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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Overview of aerosol properties associated with air masses sampled by the ATR-42 during the EUCAARI campaign (2008)" *by* S. Crumeyrolle et al.

Anonymous Referee #2

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Manuscript " Overview of aerosol properties associated with air masses sampled by the ATR-42 during the EUCAARI campaign (2008)" by Crumeyrolle et al presents airborne aerosol microphysical, optical and chemical properties in context of air mass origin, transport and synoptic situation during EUCAARI IOP May 2008. Observations are further contrasted for boundary layer and free troposphere.

Overall, the manuscript is more of a data presentation nature and interpretation is lacking behind. It does not bring some really new knowledge or science. It is in general extension of already published works by (Morgan et al. 2010a), (McMeeking et al. 2010; Morgan et al. 2010b) and (Hamburger et al 2010). The good aspect is that it

attempts to synthesize observations with meteorology and synoptic scale circulation, but on my opinion it stops half way. This is actually pity as one can deliver much more from results available and state of the art platform like SAFIRE ATR-42. Similar is valid for comparison of boundary layer and free troposphere.

First there are general considerations and comments, followed by more detail and technical issues.

1) Authors used FLEXPART for air mass origin analysis, although P sector includes London metropolitan area. Can authors clarify how this was taken into account that supposedly cleanest air mass sector includes huge pollution source nearby the most of the flights performed?

2) Table 2 brings doubts on quality of aerosol size distribution measurements. How N50 can be higher than N10 for S-EUR sector in BL during LP conditions? Similar discrepancy is for E-EUR in BL and E-EUR FT. Does it mean that Integral of the SMPS is not even closely corresponding to N10 measured by CPC? Why? Unless this is clarified, whole data analysis is questionable.

3) Water vapor/humidity, ozone, CO were present onboard of ATR-42. Why these parameters have not been used. They will make the conclusions and claims more robust.

Detail comments:

Diffusional losses and associated corrections are not mentioned in manuscript

P9458, L20: Why state variables measured onboard of the airplane were not used? How do they compare to soundings?

Chapter 3: What exactly is meant here by FT? What altitude range? Is the altitude coverage and distribution of the measurements in FT the same for every sector in absolute values and with respect to BL height?

P9459, L11-14: How do you know this? From FLEXPART?

P9459, L17: What motivation did you have to derive N500 aerosol number density? What one can learn from it?

P9460, L2-3: It is only one possibility. It can this be during LP conditions also due to spatial heterogeneity and intensity of removal processes

P9460, L23-24, Fig.3: Can you add standard deviation into the graph to see what is the variability of the size distributions or show median size distribution with quartiles?

Fig. 3: Nucleation mode usually represents newly formed particles and conditions of recent or ongoing nucleation. How do you explain that size distribution show “close” shape with no particles present in small sizes? Can Dnucl can be also result of primary emissions (traffic for example)?

P9461, L 3: Caption of Fig.3 shows that 3a is FT, but here it is stated as BL?

P9461, L25-28: Cloud processing of aerosol usually results in bi-modal size distribution (or even tri-modal when nucleation is present). On what basis authors attribute monomodal size distribution to cloud processing?

Tab. 4 and associated text on page 9462: Why there is no discussion of very high aerosol volume concentrations in S-EUR and E-EUR during LP conditions? Those values are many times higher than the rest.

P9462, L 13-24: Based on what authors claim that these particles are dust or sea salt?

P9464, L 1-5: Most of the NE-EUR sector is represented by Scandinavia and it is well known source of secondary organic aerosol from BVOC oxidation (e.g. (Tunved et al. 2006). Reference to Rinaldi paper is irrelevant as this article presents observations from Mace Head in Ireland and similar is valid for Asmi 2010 paper dealing with measurements from Antarctica. Both studies dealing with very different environments compared to NE-EUR sector. Authors should show robust analysis or argumentation

and not speculation.

P9464, L10: What relation authors have in mind?

P9464, L22: How the air mass can be clean if it is supposed to be influence by many biomass burning events? This is rather contradictive statement and I would like to ask authors to show FLEXPART simulations and analysis leading towards this conclusion

P9465, L4: what about size? It is like more important parameter than hygroscopicity of particles.

P9465, L7: Why 50 nm is representative for continental conditions, especially for rather polluted Europe? Based on what authors made this assumption? How does the picture change if it will be 70 or 90 nm instead?

P9468, end of section 4.5: Why authors did not use in situ data about LWC and trace gases to support their claims?

P9469, L10-11: Can this be supported with trace gas measurements onboard of ATR-42?

P9469, L10 and L13: First you say that it is maybe and three lines later that the occasional mixing is confirmed. How is it possible? Unless you have clear independent parameters supporting this claim, nothing is confirmed.

Fig: 2, 3, 5, 6 ,7: quality is bad, barely visible.

Concerning language, there are many typos , missing words and unclear sentences and I suggest careful check and language corrections. Overall at present level manuscript does not bring a new science and fulfil quality level suitable for ACP and major revision is needed.

References

McMeeking, G. R., and Coauthors, 2010: Black carbon measurements in the boundary

layer over western and northern Europe. Atmos. Chem. Phys., 10, 9393-9414. Morgan, W. T., and Coauthors, 2010a: Airborne measurements of the spatial distribution of aerosol chemical composition across Europe and evolution of the organic fraction. Atmos. Chem. Phys., 10, 4065-4083. âĂŤâĂŤ, 2010b: Enhancement of the aerosol direct radiative effect by semi-volatile aerosol components: airborne measurements in North-Western Europe. Atmos. Chem. Phys., 10, 8151-8171. Tunved, P., and Coauthors, 2006: High natural aerosol loading over boreal forests. Science, 312, 261-263.

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