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Comment on gmd-2021-102

Anonymous Referee #2

Referee comment on "ISWfoam: a numerical model for internal solitary wave simulation in continuously stratified fluids" by Jingyuan Li et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-102-RC2>, 2021

This article uses the ISWfoam model developed based on OpenFOAM to realize the simulation study of the generation, propagation and evolution of the internal solitary wave (ISW). By comparing with the experimental data, the authors point out that the ISWfoam model with unstructured grids and local mesh refinement can accurately simulate the generation and evolution of ISWs, the ISW breaking phenomenon and the interaction between ISWs and complex structures and topography. Due to the interpretation of the article and the code, some questions need to be solved. Compared with the original code in OpenFOAM, ISWfoam does not reflect its own characteristics and innovation. The ISWfoam built in this paper is an integration of the OpenFOAM base tools, rather than a new developed code. Compared to the existing works on the ISW simulated by OpenFOAM, ISWfoam does not show its advantages and comprehensiveness. Based on the above reasons, I suggest to reject this manuscript.

Other comments and suggestions are listed as follows.

1. The manuscript mentions that "the wave generation method is essential for a two-layer system" on Page3 line 85, as described in the manuscript and code, the ISWfoam generates the ISW by the horizontal velocity derived from ISW theory. The corresponding code is in 'setUFields.C'. The initial density distribution in the flow field is established by the ISW theory with the hyperbolic tangent function profile. The corresponding code is in 'setRhoFields.C'. The mere comparison of the DJL equation and the eKdV equation does not show that the ISW generation method used in this manuscript is excellent. More equations including KdV, mKdV, MCC et al., should be examined in the ISWfoam. The article does not do enough work on ISW generation. In addition, the initial flow fields can be set using 'setFields' in OpenFOAM and 'funkySetFields' in swak4foam.

2. According to the introduction of the governing equations in the article and the code, by taking the variation in density into account, 'interFoam' enables a simulation study of ISW,

and the value of the authors' work is not reflected. The section 2, which describes the model and the various methods, also comes with OpenFOAM and can be found in the user manual. The article should describe the characteristics of ISWfoam and how it differs from the original program.

3. It has been explained in the Introduction that ISW research has already been implemented using OpenFOAM, what are the differences or advantages of ISWfoam from those existing codes?

4. The meaning of the star icon in Figs. 4 and 5 should be indicated.

5. If a rigid lid is used for the top boundary, then the free surface should not be labelled in Figs. 6 and 7.