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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Pan-Arctic Aerosol Number Size Distributions: Seasonality and Transport Patterns" *by* Eyal Freud et al.

Anonymous Referee #2

Received and published: 23 February 2017

This is a scientifically sound, original and very well-written manuscript that should definitely be published in Atmospheric Chemistry and Physics. I have a few, mostly minor suggestions for clarifications when revising the paper.

Page 2, line 9: I would avoid using the term Anthropocene. Its starting point is ill-defined and it is very much debated how it should be defined.

Page 8, lines 31-36: I do not fully agree on the argumentation here. In a remote environment, why would an elevated site have more cloud-processed aerosols as a site close to the surface? For example, a marine boundary layer is usually well-mixed, so all the air in the BL is expected to circulated at about equal efficiency through clouds. When exposed to free-tropospheric air masses, air measured in Zeppelin is expected to be even less cloud-processed as air originating from the marine boundary layer,

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as there tends to be less clouds in the free troposphere. I would rather think that are, in general, more clouds around Zeppelin than around other sites, causing more cloud-processing, or that clouds produce secondary material more efficiently around Zeppelin.

Page 9, end of section 3.2: I would like to see a few sentences here discussing the interpretation of the observed modal structure of the aerosol. When looking at the modal parameter in the tables in Appendix A, one can easily see that the recorded modes have some features that differ from the traditional classification of the submicron aerosol into the nucleation, Aitken and accumulation mode. First, there are always three modes, even though the nucleation mode is in most cases absent. Second, there are usually two modes in the size range usually called the accumulation mode. What are these modes? Condensation and droplet mode, as defined in some earlier studies, or something else. Third, the two largest mode are sometime very close to each other. Are they really separable when fitting the modes?

Page 16, lines 31-35: There is something wrong here. The text has a totally incomplete sentence that refers to a box model which is not explained anywhere and which does not seem to fit to the context of the surrounding text.

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