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Atmospheric Measurement Techniques Discussions

Interactive comment on "Regularities of new particle formation and evolution of existing atmospheric aerosol particles in a large (3200 m^3) isolated volume" *by* Nikolay Romanov et al.

Anonymous Referee #2

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This manuscript describes a Large Aerosol Chamber (LAC), with the volume of 3200 m3. The chamber is located at the RPF "Typhoon" facility in Obninsk, Russia. The LAC is a massive environmental chamber, which has previously been used for cloud and meteorological process studies and is evolving to be used to study aerosol processes including new particle formation. The results of several experiments of particle production and growth are also presented.

General comments

Such a massive chamber is indeed unique, and there is certainly is a need for facilities that allow the study of atmospheric chemical processes with minimal wall influences. I

have some specific concerns or questions regarding its use for these types of experiments, which are outlined below. My main comment is that in its present state, the organization and use of English in the manuscript is not appropriate for publication in AMT. The authors even state that one of the reasons for writing this manuscript is that a description and use of the facility has been previously published, but there is a lack of accessibility for English readers. The poor English in the text made it so that in some parts the point could not be understood. A significant rewrite and review by someone knowledgeable with English grammar is necessary. In looking at the growth results, I don't really see anything new understanding from this work. The results rely SMPS measurements and are basically just confirmation of aerosol physics.

In the description of the LAC, it says that the walls we coated with "ship paint". Further description of this "ship paint" is necessary. As an atmospheric chemist, I find the use of a painted surface for the wall of an environmental chamber concerning. Have any tests been performed to confirm that the walls are not a source of hydrocarbons. If the authors hope that this facility will be used to study new particle formation (NPF), a chemical process, the off-gassing of the walls needs to be shown not to be a source of contamination or interference.

Along the lines of chemistry, I am surprised at the lack of chemical measurements. The authors simply use the term constituent gas without going into detail as to its makeup. A few simple instruments such as an ozone, SO2, and NOx monitors would add greatly to the understanding of the constituent gas and the subsequent chemistry it undergoes. A gas chromatograph (GC) would give a good idea of the reactant hydrocarbons are. These are all more or less standard off the shelf measurements yet would add greatly to understanding the chemical makeup of the precursor species. I would also make a sincere effort at changing the sampling strategy and move the instruments to the outside of the chamber. I find it hard to believe that the presence of the instruments and equipment shown in Figure 1 inside the chamber don't affect the chemistry.

The authors state that new particle formation is observed and then present particle size

distributions with a 15 nm lower cutoff. New particle formation involves the formation of particles in the 1 nm size range. 15 nm particles are actually quite large compared to newly formed ones and have undergone a wide range of possible processes from condensation growth to coagulation. There are instruments capable of measuring size distributions down to 1 nm (particle size magnifier and like instruments) and such instruments would be necessary to talk knowledgably about NPF and initial growth processes.

Has any thought been given to the addition of a photolytic source? Most NPF is driven by photolytic processes.

My overall impression is that the LAC has the potential to be a useful addition to the environmental chambers available to the atmospheric community. For this to happen, more chemical measurements will need to be added. The field of aerosol science, especially that of particle formation has evolved to include chemistry and the transformation and heterogeneous interactions of gas phase precursors. One has only to look at the CLOUD chamber to see the potential impact the LAC could achieve. I feel that if the experiments discussed were repeated with the inclusion of the above suggested measurements and the results discussed in terms of chemistry (oxidation, ozonolysis, formation of low volatility species, etc) this work would be a strong addition to AMT (with a rewrite from a native English speaker). However, in its present state I cannot recommend that this manuscript for publication.

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