

First results from comparison of rainfall estimations by GPM IMERG with rainfall measurements from the WegenerNet high density network

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1. INTRODUCTION

within the framework of the GPM mission.

WegenerNet network measures rainfall every 5 minutes by 150 tipping rain gauges with ≈2 km² resolution. Figure 1. shows the number of



2. DATA AND APPROACH



Comparison of extended summer datasets for two IMERG pixels.

• IMERG final, late and early processing products were compared over two pixels, which are entirely covered by 40 and 39 WegenerNet stations, respectively. We investigated data from <u>April to October of the years 2014 and 2015</u>; the first two years after the launch of the GPM Core Observatory.

• Since the WegenerNet has flexibility to work with various spatial and temporal scales, the comparison could be conducted on <u>average-points to pixel basis for a 30-minutes time scale</u> which is a default time resolution of the IMERG datasets.

5. SUMMARY AND CONCLUSIONS

• In this study, GPM-IMERG final, late, and early processing products are evaluated through comparison with WegenerNet gauge-measured rainfall data. Results based on PDFs and CDFs of IMERGs and WegenerNet, and scatter plots between datasets, show that differences between GPM-IMERGs and WegenerNet data decrease, in an order of IMERG early > late > final processing products, as more retrieval or calibration processes are applied on the satellite data.

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STATISTICAL VALIDATION OF IMERG DATASETS



rain rate [mm/30min]

- IMERG final shows a better agreement with the WegenerNet than the others; the effect of gauge correction (which is only applied to IMERG final) is clear, especially for the hot season (June – September).
- IMERG late and early have more gentle but also steeper slopes in the CDFs of rain volume compared to IMERG final, which cause wide data discrepancies from the WegenerNet.

Scatter plots of 30-minute rain rates.



Based on the results of CDFs, the scatter plots may not be always proper to evaluate general under/overestimations of IMERG late and early due to highly skewed distribution of rain rates.

IMERG final shows consistent results between two grids; IMERG late and early have to be evaluated more carefully with a sufficient number of ground references.

Occurrence probability density function, PDF, of rain rate (dashed) and cumulative distribution function, CDF, of rain volume (solid), of IMERGs (red) and WegenerNet (grey) with binning of 0.5 mm/30min (log-scale).



IMERGs at y-axis versus WegenerNet at x-axis, for each grid; 15.8 -15.9°E in orange and 15.9 - 16.0°E in violet at 46.9 - 47.0°N. Note that a correlation coefficient (r) is not really appropriate for the validation purpose due to outliers.

20:00 – 22:00, May 30, 2015; Warm season



16:00 - 18:00, July 08, 2015; Hot season



- are still affected by errors of the satellite-only datasets.
- temporal/spatial resolution of satellites, for example; measured rainfall,
 - measured almost the same high rates between 16:30 and 17:00.

• The data differences could be due to uncertainties from low spatial/temporal satellite resolution, however, we still need further analyses to figure out detailed information on errors in the IMERGs. Along these lines, future work will focus on IMERG final to assess 'best' rainfall estimates of GPM. We will evaluate the IMERG final to define general behaviors of satellite estimates by comparison with WegenerNet data, but also to identify sources of errors, for example, through data analysis by source (i.e., PMW/IR satellites).

4. STUDY OF EXAMPLE CASES OF RAINFALL EVENTS

snapshots from WegenerNet.



Rain rate of IMERG final (red), late (blue), early (green), and WegenerNet (black). Left: 30-min snapshots from WegenerNet.

We investigate two rainfall cases which show high differences between IMERGs and WegenerNet; even though IMERG final shows a better agreement than late and early, the data

Data differences between IMERGs and WegenerNet can result from uncertainties by low

i) May 30, satellite estimated rainfall started earlier (before 20:30) than WegenerNet

ii) July 08, even though IMERG late and early detected too high rain rates (\approx 20mm/30min), compared to the average rainfall of whole grids obtained from WegenerNet, the other parts of WegenerNet, i.e., the upper parts of grids and the other grid of 15.70 - 15.80 °E also



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