Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2020-172-AC2, 2020

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.

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Received and published: 26 December 2020

Response to the Reviewer

December 26, 2020

The authors express gratitude to the Reviewer for useful comments. Below are our responses to the Reviewer's comments:

1 Comment #1

1.1 Reviewer comment

The results rely SMPS measurements and are basically just confirmation of aerosol physics.

1.2 Response

We understand the importance of studying atmospheric chemical processes.

We would also like chemists not to underestimate the importance of studying the physical processes occurring in the atmosphere. Ultimately, aerosols formed because of

chemical processes will only then have a significant impact on meteorological processes in the atmosphere when, as a result of their evolution, they grow to the size of cloud condensation nuclei.

2 Comment #2

2.1 Reviewer comment

*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 poor English in the text made it so that in some parts the point could not be understood.*

2.2 Response

Many of the article authors took examinations at Oxford. Also, the article text was prepared with the participation of specialists who are native speakers of the English language.

3 Comment #3

3.1 Reviewer comment

In the description of the LAC, it says that the walls we coated with "ship paint". Further description of this "ship paint" is necessary. 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.

3.2 Response

The new particle formation is not the subject of this article.

We will undoubtedly use the advice of the referee when we investigate the new particle formation.

Studying the possible gas formation from the walls and from the equipment located in the chamber to make sure that their influence on the processes under study is negligible is methodologically unprofitable. Gaseous components do not directly affect the investigated processes of particle evolution. Their influence can only be felt when new particles are formed from them. It is guaranteed to cover by measurements all theoretically possible gas components that can form new particles. It is too difficult a task. We methodically solved this problem much easy. We experimented. And we checked whether new aerosols were formed in a hermetically sealed chamber due to all possible gas contamination from the walls and equipment inside the chamber. The experiment showed that during 300 hours of observation, a negligible number of new particles (no more than 30 particles per cm^3) are formed in the chamber. And this is more than two orders of magnitude less than the number of particles whose evolution we have studied. The article presents of this experiment results (see Fig. 3, where $t > t_3$).

4 Comment #4

4.1 Reviewer comment

Along the lines of chemistry, I am surprised at the lack of chemical measurements.

4.2 Response

The article does not consider the chemical processes of the aerosol particle formations.

5 Comment #5

5.1 Reviewer comment

I would also make a sincere effort at changing the sampling strategy and move the instruments to the outside of the chamber.

5.2 Response

In our experiments, the spectrometer is installed outside the chamber.

6 Comment #6

6.1 Reviewer comment

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.

6.2 Response

The article did not study the issues of chemical processes. Therefore, we did not investigate whether the presence of the tools and equipment shown in Figure 1 inside the chamber affects chemistry or not.

The article presents the experiment results, which shows that the equipment installed inside the chamber does not contribute to the new particle formation. Accordingly, it does not affect the investigated processes of the particle evolution formed from the external atmosphere air.

7 Comment #7

7.1 Reviewer comment

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.

7.2 Response

The study of the chemical processes of the new particle formations and their initial growth is not included in the list of issues under study.

The article presents material on the study of the growth of already formed submicron particles. It is shown that these particles during their evolution, even in the absence of light, can grow to the size of cloud condensation nuclei and, accordingly, affect the meteorological processes in the atmosphere. This is especially important for a more

complete understanding of the physics of clouds.

8 Comment #8

8.1 Reviewer comment

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

8.2 Response

The article does not consider the chemical processes of the aerosol particle formations.

9 Comment #9

9.1 Reviewer comment

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.

9.2 Response

The literature broadly covers works that describe the chemical processes of the new particle formation.

In our work for the first time, we experimentally showed that new particle formations independently evolve in size. We provided experiments under conditions corresponding to the natural conditions of a real atmosphere. Particles enlarged in size can serve as a significant source of replenishment of the numerical concentration of cloud condensation nuclei.