic approach in primitive variables that leads to rather cumbersome expressions. At the same time, the resulting equations should have evident properties of symmetry in indices of satellites 0, 2. In absence of current ($U = 0$) it has to give, in particular, the Manley-Rowe relations that are equivalent to the momentum conservation. These relations give a good basis for qualitative analysis of the effect of current inhomogeneity. Eqs. (16,17,20), unfortunately, do not emphasize this key feature of the system.

3. In sect.4 authors introduce semi-empirical functions of wave dissipation and breaking. The extension of the conservative system (16-18) to the non-conservative counterpart (21-22) looks strange. Additional terms contain terms of different orders in ε . Additionally, denominators of these terms contain small differences of wavenumbers (order of ε). This extension requires to be re-written in more consistent way or additional comments.

Authors present simulations for parameters of previous experimental studies and show strong effects of current on modulational instability for very special cases. An important question is a root to these special and, somewhat, extreme cases. A dependence of the effect on parameters of the current inhomogeneity can be presented to show a

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gradual transition from weak inhomogeneity to the extreme cases. May be additional figures can make the presentation of the results more clear and attractive.

Interactive comment on Nonlin. Processes Geophys. Discuss., 1, 1803, 2014.