Referee 3

It is a very nice simple-minded but important paper. We need results such as those reported in the paper to monitor our progress in variety of hydrologic problems. Radar-rainfall estimation is one of many of such problems in hydrology. I have very few comments to suggest to improve the paper:

1. The authors say little about the type of rain gauges used in the studies. “Automated” does not define the type and the type has implications for the expected errors (sampling). I suggest including the reference by Ciach (2003) if some of the gauges are tipping buckets.

Response: Thank you for the suggestion. The reference to Ciach (2013) will be added and more details about the gauges will be provided. See comment 1, referee 2.

2. In the Conclusions, the authors say: “On average, the radar products with higher spatial resolutions were in better agreement with the gauges, thereby confirming the importance of high-resolution radar observations in hydrological studies.” There are problems with this statement. First, it has been shown by several studies in the past that rain gauges have representativeness errors. The larger the area, the larger the error. Ciach and Krajewski (1999a,b) have established a framework on this that was followed my many subsequent studies. Therefore, it is expected that radar products with coarser resolution will show poorer agreement with rain gauges data. This says nothing regarding importance of high resolution radar observations in hydrologic studies. In fact, for many applications the resolution is not the most important aspect of the radar-rainfall product.

Response: The reviewer is right. A large part of the reported bias is due to representativeness errors. But this does not say much about the overall quality of the radar estimates. The revised version will contain more discussion about this issue and the problematic sentences will be reformulated to convey the right meaning. Note that gauges are not considered as ground truth in this study. Rather, the goal is to describe the overall discrepancies between radar and gauge measurements, combining all sources of errors (i.e., gauges, radars, algorithms, humans) as well as differences in measurement scales.

3. The quality of the figures should be improved.

Figure 1. With wide spread of GIS technology, I would expect much better quality maps. At the very least distinguish land from sea. Make the gauge locations solid dots so that they are better visible.

Response: A new fancier figure has been created (see attached file)

Figure 2. Don’t repeat the dimension for each panel, the information is in the caption. The color scale is the same for all panels. Don’t repeat it. By eliminating the legend and the axis description you gain space for the panels to be larger.

Response: OK, thanks for the suggestion.

Figure 4. Just overall poor quality (aesthetically). Also, I do not think that this figure adds much. They show just single event out of so many. I recommend removing it.

Response: In the authors’ opinion, these figures are essential for understanding the time-dependent component of the error structure. We will improve the quality but keep the figure.

Figure 5 and 6. I recommend making all panels with the same scale range. This way you can remove the labels between the panels, make the panels larger, and make the dot larger.

Response: Thanks for the suggestion. But if we use the same scale for all panels, it becomes very hard to see the details for Sweden and Finland. A log-log scale also does not seem to be appropriate here. Therefore, we think it is best to keep the figure as it is now and add a small note in the caption to alert the reader about the different scales. The main idea here is to compare the correspondence between gauge and radar measurements in each country and not to compare event intensities between countries.

Figure 7. Since you are using color in other figures, you can add color to this one. For example, you could use two shades of the color assigned to different countries to distinguish gauges and radar. This way you can remove the repetitive labels that clutter the figure.

Response: OK, thanks for the suggestion.

Figure 8. Use the colors assigned to the countries to draw nice solid lines. You can add subtle light gray horizontal grid to the panels. Change the y-axis scale range to simplify the numbers, e.g. for the correlation you can use 0.5-1.0 range with horizontal lines only. The principle to follow here is to minimize the amount of ink for the same information content.

Response: OK, no problem

Figure 9. Very busy. You can de-clutter by simple removing the labels between the panels since both axes range is the same for all panels (good!)

Response: OK

Figure 10. Same as above. Did you explain the red bump for Denmark at 45 minutes scale?

Response: OK. Yes, the “bump” is already explained in the text.

Figure 11. I recommend remove the whole story of the X-band radar. Including it seems forced. That’s not what the paper is all about. Write another study about the X-band radar performance.

Response: Yes, the story for the X-band radar is a bit different (shorter time period and different frequency). But we don’t think it looks forced. The X-band data is not in the focus of the paper but provides additional interesting results at higher resolution.

Suggested references to add:
- Ciach, G.J. and W.F. Krajewski, Radar-rain gauge comparisons under observational uncertainties, Journal of Applied Meteorology, 38(10), 1519–1525, 1999.
- Ciach, G.J. and W.F. Krajewski, On the estimation of radar rainfall error variance, Advances in Water Resources, 22(6), 585–595, 1999.
- Ciach, G. J., Local random errors in tipping-bucket rain gauge measurements. Journal of Atmospheric and Oceanic Technology, 20, 752–759, 2003.

Response: Thanks for the suggestions! All three references will be added during revision.