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Dear associate editor,
Dr. Mingjin Tang,

We have responded to all reviewer #3 comments as provided in the details in the following pages.

We hope that with these revisions and given the timeliness of the research that you will find this manuscript suitable for acceptance and publication in AMT.

Sincerely,

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Responses to reviewer #3

We thank the anonymous reviewer for their valuable and constructive comments/suggestions on our manuscript. We have revised the manuscript accordingly and please find our point-by-point responses below.

This study is well conducted and clearly reported. Measurements and data processing are robust and properly explained. The interpretations of the results of reflectance spectroscopy and XRD and their comparison are convincing, as well as the ensuing discussions. This is thus a nice methodological study. After the answers to the previous reviewers, there remains, to me, the following issues:

1. A part of experimental protocol is missing: it isn't described how dust is extracted from the MDCO. The way it is extracted (dry or wet for instance) could have an effect on measurements. If available, the mass of each collected sample could be added in the Table A.1, or at least orders of magnitude of the collected quantities. Sample preparation and used quantities should also be specified for each analytical method.

Responses: Regarding the reviewer's point that "how dust is extracted from the MDCO", we added the following statement to the section 2.1 Sample Collection:

"*As part of sample collection procedure, first, dust samples in MDCO were dried at room temperature to preserve the mineralogical and physical properties of the surface soils from which they were transported. Then, the dry samples were collected from the samplers by thoroughly cleaning the dust depositions using a brush. All samples were transferred to separate plastic bottles for the further experiments."*

Regarding the reviewer's point that "If available, the mass of each collected sample could be added in the Table A.1, or at least orders of magnitude of the collected quantities", we would like to mention that Sadrian et al., 2012 already reported the mass of each collected sample, and here we include the minimum and maximum mass of the collected dust to the manuscript section 2.1 Sample Collection, using the following statement:

"*The mass for the collected dust samples ranges from minimum ~ 0.01 g to maximum ~ 5 g."*

Regarding the reviewer's point that "Sample preparation and used quantities should also be specified for each analytical method", we added the following statements to the section 2.1 Sample Collection:

"It should be noted that there was no special sample preparation that performed for the purpose dust measurements (with XRD and spectroscopy) described in the next sections. Prior to these measurements unwanted debris as well as detectable manmade and plant materials were removed from the samples and we made sure to use similar quantity of dust (~ 1 g) for each of experiments that were conducted with spectroscopy, and for the measurements that were collected using XRD."

Reference

Sadrian, M. R., Mohammadkhan, S., Mashhadi, N., Alavipanah, S. K., and Dashtakian, K.: Analyzing and investigation of dustfall by MDCO (case study: the city of Ilam), International desert research center, University of Tehran, 2012.

2. The text should be revised avoiding confusion between atmospheric dust samples and dust deposition samples. Indeed, atmospheric dust refers rather to particles in suspension in the air, which can be long-range transported, with a very fine particle size. The study is carried out here on deposition samples with coarser particle size. Since the analytical methods used are sensitive to the amount of matter, the signal is dominated by the response of coarse particles rather than fine ones. Then these potentially airborne fine particles are negligible in such measurements. The analysis of atmospheric dust also presents different analytical constraints

(because the samples are collected in very small masses, usually on filters). To be as explicit as possible, it would be better here to use "dust deposition".

Response: In the manuscript's abstract with replaced "atmospheric dust samples" with "*dust deposition samples*" to avoid confusion and be as explicit as possible.

3. Following the remark of previous reviewer on the presence/absence of iron oxides, I think a better evidence that these black grains are asphalt would be appreciable. The fact that iron oxides are not detected (while we know that, when they are present, they often remain below the detection limits of the XRD) and that the asphalt is detected by SWIR is a bit short argument.

Response: In section 2.6 Mineral Abundance Estimation from Reflectance Spectra, we stated that "In addition to minerals, we found hydrocarbon (C-H) absorption features related to asphalt and tar in many of the samples in our preliminary analysis, and thus we included their spectra (Fig. 7a) in the input endmember bundles for modelling all 37 samples." Therefore, according to this statement and figure 7a, asphalt has a doublet diagnostic absorption feature between 2280 and 2370 nm in SWIR (which is also identified clearly in e.g., Samples 32 and 33 in Appendix C, Fig. C 1).

Regarding the presence/absence of iron oxides in the samples, in section 2.3 VSWIR Reflectance Spectroscopy of manuscript, we stated that "Since we did not see absorption features attributed to iron oxides in these samples, we truncated all spectral plots at 1350 nm in order to focus on spectral range above 1350 nm with the strongest features (SWIR range). Therefore, exclusion of the spectral range from 350 to 1350 nm will not miss any major mineral components."

We should add that iron oxides have strong absorption features in the visible and near infrared (up to around 1000 nm), however we did not detect any iron oxides in these samples' spectra. Therefore, to clarify about the presence/absence of iron oxides, we changed the above manuscript's statement to read:

"Iron oxides have strong diagnostic spectral signatures in the visible and near infrared (up to around 1000 nm), however we did not see absorption features attributed to them in these samples. Therefore, we truncated all spectral plots at 1350 nm in order to focus on spectral range above 1350 nm with the strongest features (SWIR range). Hence, Exclusion of the spectral range from 350 to 1350 nm will not miss any major mineral components."

4- Have the authors explored the relationship between composition and size distribution? If so and if possible, a short discussion on it could be added.

Response: Exploring the relationship between composition and size distribution was not in the scope of this research and that would take another paper to run the related experiments investigating the relationship between these two variables. Furthermore, this experiment will be tricky to perform for these samples given that they also contain urban materials that would affect the reflectance spectra of various size separates.