

Atmos. Chem. Phys. Discuss., referee comment RC1
<https://doi.org/10.5194/acp-2022-490-RC1>, 2022
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Comment on acp-2022-490

Anonymous Referee #2

Referee comment on "Understanding day–night differences in dust aerosols over the dust belt of North Africa, the Middle East, and Asia" by Jacob Z. Tindan et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-490-RC1>, 2022

General Comments:

This study investigates the day-night difference in dust activities over the dust belt region. The significance of the study leverages on IASIs improved features (e.g., similar-quality day/night observations, high spectral resolution) compared to the other satellites (e.g. MODIS, CALIOP). Ground-based observations are used in the study to compare with the satellite observations. Diurnal variations of dust activities are briefly analyzed using ground-based observations where high temporal resolution daily observations are available.

I've noted a few comments/concerns that I have so far below.

Specific Comments:

- I understand your study is a very comprehensive one. Yet, if possible, it would be nice if you could shorten the abstract a bit. Just a suggestion to consider. (e.g., line 24 describes DOD over the 'downwind region'. Perhaps mentioning this information in the abstract would be important to someone who knows which 'downwind region' you are referring to. For a general reader, this line in the abstract doesn't provide much insight)

- line 75: Perhaps adding local time would be helpful here.

- line 135: FIG.1 Site labels are not clear even after zooming in. I think you may have to include higher-resolution figures. Where is 'Mez'? (I see something that looks like 'Mer'. Is

it a typo?)

- One main concern I have is the very specific method you've used to determine the dust layer altitude. What would happen if you chose the mean (or median) altitude instead of the 50th-percentile altitude (line 170)? Why don't you use a consistent approach to determine the layer altitude from CALIOP? You used the mean of the highest and lowest layers to determine the altitude from CALIOP. Perhaps the highest or lowest detected layers could be optically thin and the deduced layer altitude may not serve your intentions.

- line ~700: The discussion covers most of the potential uncertainties. If I'm not mistaken, you haven't mentioned the biases due to the use of coarse AOD as dust optical depth.