

Filling radar gaps is a very important part of hydrologic study. But it is one of the difficult ones since there is not sufficient information inside the gap. The authors' effort to fill gaps using satellite datasets is worthy publication. However, there are existing methods that fill radar gaps using satellite and surrounding radar precipitation estimates (Mahani and Khanbilvardi 2009; Tesfagiorgis et al., 2012; Tesfagiorgis and Mahani 2013). The authors should explain how are their methods different from the rest, other than study area? Which part of your methodology is different? Or did you only come up with a different weight calculation? In addition, I suggest the following revisions before publication.

In the abstract, the authors stated that “the results suggested that” If the merged product is not better than the satellite product, why don't the authors fill the gaps with bias corrected satellite products without the extra effort of producing a merged product?

In Section 2: Is the proposed merging method “successive correction”? Successive correction method is a pixel by pixel calculation of the missing (gap) pixel. This method was used to fill gaps (missing pixels) by several authors before (Brandes 1975; Mahani and Khanbilvardi 2009; Tesfagiorgis et al., 2012 and Tesfagiorgis and Mahani 2013). Please cite these works in your methodology and clearly state how your methodology differs from these work. As you mentioned in the paper, you used a maximum distance of 5km for calculation of weights. I am assuming that 5 km is the size of your moving window. Am I right? Please mention that.

There are also similar equations among your merging technique and previous studies (mentioned above). For instance, your equation 5 calculates the first estimate for the missing gap pixel using the surrounding information. Brandes originally devised that same exact equation (Brandes 1975). That equation later adopted by Tesfagiorgis and Mahani 2013 for a similar purpose. Explain that very well and cite these work.

Similarly, the authors' calculation of weight (equation 6) is also from Brandes and later adopted by Tesfagiorgis and Mahani 2013 to fill radar gaps. In calculating the weight, you stated that “r is the maximum

distance (km), which was set to 5 km in this study.” It is up to the authors which value of r to choose. But, my understanding is that r should have the unit of km^2 . According to previous studies, r controls the degree of smoothing in the exponential weight calculation.

Next, the authors merged the satellite with the interpolated radar. While doing this, they calculated RMSE between the satellite and the “reference data”. What is your “reference data”? I struggled to understand this part of the methodology. It is not that clear for me. In addition, I thought the authors ultimate goal is to fill radar gaps. If there is reference data inside the gaps, why didn’t use the authors use the ‘reference’ data to fill the gaps? Or is the “reference” another independent data (other than the satellite and the interpolated radar)? And one major point at this step is that, previous studies considered error (difference between the satellite and the interpolated radar). Taking the difference (error) correction has an additional advantage that helps whenever the rainfall happens inside the radar gap. Why is yours better than the ones that considered error (difference) correction? See Brandes 1975 (equation 7 and 8); Mahani and Khanbilvardi 2009. What would happen if the rainfall falls completely inside the radar gap? The surrounding radar wouldn’t help in your cases since the interpolated value from the surrounding pixels will have a value of 0 (but in reality that pixel may be raining). Explain

The other challenge in filling gaps using satellite estimates is ‘bias correction of the satellite estimate’. The authors are using radar precipitation estimates to bias correct the satellite product. Am I correct? But inside radar gaps, there is no radar observation. So, how are you correcting the satellite estimate inside the gap?

Is this paper an introduction of your methodology using artificial gaps? Are you adopting the technique to fill real gap cases?

Additional Reference:

Edward A. Brandes, 1975: Optimizing rainfall estimates with the aid of radar. J. Appl. Meteor., 14, 1339–1345.

Tesfagiorgis, K. B. and Mahani, S. E. (2013), A multi-source precipitation estimation approach to fill gaps over a radar precipitation field: a case study in the Colorado River Basin. *Hydrol. Process.*
doi: [10.1002/hyp.10103](https://doi.org/10.1002/hyp.10103)