

Interactive comment on “Influence of semi-volatile aerosols on physical and optical properties of aerosols in the Kathmandu Valley” by Sujan Shrestha et al.

Anonymous Referee #2

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Review

General

The manuscript describes measurements of aerosol number concentrations, number size distributions, aerosol optical properties and volatility in Kathmandu Valley, Nepal. The air in the valley is very polluted as is shown by the referenced papers. The instrumentation used in the work could in principle have brought interesting new information on the aerosol physical properties in the region but there are too many strange things in the manuscript that it would bring any relevant and reliable information.

You explain in section 4.4, L367 "The constraint of the experiment is that the TDD flow
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rate, which is restricted to 3 Lpm. Because of this we could not connect multiple instruments to maintain the TDD flow rate". This should have been mentioned much earlier, in the methodology section. And still, you could have split the 3 LPM to two instruments, for instance the CPC and the SMPS which would have made the results a bit more meaningful. Also the neph and the aethalometer could have been used at lower flow rates and then you would have had simultaneous scattering and absorption data. Further: why did you not run all the instruments on the non-heated branch of the inlet, it should not have any flow restrictions? Then you would at least have continuous time series of the relevant parameters in ambient conditions which would have increased the value of the work. But that is speculation, now the data are here.

My criticism can be found in the detailed comments below.

Detailed comments

- 1) How large is the the amount of data? It is written on L102 "a few days" . This not good enough
- 2) How did you calibrate the nephelometer?
- 3) There is no description of the inlet. Cutoff diameter?
- 4) The length of the cycles varied: for some the temperature was kept constant during 24 hours, for some 1 hour. The results are not comparable because aerosol composition definitely varies within a day and also days are different.
- 5) In the manuscript "dry sample" refers to measurements carried out with instruments coupled with TDD. Well, if you heat it to 50°C or more, it is dry. But if the denuder is at room temp the sample air is just as humid as the one without the TDD.
- 6) L317 it is written "If we assume BC mixing state absorption affects is similar at 370nm and 880nm wavelengths, then the difference between 370nm to 880nm wavelength absorption is contributed by brown carbon" Well, the effect of coating depends on wavelength so definitely at wavelengths so far from each other the effect is very

different. It is not possible to calculate the contribution of BrC this way.

7) L346 - 348 it is written: "Dry absorption was deducted from wet absorption values to compute the semi-volatile aerosol absorption. Then semi volatile aerosol absorption values were used to compute AAE for the semi-volatile fraction. We computed AAE over the range of wavelengths 370nm-970nm for wet, dry and semi-volatile aerosols individually". From the wet absorption, How can you deduce dry absorption at different temperatures?? Deduction: the process of reaching a decision or answer by thinking about the known facts. Linked to this, in Table 3 there are the AAE values of wet, dry and semi-volatile aerosols at different temperatures of the thermodenuder. What is this: wet aerosol at the temperature of 300°C? It is not wet then anymore. The same applies to Table 4.

8) The scattering Ångström exponent (SAE) of the semivolatile aerosol in Table 4 reaches values like 5.5 ± 2.0 . This is another indication that there is something seriously wrong with the method. The authors obviously do not know that SAE depends very strongly on particle size and for the smallest realistic light scatterers in the atmosphere, the gas molecules, SAE = 4. It is called Rayleigh scattering.

9) The way single-scattering albedo is calculated and discussed (section 4.5) makes no sense. The nephelometer and the aethalometer were used in different days. And then you derive somehow the SSA of the semivolatile aerosol fraction at different temperatures. Even when both an aethalometer and a nephelometer are used correctly connected simultaneously to an inlet, SSA has high uncertainties. And even then, after heating sample air and volatilizing the shell of particles you would be able to get the SSA of the core but not that of the semivolatile particles. The semivolatile material is very probably as a shell on an absorbing core, not as externally mixed semivolatile particles. By heating the particle also its size changes which then changes the whole optics.

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