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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The role of mixing layer on changes of particle properties in lower troposphere" *by* L. Ferrero et al.

Anonymous Referee #2

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GENERAL COMMENT This article presents a set of size distribution and chemical composition measurements performed in Milan during 3 years. In a first step, a description on how the particle size distribution and chemical composition change with altitude over Milan city is presented. In a second step, the observed behaviour is described by a statistical model. To study how the size distribution changes with height is an issue that has rarely been investigated by airborne in-situ measurements. Although this is a topic of high interest, the results provided are not significant. I think that a more elaborated data treatment could be performed in order to obtain significant results.

SPECIFIC COMMENTS

1.In several sections of the manuscript, it is provided the percentage of growth of the particles across the mixing layer. In many parts it sound some ambiguous. For exam-

ple:

-Abstract: "An increase in the mean particle diameter....in the summer". Such growth is observed between two altitudes. I guess that between the ground and the top of the mixing layer. In my opinion, this should be described in the text, and the typical value for the mixing layer depth should be provided.

-Section 3.1.1, pag 16492 – 16493: "mean reduction in MPD was 14.9% and 10.7% .....". Between what altitudes?. Between the ground and top of the mixing layer?. The same applies when describing the particle growth of fine particles in section 3.1.2.

2.Section 2.1, page 16488, lines 23-25: "At ground level, a continuous monitoring activity of PM1 and PM2.5 was also present using CEN equivalent (according to EN12341) samplers (FAI-Hydra dual channel low volume sampler; PTFE filters, Ø=47 mm; EU sampling inlet, 2.3m3/h)".

This text needs corrections. The standard EN-12341 applies for PM10 particles (not measured in this study). The standard for PM2.5 is EN-14907, which is not cited in the text. As far as I know there is not, at the moment, European reference method / standard for PM1.

3.Section 3.1.1, page 16492, line 25: "On average the sedimentation process was observed in 94% of cases in the winter and in only 49% of cases in the summer. In the other cases no clear evidence in MPD decrease was found. Higher atmospheric instability weakened particle sedimentation in the summer; however less windy conditions and higher stability, in the winter, favoured particle sedimentation. The mean reduction in MPD was 14.9$\pm$0.6% and 10.7$\pm$1.0% in the winter and summer respectively, with maximum reductions of 27.4% and 31.6%".

I agree with this interpretation. However, I think that more processes are involved. Several studies have shown that mineral dust is the most important contributor to coarse particles, and that mineral dust concentrations are higher in winter than in summer in

Milan owing to the lower mixing layer depth and the higher resuspension of dust caused by road traffic in the urban area (Rodriguez et al., 2007, ACP, 2217-2232; Marcazzan et al. 2001, Atmos Env, 4639-4650). In my modest opinion, the fact that mineral dust concentrations are higher in winter than in summer in Milan, may significantly contribute to the higher sedimentation observed in winter in this study.

4.Section 3.1.2: pag 16494, line 22-27: "Vertical profile data were mainly collected in clear and dry sky conditions, in which aerosol properties can be derived by satellite remote sensing using different sensors (i.e. MODIS). In this case the creation of accurate look-up tables would be very useful 25 (Levy et al., 2007; Chu et al., 2003) and could be implemented for areas with characteristics similar to the Po Valley with some parametrization to distinguish periods characterized by highly stable conditions from other periods". When reading this text, it seems that authors tried to collect data in Milan city that be representative of the whole Po valley. In my opinion, the results of this study are representative of urban areas of the Po Valley, but is not necessary representative of the dominant rural areas. The fact that fine particle growth (accumulation mode) is observed during vertical transport of the air parcel in the city, is significantly prompted by the emissions of ultrafine particles in the vehicle exhaust. Particle growth is associated with the aging process (coagulation and condensation) of such particles during the vertical transport (within the mixing layer) accounts for the observed particle growth with altitude in the mixing layer. Vehicle exhaust emissions are not important in rural areas, and for this these results may not necessary be representative of rural areas.

5.Title. The current title sound imprecise:

-I am not sure if the term "low troposphere" is used properly. As stated above, these results are representative of an urban area,

-The term "...the role of the mixing layer....". This study do not analyzed how changes in the mixing layer properties prompts changes in the size distribution. This study

describes how the size distribution of particles changes vertically along the mixing layer and above it. The only processes described in the manuscript are based on aerosol dynamics (coagulation, condensation and deposition) and not in properties of the mixing layer.

I would suggest a final title that would sound something such as: "Vertically resolved particle size distribution within and above the mixing layer of Milan city".

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 16483, 2009.