

Interactive comment on “Characterization of Mediterranean hail-bearing storms using an operational polarimetric X-band radar” by G. Vulpiani et al.

Anonymous Referee #4

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This manuscript describes two case studies of rainfall observed by a polarimetric X-band radar showing the value of such a radar for observing intense precipitation. The manuscript is generally well written, though some additional technical editing would not hurt. I recommend major revisions according to the comments given below.

General comments.

1. The authors correct reflectivity and differential reflectivity for attenuation and differential attenuation in rain. How the attenuation effects by wet hail remain to be largely unknown and not accounted for. Did you make any attempt to account for hail attenua-

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tion? Or you just neglected this additional attenuation? In any case you have to justify your handling of hail attenuation and differential attenuation.

2. It appears that the authors use fixed values of the coefficients in the attenuation – KDP and differential attenuation – KDP relations (0.29 km/dB and 0.048 km/dB, correspondingly). Recent studies (see DOI: 10.1175/JTECH-D-13-00231.1) where such coefficients were derived from dual-wavelength measurements without any theoretical assumptions indicated a fair amount of variability in these coefficients from one event to another. How the natural variability in these coefficients can affect the results of your study? Please include discussion on this topic.

3. In Figs. 4 and 11. The authors present quasi-vertical profiles of observed radar variables. Even though the study is about intense precipitation, these vertical profile are shown for times when precipitation was very weak (reflectivity < 20 dBZ near the ground and the corresponding ZDR is very small). It is not very informative. Can you show the vertical profile data for heavier precipitation?

4. ZDR in the vertical profile (Fig. 4) is negative. How it could be? Especially it is very strange for the rain layer.

5. In presence of hail, it is generally unknown what fraction of the observed backscatter from a particular radar resolution volume comes from hail. The reflectivity due to rain in a hail-rain mixture will always be smaller than total reflectivity. In this case you will be overestimating rain rate when you use the Z-R relation and the corresponding weights from Eq. (3) are less than 1. How do you handle this problem?

Specific comments

1. How many gauges overall were used to get statistics in shown in Tables 1 and 2? What type of gauges they were?

2. Terminology: I suggest that the authors when talking about attenuation affecting ZDR specify this as differential attention (not just attention as some parts of the text

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refer to).

3. Page 7203, line 23: Is it the same radar or the same type of radar?

4. Page 7204, line 10: Actually all WSR-88D units are being operated in the dual-pol mode (correct the reference to these units as single polarization units).

5. Provide units for values shown in Tables 1 and 2.

6. For the radar reflectivity you use interchangeably Z and Z_H . Please change it everywhere to Z_H . 7. Fig. 4: at what elevation angle were those azimuth-average vertical profiles derived?

8. Please define Vertical maximum Intensity (VMI). Are values in Fig. 5 collected at different elevation angle or at a constant elevation angle?

9. Are Z_H and Z_{DR} values shown in Figs. 4, 5, 6 corrected for attenuation?

Typing errors

1. There is a typo in line 18 (page 7208): I believe it is $\gamma_{DP}=0.048$ not $\gamma_H=0.048$. Also here provide units of the gamma coefficients.

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