

RC1: 'Comment on egusphere-2023-1920', Anonymous Referee #1, 01 Oct 2023

Referee's Report on " A new approach to understanding fluid mixing in process-study models of stratified fluids " by Hartharn-Evans et al.

The authors proposed a tool for identifying stirring and mixing processes in stratified media. The approaches by Penney et al. (2020) and Grace et al. (2021) were extended and generalized. Bivariate weighting histograms of fluid variables were used to identify mixing fluid. The weighting was related to the probability a volume of fluid has given properties in a 2D plot.

Two test cases were considered: shoaling internal solitary wave on bottom slope and shear instability in cold temperature stratified water. Unlike Penney et al. (2020) where the density-tracer pair was considered, the authors considered the density-kinetic energy pair. The results of a qualitative analysis of the diagrams are presented.

The developed approach is new and has a perspective used in different geophysical problems. The paper can be worth to be published in Nonlinear Processes in Geophysics after minor revision.

The authors thank the referee for their time and useful comments which have helped improve the manuscript. Please find below detailed responses to each of the reviewers comments in blue. Changes in the revised paper have been tracked, and a copy made available with these changes visible.

Specific comments

Introduction. It would be useful to include in the review other diagrams of the state and evolution of turbulence in a stratified medium (e. g. Caldwell (J. Geophys. Res. 88 C12, 19) and Gibson (J. Mar. Syst. 21, 1999)).

Thank you for these suggestions, a note about the historic use of graphical methods to understand turbulence in a stratified system has been added at the start of paragraph 4.

Fig. 4 caption Explain, please, what is shown in the plates of the middle row.

These plates show the regions of interest in the flow, with the fluid that meets the paired criteria shown in dark red. Words to this effect have been added to the caption of Figure 4.

L 24 Samgorinsky read as Smagorinsky

Thank you, this is now corrected

