

Interactive comment on “ChAMBRe: a new atmospheric simulation Chamber for Aerosol Modelling and Bio-aerosol Research” by Dario Massabò et al.

Anonymous Referee #2

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The manuscript provides a characterisation of the new ChAMBRe atmospheric simulation chamber at Genova. The importance of the quantification of chamber-specific influences and interferences is not routinely recognised and the authors are to be commended on their attempts to provide such a characterisation. This manuscript provides the first part of "a user manual" for such a chamber and a demonstration of its fitness for purpose. As such, it is highly suitable for publication in AMT.

The range of important questions that can be addressed in ChAMBRe is succinctly and concisely summarised in the introduction, which thereby highlights the need for such a facility.

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Key characteristics: Size dependent particle lifetime; Preservation of bioaerosol viability through injection and extraction; Ability to explore bioaerosol viability under variable controllable and measurable changes in atmospheric composition; Repeatability under clean conditions demonstrated for 2 bacterial strains; one each of gram positive and gram negative groups, showing that it is possible to investigate viability under changing environmental conditions.

The chamber and instrument description section is sufficiently detailed to provide the reader with the information to evaluate the suitability of the facility. It appears that the facility is very appropriately designed and well-appointed.

The chamber characterisation is one of the main foci of the paper and has been carried out and described well - certainly adequately for a reader to evaluate the characteristics of the facility.

The protocol for preparation and execution of the bacterial experiments has been well-developed and is described appropriately. As a non-specialist, I am not qualified to comment on the appropriateness of the biological handling protocols or e.g. choice of bacteria; however, for the purposes of the manuscript, the details provided are sufficient to reproduce the protocol.

The description of the first experiments was informative and provided a good illustration of the suitability for purpose of the facility. The repeatability within Poisson statistical expectation was convincing evidence for this. The fact that an empirically-determined dilution was required for *E. coli* (and that CFU was extremely RH dependent) is interesting and these experiments demonstrated the great care that will need to be employed in future investigations using the facility.

Generally, I find the publication very suitable for publication in AMT. However, I think there is one very important omission that can be addressed with modest discussion. This relates to the closeness to ambient conditions that is achievable within the facility. A key challenge in investigating PBAP in general and airborne bacteria in particular is

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their extremely low ambient abundance (from 0.01 to 1 cells/cc). Such low concentrations present difficulties with particle sizing and counting instrumentation relating to the counting statistics, often physically limited by the instrument sample volume. I believe it is important that the authors discuss such limitations and the implications of necessarily studying under higher than ambient concentrations within ChAMBRe (such as differences in amount of reactant per cell). In this regard, it should be noted that the facility description indicates a maximum particle number measurement threshold of 10^7 /cc, but now lower detection limit and sensitivity. Indeed, the only mention of the instrument sensitivity for the lower limit is on line 229 where the value is still not provided. A general discussion of the accessible ranges of concentrations, the challenges with instrumentation and the comparison to ambient conditions should be provided. One final point on this subject - one might have expected that a key instrument for PBAP experiments would be one of the recent online fluorescence instruments (e.g. WIBS, UV-APS or more recent developments). Could the authors discuss whether these factor in their plans. It would appear to provide an ideal opportunity for comparison of online and offline techniques and perhaps address some of the concentration concerns I have raised above.

There are a few additional points the authors could address:

line 98 and elsewhere: Genova or Genoa? Consistency should be ensured throughout the document

line 108 and 118: I presume this should be $5 * 10^{-2}$ mbar, not 510^{-2} (presumably for AMT, SI units should be used - the editor can advise). All subsequent pressure values also suffer from this notation and it should be corrected.

line 121: I presume the 2 step procedure is to ensure the HEPA and zeolite efficiency is not challenged by operating from $5 * 10^{-2}$ mbar to 5 mbar. Is this correct? If so, it would be useful to state it.

line 142 - 147: I presume the 253 nm lamp is to allow sterilisation without ozone gen-

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eration. If so, it would be useful to state it for the reader's benefit.

line 174 - 179: It is interesting to note the dehumidification system in the OPC. This will be very useful to avoid droplet ingress into the instrument and prevent too much hygroscopic growth. It will also ensure a good chance that non-spherical "solid" particles do not assume spherical geometry by water uptake. What is the implication of this for OPC sizing of e.g. rod-shaped or other non-spherical bacteria or dust? Don't OPCs rely on refractive index and shape assumptions?

line 191: I'd suggest the upper limit to typical reaction times should be days rather than hours (e.g. the gas phase oxidation lifetime of SO₂, OH oxidation lifetime of methane, ageing of organic aerosol and increase in O:C ratio etc...)

line 198: I think the reference should be to 4.2 not 4.3

line 205: It is stated that "Aerosol dilution due to the air flow through the two counters (in total: 1.6 L min⁻¹) was taken into account and properly corrected". Does this mean that pressure is held constant and the same amount of clean scrubbed air is supplied to the chamber? This should be stated.

line 208 - 209: "nicely reproduced" - please provide a more scientific description - a goodness of fit metric ideally

Trivial: I believe the Pasteur reference was originally from Annales des sciences naturelles, Zoologie, 4th series (1861), followed by its publication in Annales de chimie et de physique, 3rd series, 64 (1862), not 1890