Earth Syst. Dynam. Discuss., referee comment RC1
https://doi.org/10.5194/esd-2022-27-RC1, 2022

Comment on esd-2022-27

Anonymous Referee #1

Referee comment on "The effect of strong nonlinearity on wave-induced vertical mixing" by Maciej Paprota and Wojciech Sulisz, Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2022-27-RC1, 2022

This article addresses the interesting question of the effect of wave-induced currents on mixing. The article could eventually be published, but some issues should be addressed in a major revision.

Regarding the wave generation:
It is not clear why the authors are using wavemaker theory here. In a numerical model, more elegant methods are available to intruduce waves.
While "monochromatic wavemaker motion" gives a clear number of cases to be examined, a more realistic scenario would be to consider a wave spectrum

About the particle tracking:
The authors state that "the improvements to the method of evaluation of mass transport velocity based on the Lagrangian
particle tracking (Paprota and Sulisz, 2018) are introduced" (line 168-169). It is not quite clear what they mean by this.
Please be more specific about the improvements.
It is also not clear why we need Lagrangian particle tracking siden for example eq. (29) only uses the Eulerian velocities.

About the mixing:
What is the relative size of the mixing efficiencies kappa(m) and kappa(v) ?
The authors state the the dimensionaless parameter alpha has been measured .....
Can you be more specific?

In the abstract, the authors state that this work may lead "to improved estimates of subsurface mixing intensity and ocean surface temperature."

Do the authors mean in the nearshor ocean?

Note: in the caption of Table 1, the authors state that they "wave-induced vertical mixing processes in offshore conditions."
However, the parameters given in this table appear to be mostly relevant for surfzone dynamics.

Two questions: 1. Does this study apply to nearshore or offshore or both? Please address this issue.

2. There could be other effects of equal or greater importance on mixing (either shallow or deep water). Please address this issue.

The arrows in Figure 2, 3 and 4 are not extremely informative. Please add more explanations of what can be seen
and learned from these figures.

In section 3.4, the authors mention "laboratory experiments" and "wave flume" many times, giving the
impression this study was conducted in a laboratory. Together with the introduction (for example third paragraph)
this leads to confusing the reader, and deflects the focus from the numerical work. Please be very clear what this
article covers, and what it does not cover, both in introduction and in discusssion.
For example, line 46: "First, the problem of the generation of waves in a laboratory flume is formulated and solved"
This is misleading.