

Title: Atmospheric composition in the European Arctic and 30 years of the Zeppelin Observatory, Ny-Ålesund

Authors: Stephen M. Platt et al.

## REFEREE COMMENTS

### General comments

The paper provides an overview on The Zeppelin Observatory, a history of the station, measurements and trends and a review of the current state of the European Arctic atmosphere. The paper is well structured and written. However, it is quite long and the authors could consider shorten the text and add some summarizing figures or statistics. The abstract could include short statement on the most scientific significant result(s). For demonstrating the scientific impact of the observatory there could be also some statistics of the published papers, number international projects over the years when / where Zeppelin dataset has been used.

### Specific / minor comments

- line 53: how the decision of the Swedish parliament accepted for a Swedish monitoring program in connected to the Norwegian approach. Please clarify.
- line 842: History; you could add the time line figure demonstrating the different atmospheric composition measurements at different locations. This would also provide a general overview on the development and availability of long term measurements and address the role of Zeppelin measurements.
- line 113: add “full stop” after parenthesis.
- lines 195-199: please add references for the location climate / vegetation classification.
- line 224: please add a reference if possible.
- line 255: you could use “/sios-svalbard.org/”
- line 285: open the acronym FLEXPART particle dispersion model:>>> “FLEXible PARTicle dispersion model”. Please re-check all the acronyms in the text and open the acronym when mentioned for the first time
- Fig 3: improve quality (resolution) of the figure
- line 316: Aitken mode particles, please add size
- Fig 4 please improve quality (resolution) of the figure
- line 340: you could add a short overall (meta) description / table of all measurements which would better describe the overall measurement capacity of the station. And give some general statistics of the measurements.
- line 350-365: (4.1) this is very detailed description of the samplings and filters, you could consider a schematic figure of the process or an annex.
- line 366: add the reference for Mann-Kendall Test/Sen’s slope.
- Fig 6., 7., 8. technical quality of the fig should be improved
- line 439: “With this set-up the Zeppelin Observatory is now one of the first global aerosol observatories with semi-continuous in-situ cloud sampling”. What are the other stations ?
- line 839, 865: some error with the reference (*Error! Not a valid bookmark self-reference*)
- line(s) 925 & 962 please check, add the reference Petäjä et al.2020 Overview: Integrative and Comprehensive Understanding on Polar Environments (iCUPE) – concept and initial results, Atmos. Chem. Phys., 20, 8551–8592, <https://doi.org/10.5194/acp-20-8551-2020>, 2020.
- line 1074: please add some specification for the acronyms “POLARCAT” “TOPSE”

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- line 1172: “strengthen the position of the Zeppelin Observatory as a leading global measurement platform, perhaps” one of the ? / Arctic ?
- line 1200: Refer to “open access”, how is the data access to Zeppelin measurements currently organized ?
- line 1227: “Changes in the Arctic aerosol burden will in turn influence climate via direct and indirect aerosol effects, i.e. via increased absorption and scattering, and changes in CCN and ice nucleating particles (INP), respectively. “ - add reference
- line 1228: “Another important non-CO<sub>2</sub> greenhouse gas is N<sub>2</sub>O, with a global warming potential 265–298 times that of CO<sub>2</sub>.” - add reference