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Interactive comment on "Exploring the potential of utilizing high resolution X-band radar for urban rainfall estimation" *by* Wen-Yu Yang et al.

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GENERAL COMMENT

This paper illustrates the processing of the observations collected by an X-band single-polarization radar in Beijing for hydrological purposes. Although the topic is of significant interest, the work is affected by a general lack of novelty (most of the employed procedures are well known and are here presented without a significant in-depth analysis) and serious theoretical flaws, in particular for the "wind drift" correction. In addition, the English language is not appropriate in many instances for a journal publication. The main issues are discussed more in detail below.

SPECIFIC COMMENTS

Radar calibration: calibration using a nearby disdrometer is actually a reasonable option, especially for longer wavelength radars (in the cited article, Lee and Zawadski

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used S-band data). Indeed, at shorter wavelength such as X-band, in addition to path attenuation, the attenuation caused by the wet radome can induce serious underestimation of the reflectivity factor, up to several dB, e.g. Schneebeli and Berne (2012), Gorgucci et al. (2013), Frasier et al. (2013). Considering that the disdrometer in this study is very close to the radar, most of the measurements analyzed are likely coming from situations with rain over the radar also. This may explain the reported underestimation for higher reflectivity (>35 dBZ). Only qualitative results are reported in the manuscript, with figure 3 representing observations from a single event during a one-year period (by the way, I would exchange the x and y axes, since the disdrometer is the reference here). What about the other events and an overall quantitative evaluation of the calibration?

Beam integration: what is illustrated in this section appears to be a simple elevation selection, depending on the visibility. There is no mention of correction for partial beam blocking. If this is the case I think it may be simply called “beam selection”, and should not be considered a correction procedure.

Local Z-R relations: the authors cite Steiner et al. (1995) work to differentiate rainfall type (convective/stratiform) based on a reflectivity threshold of 39 dBZ. However, the cited paper presents a more complex procedure based on the spatial structure of the reflectivity (intensity, peakedness,...). Steiner et al. report an overlap region between 20-35 dBZ, highlighting that “a simple reflectivity threshold method to separate convective from stratiform precipitation is insufficient”. So, where does the 39 dBZ value comes from? Why do you need a different convective/stratiform partition method for the disdrometer data? Would it be possible to use the radar-based LWC method to select the corresponding disdrometer data for the separate Z-R retrievals? This may be more consistent, since in the end you need the Z-R relations for application to the radar observations.

Wind drift: the authors seem to confuse the motion vectors (advection of reflectivity patterns) and the wind vectors. At line 330 it is stated that “the advection velocity of

a rainy pixel (equal to the background wind velocity)". This is not true: the advection velocity is not the same as the wind velocity. Although a correlation may exist between storm advection and mid-tropospheric winds (e.g. Johns and Doswell, 1992; Kyznarova and Novak, 2005), the lower layers' winds (0-2 km) may actually dramatically differ from the advection motion. In addition, the low-level shear cannot be simply attributed to a velocity change (with constant direction), as reported in section 3.2. This is an over-simplification, not supported by neither theoretical arguments nor experimental evidence. It is also not clear why this "wind drift" correction is only shown for a single event, while the other corrections are applied to a bigger dataset. I'd rather suggest to carefully check the time synchronization between the radar and the gauge observations. In particular, which time was considered for the radar observations, since these are coming from different elevations (different scan time) depending on the azimuth sectors?

MINOR CORRECTIONS

- L. 18: "X-band-radar-based", too many hyphens. "X-band radar based" may read better.

- L. 23: "non-precipitation clutter" sounds tautological, it may be better to use something like "non-meteorological echoes (clutter)".

- L. 27: here and after: "distrometer", replace with "disdrometer".

- L. 56-58: it seems that a verb is missing (maybe replace "operating" with "operate").

- L. 57: replace "America" with "U.S.".

- L. 319 and 323: the reference to Caroline (2015) is missing.

- L.82-93: I'm not convinced that the wind drift effect should be considered an issue specific for X-band systems. While it is true that X-band have higher spatial resolution, due to the short range the height of the radar beam is in general lower, with a reduced impact of wind drift.

- L. 176: which kind of “prior knowledge” do you need for VPR? This is unclear.

- L. 279-280: “real-time atmospheric temperature profiles that is commonly used for convective-stratiform classification”. Do you have a reference for this statement (convective-stratiform classification from temperature profiles)?

- L. 298: add references for the “standard” Z-R relations.

- L. 309: “distinguish” -> “differ”

- L. 318-327: the notation Delta_x may be confusing, since this usually indicates the zonal displacement.

- L. 622: “gian” -> “gain”

- Fig. 5: the mustard-colored and red lines have the same exponent (1.2) but different slopes in the plot. On the other hand, the blue and red lines show different exponents but seem to have the same slope. Looks like the coefficients are switched somewhere.

- Fig. 8: the result in panel (e) appears a bit counter-intuitive, since the “all” Z-R relation should over-estimate always respect the convective relation and also respect to the stratiform relation, for R higher than approx.. 1 mm/h. The scatterplot shows the opposite. This might be related with the Z-R coefficients issue (previous point).

- Fig. 9: if this is rainfall rate, the units should read “mm/h” instead of “mm”.

REFERENCES

Schneebeli, M. and A. Berne, 2012: An Extended Kalman Filter Framework for Polarimetric X-Band Weather Radar Data Processing. J. Atmos. Oceanic Technol., 29, 711–730, doi: 10.1175/JTECH-D-10-05053.1.

Gorgucci, E., R. Bechini, L. Baldini, R. Cremonini, and V. Chandrasekar, 2013: The Influence of Antenna Radome on Weather Radar Calibration and Its Real-Time Assessment. J. Atmos. Oceanic Technol., 30, 676–689, doi: 10.1175/JTECH-D-12-00071.1.

Frasier, S., F. Kabeche, J. Figueras i Ventura, H. Al-Sakka, P. Tabary, J. Beck, and O. Bousquet, 2013: In-Place Estimation of Wet Radome Attenuation at X Band. J. Atmos. Oceanic Technol., 30, 917–928, doi: 10.1175/JTECH-D-12-00148.1.

Johns, R.; Doswell, C.A., III. Severe local storms forecasting. Weather Forecast. 1992, 7,588–612.

Kyznarova, H.; Novak, P. Development of Cell-Tracking Algorithm in the Czech Meteorological Institute. In Proceedings of WSN05âĂŤWorld Weather Research ProgrammeâĂŤA Symposium on Nowcasting and Very Short Range Forecasting, Toulouse, France, 5-9 September 2005; p. 6.

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