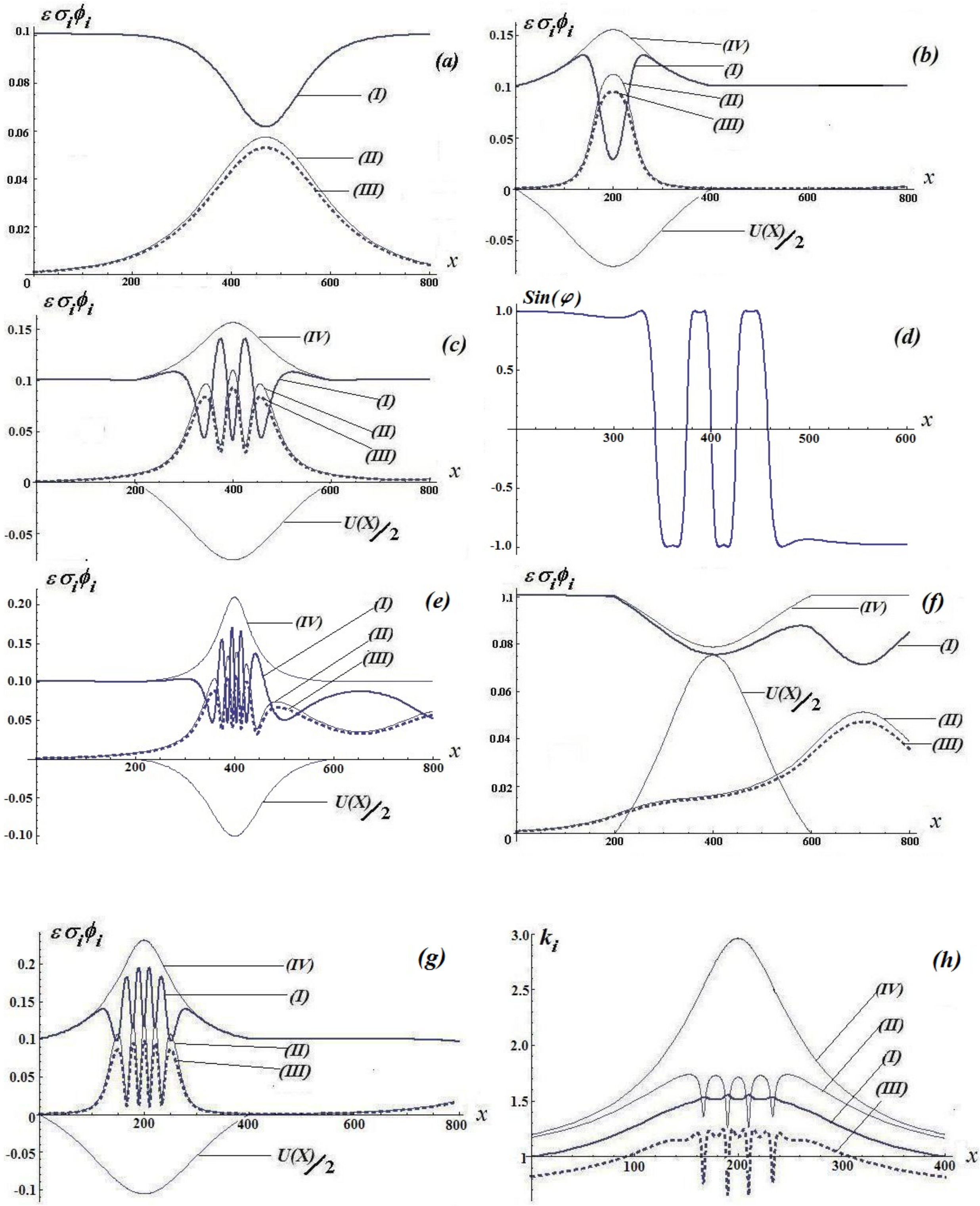
We appreciate 2^{nd} referee for the useful comments and questions which help us to go inside the considered problems.

1. *The obtained system of equations (20) in the limit of a zero (or constant) current should tend to the classic theory for a resonant wave quartet (e.g. Mei et al, Theory and Applications of Ocean Surface Waves. World Scientific, 2009, §14.7). Was this limit verified?*

   The obtained system of equations (20) in the absence of current is similar to classical Zakharov equations for discrete wave interactions (Mei, You and Stiassnie, 2009 . Theory and Applications of Ocean Surface Waves. World Scientific, 2009, 14.9.1-14.9.3). Corresponding references are added to the text.



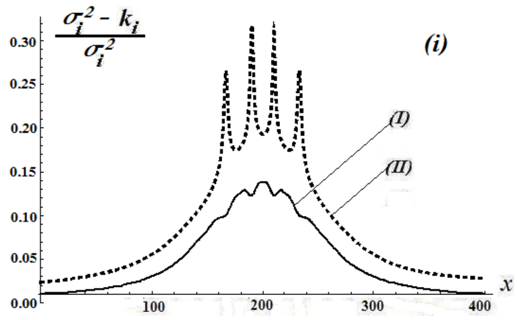


FIG. 1. (a) BF instability without current. (b), (c) Modulation of surface waves by adverse current $U = U_0 Sech\left[\varepsilon^2 (x - x_0)\right]$, ($U_0 = -0.15$); (b) $x_0 = 200$, (c) $x_0 = 400$. (d) phase difference function $\varphi[X] = 2\theta_1[X] - \theta_0[X] - \theta_2[X]$, $\theta_1[0] = 0; \theta_0[0] = \theta_2[0] = -\pi/4$, (e) Modulation of surface waves by adverse current $U = U_0 Sech\left[2\varepsilon^2 (x - x_0)\right]$, ($U_0 = -0.2$), (f) Modulation instability for following current ($U_0 = 0.16, x_0 = 400$). (g), (h) Functions of wave amplitude and wave number respectively for $U_0 = -0.2$. (I), (II), (III) Amplitude envelopes of the carrier, superharmonic and subharmonic waves, respectively. (IV) Linear solution for the carrier envelope. The initial steepness of the carrier wave is $\varepsilon = 0.1$. (i) Relative distortion of the linear dispersion relation for the case (g), (I) – carrier, (II) – higher side band.

2. Let us focus on the stationary boundary problem (Sec. 3). The interacting waves are assumed to be in resonance along entire Ox, though their local wavenumbers vary according to (19) (and some nonlinear corrections to σ_j). Therefore the waves naturally get detuned, what should destroy the description (the modal approach is applied in Shrira & Slunyaev, J. Fluid Mech., 738, 65-104 (2014) to overpass a similar obstacle). Am I mistaken?

This is a really important question. Absolute frequencies for the stationary modulation satisfy to quasi-resonance conditions (7) for the entire region of interaction. But that is may be not the case for the local wave numbers and intrinsic frequencies - they are substantially variable due to current effects and nonlinearity. Here evidently appears one more critical question: may be due to interaction with current and nonlinearity effects the almost resonance conditions are totally destroyed due to large detuning? (*Shrira & Slunyaev, J. Fluid Mech., 738, 65-104 (2014)*)

To clarify this property we add to manuscript the figure describing the typical behavior of phase-shift difference function $\varphi[X] = 2\theta_1 - \theta_0 - \theta_2$ (Figure 1d) for the wave modulation presented at Figure 1c. Intensity of nonlinear energy transfer mostly defined by this function together with wave amplitudes. (see equations (17), (20)). Result looks for us rather surprising - several strong phases' jumps take a place with corresponding changing of the wave energy fluxes direction. But in any case we see an intensive quasi-resonant energy exchange in the entire interaction zone. Quasi-resonant conditions are satisfied locally in space with a relatively small detuning value. Qualitatively similar behavior of phase-shift function we found also for other regimes of wave modulation.

3. *The authors claim that the present theory and the linear solution for the carrier envelope on variable current give different estimations for the wave maximum (Fig.1b). At the same time, the maxima are significantly closer in Fig.1c. It is interesting to know how significant is the difference between the developed theory and the analysis of the modulational instability of the current-modified nonlinear Schrodinger equation (derived in the cited work by*

Onorato et al.). The comparison between the theories and laboratory measurements (Fig. 2) does not lead to a decisive conclusion, which theory is better. In this respect the paper by C. van Duin (J. Fluid Mech., 399, 237-249, 1999) may be relevant.

We recalculate the amplification of waves on adverse current presented on Figures 2, a,b in accordance with conditions of Toffoli et al. (2013) and Ma et al. (2013) experiments. Waves are generated in a still water and then undergo a current quickly raised to a constant value -*U*. (not gradually increased opposite current through entire tank as in previous simulations)

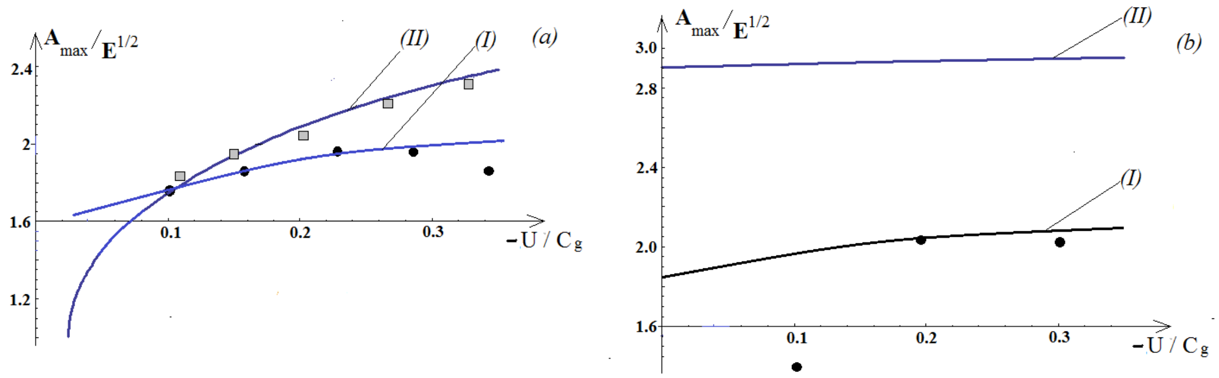


FIG. 2. Nondimensional maximum wave amplitude as a function of U/C_g, where C_g is the group velocity of the carrier wave and $E^{1/2}$ is the local standard deviation of the wave envelope.

(a) Experiments conducted by Toffoli et al. (2013) for carrier wave of period $T = 0.8s$ (wavelength $\lambda \cong 1m$), initial steepness $k_1 a_1 = 0.063$, and frequency difference $\Delta\omega / \omega_1 = 1/11$. Solid dots show measurements made using a flume at Tokyo University and squares show results obtained at Plymouth University. Line (I) shows the resonance model prediction while line (II) shows the prediction made using Eq. (2) (Toffoli et al. (2013)).

(b) Case T11 in Ma et al. (2013) for carrier-wave frequency $\omega_1 = 1Hz$, initial steepness $k_1 a_1 = 0.115$, and frequency difference $\Delta\omega / \omega_1 = 0.44 a_1 k_1$. Solid dots show measurements. Line (I) shows the resonance model prediction, while line (II) shows the prediction made using Eq. (15) (Toffoli et al., 2013).

Our simulations confirm that initially stable waves in experiments of Toffoli et al. (2013) undergo a modulationally unstable process and wave amplification in the presence of adverse current. Maximum amplification reasonably corresponds to results of experiments in Tokyo University Tank for moderate strength of current. Maximum of nonlinear focusing in dependence on the value of current is weaker compare to the model of Toffoli (2013).

Experiments of Ma et al. (2013) (Figure 2b) show that the development of the modulational instability for a gentle waves and relatively weak adverse current ($U/C_g \sim -0.1$, see the first experimental point) is limited due to the presence of dissipation. Our resonance-model simulations are in a good agreement with the experimental values for the moderate values of adverse current $U/C_g \sim -0.2 - 0.4$. Results of Toffoli et al. (2013) notably overestimate the maximum of wave amplification.

4. *The variation of sideband wavenumbers due to nonlinearity (according to authors' description, – gaps on the corresponding curves in Fig. 1f) – are of order O(1) of the carrier wavenumber. At the same time, the value of k1 is just slightly altered. Does this mean that the situation is too much nonlinear? Do the dependences look more realistic for smaller waves?*

To give an idea about the strength of nonlinearity we present one more Figure (1i) with distortion of the linear dispersion relation for different modes. As one can see the effect of nonlinearity for the carrier (at maximum is about 10%) is much less compare to side bands (at peak is more than 30 %). The main impact of nonlinearity comes from amplitude Stokes dispersion.

5. I am puzzled by the curves in Fig. 1a,b,c,e.

5.1) *Two spatial scales seem to exist: of the nonlinearity, and of the current. According to authors' choice they are of same orders, but may be aliquant. Why there is always an integer number of oscillations under the current profile? The solutions seem to be perfectly symmetric. Why?*

The modulation equations permit symmetrical solutions for the symmetrical current function, but, of course, here is no any special obligations. Outside of interaction zone we may have different kinds of nonlinear periodic waves depending from the boundary conditions and constant Stokes wave is only one of the possibilities. The symmetrical behavior is typical for a sufficiently long scale current. We add one more Figure 1.e with the same wave initial characteristics as for Figure 1c and two time's shorter space scale of the current. After interaction zone we see three wave system with comparable amplitudes and periodic energy transfers.

5.2) *Do the authors have an idea, why the location of the current maximum (cf. Fig. 1b and Fig. 1c) results in such big difference between the solutions?*

As one can see from Figures 1b -1c the initial stage of wave-current interaction is characterized by the dominant process - absorbing of energy by waves where all three waves grow simultaneously. Preliminary growth of side band modes (Figure 1c) leads to more deep modulated regime. Increasing of wave steepness in turn accelerates instability and finally these two dominate processes alternate. Correspondingly, the triggering of this complicate process is essentially depending from the displacement of the current maximum.

5.3) In the course of modulational growth the superharmonic attains larger amplitude than the subharmonic. This contradicts the classical result, which is opposite (i.e. Tanaka, Wave Motion, 12, 559-568, 1990, or the recent study by Slunyaev & Shrira, J. Fluid Mech., 735, 203-248, 2013).

Frequency upshift and not downshift first was received for the three-wave calculations by Stiassnie & Shemer (1987) using Zakharov equations. They predicted that at peak modulation the upper sideband amplitude becomes slightly bigger than that of the lower. This effect is unavoidable "price" for using three wave's weakly nonlinear conservative interaction model. (This conclusion immediately follows from the Mainly-Rower conservation integrals). (By the way, it looks like we see some confusion in the cited book of C.C. Mei et al. - Figure 14.6 really show upshift and not downshift, see Stiassnie & Shemer (1987)). The experimental evidence contradicts this prediction. The spectral downshift has been predicted by computations made by the Dysthe equations (Lo & Mei 1985; Trulsen & Dysthe 1990; Hara & Mei 1991) for a much more number of excited waves, the same prediction was also made by simulations of fully nonlinear equations (i.e. Tanaka, Wave Motion, 12, 559-568, 1990, Slunyaev & Shrira, J. Fluid Mech., 735, 203-248, 2013).

The principle aspect here seems to be the temporal character of slight frequency shift - at the end of the modulation loop the system revert to the almost initial state with some energy spreading to higher frequencies. Situation is principally different for relatively high initial wave steepness - at the peak of modulation the system loose the energy due to breaking mostly at the expense of super harmonic and higher frequency modes. So we can observe permanent frequency downshift with final dominating of the lower subharmonic and wave system does not revert to its initial state. This process can be described more or less adequately by the three wave's dynamical model including dissipation effects.

Corresponding references are added to the text

Minor remarks.

– Capture to Fig. 2. What is "SD"? The spectral widths for panels (a) and (b) are given in different manners, what may lead to confusion.

SD=Standart Deviation of wave envelope.

The value of the breaking parameter γ *is not specified.*

Empirical parameter was assumed $\gamma = 0.7$