This contribution presents number size distribution and concentration of non-volatile particle fractions and the volatile composition of ambient aerosols based on VTDMA data. In particular, even though volatility analysis of ambient aerosols in general have been intensively studied in different fields, it is the first time to provide the chemical composition based on volatility of aerosols in PRD region with a different synoptic condition.

Major comment:

The volatility information of studied site, which this work strives to provide, could be written out more explicitly both in the introduction and results. According to this, the main goals of the study, given in the end of the introduction, should be revised. At least, more discussion about how the results obtained in this study would contribute to, e.g., estimating the chemical composition of size segregated aerosols and the mixing state of the non-volatile residuals, should be added, because this is given as a motivation for this work in the introduction. In addition, the discussion of the mixing state of the non-volatile residuals is far too simplified. Please consider adding more materials from either total number size distribution measurements or chemical composition data from other instruments, or air masses origins information. Also, the literature could be rechecked for the last 2-3 years.

It is highlighted in the manuscript that in urban areas “non-volatile” aerosol fraction consists mainly of soot. This statement guides the reader to think that there are no other important non-volatile aerosol compounds. However, as it is concluded the non-volatile fraction may actually consist of some extremely low-volatility organic material that does not evaporate even at 300 ºC. More discussion on the effectively non-volatile organics should be added to the manuscript; what are these organics?

The author wrote the VTDMA measurements were performed at 25, 100 and 300 ºC, while in the discussion section; only the results at 300 ºC were present. The definition of VSF, LV, MV, HV and all relevant quantities actually were based on number size distribution after heating at 300 ºC. The author did not write clearly in the methodology part, please revise it. Conventionally, ammonium sulfate can be considered to be of low-volatility and it tends to evaporate at around 200 ºC. It seems that in this manuscript low volatile refers to material that is elsewhere referred to as extremely low volatile of effectively non-volatile (see recent literature, e.g. Donahue et al., 2013 in *Faraday Discussions*; Murphy et al., 2014 in *ACP*).

The author should avoid using too many abbreviations or use them in cautions especially they are not conventionally used elsewhere.

The discussion of the fraction of low volatile, medium volatile and high volatile materials on the non-volatile cores as well as the complete volatile materials was mainly related to meteorological conditions and traffic emissions. I thus strongly recommend that the general meteorological parameters, e.g. temperature, relative humilities as well as traffic densities are given, since all results only represent concurrent conditions. For example, plot time series or diurnal variations of air mass origins and traffic densities around by can also help for the discussion.

Concerning the number fractions, isn't it possible that the finest particles (initial diameter of 40 nm) get below the detection limit of the instrument upon heating? If so, it cannot be assumed that these particles would be completely evaporated. These particles may include an extremely low-volatility "non-volatile" fraction, which cannot be detected because of the small size of the remaining particles after the heating. This issue should be discussed in the manuscript.

Please provide the residence time in your heating unit; is it long enough for all the volatile material to evaporate? Please add this information to the manuscript.

If available, the particle number size distribution from DMPS or SMPS during the whole campaign should be given. Was new particle formation seen in this site? How does the number size distribution vary during day and night?

Minor comments:

P25271, abstract: Please explain how the medium and low-volatility aerosol fractions are determined. Also it should be clear from the abstract that by low-volatility fraction essentially "non-volatile" fraction is meant, i.e. LV aerosol fraction consists of compounds that do not evaporate significantly even at 300 C. Also, it is somewhat confusing to say "*non-volatile materials ... contain… less volatile OC*".

P25271, abstract: OC contents are named from OC1 to OC4. It is not clear in the abstract what is meant by OC2-OC4 compounds. Does it refer to the amount of carbon in the compound? Please clarify.

P25271, l 24-26: check the references during recent years.

P25272, l 4-6: were the data reported in 2007, or the measurements were performed in 2007, please clarify it.

P25273, l 1-4: Firstly, I think the definition is not clear. It should be particles with LV, MV and HV fractions, but not LV, MV and HV particles according to Wehner et al. (2009). Secondly, they performed the measurements at 300 ºC. Please add the temperature reference in the text. Thirdly, what do these completely vaporized aerosols refer to ambient aerosols, from what you wrote in the discussion part, it could be sulfate, ammonium nitrate?

P25273, line 13: Please write what AMS stands for.

P25273, line 15-21: "*However, because of its higher volatility compared to EC, they were often considered completely evaporated upon heating at temperatures above 300 C in VTDMA studies*" contradicts with "*It is therefore possible, that a significant amount of non-volatile OC can exist together with EC in ambient aerosol, even after heating in a VTDMA.*" Clarify what is meant by the former sentence. Also, using "*its*" and "*they*" causes some confusion.

P25274, section 2.1.2: The approach to determine the LV/MV/HV aerosol fractions is explained in the end of the section. I suggest that it is explained whenever LV/MV/HV are mentioned for the first time in this section.

P25275, l 5-7: Please provide the residence time in your heating unit as well as the time after the heating unit but before being sampling by the CPC as mentioned above.

P25275, l 13-15: The complete run took around two hours, during which the chemical composition of ambient aerosols might vary a lot, especially related to traffic emissions. Can this be added into your discussion part?

P25275, l 24-25: This is based on the assumptions that diffusion losses are neglected.

P25276, l 1-4: VSF is depending on chemical composition of your particles, but also depending on which temperature you are using in your measurement. The definition regarding to LV, MV and HV is not valid without giving the temperature you are using for the number size distribution (Fig. 2) after heating. Also for Fig. 2, please explain VSF in the figure caption. Figure 2 is referred in the text prior to introducing VSF.

P25276, l 8-14: Should this part be moved to either introduction part or discussion section? It is more relevant to general picture about volatility.

P25276, l 12: Provide references here please.

P25276, l 21-22: Please add references here.

P25277, l 4: Which section, please clarify.

P25277, l 8: I don’t agree it is the number fraction of LV, MV and HV residuals, but rather the number fraction of particles containing LV, MV and HV materials.

P25277, l 20-23: it will be good to provide a calibration curve or transmission curve from NaCl.

P25279, l 5: We use VFR (volume fraction remaining) conventionally here to define the ratio between the volume of the residuals and the host particles; please consider changing it.

P25280, l 14-15: Could the reason be due to the detection limit of the CPC as mentioned above?

P25280, l 20: What kind of atmospheric processes could be? Please clarify.

P25280, l 23: I don’t agree with this, please rephrase the sentence.

P25280, l 24-25: Please add appropriate references.

P25281, l 1-3: The sentence is not clearly written; please rephrase it.

P25281, l 10-12: How do you define polluted days? Please clarify. Also, please add references here.

P25282, l 1-3: The logics behind are not clear here; please rephrase the sentence.

P25282, l 10-13: Please consider rewriting it.

P25282: Please add error bars in Fig. 5 and Fig. 7.

P25282, l 19-21: What does the number concentration of MV+HV mean? Do you mean number concentration of particles containing MV+HV materials or what you wrote 'MV+HV residuals' at other part? Please rephrase the sentence. This kind of confusing statement is elsewhere along the text; please check the language before writing them into the text.

P25282, l 24-28: The sentence is too long; please try to make the statement clear in short sentences.

P25283, section 3.3: When you use extrapolation fitting the number size distribution of 300 nm particles to 5 um particles, you have to either assume the number size distribution is constant along the time or their mixing state is constant along different sizes. This did not reduce the uncertainties when comparing VTDMA results with OC/EC results. Please add appropriate discussions on the possible chemical composition within the size gap or refer to other studies.

P25283, l 19: What kind of errors could be related to the measurements; please clarify.

P25283, l 25-27: Do you mean oxidation might take place in the presence of oxygen? Please rephrase the sentence and add references there.

P25283, l 3-15: What does 'that LV and MV may contain non-volatile OC' mean? Do you mean LV+MV residuals contain non-volatile OC?

P25284, Section 4: I did not get a clear picture that what the authors want to conclude for the manuscript. Please consider revising it.

References:

Donahue, N. M., Ortega, I. K., Chuang, W., Riipinen, I., Riccobono, F., Schobesberger, S., Dommen, J., Baltensperger, U., Kulmala, M., Worsnop, D. R., & Vehkamaki, H.: How do organic vapors contribute to new-particle formation? *Faraday discussions*, *165*, 91-104, 2013.

Murphy, B. N., Donahue, N. M., Robinson, A. L., and Pandis, S. N.: A naming convention for atmospheric organic aerosol, Atmos. Chem. Phys., 14, 5825-5839, doi:10.5194/acp-14-5825-2014, 2014.

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