Answers to review 1

General comments:
In his general comments, reviewer #1 suggests possible studies beyond the present paper and expresses a principal concern.

One suggestion for future studies is a statistical analysis of fog PSDs. We are happy to let reviewer 1 know that such an analysis is already under way in our research group and will hopefully be the object of an article soon.

The principal concern stems from the quasi absence of discussion on the choice of the laser wavelength. As a matter of fact, we tested several wavelengths – those in Pinnick et al. 1979 plus the 1.5µm as it is commonly used nowadays by Doppler lidars – and we confirm the thermal IR is the only one that gives a relationship independent of the actual fog PSD. This will be stated in the revised article.

Specific comments

- Abstract: the conclusion in the abstract was misleading. The sentence "The study suggests the relationship is mostly sensitive to the real part of the refractive index and the sensitivity grows with the size of fog droplets" is true (see figures 10 or 11), but as we say in the next sentence, it should have little consequence in practice as the matter of big fog droplets is dominated by water and the refractive index should thus be close to that of water. For ths reason, it is likely that the uncertainty on the refractive index will thus mainly affect measurements in light fogs with small droplets. This shall be clarified in the revised article.
- Section 1: as people working for a weather service, it is true that airports are of a major concern for us. And it is certainly there that the major "enjeux" are. But the reviewer is right, fog is a concern for car traffic. We will open the scope of our introduction in the revised article.
- Section 2
    - We will check the notations for the instruments are uniform in the revised article.
    - Many PSDs were measured during the PARISFOG campaigns. Using all of them was not possible. Our selection was primarily based on the total liquid water content. We tried to cover a LWC range as large as possible. Visibility measurements available on the site was also a good indication of the "optical" thickness of fogs. We will try to expand a little bit more on the selection process in the revised article.
    - We have no automatic procedure for fitting modes to actual PSDs. We use a graph tool (an excel sheet). Parameters for the various modes are entered manually, and number of particles in PSD size classes are automatically computed, represented in a graph where actual particle numbers are also drawn. The user then "plays" with the mode parameters until a good match is achieved. We will clarify this in the revised article.
    - Reviewer 1 is right, we must clarify the fact that the instruments are time synchronized.
- Section 3
    - The units will be added.
    - A reference to a definition of Q_{ext} will be added (from Bohren and Huffman).
    - For the applicability of equation 4, we will add a graph showing the Q_{ext} as a

function of the size parameter $2\pi r/\lambda$ and the linear approximation and explain the Q_{ext} is given by the Mie theory (with a reference to original paper from G. Mie) and clarify the domain of applicability of this theory (spherical, homogeneous spheres).
    - We will detail a little bit more the derivation of the equation for W (again, the particle is assumed spherical).
    - Reviewer 1 is right, there is a mistake in equation 7. It should be:

$$\hat{F}(r) = \frac{2\rho\lambda}{3c_e} r^2 Q_{ext}(r, \lambda)$$

      It will be corrected in the revised article;
- Section 4
    - We will try to find additional references.
    - The formation of fog from aerosols is described in e.g. *Frank G., Martinsson B. G., Cedeifelt S.-1., Berg O.H.,Swietlicki E., Wendisch M., Yuskiewicz B., Heintzenberg J., Wiedensohler A., Orsini D., Stratmann R, Laj P. and Ricci L.,* 1998: Droplet formation and growth in polluted fogs. Contr. Atmos. Phys. 71, 65-85.
    - Figure descriptions will be improved.
    - We will remove “which dominates the extinction” as it is not a key argument. The key argument is that a higher complex index means stronger absorption of the laser light and therefore enhanced extinction.
    - The refractive index will be introduced as a third argument for Q_{ext} to clarify where the index has an impact in the equations.
    - Measurements of radiative fog thicknesses in Paris can be found in Dabas et al., 2008. We will look for a better reference.
    - Figures will be modified as suggested by the reviewer.

Technical comments will be considered for the revised version of the article.