

## ***Interactive comment on “Integrative and comprehensive Understanding on Polar Environments (iCUPE): the concept and initial results” by Tuukka Petäjä et al.***

### **Anonymous Referee #1**

Received and published: 20 March 2020

Review of the manuscript, “Integrative and comprehensive Understanding on Polar Environments (iCUPE): the concept and initial results,” by T Petaja et al., submitted to Atmosphere Chemistry and Physics.

(General comments) At first, I felt some difficulties to understand the manuscript as “Research article” which should “report substantial new results and conclusions from scientific investigation, . . .” as expressed in the Manuscript types written on ACP Home Page. The manuscript is rather “Review” or “Overview article” for the special issue. Actually, it is indicated as the articles for the special issue, “Pan-Eurasian Experiment (PEEX)”, and the manuscript most fits as “Special issue overview article”.

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Even though, I was confused to the substance of the project “iCUPE”, if it conducts observation itself or just works for analyzing activities, which are not clearly mentioned in the manuscript. I have found some expression in the iCUPE home page; iCUPE will 1) synthesize data from comprehensive long-term measurements, intensive campaigns and satellites, collected during the project or provided by on-going international initiatives, which clearly mentions the actual activities of the project. Please add this kind of explanation in the manuscript, then, it will be much understandable.

The manuscript is not well organized, all of the substances are written in chapter 3, and still the sections are mixtures of methods (3.1, 3.2, 3.3, 3.7 and 3.8) and target species (3.4, 3.5 and 3.6), so, not easy to read and understand, partly, also, due to the question in the previous paragraph. 3.8.1 is also very difficult to follow, since the substances are cloud (microphysics) and precipitation, which are quite far from other items discussed in the manuscript.

(Specific comments) - For figures which were not the original of this paper, the citation should be shown.

- Papers which were not published yet should not cited, such as “to be submitted”, “submitted”, “in preparation”, and so on. I am not sure for the paper “in press.”

- Line 218-220: The sentence “When the Polar Front retreats, anthropogenic emissions are no longer able to penetrate into the High Arctic” is miss leading. → . . . , even anthropogenic emissions penetrate into the High Arctic, they could not kept as high concentration.

- 3.2.2. Black Carbon: What is the equivalent black carbon concentration (eBC)? There is no explanation here. We could not access to the paper by Kalogridis (2019), which is just “to be submitted”. There is no explanation for the correction to the aethalometer BC concentration proposed by Sinha et al. (2017, JGR). It was reported that BC concentrations measured by aethalometer (Sharma et al., 2013) or by PSAP (Hirdman et al., 2010) at Ny-Alesund were 20 – 30 % larger compared to the value obtained by

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COSMOS (back upped by SP2). This is also in Fig. 5.

- Line 729-733: Validation of satellite cloud profiling radar by comparing with the ground based radar, as in Fig. 24 is not clear. It is better to compare the vertical profile from both the radars.

- Are the greenhouse gases not the targets of the project? Only atmospheric trace gases are expressed in line 865-866. Methane anthropogenic emission is discussed in 3.8.2.

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-1217>, 2020.