ACP Crumeyrolle Review Oct 2013

Summary

This paper utilizes data from a field campaign near Washington DC to evaluate factors that might influence retrieval of PM2.5 from AOD measurements. The two primary factors evaluated are what height is chosen as representative (e.g., top of BL or top of BuL) and hygroscopic growth. This is a good data set, but I feel that the authors have not made the strongest use of it. Below I list some of my questions as well as editorial suggestions.

Science questions

P. 23423 line 7 "Yet, the complexity and resolution of aerosol satellite retrievals…"
P. 23423 line 25 "However, the uncertainty in relating a column integrated AOD to ground-level $PM_{2.5}$ is compounded by timing mismatches between the measurements."
→what sort of horizontal resolution would be required by satellite measurements to do more than have a broadbrush estimate of air quality in a region?
→it seems like spatial mismatches will also compound uncertainty, but your study seems ideally designed to address spatial mismatches due to the relatively close profiles within close proximity. Can you provide any sort of quantification of the uncertainty induced by spatial mismatches by comparing results from one profile site with those from another profile site?

Black carbon (BC)/absorbing aerosol is an air pollutant of interest to both the air quality and climate communities. Are there any plans to use the large amount of data from this data set to evaluate AERONET retrievals of absorption optical depth? This would be HUGELY interesting to many people. See the Bond et al. 2013 so-called "bounding BC" paper published in JGR earlier this year.

The flights described here all took place in the summer time. Is more reflective surface albedo the only confounding effect to this type of analysis in the winter?

P23427 lines 15-25 Description of neph and PSAP on P3 – how was the low RH maintained for the PSAP? Was it also downstream of the perma pure dryer?
Also – the PSAP is notoriously sensitive to both pressure changes and RH variability (even at low RH) – how was that dealt with in the dataset? Or was the absorption measurement a small enough fraction of the extinction that even with PSAP noise that wasn't a big deal?

P23435, line 8-10 *"According to the Mie theory, small particles (D_p less than 100 nm) are significantly less optically active than larger paricles, but still impact the total aerosol mass"*
Perhaps I'm thinking about this wrong, but doesn't scattering vary as diameter-squared while mass varies as diameter-cubed? So wouldn't these smaller particles have more optical effect than mass effect? Also, typically Mie theory does not have 'the' in front of it so →"According to Mie theory…" You mention Angstrom exponent, but how does the in-situ and AERONET Angstrom exponent change for times when the smaller particles are present? Is it sensitive enough to be a useful measurement if these particles aren't very optically active? This would be a useful additional plot to show as it's a more readily available parameter than sub0.1um particle size.

P23436, lines 11-12 *"while the presence of an elevated layer is leading to a spread of the data set (0.71) and a slope 1.6 times lower…"*
→while the presence of an elevated layer leads to a wider spread of the data set (R2~0.71) and a lower slope (46.3).

→does this increased slope for the BL dominated profiles suggest that the Hoff and Christopher and Engel-Cox citations were affected by the pitfall of elevated layers? 46.3 is right in the middle of the slope range reported by Engel-Cox.

Discussion related to figure 8: it seems like other measurements such as effective size and chemistry (sulfate/OC) which you also have for all these profiles would be better indicators of the similarities between BL and BuL.

P23439, line 3-4 *"During this campaign, the f (RH)$_{amb}$ values were observed to vary significantly from 1.03 to 2.3 on a day-to-day basis, but the profiles were fairly constant within the BL."*
How did the f(RH=80%) and/or gamma values vary over the course of the campaign? This would give a good indicator of changes in aerosol chemistry with time

In general I found the discussion of relative humidity/f(RH)/water uptake confusing. I think more work needs to be done on this section including some discussion of changes in column RH. water uptake is not going to happen unless there is water vapor available to be taken up, but the focus was on f(RH)amb which is a less readily available parameter than atmospheric RH. I suggest the authors add some information about how know ambient RH or column RH or BL RH (some parameterization of atmospheric RH) would help with PM2.5 retrieval even if f(RH) is not known.

Typos, missing information and semantic quibbles
General comment – I feel that the authors, in general, went for the easy citations – the ones they had at hand – rather than citing the original piece of work. That feels ethically wrong to me. At the very least they could say 'and references therein' to show that the work they've cited is a branch instead of a root. Unfortunately, due to my limited access to bibliographic resources at the moment I'm not able to provide the exact citations that I think should be included.

In terms of reporting values – both the AERONET retrievals and the in-situ measurements are spectral – you need to make clear what wavelength you are using in the text and in the figures. I've made notes for all the figures, but you should also do so in the text, particularly when a wavelength dependent property is used in a calculation (e.g., MEE)

Abstract
"…(AOD) calculated with the extinction (532 nm) measured during the in-situ profiles…"
532 or 550 nm? The TSI neph measures at 550 nm and while the PSAP green wavelength is 532 nm the text immediately after (p23427, line 22) says that the PSAP measurements are interpolated to 550 nm. The only other mention of 532 nm in the paper is in reference to a paper by Ziemba et al comparing in-situ measurements to the HSRL retrievals which are made at 532 nm.

"This motivates the use of active remote sensing techniques to dramatically improve air quality retrievals."
I'm not sure this sentence belongs in the abstract as it suggests/implies that active remote sensing techniques were used in the study described in the manuscript. Perhaps it could be rephrased: "This suggests that the use of active remote sensing techniques would dramatically improve AQ retrievals." This point should more strongly be made in the text and conclusions if it is worthy of a place in the abstract.

"…the f(RH)$_{amb}$ (obtained from two nephelometers at different relative humidities – RHs)…"
fRHamb needs to be defined for the uninitiated. Alternatively, you could say: "…the *f*(RH)$_{amb}$ (ratio of scattering at ambient relative humidity (RH) to scattering at low RH) and

leave the description of how you arrived at it for section 3.

P23424 line 24. *"This changes the ambient aerosol mass…"*
Change to: "Water uptake change the ambient aerosol mass…"

P23427, line 25 "*The standard corrections…"* it's not the corrections per se but the issues with filter-based measurements of absorption and the PSAP instrument in general.

P23424, line 26-28 *"Currently, aerosol liquid water content is not measured at the ground sites of the global atmosphere watch(GAW) network and nor at a global scale…"*
You need to be careful not to paint with such a broad brush – aerosol hygroscopicity either in terms of scattering as a function of RH (i.e., f(RH)) or particle size as a function of RH (sometime called g(RH) and also sometimes called f(RH)) is measured at some GAW surface sites, it's just not a standard measurement at most sites.

P23425 lines 1-2 *"..or use an empirically-derived dependence of extinction coefficient on relative humidity f (RH).."*
Interesting – I would say that the majority of papers I've read comparing in-situ vertical measurements with AOD retrievals (more in the climate sphere than the AQ sphere) utilize measured hygroscopicity rather than 'empirically derived' functions.

P23425 line 14 "*..over geographically complex source regions..*"
Seems like the above statement contradicts this earlier statement:
"The eastern United States has been shown to be a good location for ascertaining $PM_{2.5}$ *information from aerosol optical depth (AOD) due to (1)more uniform vertical distribution of aerosols, (2) chemical composition that is dominated by sulfates, (3) a uniform topography and (4) widely distributed anthropogenic emission sources (Engel-Cox et al., 2006)."* (from p23423, lines 19-23)

P23425 line 15 "*San Juaquin*" → "San Joaquin"
P23425 line 15 "*the Houston, TX*" → "Houston, TX" unless you meant "the Houston, TX region"

P23425, line 22 "…*P-3B instrumentation and the observations…"* → "…P-3B instrumentation and the ground-based observations…"

P23427 line 1-3 *"Beltsville, Fairhill and Edgewood were also equipped with in-situ aerosol and trace gas monitors that were operated within EPA's AQS network (http://www.epa.gov/ttn/airs/airsaqs/)."*
Add after the above sentence – 'Relevant to this study are the EPA's PM2.5 and ozone measurements.'

P23427, line 19 *"…corrected from angular truncation…"* "corrected for angular truncation and other neph non-idealities" (AO1998 also corrects for non-idealities in the neph light source and I think something else as well)

P23428, line 14-15 *"..and was inversely correlated with the organic mass fraction of the aerosol (Beyersdorf et al., 2013)."* I'm assuming Beyersdorf will cite the seminal work by Quinn relating hygroscopicity and organic mass fraction. Since Beyersdorf isn't published – it might be useful to cite the Quinn paper.

P23428, lines 16-18 *"Recently, Ziemba et al. (2013) presented a statistical comparison of in-situ extinction coefficient measurements coincident with remote-sensing observations performed by the HSRL (both measurements were performed at 532 nm)."*

Just out of curiousity – were these different in-situ measurements (e.g., using an extinction instrument measuring at 532 nm? If these were the same measurements as described here then this should be rephrased because the scattering portion of extinction would need to be adjusted to 532 nm.

P23428 – should state where the measurement of ambient RH came from, i.e., standard meteorological measurements on the P3 or whatever.

P23429 – eq 1 –the 'wet' neph measures at 80% is not necessarily measuring at ambient RH, correct? I would recommend changing the subscript in equation 1 to 'wet' and clarifying the procedure to determine fRHamb: first gamma is calculated using the wet neph RH (80%) and the dry neph RH. Then that calculated gamma value is used in conjunction with the measured ambient RH and the dry neph RH to determine the actual fRHamb value. Should also note that equation 1 does not model deliquescent aerosol.

P23428, lines 24 *"…the Gasso parameterisation* (Eq. 1)"
This is one of those places where I'm pretty sure that calling this 'the Gasso parameterisation' is ignores a bunch of tandem nephelometer hygroscopicity research that has gone before. See for example work by Mark Rood's group at the University of Illinois and Covert/Hegg group at the University of Washington. Work from both these universities, particularly a paper with lead author Carrico (I can't remember what study unfortunately), cites even earlier work (from the late 1960s?) using a similar (identical?) function for hygroscopic growth. Furthermore there is no citation of a paper by Gasso to support calling equation 1 'the Gasso parameterization'.

P23429, lines 7-10 *"and assuming a particle refractive index of 1.53 – 0.00 i for ammonium sulfate (Ziemba et al., 2013). This closure exercise (slope of 0.991±0.004 and R_2 of 0.98) gives confidence in both the $\_{scat,dry}$ and dry size distribution measurements."*
Do you need the PSAP measurements at all? This closure result suggests that there is virtually no absorbing aerosol.

P23429 SP2 measurements – if they aren't used don't take up the space with mentioning them here…

P23431 lines 4-5 *"…The comparison shows good correlation (R_2 = 0.96 for each wavelength),"*
Presumably you have used the angstrom exponent of scattering from the neph and absorption from the PSAP to adjust the P3 values to the AERONET wavelengths for figure 3. You should state that somewhere – in the P3 instrument description you only mention adjusting the PSAP to 550 nm.

P23431 lines 9-14 *"The larger offset (23%), compared to the 11% offset calculated by comparing AOD_{HSRL} and $AOD_{P\text{-}3B}$ mostly due to inlet and dryer particle losses, may be due the presence of an aerosol layer above the HSRL flight level (above 8.5 km), incorect AERONET AOD cloud screening, or underestimation of the contribution below the P-3B profile height (closest to the surface)."*
This sentence is confusing – is it saying that the main issue with the HSRL/P3 comparison is inlet/dryer losses, but the AERONET/P3 comparison may have additional causes resulting in a larger offset? I would rephrase the sentence. It seems that inlet/dryer losses and the estimation of aerosol between 0-300 m would also be a problem with the HSRL/P3 comparison. You may also want to look at Esteve et al (2012?) which looks at reasons for differences between AERONET and in-situ measurements.
Also 'incorect' is spelled incorrectly.

P23432 , lines2-3 "*Each integral of the Eq. (3*)…" → "Each integral in Eq. (3)…"

P23432, line 10 caped→capped

P23432, line 10-12, *"The aerosol present in the BuL accounts for 48% of AOD$_{P\text{-}3B}$ compared to 46% within the BL (Table 1)."*
Perhaps make it more clear for the three types of profiles that the relative % contribution of AOD for the different sections of the vertical profie is the mean (median) contribution for profiles of that type rather than for the individual profiles represented in figure 4. Note: I think this whole paragraph is confusing – there are percentages of types of profiles and percentages of contributions from different parts of the profiles and it's poorly organized. Perhaps talk about the percentages of each type of profile first and then talk about characteristics of the profiles types after that. See my comments about Table 1 as well.

P23432, line 16 *"Alternatively…"*
Alternative to what?

P23432, line 19 *"Furthermore, the value of _$_{ext,dry}$ has an averaged small variability within the BL (< 9 %)."*
Presumable you mean for a given profile? Rephrase "…has a variability of 9% within the BL based on BL averages for all profiles.

P23432, line 22 *"…commonly cited in literature (Koelemeijer et al., 2006)."*
→"… commonly cited in literature (e.g., Koelemeijer et al., 2006).

P23432, eq 5 - to generalize equations 3 and 5 wouldn't it be better to replace AOD_P3B with plain AOD? They should be equally true of any vertical measurements of extinction (e.g., in-situ, lidar)

P23433, line 6 *"serie"*→series

P23433, lines 6-8 *"This time serie highlights the large variability of the hourly averaged $PM_{2.5}$ within a highly polluted period (Julian Day 201–205, $PM_{2.5}$ greater than 30 μgm^{-3}) and a clean period (Julian Day 195–199, $PM_{2.5}$ less than 10 μgm^{-3})."*
This is, perhaps, a quibble about phrasing – are you trying to contrast the wide range in PM2.5 values between clean and polluted periods or say that there is lots of variability within clean periods and within polluted periods? It sounds like the latter, but I'm guessing the former was what was intended.

P23433, lines 14-16 *"The back trajectories showed that the highly polluted periods were associated with air masses coming from the Ohio River valley, a region typically associated with power plant emissions."*
Where were the back trajectories for clean periods from? Should also comment on that even if there was no consistent pattern.

P23433, lines 26-27 *"…and the average aerosol extinction…"*→ "…and the average dry aerosol extinction (wavelength=XXX nm)"

P23434, line 16 "…*may have cause…"* → "…may have caused…"

P23434, line 27-28 *"…which is in good agreement to the values…"*→"… which is in good

agreement with the values…"

P23435, lines 19-20 *"Indeed, the non-linearity can be avoided using a threshold value for the angstrom exponent (less than 2.4)."*
Where does this value of 2.4 come from – it should either be cited or discussed based on the presented data. Also, Angstrom is a proper noun and should be capitalized (there are also diacritical marks circle over the 'A' and umlaut over the 'o' for it to be written completely correctly).

P23436, line 19 "*The BL and BuL heights are used to represent the height of this mixed layer"*
Do you mean BL and BL+BuL? As suggested further on in the paragraph? Note the figure caption for figure 7 only says BL or BuL. Should be clarified and caption/figure labels corrected if needed.

P23436, line 20-21 *"represents the BL and the BL + BuL contribution to the total AOD (Fig. 7a and c, respectively)"* →"represents the BL (Fig 7ab) and the BL + BuL contribution to the total AOD (Fig. 7cd)"

P23436, line 27 "The slopes of these tendencies…"→The slopes of these PM2.5 vs volume relationships…" this discussion of density is a little distracting. Perhaps remove?

P23436, line 29 *"Strong relationships (with low variability)…"*
I would move this sentence up to where you are specifically talking about figure 7bd.

P23437, line 3 "*the haze layer concept"*
What is the haze layer concept? Do you just mean the BL+BuL?

P23437, lines 6-8 *"The same study has been done using the haze layer calculated from the HSRL measurements (Scarino et al., 2013) and showing similar improvements (Fig. 7c and d, R^2>0.95)."*
This sentence is confusing – does Fig 7c include HSRL measurements? Please clarify

P23437, lines 8-10 *"Nevertheless, the haze layer is a Lidar product and might not been available for most of the AOD and $PM_{2.5}$ relationship."*
Bad grammar.

P23437, lines 10-11 *"Thus, this results show that using the BuL instead of the BL from radiosounding measurements will improve the $PM_{2.5}$ retrivals from the AOD."*
Do you mean BL+BuL? Or the height of the BuL which is BL(z)+BuL(z)?

P23437 lines 12-13 *"Few cases show the presence of an aerosol layer above the BuL similar to the case study shown in Fig. 2c"*
Do you mean figure 4c? on P23432, line 15 it sounds like 23% of the cases have an aerosol layer like fig 4c.

P23437, lines 13-14 "*From the profiles of the AOD contribution, the layers above the BuL contribute to more than 10% of the total AOD, on average"*
From which profiles? All profiles or just the ones that look like figure 4c? also – 'to more than 10%' do you mean 'no more than 10%'? otherwise you should clarify how much more than 10% because that could potentially be a significant contribution.

P23437, line 23-24 *"…and f (RH) constriction due to similar properties of the aerosol*

*sampled within the BL and the BuL"→"…*and *f* (RH) constraints. We assume this is due to the similar properties of the aerosol within the BL and BuL, e.g., f(RH) and Angstrom exponent (Fig 8)."

P23437, lines 24-29 "*The comparison of the scattering Angstrom exponent (between 450 and 700 nm) and the f (RH) measured during each P-3B profile performed over the DISCOVER-AQ ground sites (Fig. 8) and the average within the BL and the BuL highlights strong similarities of the aerosol physical and chemical properties in each layer."*
Change to: "Figure 8 shows a comparison of BL and BuL values for scattering Angstrom exponent (between 450 and 700 nm) and f(RH=80). The plots show the parameter averages for each vertical layer (BL or BuL) during each P-3B profile and highlight the strong similarities of the aerosol physical (represented by Angstrom exponent) and chemical (represented by f(RH=80) in each layer."

23438, lines7-8 are Twohy and Schuster really the first references to note aerosol properties might change at high RH?

23438, eq 6. This water fraction equation is also equivalent to 1-f(RH)amb, right? You could provide a second x-axis on figure 9 with the values of f(RH)amb.

23438, lines 14-21 There has got to be an AOD climatology paper that would be a more appropriate reference for AERONET AOD values at different site regimes. How about the paper by Augustine which summarizes AOD at several remote rural sites including the Oklahoma site mentioned in the Andrews 2011 paper. MLO is perhaps a bad site for comparison. It's in the free troposphere at night, but AERONET measurements occur during the day so the average AOD measurements at MLO are more likely to be representative of upslope air from the coastal communities below the volcano unless the data are screened for that.
P23438, line 24 *"…aerosol loadings versus the contribution of water uptake and the aerosol loading…"*
I would rephrase: "…aerosol loadings versus the combined contribution of aerosol loading and water uptake…"

P23438, line 25 "*The AOD is increasing with the water fraction (Eq. 6), on average from 0.15 for AOD around 0.1 to 0.35 for AOD around 0.35, showing that the larger AOD values (> 0.4) are mainly driven by aerosol water uptake…"*
This is a confusing sentence. I think what you mean to say would be clearer if you said: AODamb increases with water fraction by XX% for AODdry around 0.1 to XX% for AODdry around 0.35. This suggests, that at this location and for these profiles, the larger AOD values are mainly driven by water uptake."
Also, please clarify - are the higher AOD cases also associated with higher ambient RH values? Is this a meteorology effect or an aerosol chemistry effect or a combination of the two?

P23438, line 25+++ *"on average from 0.15 for AOD around 0.1 to 0.35 for AOD around 0.35, showing that the larger AOD values (> 0.4) are mainly driven by aerosol water uptake.*
"on average from 0.15 for AOD around 0.1 to 0.35 for AOD around 0.35, showing that the larger AOD values (> 0.4) are mainly driven by aerosol water uptake.

P32439, lines 5-11. This section is very confusing to me. Are you trying to separate the contribution of aerosol water AOD and aerosol AOD? Are the AODP3-B values for dry

or ambient AOD? In the figure, presumably the volume measurements are at low RH while the AOD are at ambient RH so you are observing that low aerosol volume corresponds with low hygroscopicity (low fRHamb). Please make this section more clear – I think there is something interesting to talk about here.

P32439, lines 12-22 this section is also not clear. The paper by esteve et al in ACP also found better agreement between in-situ derived AOD and aeronet AOD when atmospheric RH was low. I think the point you are trying to make is that there can be vertical variations in RH which will affect aerosol optics so surface measurements of hygroscopicity or RH may not be representative of the column. I would rephrase this section. I would also put a second set of points on the plot showing the ratio of RH_ground/RH_P3-B. That's the more important ratio as vertical profiles of RH are more readily available from sondes.

P23440 lines 2-4 *"The measurements were performed during one month and show that the aerosol mass concentrations ($PM_{2.5}$) measured at the surface (EPA ground sites) are driving the AOD."*
In section 5.1.2 it seems like you are trying to make the argument that AOD is driven by RH. please clarify

P23440 lines 14-16 *"…which highlight different tendency as a function of the presence and the optical thickness of the elevated aerosol layer."*
This phrase doesn't make sense

P23440 lines 17-18 "*Using the BuL instead of the BL top as the height for the aerosol layer dramatically improves the $PM_{2.5}$ estimation."*
Rephrase: Using the top of the BuL instead of the BL top as the height…."

P23440 lines 19-20 "*The $f(RH)_{amb}$ effect on the estimation of the $PM_{2.5}$ is secondary compared to the BL contribution and induced an error factor of 1.6. Comparision of the observed $f(RH)_{amb,P\text{-}3B}$ and the calculated $f(RH)_{amb,ground}$ show that the errors are lower than 10% when the RH within the BL is lower than 55% while the errors are larger than 19% when RH within the BL is larger than 75 %."*
Rephrase. This isn't clear. Presumably you mean the error in the calculation of PM2.5. you should say what direction the error is – over or under estimate of PM2.5. Related to my comments in the text – the more important thing is humidity and perhaps this entire section should be re-evaluated.

PM23440 line 27-28 *"…shows a less-pronounced improvement.."* →is less important for estimated PM2.5

PM23440, line 26 "…The generally dry conditions observed throughout the study may…" did you quantify the 'dry' conditions in the main text of the manuscript? i.e., were you able to compare column average RH for the time of the study with a climatology of column average RH for the reason – 2x daily sondes are available for that sort of analysis.

References
Beyersdorf is not in alphabetical order

Tables
Table 1
→refers to figure 3abc, but should refer to figure 4abc.
→Caption has grammatical and spelling errors.

→Add another row to table giving percentage of each profile type.
→if the percentages are indeed just for the 'case study profiles' then I would recommend deleting this table or changing so the percentages are for the profiles of each type.

Table 2
→Caption has grammatical errors
→Why not include all profile sites in this table?
→having all blanks for Beltsville is not useful – put a note at the bottom of the table explaining why no values for Beltsville

Figure 1 – it might be helpful to put a scale on the map as well as lat/long coordinates

Figure 3 – (a) include a regression on the plot (b) color code the dots by wavelength – e.g. blue dots=440 nm, green dots=500 nm and red dots=675 nm. Also it's not clear the value of including all wavelengths on the plot – you could probably do just one of them and state that similar results were observed for all three wavelengths.

Figure 4 what wavelength of extinction in figures 4abc and what wavelength of AOD in figure 4d?

Figure 5 what wavelength of AOD?
→Why no R2 for the blue equation?
→what does the black font equation represent? All points or points not included in the blue fit?

Figure 6 caption does not match plot. If plot is correct please provide AOD wavelength

Figure 7 "***Fig. 7.*** *Ambient AOD measured by the P-3B as a function of the Volume concentration weighted by the BL height and the f (RH)$_{amb}$. The color code represents the BL contribution to the AOD and the size of each dot correspond to the BL height. The red line is coresponding to the linear fit of cases where the the AOD contribution of the BL is higher than 75 %."*
→please provide AOD wavelength.
→lower case Volume
→volume conc. weighted by BL(z) and f(RH) is a function of AOD the way the plot is presented
→coresponding is spelled wrong, and rephrase: 'The red line corresponds to…'
→two 'the's in front of AOD in last sentence
→why are there 4 different plots
→why does only one of the plots have a fit line?
→figures should be described more clearly in the caption for each of the abcd labels.

Figure 8 "***Fig. 8.*** *Comparison of the Angstrom exponent between 450 and 700nm* ***(a)****, and the f (RH)* ***(b)*** *averaged within the BL (Boundary Layer) and the BuL (Buffer Layer) at the different DISCOVERAQ sites (Beltsville, Padonia, Fairhill, Aldino, Edgewood and Essex). The black line corresponds to the 1 : 1 line and the gray area represents the 10% variability."*
→Rewrite caption. Very confusing.
Something like:
Comparison of aerosol properties averaged within the BL and the BuL for all DISCOVER-AQ sites (a) the Angstrom exponent between 450 and 700nm (b) f(RH). The black line corresponds to the 1 : 1 line and the gray area represents the 10% variability."
→what wavelength f(RH)?

→Label axes better. How about something like Angstrom in BL and Angstrom in BuL or subscript the BL and BuL
→presumably this is f(RH=80) not f(RH)amb. Should clarify in caption and text.
→provide linear fit equation and correlation coefficient so readers can have feel for correlation.

Figure 9 "***Fig. 9.*** *Frequency of the AOD retrieved from ambient extinction coefficient measured aboard the P-3B and the water fraction (WF, %) associated with observed dry (P-3B) and ambient (P-3B) AOD."*
→what wavelength AOD?
→presumably the black line is the water fraction?
→why do you need to say dry and ambient P3 AOD? Can't you just say ambient?

Figure 10 what wavelength AOD?