

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-349

Anonymous Referee #2

Referee comment on "A scheme to detect the intensity of dusty weather by applying microwave radars and lidar" by Xuebang Gao and Li Xie, Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-349-RC2>, 2022

The paper presents results from radiative transfer simulations on the attenuated backscatter received from sand particles by different kinds of radar and a lidar. The simulations cover different concentrations of sand dust representing different levels of visibility. The goal of the simulations is to estimate the maximum detection range for different levels of visibility given the characteristics of five radar and one lidar systems. In addition, the influence of surface charge of the sand particles and the relative humidity within the sand storm are investigated. The proposed scheme for the detection of sand storms over a wide range of conditions and over a large area consists of a W-band radar and a 535 nm lidar.

It is challenging to follow the manuscript due to poor use of English language. I would suggest the authors to have their manuscript checked by a native English speaker or somebody with fine English proficiency prior to the initial submission. The manuscript in its current form strains the voluntary review process.

Specific comments

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Please give more details on the chosen parameters for the particle size distributions in section 2.1. How much does the maximum detection range depend on the number of very small particles in relation to fewer larger particles? How are \bar{r} and σ_r related to V ?

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Based on your simulations you should also discuss whether special specifications could be proposed for different radar wavelengths to be better suited for sand detection. This could include the possibilities of increasing the radar sensitivity by increasing the pulse lengths or integration time. Can spatial resolution be exchanged with sensitivity?

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You should elaborate more on the elements shown in Fig. 5 or leave it out.

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In Section 4 it would aid the understanding to discuss the increased backscatter and increased attenuation/scattering due to the surface charge and relative humidity. The assumptions on the vertical distribution of humidity remained unclear to me. Furthermore, the water vapor concentration or at least the assumed air temperature should be given. I would have expected a signal attenuation due to the water vapor at least in the W-band by a few dB. I might have missed it in an earlier part, but it is unclear to me if the sand storm is horizontally homogeneous over the whole plane or if it just starts at a certain range.

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Overall I am missing a comment on the effect of gaseous attenuation for the simulations.

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Besides the effect of particle charge and humidity, the authors should also discuss the following

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How does the beam broadening and Earth's curvature affect the detectability of (shallow) dust storms?

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How good is the assumption of spheres for sand particles?

Minor comments

- L 45: Check if Elsheikh et al. (2017) is the correct reference for moisture inversions in sand storms.

- L 64: "Meteorological radars are usually used to detect the sandy dust weather". This sentence should be reconsidered. At least in my field of work, meteorological radars are primarily used to observe hydrometeors.
- From my understanding, the term "radar" stands for "**radio detection and ranging**" and is therefore different to a "**light detection and ranging**" system. Thus I am confused by the term "lidar radar". Instead, I would personally prefer the simple term "lidar".
- Fig. 1: As the yellow background does add nothing to the understanding of the figure, I would make it white.
- Figures 2 and 8 should use one color bar each for all six panels. This makes the panels more comprehensible.

I would like to encourage the authors to re-submit after a thorough revision.