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Atmospheric Measurement Techniques Discussions

AMTD

7, C477–C479, 2014

Interactive comment on "Measuring the atmospheric organic aerosol volatility distribution: a theoretical analysis" *by* E. Karnezi et al.

Anonymous Referee #2

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General comments

The authors present a theoretical analysis of thermodenuder data and the challenges in deducing actual organic aerosol (OA) properties such as volatility distribution, accommodation coefficient, and vaporization enthalpy. Volatility is a crucial property of OA worth exploring in detail, and thermodenuders are a widely used tool for its assessment; the correct interpretation of these data is thus of high importance. One of the fundamental problems in thermodenuders is that with the residence times employed, most of the times equilibrium cannot be achieved, leading to significant uncertainties in the interpretation of MFR curves. Whereas the authors mention this particular issue several times, a detailed discussion is missing, but should absolutely be part of a theoretical paper on the interpretation of thermodenuder data. In addition, the paper would

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Interactive Discussion

Discussion Paper

merit from an additional round of reviews by the authors; some paragraphs should be written more clearly and focused, and some of the references seem to be incorrect. I thus recommend accepting it for AMT after major revisions, considering the following comments:

Specific comments

P. 862, lines 7 - 12 ff.: Give information on residence times in the thermodenuders, since they highly influence thermograms/MFR curves. As you say, as particles evaporate, the vaporization enthalpy and potential mass transfer resistance is very important – however, the time spent at a certain temperature plays a huge role here.

P. 862, line 21: Since you change the order of magnitude of the accommodation coefficient by 2, how is it so surprising that the volatility distribution changes by one order of magnitude?

P. 863, lines 6 – 8: See previous comments – this confirms again how important residence time and achieving equilibrium are.

P. 863, lines 8 – 29; p. 864, lines 1 – 15: Here you start the discussion on residence times – however, I would start this discussion further up. Would reaching equilibrium allow quantitative interpretations of physicochemical/thermodynamic properties of a certain compound?

P. 867, lines 11 16: Similar thermograms for compounds with different volatilities – do we have to conclude that thermodenuders are not very useful unless we reach equilibrium? How would Figure 1 change with increasing residence time?

P. 867, lines 17 – 27: why do you need pseudo-experimental data when modeling? Why not just use the red curve?

P. 871, lines 9 – 11: I assume with number of measurements you mean the temperature resolution – please specify here.

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P. 873, lines 10 ff.: This paragraph should be structured better and the results presented in a clearer way, so that it becomes more evident which conditions lead to better results/lower errors. A graph might help.

P. 874, lines 15: So the residence time is still too short?

P. 876, lines 7 -8: Since this is a crucial part of the paper, more information should be added on the combination of TD and isothermal dilution measurements. This is a very unspecific statement.

Technical corrections

P. 860, lines 22 – 23: [. . .] influencing the properties and lifetime of clouds.

P. 862, line 17: respectively, not accordingly

P. 864, lines 20 – 21: Reference is missing in bibliography. Or did you mean to cite Vesala et al (1997), which use, however, ln((1-pi/p)/(1-pio/p))?

P. 871, line 11: Reference is not in bibliography (or year is wrong)

Table 1: Repeat in the caption what the letters mean, especially Xi

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Interactive comment on Atmos. Meas. Tech. Discuss., 7, 859, 2014.