This article analyzes the association between the particle size distribution of windblown dust and topographical wind conditions over the Sahara, using linear regression models with inputs from the coarse fraction of dust from MONARCH dust reanalysis dataset, the wind conditions from MERRA2 meteorological reanalysis fields, and surface elevation data. Positive correlations between particle size and wind speed and uphill slope wind direction are found in this study. The scope of the manuscript is very important. However, I am concerned about the soundness of the method and thus the associated interpretation and conclusions.

General Comments

1. The linear regression model used in the study to state the relationship could be misleading and lack of strong evidence. The dust emissions are inherently nonlinear and vary with the cube (subjected to land surface properties) of surface friction velocity. The initiation of dust emissions is also subjected to the threshold friction velocity. The application of linear regression model and simple treatment of adding interaction terms between independent variables impose violation against the nonlinear processes in dust emissions, transport and deposition.
2. The poor explainability from the linear regression model without interaction terms (R^2 of 0.224) and with interaction terms (R^2 of 0.239) between independent variables questions the soundness of the results and interpretability. Thus, the interpretation from the manuscript is not based on strong evidence and at a worse case potentially causes misleading conclusions.
3. The coarse resolution of input data and the validity of capturing fine-scale terrain-induced wind fields and dust emissions are not strongly evaluated. The coarse resolution of MERRA2 at $0.5^{\circ} \times 0.625^{\circ}$ cannot resolve localized wind fields over regions with steep slopes, and the usage of 2-m winds from MERRA2 cannot represent actual localized 2-m winds due to elevation averaging. The manuscript is heavily based on the MONARCH dust reanalysis dataset. Although it has satellite assimilation embedded and shows generally agreement against regional mean measurements, it is still questionable to resolve the fine-scale dust emissions or concentrations. Considering the target of this manuscript over locations with prominent surface elevation changes, fine-scale variability is especially important to gain insights. Thus, the coarse resolution of independent variables, and questionable fine-scale validity of dependent dust concentrations from MONARCH can impose severe reliability of the interpretation and conclusions from this manuscript.
4. As said in the paper, MONARCH assimilates coarse dust optical depth (DOD) from satellite with fixed first-guess particle size distribution of emitted dust. How would the uncertainties for the assimilation of coarse DOD propagate into the particle size distribution of dust?

5. The article uses coarse fraction of dust concentrations as a surrogate for the particle size distribution. This is an importance piece of information. I recommend clarifying it in the abstract.

Specific Comments

1. Line 101-103: what is the performance of first-guess particle size distribution of emitted dust compared to Fennec?
2. Line 109-111: How would the interpretation be sensitive to the definition of coarse fraction used here? For example, how would the results change when using coarse fraction as the mass of largest dust bin over the total mass of dust?
3. Line 186-189: From Figure 3, it looks like the size distribution for size bins of 0.6-12 μm is overestimated by MONARCH compared to Fennec. How would that affect the analyses for particle size distribution of dust?
4. For Figure 6, the points overlap with each other too much, making it hard to see clearly. Could it help to show the results with the number of points color coded?