Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2020-2-AC2, 2020

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Spatial and vertical structure of precipitating clouds and the role of background dynamics during extreme precipitation event as observed by C-band Polarimetric Doppler Weather Radar at Thumba (8.50° N, 77.00° E)" *by* Kandula V. Subrahmanyam and K. Kishore Kumar

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Received and published: 4 August 2020

We are very much thankful to the referee for reviewing our manuscript and providing valuable suggestions. We have exactly followed the referee's instructions and revised the manuscript. We are herewith providing point-by-point response to the referee's

comments. The replies are typed in 'bold' letters.

General Comments The work presented in this paper mainly shows that lower wind caused increased rain due to convection, which is a quite typical situation. According to the title of the paper I would expect to see flow convergence (from Doppler data) due to convection and actual polarimetric signatures (i.e. indication of particle type) in convective and precipitating clouds (i.e. their vertical structure), but this was not done. Also, peak reflectivities are too low for extreme rainfall probably due to bad calibration of the radar. Finally, the text has a lot of grammar errors. The authors should make a careful editing of the paper whenever they want to resubmit it.

We have included the convergence flow in the revised manuscript. We considered the referee's valuable suggestions and utmost care is taken for correcting the English grammar in the revised manuscript

Specific Comments l. 27: Low convergence by convection leads to upper divergence and not the opposite as it looks the way that this statement is structured. It may be due to the bad grammar which changes the meaning of many sentences in the paper. See other comments below for some of the many grammar errors in the text.

Corrected in the revised manuscript

Introduction: This section is too long with many details and discussion which are not really needed and it should be shortened.

We have shortened this section in the revised manuscript

l. 42: Obviously, "dry" goes to winter season but this is not clear from the structure of the statement.

Rewritten this sentence in the revised manuscript

l. 58: replace "happen" with "create".

Corrected in the revised manuscript

l. 60: replace "vertical ascent" with "convection" and " adding the additional" with "increasing the".

Corrected in the revised manuscript

l. 63: replace "attributed to" with "connected with".

Corrected in the revised manuscript

l. 65: replace "attributed to" with "examined ".

Corrected in the revised manuscript

l. 67-69: delete the sentence "Further, ...in the atmosphere". It just repeats the same thing mentioned many time before.

Corrected in the revised manuscript

l. 69-70: replace "have contributed" with ",correspond to".

Corrected in the revised manuscript

l. 93: delete "were".

Deleted in the revised manuscript

l. 169-177: put specifications in the table for short and long range operation and dual/single prf instead of discussing them in the text.

We have included the scan strategy details in the table

l. 179: describe the method to convert from polar to Cartesian coordinates. This is not that simple because the radar cell is of fixed gate length and angular width, which leads to sparse data at long ranges.

We have described the method in the revised manuscript

l. 223: probably the authors mean Fig. 2b, but the red circle is not visible. Also, Rho

is a bit low in high rain areas, where it should be steadily above 0.95. This imply some V/H channel synchronization problem (thus, Phidp is a bit noisy too).

Yes, it is for Figure 2 b, we apologize for this and corrected in the revised manuscript. We have also included a red circle in Figure 2. We have re-examined the Rho values and discussed accordingly in the revised manuscript.

l. 240: The authors, state that negative Zdr represent vertically oriented (prolate) particles. Can they be more specific? There are other reasons for negative Zdr measurements, like differential noise (at edges of rain cells) or differential attenuation effects.

We have modified the text and discussed the reasons behind the negative Zdr values as suggested by the referee.

l. 247-248: The authors mention that Phidp is very useful for calibrating the radar. Was the radar actually calibrated with such or some other method? Did they verified it against e.g. in situ rainfall data?

Yes, the radar used in the present study was calibrated and validated with in situ rainfall data. The detailed calibration and validation results can be found in Mishra et al. (2020). This reference is now included in the revised manuscript.

Mishra et al. (2020), First indigenously developed polarimetric C-band Doppler weather radar in India and its first hand validation results, 825-840, Journal of Electromagnetic Waves and Applications, https://doi.org/10.1080/09205071.2020.1742798

Fig. 5: This not a really useful figure. Figure 4 is sufficient to show the vertical extend of the storm clouds.

We have removed the Figure 5, as suggested by the referee in the revised manuscript

l. 312: The rainfall described as "intense" corresponds to low to moderate reflectivity (rainfall rate correspondence?). Thus, it is not an intense rainfall and the time duration of core events is not many hours to result to a flood because of accumulated rainfall.

Figure 6 is generated by taking mean along south-north direction. Due to this, the relatively large reflectivity values are averaged out. Relatively larger reflectivity (> 40 dBZ) is observed as seen in Figure 4. We have now included this aspect in the revised manuscript.

l. 333-334: The same comment as before for negative Zdr measurements.

The explanation for negative Zdr values are now included in the revised manuscript.

Fig. 6b: change "2019" in the title with "2018".

Corrected in the revised manuscript

Fig. 7: There is a lot of blockage (missing azimuth sectors) and ground clutter (non-regular texture of estimated rainfall field), which is strange with 11 elevations in each volume to select the one with less beam blockage and ground clutter. The 300 mm accumulated rain peaks in 4 days does not look to be a too extreme event (this depends on terrain too, but no information is provided).

We have used lowest elevation scan for estimating the accumulated rainfall. We have now selected the 2 degree elevation with less beam blockage and ground clutter. We also provide the terrain information in the revised manuscript.

Fig. 10: No wind direction is shown in Fig. 10. The authors should add wind arrows or mention which wind component they show.

We have now added the wind arrows in Figure 10 in the revised manuscript.

Please also note the supplement to this comment:
https://nhess.copernicus.org/preprints/nhess-2020-2/nhess-2020-2-AC2-supplement.pdf

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