

Interactive comment on “Arctic smoke – aerosol characteristics during a record air pollution event in the European Arctic and its radiative impact” by R. Treffeisen et al.

Anonymous Referee #2

Received and published: 30 March 2007

(General Comments) The paper describes aerosol characteristics and radiative effects of smoke plume in the Arctic. Extraordinary large aerosol optical depths and strong radiative heating shown are of great interest for the study of atmospheric science in the Arctic, and worth while to be published in "Atmospheric Chemistry and Physics". However, the manuscript contains several parts to be revised, which will be listed below.

(Specific comments) 1) abstract, line 9 - 10: The sentence "almost 1.6 for geometric standard deviation of the mode" is not easy to understand in the abstract. More specific explanation needs to be added.

2) p 2278, line 22: "most severe air pollution"; can you show any reference to prove

this fact?

3) p 2280, line 3: It is not easy to show three parameters bsca, babs and bext, only by one equation for bext, eq. (1), though we know that all three parameters are shown by the same style of formula. Eq (1) shows only bext.

4) p 2281, line 6: Why "a spectrally uniform surface albedo" was assumed?

5) p 2281, line 11 - 12: Why you can say "There was no evidence of dry or wet deposition"? Are there any evidence of "no dry and wet deposition"?

6) p 2282, line 6-7: What is your intension by the sentence "the smoke plume further accelerated to maximum velocity of about 48 km/h"?

7) p 2284, line 6-7: Why only Fig. 7 is made by ECMWF analysis? Other trajectory analyses and horizontal maps such as Fig. 2 and 3 are all from NCEP/NCAR reanalyses. Is there any special reason? Also, in Fig. 5, the ordinate should be shown in altitude (km), not in model level.

8) p 2284, line 25: What will be suspected by the 100 % humidity?

9) p 2285, first paragraph: It should be better to mention about the measurement site in Ny- Alesund. Already mentioned about Mt. Zeppelin in the Abstract, there is no expression as for the actual site in the main text (all made at Zeppelin or not).

10) p 2285 - p 2286, 4. 1. 1: More deep discussion is needed for AOD. AOD amount during this plume episode is among 0.4 and 0.8, which is quite higher than normal condition including haze and dust. More over, Angstrom Exponent is also highest among all the Arctic measurements. Also, it is needed to show day to day variation of AOD (as a figure), which will be better compared to the satellite data in the next section (Table 2 is only for two occasions).

11) p 2288 line 25 to p 2289 line 2: It is difficult to conclude as written, because the satellite retrieval in Fig. 8 is only limited to the clear area and most part is not retrieved

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

because of cloud mask. On 1 May 2006, Svalbard area is not retrieved might be due to the cloud cover, so it is not clear that the plume had arrived at Svalbard or not. Is it also covered with cloud for the whole Scandinavian Peninsular?

12) p 2289 line 26 to p 2290 line 1: What is the meanings of "using a cyclone" and "A Fuchs charge"?

13) p 2292 line 11: What is "the second period"? Is this same with the "week 2"?

14) p 2293 line 11: What is the reason for high SS in the week 3?

15) p 2294 line 9-11: It is much important to mention about each comparison than to describe "Overall, ...". In the week 3, observation shows rather closer to the internal mixture, while observation is closer to external in the week 5. It was already reported that fresh particles are liable to have much external mixture, while aged particles are abundant in internal mixture (Yamaouchi et al., 2005: Tellus 57B, 141-152; last part of p 149; Hara et al., 2003).

16) p 2294, line 14-26: It is still not clear how the vertical extinction profile was calculated only from hygroscopic growth factors. Is this calculation based on humidity profile as in Fig. 4?

17) p 2296 line 24 - 25: AOD data (measured and calculated) should be shown in the figure, possibly with the figure I requested in the comment (10).

18) p 2296 line 26 to p 2297 line 4: AOD and extinction coefficients even on 27 April when plume had not arrived are still so high, just comparable to the AOD or extinction coefficients on Haziest day during ASTAR 2000 campaign (Yamanouchi et al., 2005, Fig. 6 and 7). Fig. 12 is rather similar to the Arctic haze condition of Fig. 7 by Yamanouchi et al. (2005) for the lowest 2 km.

19) p 2297 line 15-16: "the 27 April 2006 which was already influenced by smoke particles" is surely confirmed as the comment in (18). Then it is better to show the calculation for the real background condition, with no influence of smoke. It might be

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

explained from the temporal variation of AOD, if shown, 5 whole weeks.

20) p 2297 line 25: Following the discussions above, it is not appropriate to mention 27 April as "the pre-smoke day".

21) p 2298 line 27 and p 2300 line 19: a factor of 3 on 27 April and almost a factor of 7 on 2 May —> a factor of 7 on 27 April and almost a factor of 3 on 2 May

22) p 2299 section 5. 3: Difference in heating rate profile depending on the surface albedo is not so large, only 30 - 40 %; while the difference due to the mixing state is so grate.

23) p 2300 line 23-24: Can you show any evidence of this gradual change to the more internally mixed condition?

(Technical corrections) 1) p 2278, line 14: 2003) Northern —> 2003). Northern

2) p 2282, line 13: period end —> period from the end

3) p 2287, line 12 and 21: It is needed to insert "," between "event" and "the mass fraction", between "measurements" and "although", respectively.

4) p 2293 line 24: absorption coefficients and Zeppelin —> absorption coefficients at Zeppelin

5) p 2301 line 2: ground also —> ground, also

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 2275, 2007.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)