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Atmospheric Measurement Techniques Discussions

Interactive comment on "A miniature Marine Aerosol Reference Tank (miniMART) as a compact breaking wave analogue" *by* M. Dale Stokes et al.

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(1) In the introduction part, you state that a limitation of the MART is that it can be difficult to culture delicate organisms in the reservoir due to the high flow rate leading to damage of the fragile cells. Did you perform experiments on the cell stability and could you discuss them a bit? Could you give a reference here? Regarding the cell cultures: can you control the temperature in the mini MART? Finally, did you perform tests with the miniMART on the stability of growing organisms? This point is probably addressed in the chapter 4 (page 12, line 7-22). However, it is not clear to me if this passage together with Fig. 7 should demonstrate the ability of the miniMART to stabilize the biological organisms. Could you comment on this point more clearly? .....

The problems in using MART systems to culture plankton is based on obvious, al-

beit anecdotal, evidence from the users MART systems, and is well-known from research community experience culturing plankton as well as research users of field pump-sampling systems to collect marine plankton at sea. Hi-speed centrifugal pumps damage cells due to the high shear forces generated within the pump. Continuous operation of a MART system does not allow plankton growth and culture blooming, unless gentle mixing (from a paddle or large diameter air jets) is used during the culture growth phase, and the MART plunging sheet is only operated once the tank cell density is high enough and growth is exponential, such that cell growth is more rapid than cell death in the external pump. Temperature control is important for some cultures, in which case the small size of miniMART allows it to be partially immersed in a thermostatically-controlled water bath. Alternatively we have operated miniMART in temperature-controlled environmental chambers or rooms. This was easier (and easier to keep clean) than including thermostatically controlled heating/cooling loops within miniMART (although they could be added). We are not sure what 'organism stability' is in reference to. Culturing plankton in miniMART while it is continuously generating aerosols has been replicated by multiple miniMART users – with culture growth monitored through multiple plankton growth – bloom – decay phases and the associated bacterial and viral growth and decay phases. Figure 7 shows just one continuous culture experiment. Cultures have been grown and tracked for up to 30 days continuously

(2) In (2) the authors report about jet and film droplets that are formed via bubble bursting and the sensitivity of the mechanisms to the bubble size. Is it possible – with the mini MART as proposed standardized method for sea spay production – to distinguish between film and jet drops? How is the contribution of these two drop classes to the bubble size distribution in Figure 1? Could the authors comment on this point? ....

With the size classification instrumentation used here (APS, SMPS, SEMS), it was not possible to distinguish between the jet or film drop origin of the generated aerosols and we feel that a detailed examination of the physics of the process is beyond the

scope of this method/description manuscript. However, ongoing research by others is examining charge mobility distributions of aerosols using MART, miniMART, static bubble chamber and natural sources, and highlights the importance of submicron jet drops in SSA production.

(3) There seems to be a good agreement in the bubble size distribution of the MART and the miniMART (Fig.1). However, as the authors state, there are some discrepancies in the size range around 0.1 mm. Do the authors therefore expect discrepancies on the aerosol formation (e.g. comparing the MART and the miniMART?) ....

There are some minor discrepancies in miniMART (and MART) bubble size distributions from the ideal power law scaling (dark grey lines). However, the slopes of the distribution curves at sizes greater and less than the Hinze scale are very consistent (and critical) to simulating a realistic bubble plume. So, despite these discrepancies we don't expect large effects on the gross dynamics of aerosol production between the systems at least compared to the natural variability under oceanic conditions.

(4) Cleanness of the mini MART / Contamination issues: The authors consider the miniMART to be clean when the surface tension from water samples are the same as those from the filtered water supply used for experimentation. However, what about organic contamination? Organic compounds are present in seawater in trace levels. In Figure 7 the authors show the evolution of cDOM in seawater, starting at around 3 ppb. Did you check the blank level of cDOM concentration in the cleaned miniMART? And did you perform measurements of the organic content of aerosol particles in the miniMART (regarding contaminations?) ....

In the data shown in this manuscript additional attempts at total elimination of organics from the seawater cultures were not made, and their effects on the culturing and aerosol generation are beyond the scope of this manuscript which is focused primarily on physical bubble generation. As it is, cDOM (colored dissolved organic matter) is only a reference to the color of the sampled water and its associated with organic con-

tent. And, as pointed out by the referee, there are trace levels of organics in seawater, which is used (although filtered) for the culturing. "Blank" levels of cDOM are noted at time zero of cultures and organic contamination in miniMART is probably similar (or perhaps less) than that from the larger MART systems which have had extensive chemical analysis. Ongoing experiments using miniMART include extensive inorganic and organic chemical analysis (mass spectrometry etc.) on system bulk water, surface microlayer and ejected aerosols in the context of detailed studies on SSA properties.

(5) Finally, as mentioned by Referee one, it would be helpful for future operators to state under which circumstances the MART and the miniMART should be used. ....

As responded to Referee one, text can be added to the final paragraph emphasizing that the miniMART is well suited for studies requiring the maintenance of delicate organisms, but for experiments needing the generation of larger numbers of aerosols (due to sampling and instrumentation requirements for example), the larger MART system is the preferred tool.

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