Dear Editor,

Please extend our deepest acknowledgements to Anonynous Reviewer #2 for his/her comments on our work.

Please find below in italic the comments received by Anonymous Reviewer #2 after submission to ANGEOD, followed by our replies in normal style.

Anonymous Referee #2

General comments:

This study reports the aerosol measurements obtained by the BEXUS18 stratospheric balloon flight. Its distinct feature is being equipped with ion counters. A role of ion chemistry in the stratosphere is still an open question and could be essential for the understanding of the atmospheric impact from the space. This topic is suitable for ANGEO. However, information on the instruments of aerosol and ion measurements is completely lacking in this manuscript, so that it is impossible to evaluate whether their observations are reliable or not. Thus I recommend a rejection of this manuscript.

We thank the reviewer for his/her comments. The revised version of the manuscript now contains information on the instruments of aerosol and ion measurements, as will be detailed more precisely in the following answers.

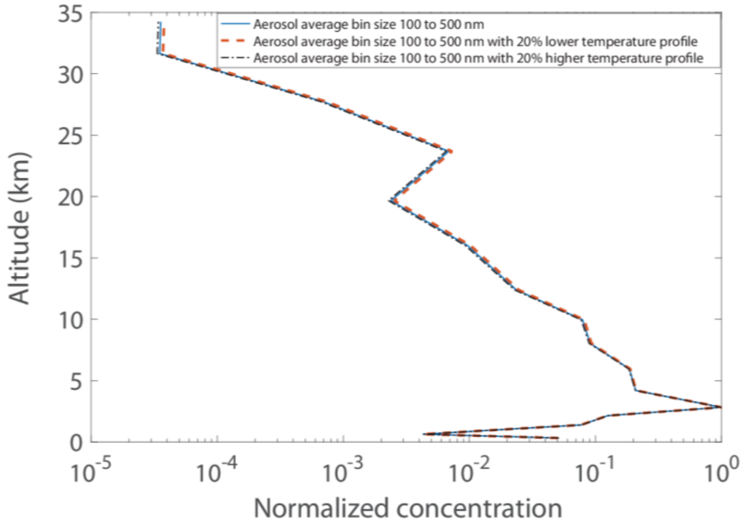
Detailed comments are given below.

Specific comments:

-Temperature and pressure measurements

The authors showed results of temperature and pressure measurement in Fig. 1, but it is found that their results are not so reliable compared to nearby radiosonde observation. Including a radiosonde in their payload does not look difficult, so that I am wondering why they did not do it. In addition, they used temperature and pressure data in their model calculation. Is it really meaningful to use such unreliable data? They need to show how sensitive their model calculation is to temperature and pressure errors.

In the revised version of the manuscript, we have addressed and provided the results of the sensitivity tests of the model simulations to changes in the T-p profile. In particular, the change in temperature and pressure profile affect only the ion aerosol attachment (approximately 10% change for 20% change in temperature) and the charge particle coagulation coefficient (approximately 6% change for 20% change in temperature and pressure. This does not affect the final model results drastically, as steady state conditions are reached in a couple of hours. Only 1% change in aerosol concentration is observed for an input temperature profile 20% higher/lower in the model input. Because of this, repeating the model calculations with the Kandalashka T-p profile, no significant differences are observed in the final result. To conclude, the T-p profile only changes the rate of the reaction, but not steady-state concentrations. This can be observed from the following Figure, which was added in the Supplementary Material of the revised version of the manuscript.



-Aerosol measurements

Their aerosol instrument, LOAC, has been used in 150 flights, so that its precision, resolution, etc. should be well known. However, they did not give those information at all in the manuscript. Although they mentioned an existence of the thin aerosol layer with a thickness of less than 100m at p.10, l.25, I cannot judge whether this instrument has a vertical resolution high enough to detect such a layer.

We thank the reviewer for his/her comment. Indeed, this information was missing from the previous version of the manuscript. Instead of applying a smoothing procedure, in the revised version we have integrated the raw measurements over 5 minutes. Thus, we have changed the figures 2 and 3 according to this new procedure. We have added in the text:

"The LOAC vertical resolution is linked to the total concentrations of aerosols, as due to the Poisson counting statistics and the instrument capability to detect the smallest particles. A detailed analysis of the raw measurements has shown that the data must be integrated over 5 minutes to remove the oscillations due to the measurements' uncertainty. Considering the balloon ascent speed, this procedure provides a resolution of about 1 km."

And later:

"To compare directly with the aerosols' measurements, the ions' measurements data are also integrated with a 1-km vertical resolution."

-Ion measurements

They mentioned that the performance of their ion measurement was checked by preflight lab experiments, but it is not shown in the manuscript at all. Thus I cannot judge whether their ion measurements are reliable or not.

Indications of the performance of the ions' measurements as derived by preflight lab experiments are provided in the revised version of the manuscript, in particular in the form of median absolute deviations separately for positive and negative ions measurements at the 200 mbar pressure level.

-Average

In order to show the aerosol data, they often used arithmetic mean/smoothing. Since aerosol density changes by several orders of magnitude, the arithmetic mean strongly depends on the largest value. Geometrical mean or median filter would be better to represent aerosol distributions

The aerosols data are now not smoothed (see previous comment).

-Figs. 3 and 4

What is dN/dlog(D) in Fig. 3? A caption of Fig. 4 does not correspond to Fig. 4 about their y-axis.

dN/dlog(D), or DN/dln(D), represents a commonly used notation in aerosol science to indicate the number concentration of particles in the various size classes (dN) divided by the width of the size classes (dln(D)). The caption of Figures 3 and 4 was slightly modified to indicate more correctly what is shown in the Figure.

-Eq. (3)

Units look different between the terms. Probably some variables are missing.

The reviewer is right, and Eq. 3 has been corrected in the revised version of the manuscript.

$$\frac{dN_{i,j}}{dt} = \beta^{+}_{i-1,j} N_{i-1,j} n^{+} + \beta^{-}_{i+1,j} N_{i+1,j} n^{-} - \beta^{+}_{i,j} N_{i,j} n^{+} - \beta^{-}_{i,j} N_{i,j} n^{-} + \frac{1}{2} \sum_{l,m=-p}^{l,m=p} \int_0^v K^{l,m}_{j-v,v} N^{l}_{j-v} N^{m}_{v} dv - N_{i,j} \sum_{q=-p}^{p} \int_0^v K^{i,q}_{j,v} N^{q}_{v}\, dv \qquad (3)$$