

Interactive comment on “Ice nuclei properties within a Saharan Dust Event at the Jungfraujoch” by C. Chou et al.

C. Chou et al.

cedric.chou@env.ethz.ch

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Comment) Authors deployed the ice chamber instrument at high alpine research station and measured ice crystal concentration. The analysis showed larger dust particles produced higher ice crystal concentration. The analysis could have been strengthened in the presence of instrument that characterizes the chemical composition of aerosols. However, the measurements reported here are important to constrain the climate models and I recommend the manuscript for publication after following comments are addressed.

Reply) We thank reviewer 3 for helpful comments and suggestions. The detailed responses are given below with their respective locations in the revised manuscript.

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Comment) Please mark the location of JFJ research station in Fig 6, 7, 9 and 10.

Reply) The location of the JFJ has now been marked in the above figures in the revised version of the manuscript

Comment) Describe the PINC instrument in detail. Please mention the ice coating thickness, how frequently the icing is done at field site and particle losses within instrument.

Reply) The average frequency of re-icing PINC at the field site is about 2.5 hours. This has been added to the manuscript (page 6, line183). The particle losses have been measured and are below 5% which is within the precision of the CPC. The ice coating thickness is 550 microns and has been indicated in Table 2. Comment) Atmospheric implications of the present work should be discussed in detail. I suggest authors to add another section.

Reply) We agree with the reviewer and a new section (Section 3.2) has been added (page 10).

Comment) If possible ensemble of backtrajectories should be used to understand the origin of air mass. Did the calculations show similar results as would be given by HYSPLIT?

Reply) The calculations using HYSPLIT showed similar sources. Nevertheless, in the revised manuscript we have now reported ensemble of backtrajectories calculated by HYSPLIT in order to understand the air masses' origin. (see Figures 6 and 10)

Comment) Page 23706, line 25: Sentence 'On the other hand, aerosols ...'needs reference.

Reply) The sentence has been merged with the sentence afterwards which contains the reference. (page 2, line 26)

Comment) Page 23707, line 10: The reference list is incomplete; there are other few

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groups who have done work in deposition freezing. Either specify all references or use 'for example' wording.

Reply) The list of references has been completed (page 2, line 33).

Comment) Page 23708, line 16: It is not clear what are PINC II and PINC III. The PINC stands for portable ice nucleation chamber, so did you use two different chamber instruments or similar instrument but with version II and III?

Reply) We didn't have other versions of the instrument, meaning that PINC II and PINC III refer to names of the campaign. No names were defined as these campaigns were conducted internally with the help of the Paul Scherrer Institute scientists. We agree with the reviewer that these acronyms are confusing and therefore PINC II and III have been entirely removed from the manuscript.

Comment) Page 23711, line 18: Do the RH was measured at lab or field site? Also at what temperature the RH readings were recorded. I imagine at lower temperatures the 1% RH moisture (at room temperature) leads to couple percent of RH moisture. This might influence the water vapor distribution within PINC and could affect results. Please clarify.

Reply) The RH at the exit of the drier has been measured at the lab and field site, before and after a campaign, and displayed 1% in all the cases. After calculation the RH moisture for our operating conditions, i.e. -31°C inside the chamber is 62% which is below our RHw conditions inside the chamber (91%). Therefore no influence of the water vapor distribution in PINC takes place.

Comment) Page 23712, section 2.1.4: Did the PINC was operated 24 hours a day? Does the JFJ station is exposed to the free troposphere for all 24 hours of a day. I imagine during day time the conditions would be different.

Reply) PINC was not operated 24 hours a day since it is not fully automated. The JFJ is not always in the free troposphere. During the campaigns, the JFJ was some-

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times within the PBL during the day time, and this can be seen in the increase of the accumulation mode (Figures 4d and 7d in the current manuscript).

Comment) Page 23713, section 2.2: Please add more details or merge within another section. I think more details are needed to complete the section. At present it is too short of details.

Reply) More information has been added to the revised version of the manuscript.

Comment) Page 23713, line 24: Can other aerosol types (apart from dust) produce SSA exponent negative? If yes then it would mislead the interpretation of how dust event are observed. Please clarify.

Reply) In general large particles produce negative SSA exponent, so pollen for example could potentially produce negative SSA exponent. Unfortunately no measurements and characterization of pollen at the JFJ are available in the literature. Therefore negative SSA exponent are attributed to dust episodes. However Coen et al., 2004 showed that in 92% of the cases this method to assess dust episodes correlates with backtrajectories calculations, satellite images or filter measurements that show dust concentration.

Comment) Page 23717, line 4: Correct Fig 8 to Fig 8c.

Reply) The correction has been made.

Comment) Page 23719, section 4: Did anyone in the past looked at the chemical composition of aerosols observed at JFJ station. If yes please mention the reference. Also the Saharan dust event over Europe is well characterized to understand the dust particle chemical properties. Do the literature results show any ageing of dust particles? Variability of IN concentration shown in Fig 5 and Fig 8 is not clearly explained and could be linked to dust ageing. Please explain.

Reply) We acknowledge the reviewer for this suggestion. We think that the chemical aging could also play a role in the IN properties of Saharan dust and modified the IN

concentration measured, but no literature characterizing the chemical composition of dust sampled at the Jungfraujoch as a function of the air masses trajectories (North Atlantic, Mediterranean Sea, Eastern Europe, Northern Europe, etc. ...) has been found. In addition, as mentioned by reviewer 1, the fraction of IN seems to be equivalent and therefore the IN number concentration is more related to the intensities of the SDEs rather than the chemical composition in our study.

References:

Collaud Coen M., et al., (2004). Saharan dust events at the Jungfraujoch: detection by wavelength dependence of the single scattering albedo and first climatology analysis. *Atmos. Chem. Phys.*, 4, 2465–2480, 2004

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 10, 23705, 2010.

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