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Atmospheric Chemistry and Physics Discussions

Interactive comment on "One year of aerosol refractive index measurement from a coastal Antarctic site" *by* Z. Jurányi and R. Weller

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reviewer comment: The authors report on aerosol refractive index observations but never mentioned that the index of refraction is a complex number. Particularly, the imaginary part of the refractive index constitutes the light-absorbing properties of the sampled aerosol. As Weller et al. (2013) reported, there is a small but significant fraction of lights-absorbing material contained in the aerosol in Antarctica. However, the authors never refer to this observation in a quantitative manner, nor they stated the assumption of a zero imaginary part of the refractive index. Furthermore, the scattering cross-section as calculated by Mie or Rayleigh-Debye-Gans theories depends on the square of the complex refractive index which includes the imaginary part. I request a discussion of the uncertainties in calculating the real part of the refractive index, when

neglecting the imaginary part. The effect may be small but it should be mentioned since the imaginary part plays a crucial role in the aerosol radiation interaction.

answer: First of all we would like to thank anonymous referee #3 for his/her helpful comments. We agree about the importance of the imaginary part of the refractive index and the light absorption. However, we do not agree, that we did not mention the assumption of a zero imaginary part of the refractive index: Page 8, Line 7-9: " The imaginary part of the RI was kept at 0 which is an acceptable assumption considering that the absorption is very low compared to the scattering at our measurement site, average single scattering albedo at Neumayer is 0.992 (Weller et al., 2013)." Page 8, Line 16-17: "The other assumption we use is that the aerosol particles are spherical and that the imaginary part of the RI is negligible." Page 13, Line 17-18: "The imaginary part of the RI was again neglected, which is surely a justified assumption, because the volume fraction of the BC never exceeded 0.1% in 2017." But, we agree, that a thorough discussion on the effect of the neglected imaginary part of the RI improves the manuscript. And therefore, we modified the text as follows: Abstract "Given the high average scattering albedo of 0.992 (Weller et al. 2013), we assumed that the imaginary part of the RI is zero." Section 3.5 "The imaginary part of the RI was again neglected, which is a justified assumption, because the volume fraction of the eBC never exceeded 0.1% in 2017. This amout of eBC would add at most a $\sim$4x10-3i imaginary value of the RI." Section 3.7 "Finally we investigate the effect of neglecting the imaginary part of the RI on the scattering coefficient. As we have seen in Section 3.5 including the eBC in the chemical composition adds at most an imaginary part of $\sim$4x10ˆ-3i to the RI. We recalculated the average scattering coefficient size distribution adding this imaginary part to the RI. This gives us a highest possible estimate on the error we make if we would neglect the imaginary part of RI. It turns out that the relative difference of the scattering coefficient size distribution considering 4x10ˆ-3i RI instead of 0.0i never exceeds 1.7% irrespective of the particle diameter."

reviewer comment: Figure 3: I assume that the dashed green line refers to the LAS

uncorrected best fit, please add.

answer: Yes. The figure was corrected.

reviewer comment: Figure 10: I propose to specify LAS original as LAS (m = 1.59); the term “original” suggests that data were modified, which is, however, not the case.

answer: Thanks for the good suggestion! It was adopted for the other figures as well.

reviewer comment: When reporting on the black carbon mass concentration determined by the MAAP, the authors should use the today accepted terminology of “equivalent black carbon” (eBC); see Petzold et al. (2013).

answer: The terminology was adopted in the text, and the reference was added.

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