

Interactive comment on “Relative humidity impact on aerosol parameters in a Paris suburban area” by H. Randriamiarisoa et al.

Anonymous Referee #1

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This paper uses a suite of measurements (chemical, physical and optical) to estimate the influence of relative humidity (RH) on particle properties. The unique approach they take in this paper is to use measurements at ambient RH and use the natural changes in RH to look at the hygroscopicity of the particles. The suite of measurements allows them to check parameterizations of aerosol water content. In addition, one useful product of this paper is reported $f(\text{RH})$ values (scattering $f(\text{RH})$) as opposed to diameter $f(\text{RH})$ for an urban environment. Typically most $f(\text{RH})$ studies are done for remote environments or for specific aerosol types (e.g., studies such as INDOEX, ACE-ASIA or SCAR-B)

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While I think the approach the authors take is interesting, I think it would be more useful to go beyond 'coherence' and take the data they have one step further. It would be great if they could actually try to achieve closure i.e., how does scattering calculated from Mie theory (using the measured size and chemistry) compare to the measured scattering. There are a variety of Mie codes which can easily be downloaded from the web to do these calculations or one can do them using a spread sheet. These closure calculations have been done by other groups but not necessarily at ambient RH (e.g., Wex et al., JGR, 2002; Quinn and Coffman 1998).

Page 8093 since diameter growth is discussed as a function of $f(\text{RH})$ using TDMA type instruments, the authors should also reference some of the large body of humidified nephelometer work (e.g., work by Carrico, Covert, Ogren, Rood to name a few)

Page 8095 radius ranging from 0.05 to 1.5 μm how get 100% efficiency for 0.1 μm ?

Page 8097 what are the precision/uncertainties inherent in the size distribution measurements? Optical particle sizers are typically calibrated for particles of one refractive index which is usually quite different than the refractive index of ambient aerosol particles. This can lead to uncertainties in the sizing of the particles. See papers by Baumgardner for general discussion of this for some specific OPCs and also papers by Hand and Kreidenweis.

Page 8097 at what RH were the size distribution measurements made? Note: if at ambient conditions the refractive index will be significantly lower than for dry conditions and will lead to further uncertainties in the size measurements.

Page 8097 Give the size cuts for each of the chemistry measurements (or say that there was no size cut.

Page 8097 contribution of 0.1 μm particles to mass is typically small so can caveat comment about losses for $dp < 0.1 \mu\text{m}$ increasing rapidly (this comment is made later in the paper, but should be made now) This would also be a good use of the Mie code

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and measured size distributions to estimate what the contribution $dp < 0.1 \mu\text{m}$ particles to scattering are.

Page 8099 using N_t to normalize neph scattering for changes in aerosol amount can bias the normalization towards smaller particles which are less likely to scatter light. With the number concentration and scattering data that I am familiar with any relationship between N_t and scattering is the exception not the rule! It might be better to use KC18 data which will encompass most of the particles which scatter light (i.e., $dp > 0.1 \mu\text{m}$).

Page 8102 I agree that the nucleation mode particles are hydrophobic, but perhaps should mention this could be a chemistry or size effect as these are the particles that won't pick up water because of the curvature term in the Kohler equation.

Page 8103 what is meant by occupation rate?

Page 8103 The authors spend some time discussing coarse aerosol mass size distribution and the need to know it and then suggest that aerosol emissions are probably mainly due to automobiles. Automobile emission is more likely to be in the fine mode while coarse mode aerosol tends to be 'natural' such as sea salt or dust.

Page 8104 Say in the text what elements make up most of the mass of the coarse mode and hypothesize on what the source of this aerosol might be (e.g., dust) (see following comment)

Page 8104 the authors suggest a mode radius for the dust particles in the coarse mode. This is the first mention of dust. They should explain why they are assuming dust (and not, for example, sea salt since the air masses also pass over the ocean)

Page 8105 I'm not sure why the authors state that they are going to focus on water soluble particles with $dp < 1 \mu\text{m}$ in this section. The nephelometer was presumably measuring all aerosol not just sub- μm aerosol. The other chemical measurements don't have a size cut (at least there is not one noted in the text). One can probably

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safely assume that most of the POM and BC are in the sub- μm mode. However, the residual appears to mainly be in the coarse mode based on figure 6. If the residual is dust it may be hygrophobic and may strongly affect the total aerosol water content. I suggest that the authors (a) get rid of the sentence saying they are focusing on sub- μm water soluble and (b) add the total water soluble mass concentration to Figure 6.

Page 8107 The authors assume that the POMs and BC are hygrophobic. This is a fine assumption but should be supported by some references.

Page 8111 give references for where you say fscatt is typically reported in the literature for $\text{RH}=80\%$

Table 4 include fscatt measurements by Covert et al 1972 for urban aerosol (Seattle, Altadena, Denver) and Covert et al 1980 (Pasadena Pomona and Fresno). These sites should be fairly comparable to $f(\text{RH})$ measurements in a Paris suburb.

Figure 2 the differing scales for these plots was a little deceiving. I would recommend using 10^{-10} for all y-axes so that P4 would stand out. It would have values up to 12 instead of 1.2.

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