Review on paper

**Modulational instability and rogue waves in finite depth water depth**

by

by L. Fernandez, M. Onorato, J. Monbaliu & A. Toffoli

The paper reports on $3D$ numerical simulations of gravity wave trains on finite depth subject to the Benjamin-Feir instability. The study includes values of the dispersive parameter, $k_0h$, less than the critical value 1.363. This investigation is aimed at showing that rogue waves can be generated by modulational instability in finite depth, namely when $k_0h < 1.363$.
Before acceptance of the paper, I have important and minor comments that I would like the authors take into account.

**(i)** What are the values, in the computational domain, of the components of the wave vectors of the carrier wave ($k_0 = 5?$) and sidebands ($\Delta K_x = 1$, $\Delta K_y = 0.7 \,\mathrm{or}\, 0.77?$). The values of these parameters are not given explicitly. What is the number of modes in the two directions? As I understand the values of $\Delta K_x$ and $\Delta K_y$ are unchanged while $k_0h$ and $a_0k_0$ vary and so it is not always the most unstable or almost unstable modes which are selected. For instance, the linear stability analysis of McLean for $k_0h = 1$ and $a_0k_0 = 0.10$ shows that the most unstable class I instability corresponds to $\Delta K_x/k_0 = 0.28$ and $\Delta K_y/k_0 = 0.19$, i.e. $\Delta K_y/\Delta K_x = 0.67$ instead of 0.77. For infinite depth, $\Delta K_x/k_0 = 0.18$ which is close to the value used in the paper. To conclude section 3 does present clearly the choice of the parameters discussed above.

**(ii)** How is computed the nonlinear basic wave?

**(iii)** In $3D$ (or $2D$ propagation), I believe that the frequency downshifting phenomenon observed in tanks or in numerical simulations without dissipation, is due to the confined aspect in the transverse direction. If $l$ is the transverse dimension of the tank, there is a forced selection of modes whose transverse wavenumbers are $n\pi/l$ with $n = 1, 2....$ The same mechanism may work in numerical tanks. In other words oblique perturbation is selected at the expense of the collinear perturbation. Furthermore, I suspect a numerical artefact when I see in Fig. 3c that for infinite depth the dominant mode becomes an oblique one. From my point of view the frequency observed by Trulsen *et al* (1999) in confined geometry does not prove that it prevails in open natural conditions.

**(iv)** Results presented in Fig. 9 are biased because the instability of higher order are not introduced in the initial conditions or excited at the maximum of modulation. In fact, there is a coupling between class I instability and class II instability that leads to breaking wave in infinite and finite depth as well. A deeper discussion is needed in the paper about this coupling. I do not agree with the last paragraph of section 4 (pages 5246-5247). In deep water, it is shown experimentally (see Su & Green, 1985) and numerically (see Fructus *et al*, 2005) that there is a coupling between class I and class II instabilities that results in $3D$ breaking waves of wave trains with initial steepness as low as 0.12. When $a_0k_0$ is less than 0.12, class I instability stabilizes class II instability. A diagram can be found in Fructus *et al* showing predominance of class I instabilities versus class II instabilities for $k_0h = \infty$ and $k_0h = 1$ as a function of the wave steepness. These results were confirmed and supplemented by Kristiansen *et al* (2005) in finite depth. In addition, it is shown by Francius & Kharif (2006) that higher-order instabilities become more important in shallower water.

## Refrences

**Su M.Y.** & **Green A.W.** 1985 Wave breaking and nonlinear instability coupling. In *The ocean surface: Wave breaking, Turbulent mixing and Radio Probing* (eds. Y. Toba & H. Mitsuyasu).

**D. Fructus** *et al* 2005 Dynamics of crescent water wave patterns. *J. Fluid Mech.*, **537**, 155-186.