Evaluation of Satellite Quantitative Precipitation Estimates (QPEs) Products

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Introduction

In this work, we conduct a long-term assessment of the different satellite based precipitation products from the Reference Environmental Data Records (PERSIANN-CDR; GPCP; CMORPH-CDR; AMSU-A,B, Hydrologic bundle) :

- PERSIANN-CDR (UC-Irvine S. Sorooshian) : 1983-Present (Daily) 0.25x0.25 deg. (60N-60S, 0-360)
- CMORPH (CPC P. Xie) : 1998-Present (Daily, 3-hourly) 0.25x0.25 deg. (60N-60S, 0-360)
- GPCP (UMD R. Adler) : 1979-Present (Monthly, Pentad) and 1997-Present (Daily) 2.5 deg. and 1 deg. (90N-90S, 0-360)
- AMSU-A,B, Hydro-bundle (NOAA R. Ferraro)

Objectives :

- Evaluation of the REDRs at various temporal (annual, seasonal, daily) and spatial scales (global, land, ocean, tropics, high latitudes, high elevation).
- Comparison of the different REDRs against in-situ data sets : Global Historical Climatology Network (GHCN-Daily), Global Precipitation Climatology Centre (GPCC).
- Evaluation of the datasets ability to capture global precipitation patterns and extreme precipitation events (percentiles).
- Provide guidelines toward a synthetized dataset.

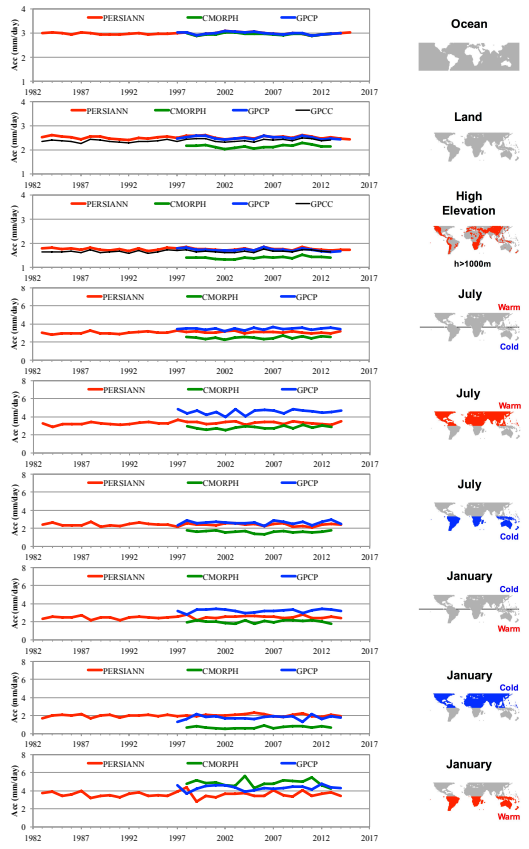

Figure 2. Average annual precipitation for selected areas (ocean, land, high elevation) and months (January, July) for the different satellite based products. Annual averages are compared with in-situ data from GPCC.

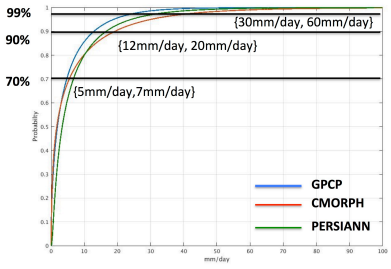

Figure 3. Cumulative distribution of daily precipitation from PERSIANN-CDR, CMORPH, and GPCP for the period 1998-2013. The ranges of daily rainfall corresponding to the 70th, 90th, and 99th percentiles display large differences between the three products. At the 99th percentile, the difference is two fold between the lowest value from GPCP (30mm/day) and the highest value from CMORPH (60mm/day).

References
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Ashouri, H, K. Hsu, S. Sorooshian, D. Braithwaite, K.R. Knapp, L.D. Cecil, B.R. Nelson, and O.P. Prat, 2015. PERSIANN-CDR: Daily precipitation climate data record from multi-satellite observations for hydrological and climate studies. *Bulletin of the American Meteorological Society*, 96, 69-80.

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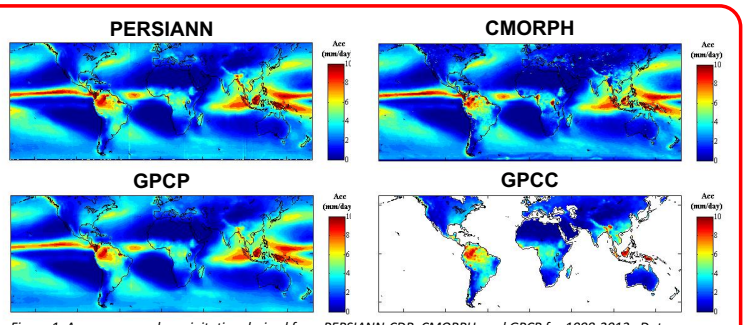

Figure 1. Average annual precipitation derived from PERSIANN-CDR, CMORPH, and GPCP for 1998-2013. Data are compared with annual rainfall from the Full Data Reanalysis Product from the Global Precipitation Climatology Centre (GPCC) at 1deg. resolution. All satellite based products and in-situ GPCC data present similar long-term daily averages.

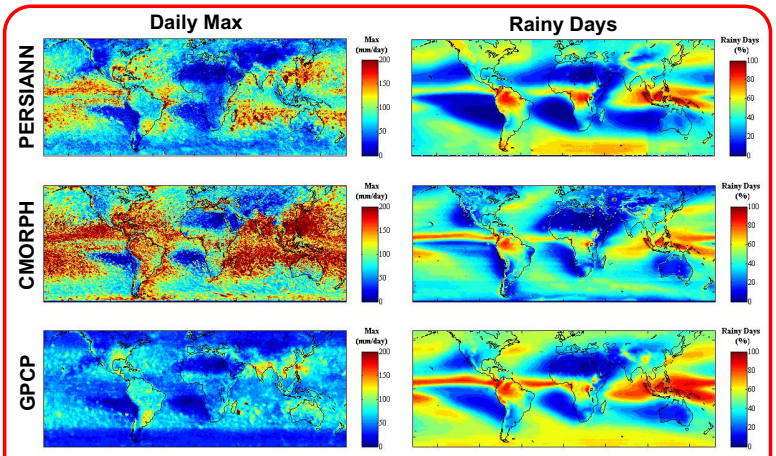

Figure 4. Daily maximum rainfall (left) and number of rainy days (right) for the different products. CMORPH displays the highest max daily rainfall (left) while GPCP indicates a higher number of rainy days (right).

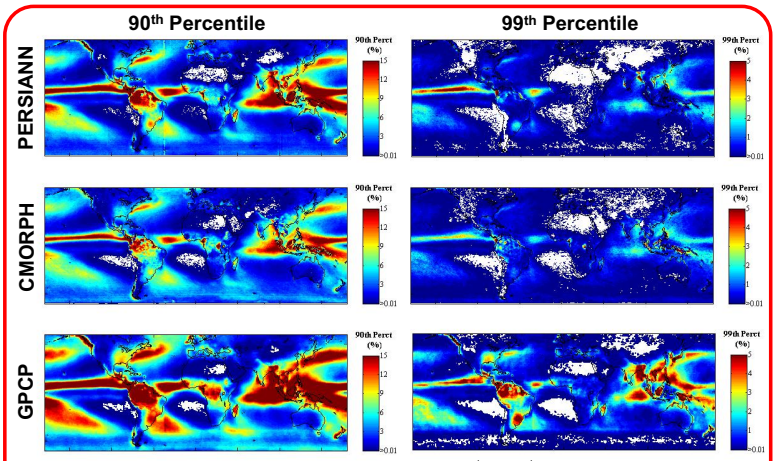

Figure 5. Global repartition of the daily rainfall corresponding to the 90th and 99th percentile for the three products. GPCP displays a more widespread area reaching the 90th and 99th percentile thresholds. Conversely, mostly areas along the ITCZ experience precipitation reaching the 99th percentile threshold for CMORPH with few localized occurrences over land.

Conclusions

- Similar long-term daily averages and variability between products.
- PERSIANN-CDR and GPCP are close while CMORPH displays lower averages.
- Products are close over the ocean (GPCP used as calibration).
- Seasonal differences are more pronounced and depend on location. Globally PERSIANN matches GPCP but differences exist when considering N/S Hemisphere.
- Differences between products are important when looking at daily extremes (CDF).