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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparison of ambient aerosol extinction coefficients obtained from in-situ, MAX-DOAS and LIDAR measurements at Cabauw" *by* P. Zieger et al.

Anonymous Referee #2

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Review of 'Comparison of ambient aerosol extinction coefficients obtained from in-situ, MAX-DOAS and LIDAR measurements at Cabauw' by Zieger et al.

Overview

This paper utilizes humidified nephelometer measurements to (a) determine if there is a somewhat simple aerosol measurement that can be used to predict f(RH) – the scattering enhancement value due to hygroscopic growth and (b) compare in-situ extinction measurements adjusted to ambient conditions with remote sensing extinction measurements. The authors do a very nice job of pulling together information from many different instruments. The comparison with the MAX-DOAS and lidar imeasurements

is especially nice as we need to be able understand how remote sensing instruments relate to the much longer term record of in-situ monitoring.

Science related comments

P29690

Lines 8-11 – the two sentence discussion of losses was vague – in what way were the attempts to characterize losses inconclusive? Be a little more detailed about the losses according to theory. I wouldn't be picky about this except that in the comparison with remote sensing instruments, losses are mentioned as a possible reason for disagreement but the reader doesn't get any feel for what the losses might be (i.e., what size of particles might be lost and the order of magnitude of the particle transmission efficiency is as a function of size – is it mostly coarse aerosol or tiny, optically inactive particles that are lost...or both?)

P29692

Out of curiousity – why not use the Collaud Coen 2010 correction for the MAAP? I think it's more different than merely changing the value of 'C' in the Weingartner correction. (i realize that for the purposes of comparing with ambient extinction it makes little difference).

P29701

Lines 1-27 – I could not follow the discussion in this paragraph and it needs to be rewritten for clarity. I think the point is that both chemistry and size distribution play a role in determining f(RH) but the role of each differs depending on the actual aerosol and perhaps chemistry is most important most of the time. One possible re-write could be making two paragraphs one describing the correlations (or lack thereof) with f(RH) and a second paragraph doing the same for g(RH). Some other things that might improve clarity would be to provide some scattering size distributions (i.e., dscat/dlogdp vs dp instead of dNdlogdp vs dp) for different types of aerosol – you should be able to do

that using the measured size distributions and the mie code. I would imagine (perhaps incorrectly) that for the clean marine and slightly polluted marine most of the scattering at both low and high RH is for the larger particles. You could also present scatter plots of the different properties in figure 3 vs f(RH) colored by air mass type. It might at the very least be helpful to show a plot of g(RH) and f(RH) – either a scatter plot or a time series (maybe for the time period covered in figure 6), colored by some parameter such as airmass origin or coarse mode fraction. I'm not saying any of these plots would be required, I'm just trying to help figure out the best way to explain what you're trying to explain.

I am particularly confused by the sentence: 'The rather low correlation to f(RH) and the significant correlation to g(RH) can be explained by the fact that a larger coarse mode fraction is an indicator for the presence of sea salt, which exhibits a higher hygroscopic growth while a larger BC fraction is an indicator for anthropogenic pollution with a reduced hygroscopic growth.'

Both f(RH) and g(RH) are indicators of hygroscopic growth of the aerosol and the f(RH) curves for different aerosol types in figure 2 suggest one might expect correlation between f(RH) and larger coarse mode fraction and/or BC fraction.

P290702

Line 17 – 'inversion of the dry scattering and absorption coefficients' just for clarity: (a) does this mean you are adjusting refractive indices until calculated scattering matches measured scattering? (b) are you using a size-dependent refractive index or a constant refractive index for the whole size distribution?

P29708

BIRA uses asymmetry and SSA from sunphotometer but comparison improves if use in-situ measurements. . .is this related to poor inversion results of sunphotometer data at low AOD? I believe AERONET only includes SSA and asymmetry values in their

level 2 inversion products at AOD (blue) > 0.04

Typos, wording suggestions

Please use g(RH) for growth factor. This makes it more consistent with the f(RH) usage and also the letter g is used for other aerosol parameters such as asymmetry parameter.

LIDAR is capitalized in title but not in text...

P29685

Line 5 – add the word 'also': . . .are ALSO strongly dependent. . .

Line 20 – second 'needs' should be 'need': . . .and size distribution NEED to. . .

Line 25 – add 'from MAX-DOAS': . . .extinction coefficients FROM MAX-DOAS were. . .

Line 27-28 – change sentence: Differences WERE SHOWN to be dependent on the MAX-DOAS retrieval algorithm applied.

Line 28 – add the word 'extinction': . . .in-situ EXTINCTION data. . .

P29686

Line 10-11 move the word 'also' on line 10 to before 'strongly depend' on line 11

P29687

Line 24 – add the word 'almost': . . ..but ALMOST always. . . (since you provide the Morgan et al 2010 reference which does use humidified neph data)

P29688

Line 12 – change 'was' to 'were': The data WERE compared. . .. (the word data is plural)

Line 15 – add the word 'also': . . .measurements were ALSO compared. . .

P29690

Line 2 – define MAAP and SMPS the first time they are used

Line 20 – get rid of the word ‘and’: . . .humidifier followed by a dryer. . ..

P29691

Line 2 – I don’t like the choice of the word ‘known’ but I’m not sure what is better – described?

Line 18 – the Anderson corrections also account for lamp non-idealities

P29692

Line 13 – rewrite: . . .larger than 0.8 most of the time. . ..

P29693

Line 14 – rewrite: . . .which results in a reduction in size. . . .

Line 25 – rewrite: . . .monodisperse particles are exposed to controlled. . ..

P29697

Line 25 – replace ‘between’ with ‘over’: . . .varying LR’ OVER a range of values. . .

Line 26 – replace ‘verified’ with ‘determined’

P29698

Line 5 – rewrite: The prediction of f(RH) without explicit wetneph measurements at Cabauw is also discussed in section 4.3.

Line 26 – I’m guessing the 90th percentile value should be higher than 1.52?

P29699

Line 1 – add the word ‘dry’ in front of absorption: . . .and DRY absorption. . .

Lines 7-8 – rewrite: Distinct periods of lowered or elevated f(RH) values (see Fig 1a) were correlated with the origin of . . ..

P29700

Line 6-8 – rewrite: The maritime slightly polluted cased (Fig 2d) reveals a similarly high magnitude of f(RH) as the clean maritime case (Fig 2b), but without deliquescence, while the maritime heavily polluted case is. . .. (I think you mean ‘clean’ instead of ‘clear’ in this sentence)

Line 11 – Russell reference – two ‘L’s in Russell.

P29702

Line 21 – replace ‘the one’ with ‘that’: close to THAT of water

P29703

Line 1 – ‘low absorption’ clarify – do you mean organics cause little to no absorption or that they have an absorbing component? If you mean the second should include a citation.

Line 7 – replace ‘next to’ with ‘in conjunction with’

P29706

Lines 13-20 – rearrange: put period after ’. . .JAMSTEC are used’. Then move sentence ‘BIRA and IUPHD retrievals to after . . .JAMSTEC are used. Then have new sentence: For the MPI data a mean aerosol extinction coefficient in the BL is estimated by retrieving the layer height and aerosol optical thickness.

P29707

Line 6 - should be 12 pm ?

Line 13 – replace ‘giving’ with ‘and gives’: . . .being compared AND GIVES no information. . .

Line 15 – replace ‘;displays’ with ‘display’: Figures 8 and 9 DISPLAY the . . .

P29711

Line 11 – replace ‘main’ with ‘best’: The BEST quantity to estimate. . .

Line 13 – ‘or derived from chemical composition measurements’ I think you need to be careful here – I imagine you could get a useful g(RH) value from high time resolution, size-resolved chemistry measurements (e.g., AMS) but I’m guessing a g(RH) value derived from bulk filter measurements might not be as helpful (if one can even get g(RH) from bulk filter measurements!).

Line 14 – replace ‘provide favorable results’ with ‘correlate well with f(RH)’

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 29683, 2010.