

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-42

Anonymous Referee #2

Referee comment on "Evaluation and Impact Factors of Doppler Wind Lidar during Super Typhoon Lekima (2019)" by Xu Wang et al., Atmos. Meas. Tech. Discuss.,
<https://doi.org/10.5194/amt-2021-42-RC2>, 2021

General comments:

The paper presents measurements taken during the presence of a typhoon close to Doppler lidar instruments. The paper is dealing with an interesting topic and tries hard to assess the performance of Doppler lidar instruments under extreme weather conditions. However, the typhoon obviously provides too many challenges at once so that no clear picture evolves, how extreme precipitation, humid aerosol and clouds may influence Doppler lidar measurements of horizontal and vertical wind. Observations like this are actually unique and very precious. But it remains unclear in the paper if Doppler lidars can actually provide useful information for analysis and prediction of (super) typhoon properties.

The paper is hence rejected in its current form. Taking into account the highly valuable and unique observations, I encourage the authors to rethink and reshape their work and present a new version of their paper also incorporating the comments below.

Detailed comments:

- Quantitative definitions are needed for statements like "fairly accurate" or ambiguous words like "impact factor" (do you mean "co-factor" or "influence factor"?, see Chapter 5).

- Relative humidity of more than 80% doesn't keep a Doppler lidar from working. Its mostly haze and cloud formation under high relative humidity conditions. The discussion of this effect stays blurry and needs a more detailed approach, separating all potential

influence factors.

- Measurement conditions with a typhoon present are very challenging, but in itself very precious. More emphasis should be laid on the evaluation of the basic data from the Doppler lidar, including highly resolved raw profiles of SNR allowing assessment of attenuation by rain, clouds and aerosol.

- The possible presence of clouds is not discussed. The presence of clouds of any size and form can limit the measurement of horizontal wind velocity, because attenuation can affect individual beams during Doppler beam swinging.

- The influence of rain and other factors on Doppler lidar observations can (and should) be studied when more controlled conditions are available. A lot of discussions in the paper are centered around the capabilities of a Doppler lidar under extreme environmental conditions, but this also means that comparison with other methods (e.g. radiosondes) is extremely challenging under such conditions. Heavy rain can also occur without extreme wind, and the other way around. A lot more data taken under more controlled conditions should be available at the given sites which could be used to clearly separate the effects of heavy precipitation, aerosol and clouds individually.

- Scanning angle or the angle of the Doppler lidar window plates need to be discussed here, because it can greatly affect the susceptibility of a system to rainfall, because with a lower scan angle, water runs off more easily from the window.

Technical comments:

L.18: root mean square: This seems to be slang, please specify if you mean root mean square deviation or error...

I.35 "good agreement": please specify

I.93: Please use UTC time or specify the difference of local time to UTC

Table 2: Speed range: Is this the raw velocity range of the detector or the range for a

VAD scan?

I.177: "Assumption that the horizontal wind field has a linear distribution": What is meant by "linear distribution"? A linear change within the observation volume?

I.255ff: Horizontal wind below 100m shows other effects that limit the comparability between radiosonde and Doppler lidar (e.g., stronger turbulence close to the ground, exponential increase with height, ...), which should be discussed here)

I.347: The definition "sunny" is misleading, since it there could be no rain and and anyway no sun.

I.355: The analysis of rain impact on the measurements is a bit superficial. There is plenty of information available from the Doppler lidar instrument itself which are not shown. E.g. high-resolution plots of SNR vs. range would be helpful in order to assess the situation in detail. If spectral data is available rain should also turn up in the spectra. Presence of cloud droplets could also easily be identified.

Fi. 11 b: Do you really mean bias? The scale seems to be the actual angle (?)

I.452: It is not clear how the deficiencies of the balloon can be judged if data close to the ground is (a) hardly available and (b) difficult to interpret without additional information (e.g., orography). With a lower scanning elevation ($\sim 5^\circ$ elevation) this height range actually could be accessed with Doppler lidars.