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Interactive comment on "Evaluation of precipitation estimates over CONUS derived from satellite, radar, and rain gauge datasets (2002–2012)" *by* O. P. Prat and B. R. Nelson

Anonymous Referee #2

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The aim of this paper is to assess the characteristics of a suite a ground-based (GHCN-Daily, PRISM and Stage IV) and space-borne (TMPA) QPE products over the CONUS over a 10-years period at various time scales. Rain gauge observations and PRISM are taken as a reference for the evaluation of remote sensed products at the annual, seasonal, and daily scales over River Forecast Centers (RFCs). It is shown that if all products present similar annual average accumulation over the CONUS, discrepancies appear at the RFC scale in particular with 3B42RT. The gauge correction in 3B42 often mitigates these biases compared to 3B42RT at the annual and seasonal scale except for the Western US. Extreme daily precipitation is shown to be challenging to retrieve for all remote sensing products.

The research area of using ground and satellite data to obtain good quality distributed rain estimations at the global scale recovers a real need for a number of applications ranging from climate analysis to prediction of floods.

The paper is clear and structured, but the first part is hard to follow with numerous statistical numbers and too few interpretation of the results. The novelty of the work needs to be better highlighted. The results are not always or poorly explained. Keys aspects in the comparison methodology are not well described. Recommendation is “major revision”. I would recommend that the authors address carefully the points mentioned below for the manuscript to be ultimately accepted for publication.

1. Title: the authors should include the time scales they are considering (daily to annual). One important value of TMPA and Stage IV is that these datasets are available at sub-daily scale. This is not evaluated here.

2. As a basis for this analysis, the GHCN-Daily gauges are is used as a reference to remote sensed precipitation products. It is probably not suitable since some of these products (3B42, Stage IV) ingest gauge correction over the CONUS and are not mutually independent. This is particularly highlighted with some extremely high correlation coefficients (e.g. p.11496 l. 24, p.11501 l.29). In this context what is the contribution of this analysis, and can it be better explicated?

3. “Seldom studies that deal with the long-term assessment of precipitation products (annual or multi-annual basis) are available in the scientific literature” (p. 11492 ll.9-11): could you please cite some studies? E.g. Chen, S., et al. (2013), Evaluation of the successive V6 and V7 TRMM multisatellite precipitation analysis over the Continental United States, Water Resour. Res., 49, 8174–8186, doi:10.1002/2012WR012795.

4. The impact of the resolution of these various products on the comparison results needs more discussion. The limitations of point raingauge measurements for eval-

uation of area-averaged precipitation estimates have been documented for years by Ciach and Krajewski (1999), Ciach et al, (2003), Habib et al (2004) to cite a few. This issue is acknowledged in recent studies using gauges to evaluate satellite precipitation estimates (e.g. Kirstetter et al. 2013). References: Ciach, G.J., Krajewski, W.F., 1999. On the estimation of rainfall error variance. Adv. Water Resour. 2, 585–595. Ciach, G.J., Habib, E., Krajewski, W.F., 2003. Zero-covariance hypothesis in the error variance separation method of radar rainfall verification. Adv. Water Resour. 26, 573–580. Ciach, G.J., Krajewski, W.F., Villarini, G., 2007. Product-error-driven uncertainty model for probabilistic quantitative precipitation estimation with NEXRAD data. J. Hydrometeorol. 8, 1325–1347. Kirstetter, P.-E., Viltard, N. and Gosset, M. (2013), An error model for instantaneous satellite rainfall estimates: evaluation of BRAIN-TMI over West Africa. Q.J.R. Meteorol. Soc., 139: 894–911. doi: 10.1002/qj.1964

5. p. 11494 ll.21-22: “The reader will find a more detailed description of the Stage IV precipitation estimates generation from the RFC level and up to the final mosaicked product as well as related artifacts and uncertainties in Nelson et al. (2014)”. The present paper is dealing with such artifacts and uncertainties, so would you mind remind them even briefly here?

6. Could the authors provide some explanations for the seasonal bias adjustment on 3B42 described on p.11500 ll.22-26?

7. Sections 3 and 4 mainly describe the results. Explanations for the observed discrepancies between the products, when provided, are simply listed randomly as in p.11502 ll. 24-29. More constructive and structured analysis and interpretation is necessary. What contribution does these sections bring to the state of knowledge?

8. On p. 11502 ll. 19-20: “The real-time 3B42RT displays moderate positive biases when compared to GHCN-D (+2.4%) and PRISM (+0.4%)”. The scatterplot on Fig. 7b for 3B42RT shows much more discrepancies that compensate each other. Why is that?

9. On p.11500 ll.26: “For summer, important negative bias adjustment (3B42<3B42RT) is found over the Midwest (MB, NC, AB) and corrects for the overestimation of summertime convection by PMW sensors that mistake sub-cloud evaporation for precipitation”. Is there any citation for this statement?

10. The gauge stations have notorious issues to quantify precipitation during the Winter season, caused e.g. by icing, underestimation related to snow drift, etc. This propagates to precipitation products making use of this information (Stage IV, 3B42). The authors need to address this point in order to provide critical insight on the precipitation estimates over CONUS.

11. p. 11503 ll.27-29: Any explanation why the correction is insufficient in mountainous areas?

12. On p. 11505 ll.8-10. Chen et al. (2013) mention this issue. Chen, S., et al. (2013), Evaluation of the successive V6 and V7 TRMM multisatellite precipitation analysis over the Continental United States, Water Resour. Res., 49, 8174–8186, doi:10.1002/2012WR012795.

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