

## ***Interactive comment on “Annual cycle of Antarctic baseline aerosol: controlled by photooxidation-limited aerosol formation” by M. Fiebig et al.***

**Anonymous Referee #2**

Received and published: 28 October 2013

### **GENERAL**

The paper presents the analysis of scattering coefficients and number concentrations at two Antarctic stations, Troll and South Pole, and the particle number size distributions at Troll. The analysis shows quite convincingly that the observed aerosol mainly originates from the free troposphere. The paper also presents a hypothesis of that the particle growth to observable sizes is limited by the photooxidation capacity of the air masses containing the particles. This is deduced from the correlation of aerosol volume concentration and cumulative insolation during the previous 20 days before arrival at the site.

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The paper also gives a quantitative formula, the linear regression for the above relationship. This is actually the only problematic point I find in the paper. First of all, any backtrajectories longer than let us say 5 days are highly uncertain anywhere and especially in Antarctica. Sensitivity analyses? Secondly, how did you select the number, 20 days? Why not 5 or 10 days? Would the regression in Fig 10 actually be any worse if you used simply the global radiation observed at the site? Any of these choices would give quite a different formula for the regression line so its quantitativity is problematic. Discuss this point in the next version. In addition to that, I only have some minor comments.

### **MINOR COMMENTS**

Section 2.1 Describe the inlets, especially the cutoff sizes.

p.23061, L24-25. Is the criterion for contamination that number concentration in the range 30 – 40 nm is more than 3 times larger than in the range 100 – 150 nm a bit too restrictive? Why wouldn't that happen in natural particle formation?

Section 4, p. 23064. Did you try iteration for the refractive index?

p. 23068, L26-28 “Particles in the accumulation mode size range are the result of coagulation between Aitken-mode particles and between Aitken- and accumulation mode particles” You miss cloud processing. It results in clearly higher masses than could in practice be reached by coagulation only. This has definitely consequences also in the interpretation of the relationship between aerosol volume and solar insolation integrated over the last 20 days. Discuss this.

Fig 1. Please use a clearly different color for the lines that are now black and blue. It is difficult to see which is which. Black and red would be a more easily distinguishable pair.

Fig 5. I cannot see the Antarctic coastline in the figure. Please use some different color coding.

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Fig 10. The unit of the slope of the regression should be  $\mu\text{m}^3/(\text{MJ m}^{-2})$ . However, the exponent (-2) is missing in the figure legend. Also in the abstract, and elsewhere. Check it.

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 13, 23057, 2013.

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