General comments

The study by Ueda et al. addresses the effect of coatings on the absorptive properties of atmospheric black carbon particles, which is important in evaluating their radiative impacts. The authors conducted a field campaign at Noto Peninsula, Japan, a site that frequently receives pollutants transported from mainland China. A variety of instruments, including PASS-3, SP2, SMPS, and TEM were employed to measure the physical, chemical, optical, and morphology of aerosols. NOx and NOy were also measured to assist photochemical age determination. The main conclusion is that coatings on black carbon particles can enhance the absorption by uncoated black carbon by ~22%. This observation adds to the limited database on field measurements of the lensing effect of black carbon. The measurement and discussion are generally sound but a number of details need to be added or explained, most importantly the charring of aerosols in the thermodenuder and its impact on the absorption enhancement measurements. I recommend publication of this manuscript after the following concerns are addressed.

Specific comments

1. Abstract, L13, the absorption enhancement is 22-23%. This is not a range. I suggest to report either 22% or 23%. The same comment applies to the Eabs of 1.22 – 1.23 in the conclusion. In addition, please either use percentage or absolute numbers to be consistent throughout the text.
2. Please use “thermodenuder” instead of “heater” throughout the text to be consistent with literature in this field.
3. Abstract, L21-22, it is a bit surprising that most of the coatings on black carbon are sulfates, given that organic materials dominate the aerosol mass (Table 2). The measurement period is after the intense coal burning season in northern China, so it is expected that the coatings are dominated by organics.
4. P25093, “Models often estimate Eabs assuming a core-shell…” Many models simply apply a constant Eabs value rather than estimating Eabs.
5. P25093, the last paragraph. What are the values reported from these previous Eabs measurements? These values should be summarize here. In addition, two recent studies that address Eabs via field measurements are missing and should be added to the summary: “Healy, R. M., et al. (2015), Light-absorbing properties of ambient black carbon and brown carbon from fossil fuel and biomass burning sources, J. Geophys. Res.Atmos., 120, 6619–6633, doi:10.1002/2015JD023382” and “Liu, S. et al. Enhanced light absorption by mixed source black and brown carbon particles in UK winter. Nat. Commun. 6:8435 doi: 10.1038/ncomms9435 (2015).”
6. P25093-25094, “However, these studies were conducted … has been reported.” The Liu et al. study mentioned above was conducted at a rural site and measured aged air masses. That study also combines optical and morphology measurements. Therefore the author’s statements need to be removed or changed.

7. P25094, the second paragraph is not discussing absorption enhancement and is not closely related to the paragraphs before and after, this paragraph should be moved forward where the concept of black carbon is introduced.
8. P25095, the CE of 0.3 is very low compared to the typical CE of 0.5. It says the CE was derived by comparing the mass concentration of the ACSM data with filter data, but how the filter sample was collected is not clear, e.g., what is the duration of the sample collection, what is the size cut of the filter measurements, was the filter weighed to get the mass concentration. In addition, the ACSM does not measure refractory components, while the weight of the filter is a sum of all materials on the filter. This could result in a low CE.
9. Related to the question above, the CE can also be derived by comparing ACSM with SMPS measurements. Since the SMPS data are available, this approach should be tested and may result in a different CE.
10. P25096, more details about the thermodenuder should be added, e.g., what are the dimensions of the denuder? What is the residence time of particles in the denuder? These are important features as a short residence time will result in incomplete removal of the coating materials on BC.
11. P25097, it is surprising that there is no particle loss in the thermodenuder as the ratio is not significantly different than 1. This is inconsistent with many previous studies, e.g., the Cappa et al. 2012 paper cited in the manuscript and the references therein. Could this be due to the generation of brown carbon in the thermodenuder? This could be a critical problem as it affects the calculation of Eabs.
12. P25097, L1, references are needed after “scattering signal”.
13. P25097, was a NO2 scrubber installed upstream of the PASS-3 instrument? If not, NO2 could influence the absorption measurement at 405 nm and also the Eabs calculation at 405 nm. This needs to be examined as it may influence the hypothesis of brown carbon formation in the thermodenuder.
14. P25097, the detection limit of the PASS-3 measurements. Are the data reported as 3-h averages, e.g., the data presented in Fig. 2? If not, the detection limit should be calculated using data with the same time resolution as the real measurements.
15. P25097, “Using babs values after the above ratios,” it is not clear what this sentence means. In addition, how was the particle loss accounted for?
16. P25099, L11, “a prior test”. What test is it? When was the test? More information is needed here.
17. P25100, “the Eabs values at all wavelengths are expected to be greater than 1.0”. This is not true given the sequential bypass and thermodenuder measurements in this study. Values smaller than 1.0 are likely due to the atmospheric variability the BC concentration.
18. P25100, L17, “This can be explained by the increase of absorbing materials by heating.” The formation of brown carbon in thermodenuder is interesting, is there any literature on this topic? Later it says in P25112 that the formation of brown carbon is “probably due

to the condensation of non-volatile organic." Under the 300 – 400 C condition in the thermodenuder, how can condensation occur?

19. Charring in the thermodenuder could produce elemental carbon, how can formation of elemental carbon be excluded? This could affect the calculation of Eabs at 781 nm, and could also be related to the observation that the Eabs at 781 nm is independent on NOx to NOy ratio.
20. P25101, L11, "north and west of the site." There is a significant fraction of air mass coming from northeast section of the site.
21. P25101, L25, the location of Shanghai should be added to the figure as it is the origin of air masses.
22. P25103, L1-2, the photochemical age can be directly calculated using NOx and NOy.
23. P25104, L14, "a mechanical issue", it is not clear what issue results in the inability to calculate BC coating thickness.
24. P25105-25111, section 3.3.2 and 3.3.3. There is a vast amount of information in these two sections (6.5 pages). While the information is useful to understand the aerosol properties, much is not related to the absorptive properties of BC, which is the theme of this paper. I think these two sections can be substantially shortened, or some information and related figures can be moved to SI information so that the main text is more succinct.
25. Fig 1 e-f, the green and blue traces cannot be differentiated visually. Please make separate panels.

Technical corrections

1. Abstract, L14, change "under high absorption coefficient conditions" to "under high absorption coefficient periods"
2. Abstract, L18, remove "coefficient"
3. P25092, L12, change "defined operationally" to "operationally defined"
4. P25093, change "noncoated" to "uncoated"
5. P25093, L22, change "estimated" to "measured"
6. P25094, L18, change "absorbing" to "absorption"
7. P25094, L19, remove "suspended in air"
8. P25098, L5, remove "a"