Ocean Science Discussions

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Comment on os-2021-103

Anonymous Referee #2

Referee comment on "Ocean bubbles under high wind conditions – Part 1: Bubble distribution and development" by Helen Czerski et al., Ocean Sci. Discuss., https://doi.org/10.5194/os-2021-103-RC2, 2021

Czerski et al. present bubble and void fraction measurements collected under moderate to relatively high wind speed. Bubble and void fraction measurements are difficult to obtain, therefore the data set is valuable to advance our understanding of bubble evolution and quantifying their roles in gas transfer, sea spray, and turbulence. The contents are of interest to the readers of ocean science and the manuscript is generally clear. Below are my suggestions.

Panel (a) of Figure 3 indicates that bubble ~ 12 microns could go down to 6 m at a wind speed of 18 m/s. I recall backscatter data at ocean station Papa (by Svein Vagle) showing that bubbles of around 20 to 30 microns go down to more than 10 meters at a wind speed of ~10 m/s. I believe a figure showing the data is in the textbook "Chemical Oceanography and the Marine Carbon Cycle" by Steve Emerson (I apologize that I do not have the book with me right now and do not have the figure number). Do bubbles of 12 microns dissolve quickly in the water column and do not exist below that depth? Or is there any limitation in the observation that bubbles deeper than 6 m cannot be detected?

Also for Figure3: I would suggest revising the ylabel for panels b and c as “void fraction”. The current ylabels seem to be more appropriate as titles.

Regarding the results in Figure 4: Figure 10 shows that the void fraction at 4 m could lag behind that at 2 m. Is that already considered in the correlation presented in Figure 4?

Currents in Figure 6 are useful to explain void fractions in Figure 5. I would suggest the author also try to connect Figure 6 to explain Figure 3. For example, the downward current at around 18:30 is strong than at around 18:10, but the increase in the void fraction is smaller. Is it because there is no breaking wave observed at 18:30?

Although this is mentioned in the text, I would suggest adding that the measurement is at 3.8 m in the caption of Figure 6.

Figure 9: I would suggest the authors clarify if the rising/falling wind means a sustained period of rising/falling wind, like in Liang et al. 2017 JGR-Oceans referenced in the manuscript. Or do the authors include substantial periods when the wind is fluctuating?

The data in Figure 9(a) show that void fraction is higher at falling wind than at rising wind until about 20 m/s. This could be interesting results and I have different thoughts from the paragraph starting from line 456. Breaking waves are bigger at the rising wind, but Langmuir turbulence is stronger during the falling wind. I wonder if there is a possibility that void fraction at this depth is primarily due to Langmuir circulations at wind speed < 20 m/s and gets more contribution from breaking waves when wind speed > 20 m/s.

The same argument could be used to explain that void fraction is mostly larger during falling wind than during rising wind at 4 m. However, I could not make sense of why the void fraction is the largest when wind speed is at 10 m/s and 12.5 m/s. Is there any sampling error there?

Regarding the presentation of Figure 9. I would suggest stating in the caption that panel a is from data at 2 m and panel c is from data at 4 m.

Figure 9(b) is referenced after Figure 9(c). Perhaps the order of the panels could be changed.

Both "parametrization" and "parameterization" are used. I would suggest the authors pick one of them.