Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-349

Anonymous Referee #1

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-RC1, 2022

The paper presents results of simulated detection capability for dust storms by using various radar types and lidar. The simulation considers various dust concentrations mostly expressed as visibility by human eye, and includes effects of relative humidity and electric charge for fixed particle concentrations. Based on the simulation results, the authors propose to use radar of different wavelength and lidar to detect dust storms.

The paper does not attempt to calculate the influence of polarization diversity of radar and lidar to distinguish dust storm returns from other returns; this is reasonably not scope of the paper. All calculations are based on spherical particles.

The English language is fair to poor which makes it sometimes difficult to follow the authors' argument. The authors should try to seek for support from a native English speaking person or someone being firm with English language.

Specific comments:

- Table 1 (and general): Why is C-band radar not considered? It is one of the most common types of meteorological services.
- Table 1: Lidar characteristics given indicate a device transmitting visible light with a pulse power of 4 kW. Such lidar is far from being eye-safe and thus not very likely to be used as a scanning device.
- Fig.2 (and others): The analysis is limited to a range of 10 km. Most ground based precipitation radar can detect dust storms at much larger distances; observations beyond 100 km have been reported. The authors should extend the analyses, at least

for figures 2 and 3, to at least 50 km (better 100 km) range. Detection ranges below 100 meters need not to be considered.

- Section 2.3, manuscript lines 172ff: "centimeter-band radar has not yet been used to detect sandy dust weather" and "for sandstorms that occur in desert areas, it is impossible to detect them from such a long distance." Both is not correct. Centimeter wavelength radar is used since decades for dust storm detection, see e.g. Hannesen and Weipert, 2003, and Saeed at al 2014.
- Fig. 2 b and c: According to the authors' calculation, the detection range of centimeter-wavelength radar is limited to about 10 km for visibilities of several hundred meters. But in Saeed at al 2014 (e.g. figs 6 and 7), detection range of the Kuwait C-band radar is about 100 km for similar visibilities. The authors need to revise their calculation and should comment on such huge discrepancy.
- Fig. 2 f and discussion in the text: The authors should compare their derived detection ranges with those according to ISO 28902-2:2017
- Fig. 3: This figure should be given also for a visibility of 100 meters (not only for 10 and 1,000 meters)
- Section 4 (manuscript lines 228-308): The authors describe the influence of electric particle charge and relative humidity in many sentences, with the data given being of limited value. For the reader, e.g. "considering the influence of relative humidity, when detecting severe sandstorms, the effective detection range is reduced by 502 m and increased by 201 m, respectively" means that he has to figure out to which original data such reduction refers to. A reduction by 502 m is significant if it means e.g. from 2,000 down to 1,498 meters, but it is marginal if it means e.g. from 20,000 down to 19,498 meters. Instead of many such sentences, the authors should present a few tables with all these data and should summarize the tables in the text.

References:

- Hannesen, R., A. Weipert (2003): Detection of Dust Storms with a C-Band Doppler Radar. Preprints, 31st Int. Conf. on Radar Meteorology, AMS, Seattle (USA).
- T. M. Saeed, H. Al-Dashti, C. Spyrou (2014): Aerosol’s optical and physical characteristics and direct radiative forcing during a shamal dust storm, a case study. Atmos. Chem. Phys., 14, 3751–3769, 2014. doi:10.5194/acp-14-3751-2014
- ISO 28902-2:2017: Air quality — Environmental meteorology — Part 2: Ground-based remote sensing of wind by heterodyne pulsed Doppler lidar