

## Response to Referee #1 (Dr. Patrice de Caritat)

On behalf of my coauthors, I wish to thank Dr. de Caritat for his thoughtful overarching comments, his list of careful editorial suggestions in the pdf, and his supportive assertion that “*This is a very well designed and described study.*” Here I explain how I will address these comments in revision.

I have marked many (mostly minor) comments in the edited PDF, which should make the paper clearer to the reader.

Thank you, these editorial comments in the pdf will be simple to address, and will undoubtedly improve the readability of the paper.

1. I would like to see a more detailed description of the meteorological conditions of the area, particularly where it comes to wind and aridity parameters (dominant wind directions, strengths, seasonality; precipitation and humidity values, seasonality?).

I agree that it would be useful to have more direct information about the climatic conditions at each of these study sites. Unfortunately, they are located far from observing stations, and installation of meteorological equipment at each site was beyond the scope of our study. As an imperfect, but hopefully helpful solution, I will extract values for mean annual temperature and monthly precipitation for each location from the interpolated PRISM climate dataset, 1991-2020. This will permit a broad comparison of climatic conditions at the 6 sites (which is warmest, which is wettest, which receives most precipitation in winter vs. summer, etc).

2. This should logically extend to what is known of the geochemistry and mineralogy of the most obvious source areas for eolian dust likely to be transported over, and deposited on, the mountain region considered. Here I would like the authors for instance make use of the USGS soil geochemical landscape survey dataset.

In a related part of this project, published last month in *Environmental Research Letters*, properties of likely source regions for dust in the year 2020-21 are presented. Now that it has been published, I will explicitly reference that study here. A detailed exploration of the properties of surficial materials in all the source regions involved is easier said than done though, particularly at the scale of this project, where dust collectors are deployed across a substantial region. I am familiar with the USGS dataset suggested, and in a separate component of this overall project, I am exploring linkages between dust and properties of surficial sediments in areas suggested as possible sources by numerical modeling and back-trajectory analysis. However, that analysis is beyond the scope of the soil investigation presented here, which is already a comprehensive study and a correspondingly long manuscript.

3. The paper is quite long and much detail could be placed in the supplement. For instance the Methods could almost entirely be moved there, with minimal loss of readability.

Deciding how much detail to include in Methods is always a balancing act. This study employed a wide variety of analytical techniques, and I wanted to be clear about the steps followed in the field and the laboratory. Different journals have different thresholds for how much method detail should be presented in the article text, and how much should be moved to an appendix or

supplement. I will defer to the SOIL editor for their judgement on what, if any, changes we should make to this part of our manuscript.

Other than that, this is a very good contribution to understanding soil formation and putting implications into perspective. I commend the authors on an interesting and well-constructed manuscript

Thank you! And thanks once again for your thoughtful comments.