

Atmos. Meas. Tech. Discuss., author comment AC3
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Reply on RC2

Roberto Cremonini et al.

Author comment on "Estimation of extreme precipitation events in Estonia and Italy using dual-polarization weather radar quantitative precipitation estimations" by Roberto Cremonini et al., Atmos. Meas. Tech. Discuss.,
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RC2: 'Comment on amt-2022-220', Anonymous Referee #2

The manuscript by Cremonini et al. presents an interesting application of radar dual polarization QPE to analyze extrema of precipitation to compute return times. Most of existing studies are based on raingauge rainfall measurements or reflectivity-based radar rainfall estimation. Kdp is instead used and expected advantage in estimating maxima is related to the better performance in QPE, especially at C-band and for intense precipitation, with respect to the Z-R based estimation. I recommend publication, after revision.

Major comments:

After reading abstract and the introductory parts of the manuscript, I was expecting some comparisons with Zh or Zh-Kdp rain algorithms, not in terms of QPE, but in term of impact on the GEV analysis in order to pointed out the need or the benefits of using a dual-pol radar approach. Such evidence is not made clear by the manuscript. Maybe a comparison with a single-pol approach could be helpful.

Benchmarking against single polarization QPEs has been reported, comparing results for all three areas for $R(Zh, Kdp)$ and $R(Zh)$ respect raingauges. The study demonstrates for 1-hour rainfall accumulation maxima that QPEs based on Zh-Kdp have a better agreement with rain gauges estimate of rainfall maxima.

Radar QPE is affected by the choice of parameters of radar rainfall algorithms. Even the performance of the R-Kdp estimator, which, theoretically is marginally affected by the DSD variability, can be influenced by such parameterization. If I am not wrong, authors have use relationships from literature. Also, the Kdp estimation method (different methods are used for the two study areas) can have an impact on results. Could the manuscript discuss this point ?

The agreement between weather radar-based retrieval has been deeply investigated by Voormansik et al., 2021. The work evaluated algorithms' performances.

Minor issues:

Line 32: Zh is more precisely the equivalent reflectivity factor at horizontal polarization. Please specify that authors prefer using a shorter language.

Corrected with improvement in description at line 32

Line 60: "...rainfall intensity estimations based on $R(Zh, Kdp)$ ", why not $R(Kdp)$?

$R(Kdp)$ derived from C-band weather radar for low rain rates is insensitive and then, affected by large errors. The algorithm $R(Zh, Kdp)$ allows for overcoming these large errors by relying on Zh for precipitation regimes where rain attenuation at C-band is negligible.

Line 141: Is the 3-dB variation of bias resulting from self-consistency consistent with technical issues occurred ?

Some miscalibration occurred during some device failures. The Zh bias is generally related to the miscalibration of the radar.

Line 149: About $R(Zh, Kdp)$: Is Zh corrected for attenuation ?

No, attenuation correction is not needed as Zh attenuation at C-band is negligible for low rain rates (< 25 dBZ).

Line 205: It is not clear to me what is "z" in the formula and "Z" mentioned in the caption of Fig- 3.

The semi-variograms have been derived from $R(Zh, Kdp)$ rainfall estimations. Corrected both text and caption.

Figure 4. Please define units of axes.

Added units for x-axis of the leftmost plot (mm/h). The other plots show dimensionless quantities like sample numbers and quantiles.

Figure 5. please specify in the caption the meaning of dash lines.

Added to the Figure's caption.