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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Experimental study of the aerosol impact on fog microphysics" *by* Marie Mazoyer et al.

Anonymous Referee #4

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The manuscript "Experimental study of the aerosol impact on fog microphysics" by Mazoyer et al., aims at describing fog droplet size distribution in a semi-urban environment and at improving model ability to describe the impact of aerosol properties on fog microphysics. In particular the paper derives k-Kohler parameter of aerosol during different different fog events and evaluates the different modelling approaches to describe CCN concentration.

The paper is well written and clear, the data are presented in detail and, although the complexity of modelling/observation integration, the reader can follow the discussion easily. Assumptions used to estimate k variability and particle size distribution variability are clearly described.The number of figure is high and I would suggest to move some figures to the supplementary material. For examples Fig 2 used to validate the

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Discussion paper

droplet size distribution measurements can be moved in supplementary. Figure 3, as well, can be moved to supplementary, since the variability of Na and NFM is already clear in Table 2. Figure 5 and 6 can be moved to supplementary, as well, as an example to show the variability of particle size distribution and the variability of kappa.

Major comments

The paper deals with fog formation considering only fog droplets formed in super-saturated conditions, i.e. at RH larger than 100%. Thus, the authors analysed the aerosol and fog microphysical measurements using the k-kohler theory, derived from a parametrisation of the Kohler theory. Nevertheless, Charlson et al. 2001 claimed that "soluble gases, slightly soluble solutes, and surface tension depression by organics also influence the formation of cloud droplets in a manner unforeseen by Kohler". They concluded that "clouds or fogs with micrometered-sized droplets may exist even though the droplets have not undergone traditional activation and even though the ambient relative humidity never exceeds 100%" It would be useful if the authors could discuss their results at the light Charlson et al. conclusions, which strongly depends on the level of aerosol and gas pollutant concentration. (Charlson et al. 2001, Reshaping the theory of cloud formation, Science, Vol. 292, Issue 5524, pp. 2025-2026, and reference therein)

The authors conclude that particles composition is less determinant than particles size for the number of activated particles. Figure 4c is used to derive such conclusion, since no correlation is observed between Nact and kappa. Is it possible that particle hygroscopicity has a stronger influence for small activation diameter than for large activations diameters? Does kappa explain the scatter of data points in fig 9b at low activation diameter (<0.35)?

One additional evidence to prove that "size matters more than chemistry" is the analysis reported in figure 10b. The graph shows that the ratio of Nact over N>200 decreases with the activation diameter increase. This is obvious considering the log-normal shape

of particle size distribution and derived form the assumption that all particles larger than 200 nm can be activated, i.e. on the assumption that “size matters more than chemistry”. The result of the analysis is biased by the starting assumption.

Minor comments

The manuscript concludes that aerosol size distribution impacts fog microphysics more than chemical composition. Please discuss if the limited variability of the k parameter observed during the experiment can bias this conclusion.

Page 5: do the authors see a difference in kappa values for easterly and westerly flow conditions. Is the origin of air masses reflected in kappa variability?

Technical corrections

Table 1, In the manuscript DMT fog monitor is referred to as FM-100. Please update Table 1 to make it clear the equivalence of the two instruments. In addition CPC counter is missing from the table.

page 5 line 27: CCN, which allows to characterise aerosol chemistry, have. . .add comma.

page 6 line 19: values are as low as. . .

page 7 line 20 wether or not. . .

page 10 line 2: ..are rather identical.

page 10 line 25: ..wood burning are. . .

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