

# ***Interactive comment on* “The PERSIANN Family of Global Satellite Precipitation Data: A Review and Evaluation of Products” by Phu Nguyen et al.**

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# Reviewer 3

General comments

This short paper presents three PERSIANN satellite-based precipitation products. A comparison of the products with the CPC ground-based precipitation is performed over the United States from 2003 to 2015, as well as an intercomparison between products at the global scale. While this broad overview may be valuable to the research community and the topic fits the scope of the journal, there are some questions to address.

We greatly appreciate your comments and suggestions which we believe will result in a much-improved version of the manuscript. The manuscript has been revised according

to some of your comments while incorporation of other comments is in progress.

1. Applications of these precipitation products, especially for hydrological applications should be more discussed in the perspective of the presented performances. For example there is no discussion in the manuscript on the impact of uncertainty from PERSIANN-CCS on the GPM IMERG product.

Response: We thank you for this constructive comment. In the new version, the manuscript includes a discussion about the suitability of each PERSIANN product to different hydrological and water resources management applications taking into consideration their characteristics and the analysis results.

2. The interpretation of the comparison results needs to be expanded throughout the manuscript. More information is needed regarding satellite precipitation uncertainty structure. For example how do you explain PERSIANN-CCS climatological features in Fig. 2? Only gauge correction in PERSIANN-CDR seems to correct efficiently the PERSIANN and PERSIANN-CCS climatologies. How can this be explained? A discussion of precipitation products assumptions, strengths, and limitations should be added in the context of this evaluation. Aspects like remote sensing physics, precipitation physics and algorithmic influence should be addressed. For example regarding PERSIANN-CCS: under the assumption relating colder Tbs to higher rain rates using PDF matching, the resulting precipitation estimates could be influenced by the climatology of (cold) Tbs generated by specific types of precipitation systems, e.g. mesoscale convective systems in the Great Plains.

Response: We agree that a more extensive interpretation of the analysis results is necessary. Currently, the manuscript is being revised to extend the discussion about comparison results both over CONUS and globally.

3. Can the authors elaborate on the representativeness of the CPC comparison analysis outside the U.S. (regarding all products), and especially at locations devoid of gauge networks (regarding PERSIANN-CDR)?

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Response: Thank you for this comment. Due to the wide variability in climate and precipitation regimes across the CONUS, we expect that the performance patterns observed for each product might be representative of regions outside the CONUS with similar climate and precipitation regimes. However, we refrain from making strong conclusions about this as other unknown factors might have an important role. Furthermore, it should be noted that previous studies have investigated the performance of the different PERSIANN products outside the US at local spatial scales (i.e. countries or catchments); some of these studies are referred to in this manuscript.

4. It is not fair to compare a gauge-adjusted product (PERSIANN-CDR) with satellite only precipitation products (PERSIANN and PERSIANN-CCS). Besides it is important to use an independent reference for an objective comparison and evaluation. Finally the ground reference should present consistent accuracy across CONUS, which may not be the case with CPC if the gauge network density is not homogeneous.

Response: It is true that PERSIANN-CDR is inherently different than PERSIANN and PERSIANN-CCS since it incorporates ground-based information due to bias adjustment. However, the aim of the global inter-comparison is to reveal general patterns about the products behavior in different geographical regions. It is not our intention to perform any kind of evaluation since neither of the products can be considered as a baseline. As for the evaluation of each product over the CONUS, it is true that PERSIANN-CDR is not completely independent of CPC because of bias adjustment. However, it should be noted that the bias adjustment of PERSIANN-CDR is on a monthly scale, meanwhile, the evaluation is performed at a finer resolution of daily scale.

5. The evaluation is performed at the daily time scale at the nearest. As precipitation varies across space and time scales, the concluding remarks should recall this comparison scale. An evaluation at the native resolution of the products (i.e. hourly for PERSIANN and PERSIANN-CCS) would be more insightful and relevant. Can the authors comment on the representativeness of their findings and their dependence

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on resolution?

Response: We agree that the results should be interpreted in light of the evaluation temporal scale (daily). In the revised manuscript, additional discussion will be added to reflect on this. Hourly evaluation for the products is not feasible due to unavailability of high spatial resolution CPC data at an hourly temporal resolution. The hourly CPC data is available up to 2002 and available at a coarse resolution of 2 x 2.5 degrees. Another alternative for a reference data is ST4 data which doesn't have good accuracy over the western US. Furthermore, It worth mentioning that both PERSIANN and PERSIANN-CCS have been evaluated at an hourly scale at some locations over the CONUS (Hong et al., 2004).

Specific comments

1. p.3 l. 15-20: what about NOAA precipitation products?

Response: CPC CMORPH is the NOAA satellite-based precipitation product. In the revised manuscript, "NOAA" has been added to clearly illustrate this.

22. p.6 l.16: "it combines all ground-based information sources": does it combine also radar data?

Response: Thank you for pointing out to this. The sentence has been clarified in the revised manuscript, as CPC data include all gauge-based information available at the Climate Prediction Center (CPC) but does not include radar data. See <https://www.esrl.noaa.gov/psd/data/gridded/data.unified.daily.conus.html>.

3. What is the precipitation rate threshold used in categorical indices like POD and FAR? 4. p.7 ll.17-20: why not using the volumetric indices?

Response: The threshold for POD and FAR calculation is 0.1 mm. We opted not to use the most commonly categorical indices of POD and FAR due to its widespread use in literature instead of the volumetric indices.

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References Hong, Y., Hsu, K., Sorooshian, S. and Gao, X. (2004). Precipitation estimation from remotely sensed imagery using an artificial neural network cloud classification system. *J. Appl. Meteor.*, 43, 1834-1852.

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Interactive comment on *Hydrol. Earth Syst. Sci. Discuss.*, <https://doi.org/10.5194/hess-2018-177>, 2018.

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