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Interactive comment on "Trends and annual cycles in soundings of Arctic tropospheric ozone" *by* Bo Christiansen et al.

Anonymous Referee #1

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This paper analyzes a homogenized ozonesonde data set from nine stations in the Arctic region. The homogenization procedure is the one recently proposed by the WMO/GAW ozonesonde activity group. The focuses of the data analysis are the annual cycles and long-term low frequency variability in the past ~25 years, by using a polynomial model with these components. There were similar studies (but published several years ago) for northern-hemisphere mid and high latitudes, but this is the first study looking at the Arctic region, with the homogenized data set and with the period up to more recent years. I think that the paper would be suitable for publication in Atmospheric Chemistry and Physics, with some more explanation on the homogenization procedure and on the model as explained below.

1. For the homogenization, please clarify whether data from all 9 stations were homogenized by the authors or some were homogenized by the researchers listed in

the Acknowledgements section. Although the guidelines of the homogenization procedure are documented by Deshler et al. (2017), there should be several details at each station. Will the authors prepare a separate document on the details of the data homogenization at each station? Also, at the Data availability section, the authors write that the data can be obtained from WOUDC and NDACC website. Are both the original and homogenized data available from there? For this paper, I think that an additional figure showing the change points of the ozonesonde type and solution type at all the nine stations would be very useful, in particular when the long-term trends for the same station obtained by previous studies and by this study may differ.

2. I am not sure to what degree the model description should be detailed, but I think there are few more things that the authors can do to convince the readers of the goodness of the fit. (For your information, I only know multiple regression analysis (e.g., Chapter 8.4 of von Storch and Zwiers, 1999: Statistical Analysis in Climatic Research, Cambridge Univ. Press, Cambridge, UK, 484 pp.) where coefficients are obtained with the least squares method and the statistical significance test is made based on the residual time series x_i.) At least, please add some more explanation on (1) how (or which part of the model) to use the two different noise models and on (2) the Bayesian approach by contrasting it with other approaches. One potential way might be to provide (the essential part) of the code as a supplement (or, specify the paper that is most relevant in terms of authors' actual calculations for this paper.) More important is to simply show (for one or two cases) that the residual time series has no significant trends/low-frequency variability, i.e., show no strange behavior (perhaps just in the authors' response or in another supplement), so that the readers can see that the model is reasonable.

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