

## ***Interactive comment on “Multiscaled Solitary Waves” by Oleg G. Derzho***

### **Anonymous Referee #2**

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Author studies the structure of the solitary wave in the weakly stratified fluid on density. If the difference in the density profile from the linear one can be presented by the high-order polynomial. If all terms of this polynomial have the same order, the solution of the Dubreil-Jacotin-Long equation can describe the multiscaled solitary waves. Author also discusses how this result can be obtained from the high-order Korteweg-de Vries equation but KdV-like equation is not derived. This result is interesting, meanwhile, I have some comments.

First of all, author says that usually the KdV-like equation contains quadratic and cubic nonlinearities, and highest nonlinear terms can be neglected. In fact, the analysis of the three-layer fluid demonstrates that such both nonlinearities can be small and here highest nonlinearity should be accounted. In particular, the specific “2+4” KdV-like equation has been derived with use of asymptotic procedure for waves in three-layer fluid in papers:

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Kurkina O.E., Kurkin A.A., Soomere, T. Pelinovsky E.N., Ruvinskaya E.A. Higher-order (2+4) Korteweg-de Vries - like equation for interfacial waves in a symmetric three-layer fluid. Physics Fluids. 2011, vol. 23, 116602.

Kurkina O. E., Kurkin A.A., Ruvinskaya E.A., Pelinovsky E.N., Soomere T. Dynamics of solitons in a nonintegrable version of the modified Korteweg – de Vries equation. JETP Letters, 2012, vol. 95, No. 2, 91-95.

In general, it contains all nonlinear terms of the same order, but authors of cited paper analyzed in details a case when only cubic and quintic nonlinearities are keeping in the KdV-like equation. The structure of the solitary waves in the KdV-like equation with all nonlinear terms up to 5th order is also discussed in two papers:

Poloukhina O.E., Pelinovsky E.N., Slunyaev A.V. Extended Gardner equation for internal waves in stratified fluid. Institute of Applied Physics, Preprint, 2002.

Poloukhina O.E., Slunyaev A.V. Extended evolution model based on the Gardner equation for internal waves in stratified fluid. Izvestiya, Academy of Engineering Science, 2006, vol. 18, 82 – 90.

(Both last papers are in Russian and I ask Efim Pelinovsky to send these papers directly to author). The solitary waves interact inelastically. All such models are not integrable and they lead to instability of waves of large amplitudes.

Instability of solutions of the “n-nonlinear” KdV equation (with term  $u^n$ ) for  $n > 4$  is well-known, and it is evident for me that such instability should be in Derzho’s model which is not discussed. This should be clarified in revised paper.

Minor remarks:

Page 1: line 12 - may be useful to add the reference as Grimshaw R., Pelinovsky E., Talipova T. Damping of large-amplitude solitary waves. Wave Motion, 2003, V. 3, No. 4, 351 - 364 where the various kinds of damping terms and their influence on the shapes of the solitary wave are studied.

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page 4: Fig.1 - the title of axes "alfa" is plotted instead of "alpha" Fig.2 - to add the title in the vertical axes

line 10 - may be "three - humped"?

page 5: Fig.3 - to add the titles in both axes

I recommend to accept the paper after the revision.

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Interactive comment on Nonlin. Processes Geophys. Discuss., doi:10.5194/npg-2017-11, 2017.

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