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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Droplet activation behaviour of atmospheric black carbon particles in fog as a function of their size and mixing state" *by* Ghislain Motos et al.

Anonymous Referee #3

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General comments: This paper investigates the activation of internally mixed black carbon in fog by making use of the low supersaturations within fog to do a closure study on the droplet activation behavior of BC-containing particles. The measurements were taken during a field campaign in a residential area of Zurich in the winter, and indicate that aerosols sourced from traffic during rush hour periods are generally less hygroscopic than aerosols sourced from wood burning.

The paper is well-written and uses novel methods to demonstrate good agreement between predicated and observed behavior. It is appropriate for ACP and is a useful scientific result that will help to constrain the lifetime of BC in the atmosphere, and

demonstrates that simple parameterizations of hygroscopicity in terms of a kappa-Köhler parameter are in good agreement with atmospheric observations.

The methods and measurements are adequately described, as are comparisons with previous atmospheric observations. There are a few minor points that should be clarified to make the paper clearer. The paper would also benefit from a more focused discussion on the major conclusions of the paper, as it is sometimes challenging to follow.

Specific comments: Some of the figures are hard to read (the text is very small). There are also quite a large number of figures (11) and I would suggest moving some of the less important figures (e.g. figures 4, 5, or 6) to the supplemental information to draw more attention to the other figures.

To improve the clarity of the discussion it would be useful to have a table summarizing the different variables, such as the activation diameters and supersaturations.

It would be useful to clearly state the upper and lower limits for the optical size range of non-BC containing particles detected by the SP2 in the 8-channel configuration, and at what optical size the scattering detectors are saturated.

It looks like the laser power in the SP2 used to determine the optical size was only calibrated twice with PSL's, before and after the campaign; were these two calibrations consistent?

Why was the AMS not used to estimate the index of refraction of the coatings based on the chemical composition of the bulk aerosols? Also, what is the motivation behind choosing the refractive index values for the coatings? These values were given without justification or reference. How much would the index of refraction vary based on the observed bulk aerosol chemical composition, and what is the sensitivity of the calculated kappa values for different values of index of refraction for the BC coating?

Figure 9 – This size dependence could also potentially be explained by dry deposi-

tion removing larger, thickly coated BC particles more efficiently. It would be useful to estimate the relative importance of dry deposition. Also, are there any potential size-dependent biases in using the delay time SP2 method for separating the two populations of aerosols?

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