

Interactive comment on “

Potential of high-resolution detection and retrieval of precipitation fields from X-band spaceborne Synthetic Aperture Radar over land” by F. S. Marzano et al.

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This paper presents analyses of X-SAR retrievals of rainfall, using both reflectivity and phase measurements. This study is highly relevant because of the need for high-resolution rainfall data. In this sense, X-SAR measurements nicely complement the
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existing TRMM and the planned GPM missions. I do, however, have some comments regarding the manuscript. I feel that the analyses regarding TRMM (both Figure 2 and the analyses regarding the downsampling of X-SAR data) could be removed so that more attention can be given to quantitative analyses of X-SAR rainfall retrievals. Detailed comments are given below.

Major comments:

I find Section 4 (Spatial variability of rainfall fields observed from space) difficult to understand for several reasons. First of all, it is not clear to me what the authors would like to show in this section. It is clear and somewhat trivial that spatial averaging (with and without a spatial weighting function) will alter the characteristics of a spatially variable field. What is the question they would like to answer, or what is the hypothesis they want to (dis)prove? This should at least be clearly stated in this section as well as in Section 1 (Introduction). Secondly, it is unclear how the downsampling of TSX was exactly done. If it is done through simple averaging in space (as I understand from Fig. 7), then the error bias should not be influenced (which it clearly is on p. 7467). A more detailed explanation should be provided. Thirdly, it is unclear to me how the histograms of Figs 8 and 9 are constructed. Why are the classes different, and what is meant by "pixels are grouped by a down-sampling factor" (p. 7467, line 26 and p. 7468, lines 22-23)? For this reason I find it very difficult to interpret these figures, and to understand what message the authors want to convey with them.

The X-SAR retrievals could be analyzed in a more quantitative manner with the data that are available. Adding such analyses to this paper would certainly make it stronger. It would give insight into the quality and possible weak points of the use of X-SAR for rainfall retrieval. The quantitative analyses of the comparison between WR and TerraSAR-X reflectivity-derived rainfall could be elaborated. And why not include a comparison of COSMO SkyMed X-SAR reflectivity-derived rainfall to WR data similar to the TerraSAR-X analysis? Furthermore, the comparison between WR rainfall estimates and the COSMO SkyMed X-SAR interferograms could be made more quantitative.

A simple regression analysis would already add very valuable information, whereby results could be compared to values previously observed in literature.

If TRMM data are used in this study, and TRMM data are simulated from X-SAR measurements, why are the two not compared quantitatively?

I think it is important to stress the effect of the long revisit time of typical X-SAR satellites, and that the potential for shorter revisit times is at the cost of coverage.

Was the regression analysis to derive a , b , b_v , c_v , and c_e carried out using the TerraSAR-X and WR data from hurricane Gustav? If so, this should be clearly stated in the Section where statistics of the comparisons of the two are discussed.

Minor comments:

In Section 1 (Introduction), the authors state that they will investigate the effect of non-uniform beam filling. From this I expected that this would be related to the X-SAR retrievals, but in the remainder of the paper this investigation is about the this effect for the TRMM instruments (PR and TMI).

The second part of Eq. (1b) is missing a dz .

Can the values of a_e and b_e (p. 7461, line 7) be related to relations between specific attenuation and rainfall intensity derived from drop size distributions?

Can the values of a , b , b_v , and c_v (p. 7461, line 24) be related to relations between specific attenuation, radar reflectivity, and rainfall intensity derived from drop size distributions?

Eq. (4) on p. 7462 is incorrect. It should be:

$$\hat{R}_{WR} = [Z(x)/a_r]^{1/b_r} .$$

On p. 7463, line 20, it should be "Moisseev".

On p. 7469, line 2, it should be "TSX-TMI".

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On p. 7469, lines 8-9, could you quantify this correlation between the X-SAR temporal coherence reduction and the WR reflectivity field?

On p. 7471, there is an error in Eq. (A9). It should be:

$$\hat{R} \simeq \left[\frac{\Delta\sigma_{SAR} + B \left[a_e (4.343\Delta\sigma_{SAR})^{b_e} \right]^d}{A} \right]^{1/b} .$$

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