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Atmospheric Measurement Techniques Discussions

Interactive comment on "Evaluation of GPM-DPR precipitation estimates with WegenerNet gauge data" *by* Martin Lasser et al.

Anonymous Referee #1

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The paper "Evaluation of GPM-DPR precipitation estimates with WegenerNet gauge data", by Lasser and co-workers, presents a validation study of DPR precipitation products after comparison with rainfall rate measured by a very dense and well maintained raingauge network in the Alpine region. 22 precipitation events are considered and a number of statistical indicators are computed to quantify the accuracy of the DPR products.

The paper is fairly well written, and the topic falls within the scope of the journal. I feel, however, that experiment is not well designed for two main reasons.

First, the cumulation time selected for the raingauges is too short. If I well understood, the sensitivity of the TB is 0.1 mm, so that any measure X has to be intended as XïĆś0.1 mm. By considering such short time, most of the time (given the low rainrates

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Discussion paper

measured in the area) the data should be (looking at figures 6 to 9) for a single gauge 0.1 mm, resulting in a value of 1.2ïĆś1.2mm/h, that means a relative error of 100% for the most frequent value. Tokay et al., (2003, J. Atmos. Oceanic Technol., 20, 1460-1477) shows that for very light rain amount, the correlation between co-located tipping bucket raingauges can be very low. I suggest to use longer raingauge cumulation intervals (see also Porcù et al., 2014, Atmospheric Research) and to discuss the error associated to the ground measure.

The second issue is on the use of binary indicators to assess the quality of the DPR estimates. Two indicators (PC and POFD) includes the number of correct negatives as input. This number should not be considered in the evaluation, since can be arbitrarily larger or smaller by changing the selection of cases, and thus the results are not general. Moreover, I suggest to use other indicators (ETS, HSS, HK) to synthetize POD and FAR information.

More specific comments follow.

Page 2, Lines 18-19. The imager is only one (GPM Microwave Imager) and it is designed to provide a radiometric standard for the other radiometers of the GPM constellation.

Page 3, Line 1. There are two recent papers (Speirs et al, 2017; Petracca et al., 2018) performing a similar analysis in the same region (Switzerland and Italy): they are reported in the reference list but not mentioned in the paper. Also the important paper Seto and Iguchi (2014) is in the reference but not mentioned in the text. The Authors should carefully read these papers and discuss their results.

Page 4, Lines 12-15. No solid precipitation in summer (i.e. hail)?

Page 4. Line 27. Inverse distance interpolation does not add information to the gridded data, since the only information is in the raingauge measurements. The increased resolution can be good or bad, depending on how the precipitation pattern agrees with

the inverse distance model.

Page 5, Line 1. Frozen hydrometeors attenuate radiation as well.

Page 5, Lines 19-20. It has to be considered that the radar measures precipitation in a volume at a given altitude (near surface bin, I guess), and it takes time to the raindrops to reach the ground. In case the Authors claim for a very precise temporal matching, this issue should be discussed. It should also be mentioned if the "near surface bin" value is used to evaluate the vertical distance between the DPR estimate and the ground.

Page 7, Line 12.It is "8 to 10" or 8-12 (Page 6, Line 1) stations for footprint?

Page 9, Lines 15-16. Bias and Normalized Bias give different information and should be computed both. The fact that the NB gives huge values simply tells that the error is much larger than the measurement, this is often the case when a too short cumulation time is used (5 min).

Page 9, Lines 19-22. To build any contingency table the threshold to define rain and no-rain sample has to be carefully defined and reported here.

Page 9, Lines 23-24. As mentioned, the direct use of correct negatives should be avoided in any validation study (see Nurmi, 2003, Recommendations on the verification of local weather forecasts. ECMWF Technical Memoranda. Technical Memorandum No. 430 for reference). What is the precise meaning of the "careful choice" of the events? For this reason the indicator PC and POFD should be removed by the analysis.

Page 10, Line 21. A key indicator is the Equitable Threat Score (see Nurmi, 2003) that summarizes both POD and FAR, and gives the skill with respect to the random assignment of rainy footprint.

Page 10, Line 25-26. This sentence is useless and should be cancelled.

Page 10, Line 27. What is the "general structure"?

Page 10, Lines 28. What does it mean “70% of the GPM-DPR precipitation rates are within the range of the respective WegenerNet gauges”? What is the “range of WegenerNet gauges”?

Page 11, Line 7. What does it mean “close to zero”? How are the numbers rounded? How many significant digits are considered?

Page 12, Lines 8-10. Please avoid misleading numbers and cancel PC and POFD from the analysis.

Page 13, Lines 1-4. FBI gives a measure of the under-/overestimation of the wet area, not of precipitation.

Page 14, Lines 1-end. I’m not sure this analysis is well designed. If I understood well, hit is when the DPR products falls within +- 1 standard deviation of the corresponding gauges value, misses is if the DPR is lower than the gauges – 1 standard deviation, and false alarm if the DPR is higher than the gauges+1standard deviation value. Who are the correct negatives? How large is the standard deviation (roughly)? The main problem I see is that the distribution of rainrates is strongly asymmetric (power law) so that the standard deviation is asymmetric with respect to the mean value. In case of very light rainrate the value gauge-1 standard deviation could become negative. I suggest to cancel this section or to better argument its goal and procedure.

Section 4.2. In many cases, there are footprints where the raingauges do not measure rain, while gridded value is above zero. In some cases (e.g. footprints 2, 5, 8, 11 and 13 of event 9) eight or nine gauges measure zero, but interpolation fills the footprints with not negligible amount of rain. The Authors should justify the use of the interpolated data.

Page 16, Line 5. The convective/stratiform discrimination can be done in several ways (see Bringi, et al., 2003, J. Atmos. Sci. 60, 354–365 for an example). How it is done here? It is quite strange that light precipitation belongs to convective events. . .

Page 16, Line 10. Are the DPR footprints in chronological order? In terms of milliseconds?

Page 19, line 5 to the end. I understand the point (see my previous comment), but if the lag is supposed to be due to the time needed to raindrops to reach the ground, it is largely overestimated here. A raindrop of 2 mm of diameter has a terminal velocity around 6 m/s, that means that in 5 minute it covers around 1800 m, and I guess the DPR near surface bin is closer to the ground. Thus to search a time lag larger than 5-10 minutes is not justified. The relatively higher correlation found at lag of 10-20 minutes are very likely due to the patchy rain pattern and to the very small rainrates.

Conclusions.

Page 20, Line 13. Probably gridded data add information, but there is no guarantee that the information is correct.

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