GDAP Precipitation Assessment

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GDAP Precipitation Assessment Plan

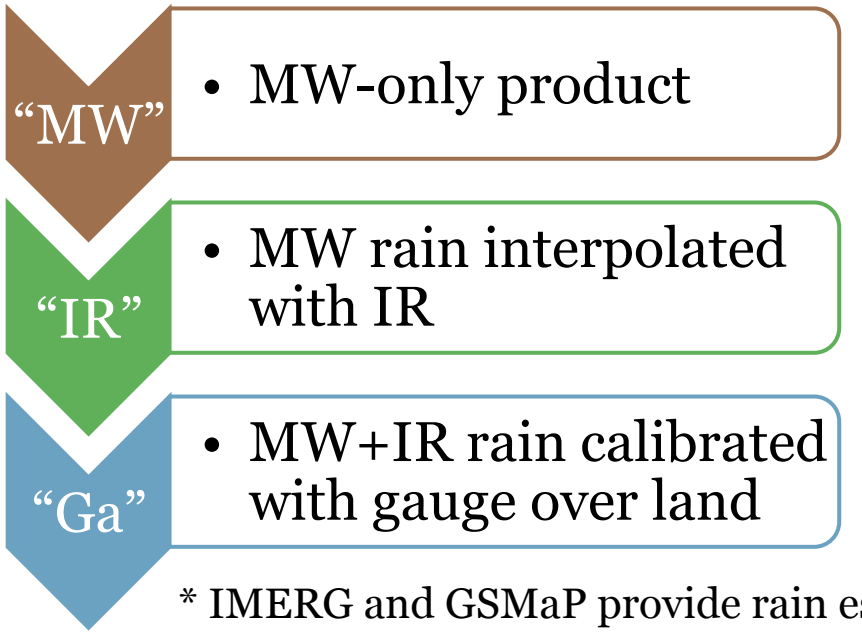
- Need for a new precipitation assessment
  - Increasing availability of precipitation products
  - Recent satellite programs such as GPM
- Lessons learned from previous assessments
  - Past GRP/GDAP Assessment Reports, while thorough and detailed, took nearly a decade to complete.
  - It is desired, however, to address the urgent needs of broad science community in a timely manner.
- Strategies for timely delivery of assessment reports
  - **1)** *Publish a series of concise interim reports.*
  - **2)** *Identify the foci of assessment in advance.*

Assessment foci

- The list of prioritized foci for the assessment
  - **1) *Global and Regional Climatology (long-term mean and trend)***
  - **2)** *Time series analysis in the context of different modes of climate variability*
  - **3)** *Extremes*
  - **4)** *Frozen precipitation*
  - **5)** *Structural Errors*

Global multi-satellite datasets

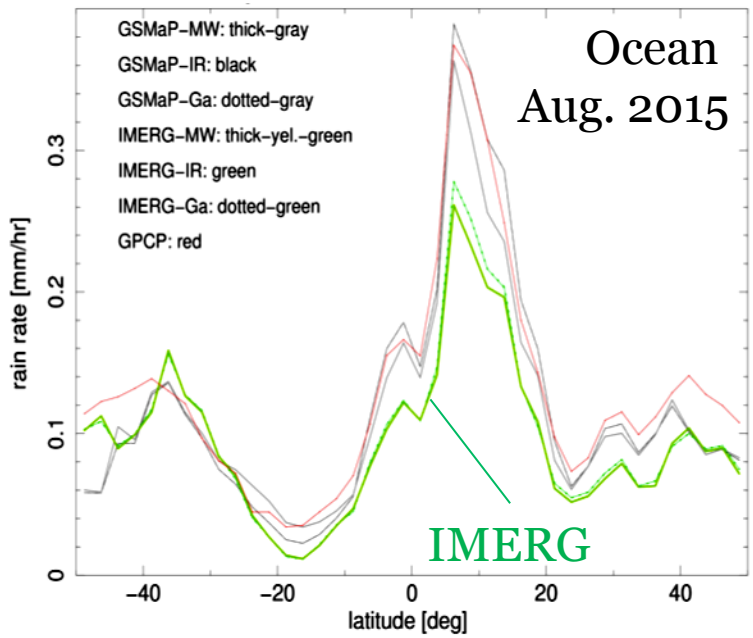
- Global and regional climatology: Strategy
  - Global mutli-satellite data products are compared as a starting point, since they are among the most widely used.
    - GPCP, IMERG (MW, IR, & Ga), and GSMaP (MW, IR, & Ga)

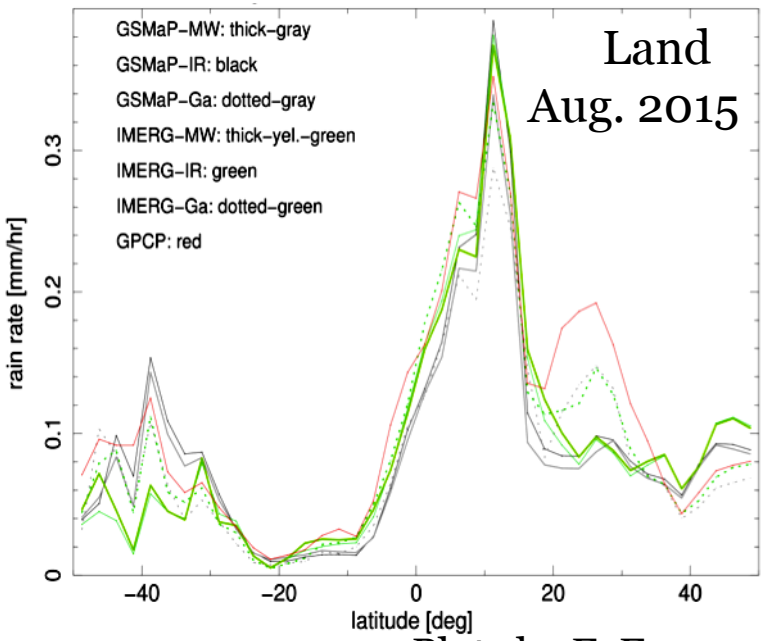


* IMERG and GSMaP provide rain estimates at each stage.
* Only the final product is available for GPCP.

Global multi-satellite datasets

- Zonal mean rainfall (August 2015)
  - Global mutli-satellite data products are compared as a starting point, since they are among the most widely used.
    - GPCP, IMERG (MW, IR, & Ga), and GSMaP (MW, IR, & Ga)

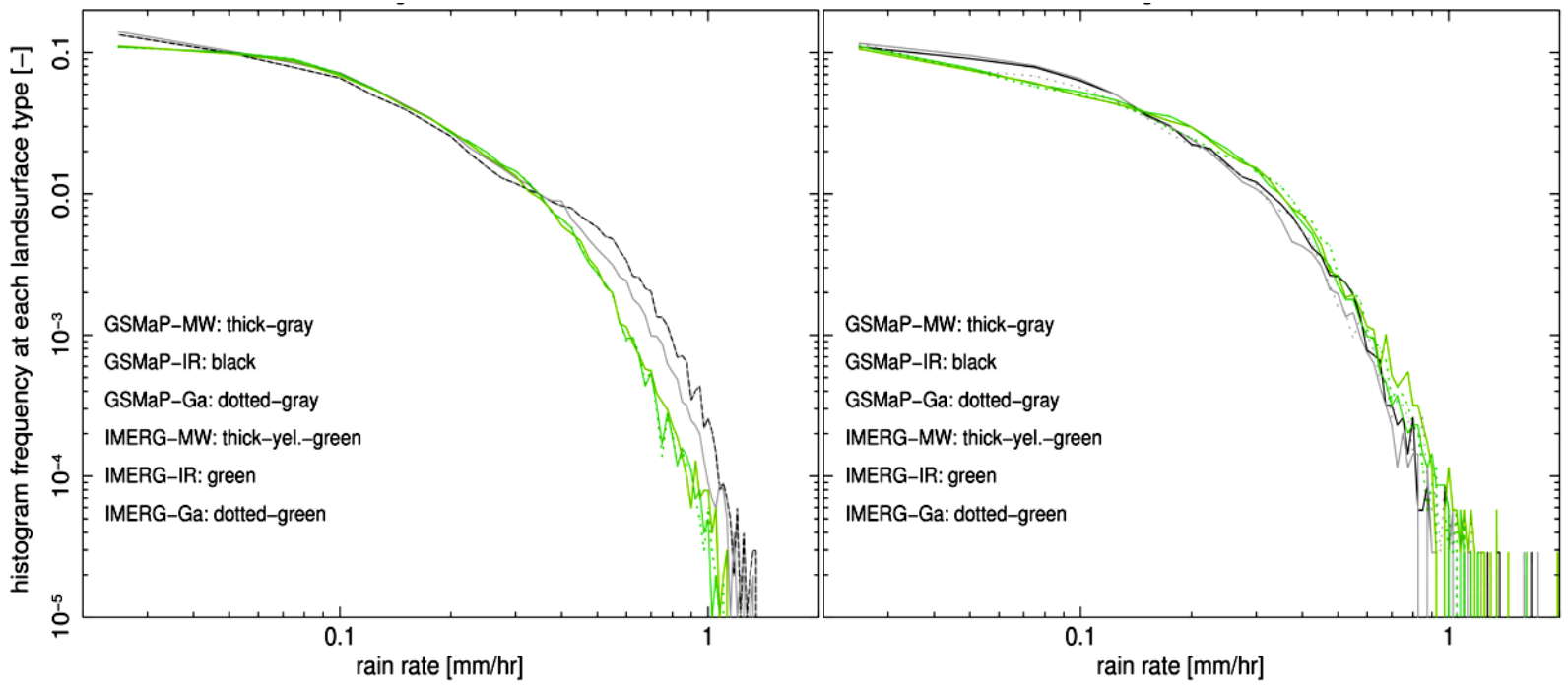




Plots by F. Furuzawa

Global multi-satellite datasets

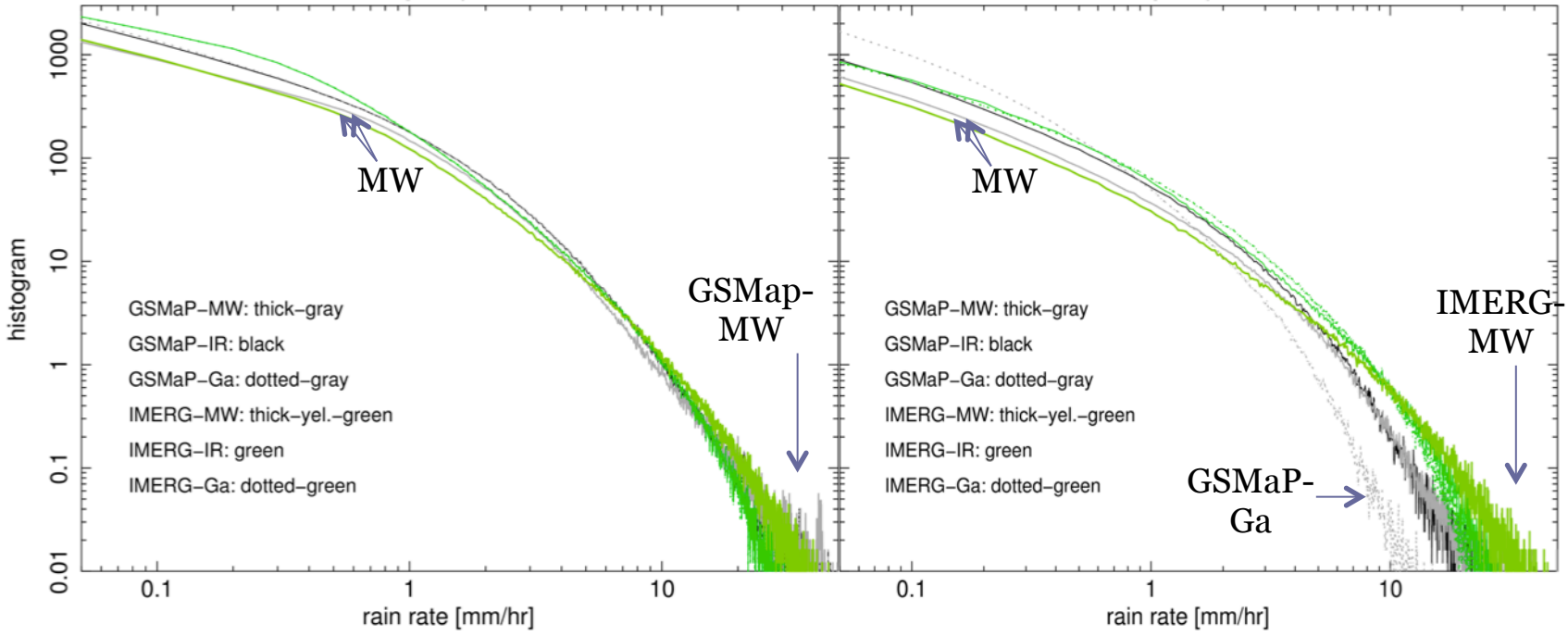
- 0.5°x0.5°, monthly-mean rainfall histogram
  - GPCP is not plotted (because of the resolution difference).



Plots by F. Furuzawa

Global multi-satellite datasets

- 0.5°x0.5°, 3-hourly rainfall histogram
  - Resembles within the MW family (GSMaP ~ IMERG) more than within the same product (MW vs. IR vs. Ga).



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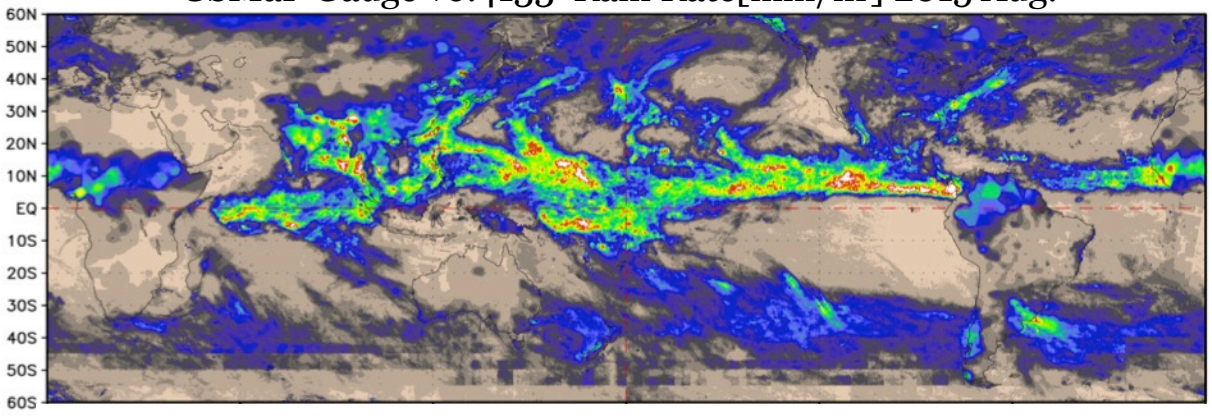
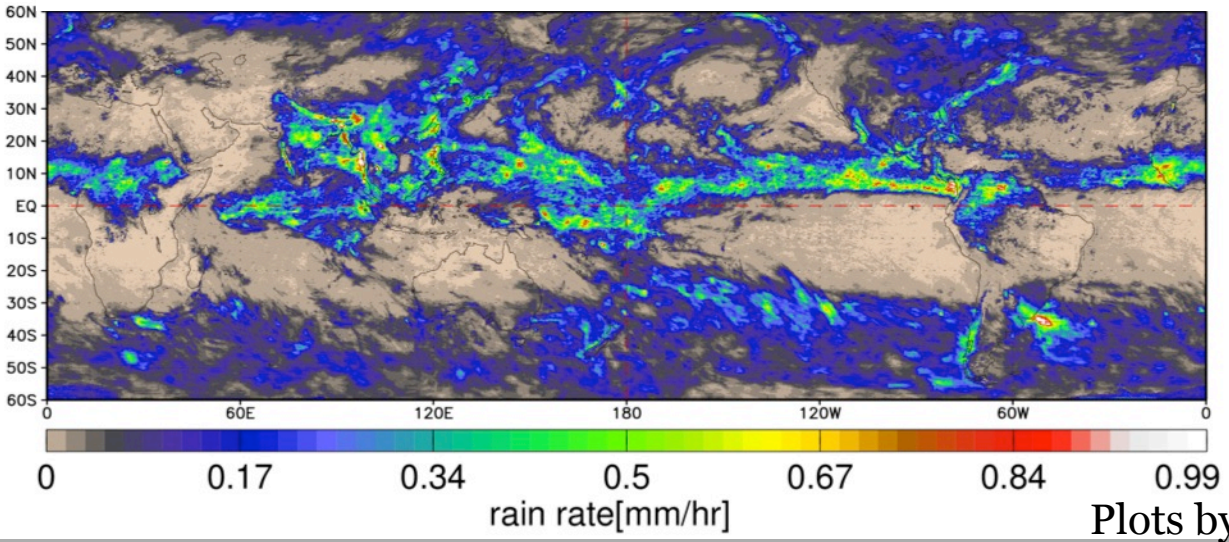
Global map: GSMaP-Ga and IMERG-Ga

GSMaP Gauge v6.4133 Rain Rate[mm/hr] 2015 Aug.



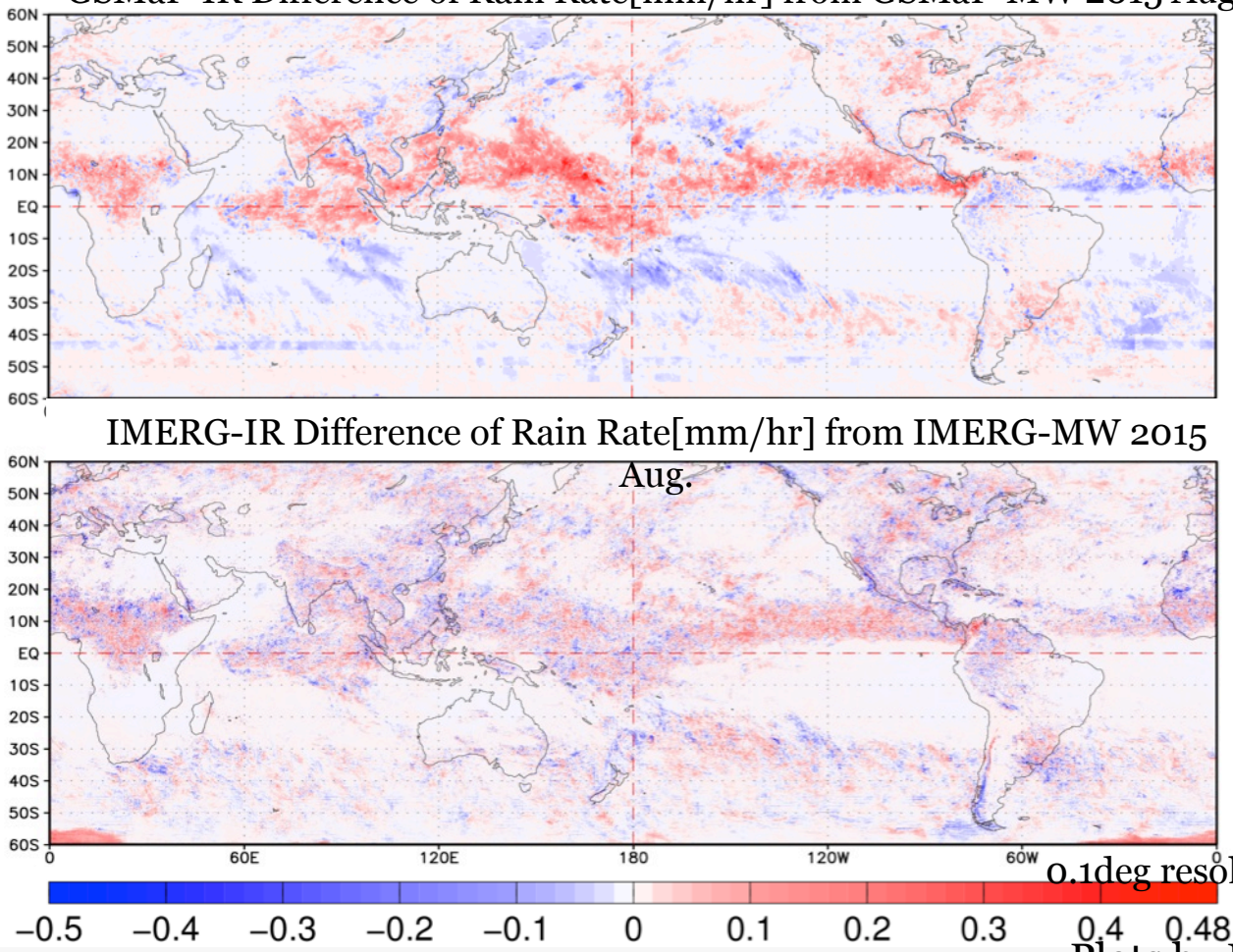
IMERG Gauge v03D Rain Rate[mm/hr] 2015 Aug.



Plots by F. Furuzawa

Difference (IR-MW) for GSMaP and IMERG

GSMaP-IR Difference of Rain Rate[mm/hr] from GSMaP-MW 2015 Aug.



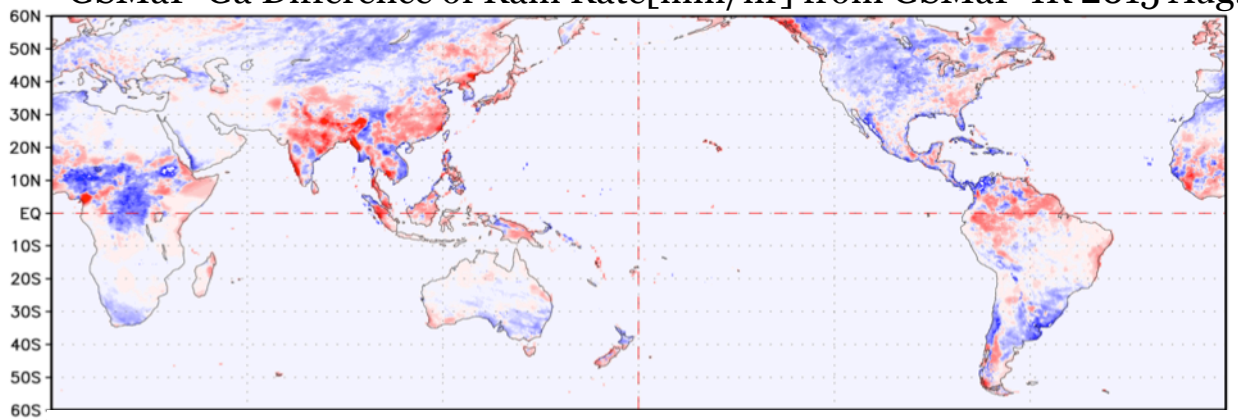
IMERG-IR Difference of Rain Rate[mm/hr] from IMERG-MW 2015 Aug.

0.1deg resolution

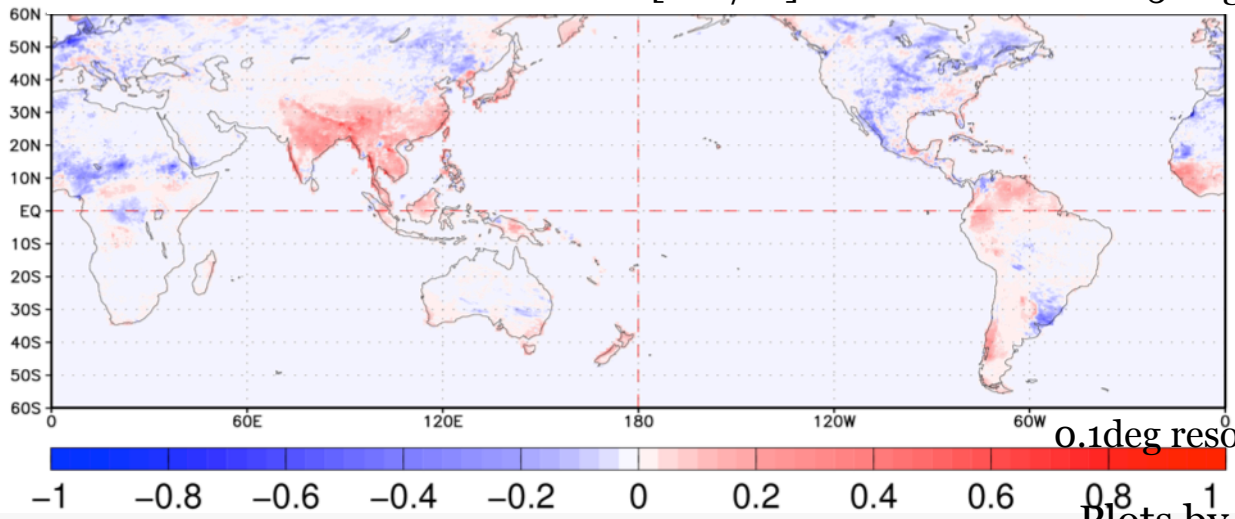
Plots by F. Furuzawa

Difference (Ga-IR) for GSMaP and IMERG

GSMaP-Ga Difference of Rain Rate[mm/hr] from GSMaP-IR 2015 Aug.



IMERG-Ga Difference of Rain Rate[mm/hr] from IMERG-IR 2015 Aug.

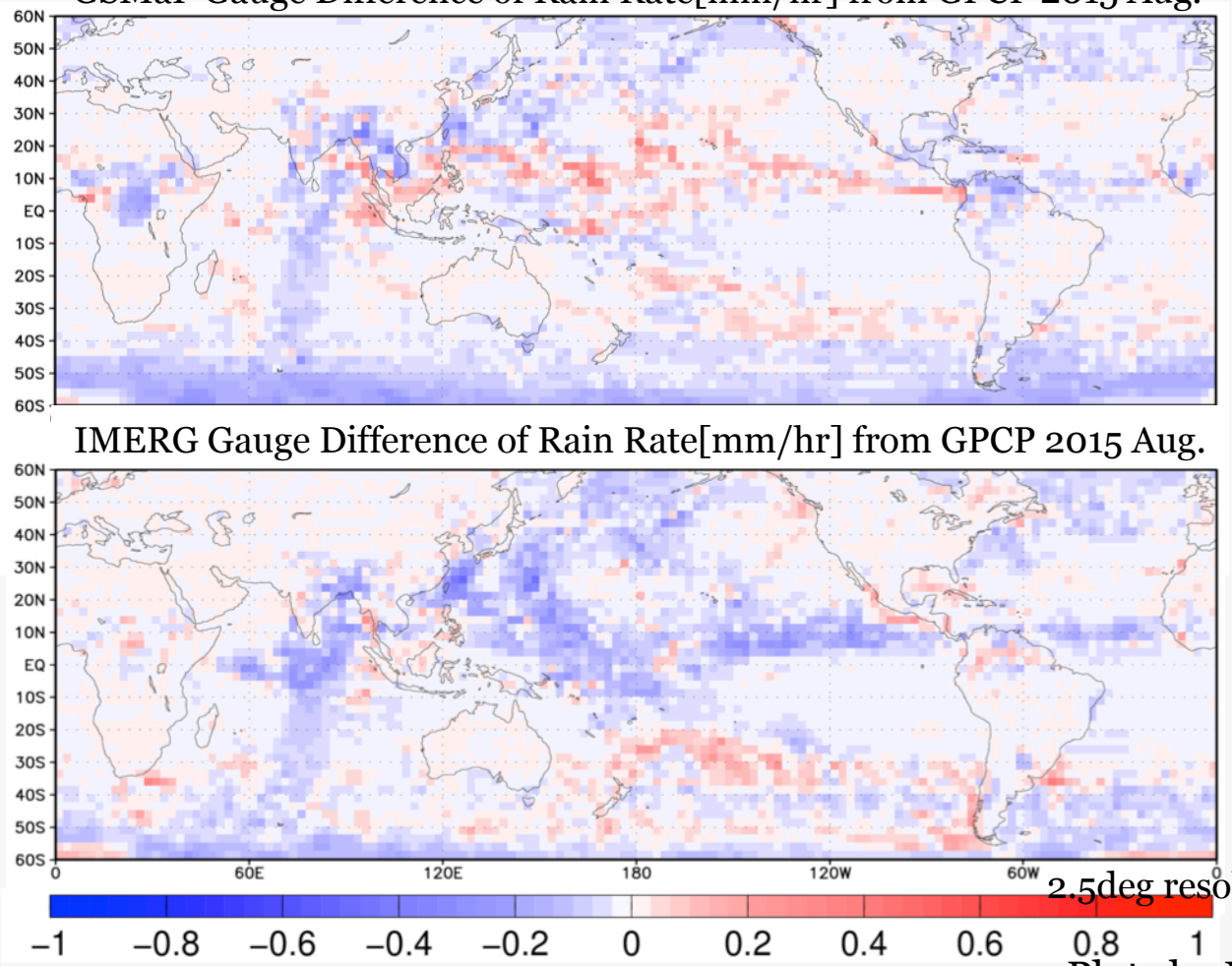


0.1deg resolution

Plots by F. Furuzawa

Camprison against GPCP (for reference)

GSMaP Gauge Difference of Rain Rate[mm/hr] from GPCP 2015 Aug.

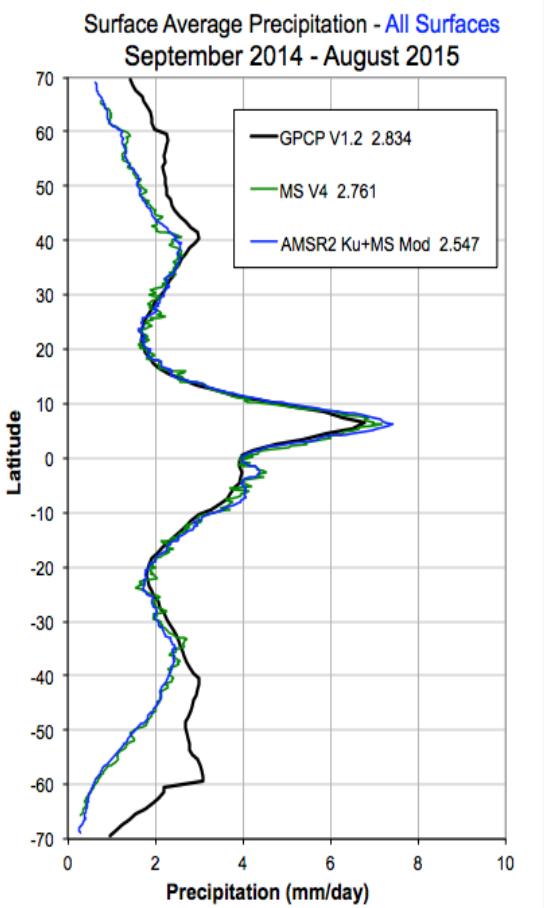


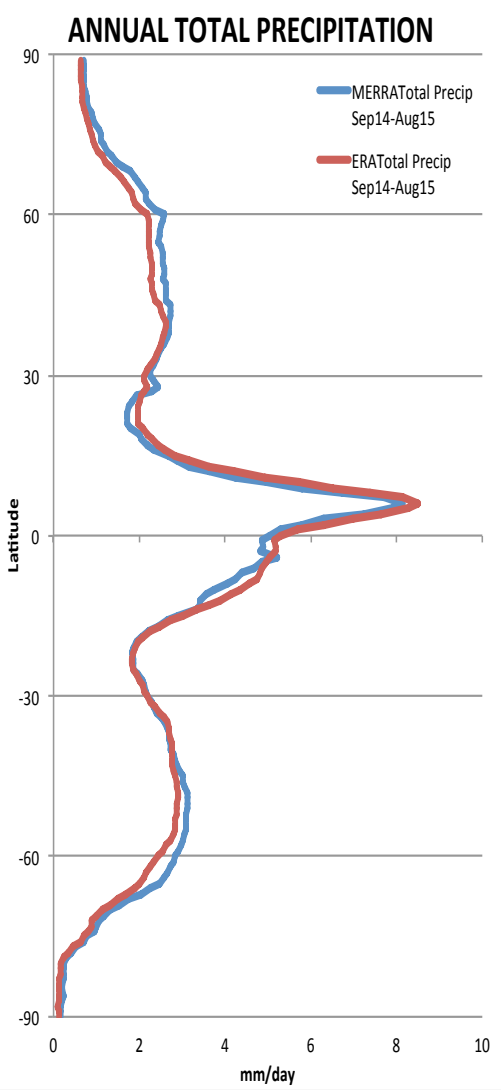
IMERG Gauge Difference of Rain Rate[mm/hr] from GPCP 2015 Aug.

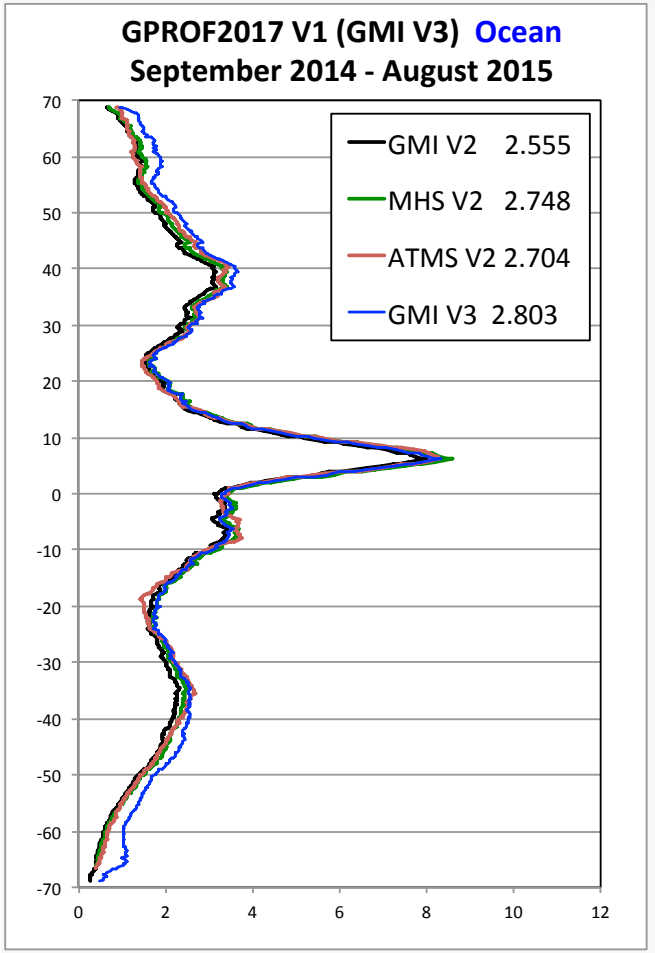
2.5deg resolution

Plots by F. Furuzawa

High latitude precipitation







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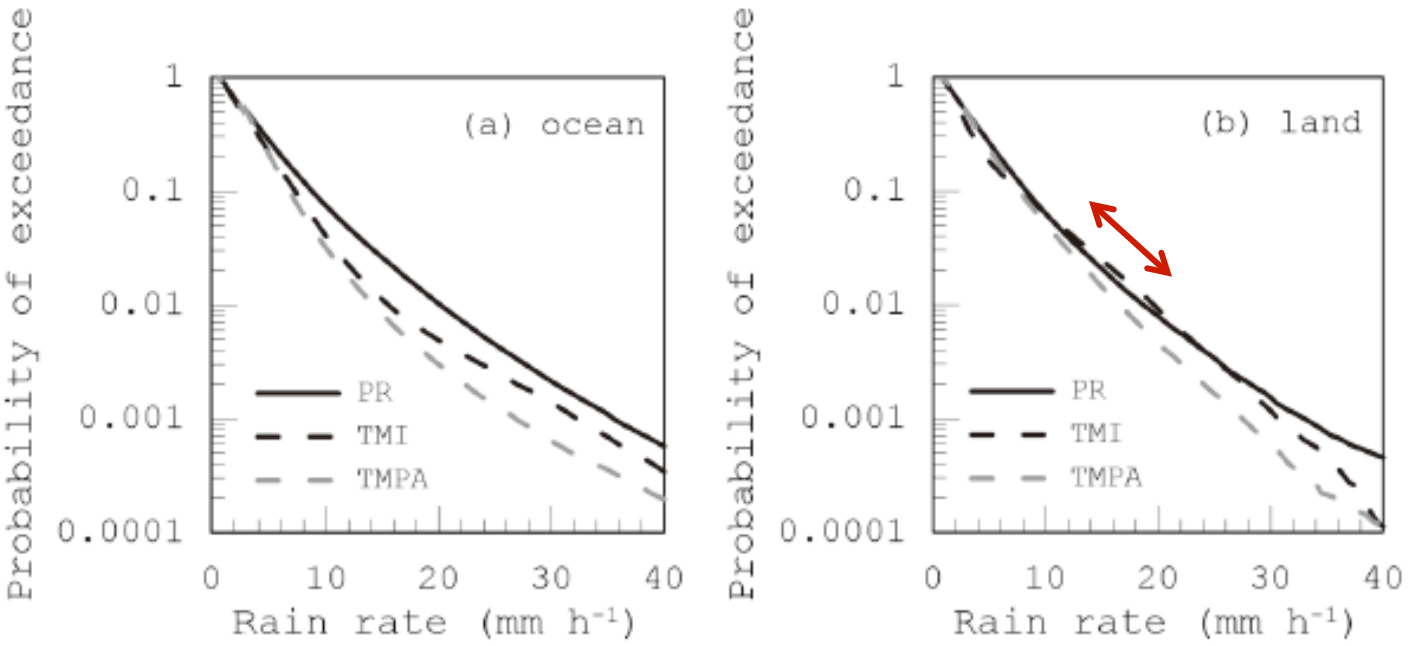
TRMM rains over maritime continents

- PDF of PR, TMI, and TMPA rains



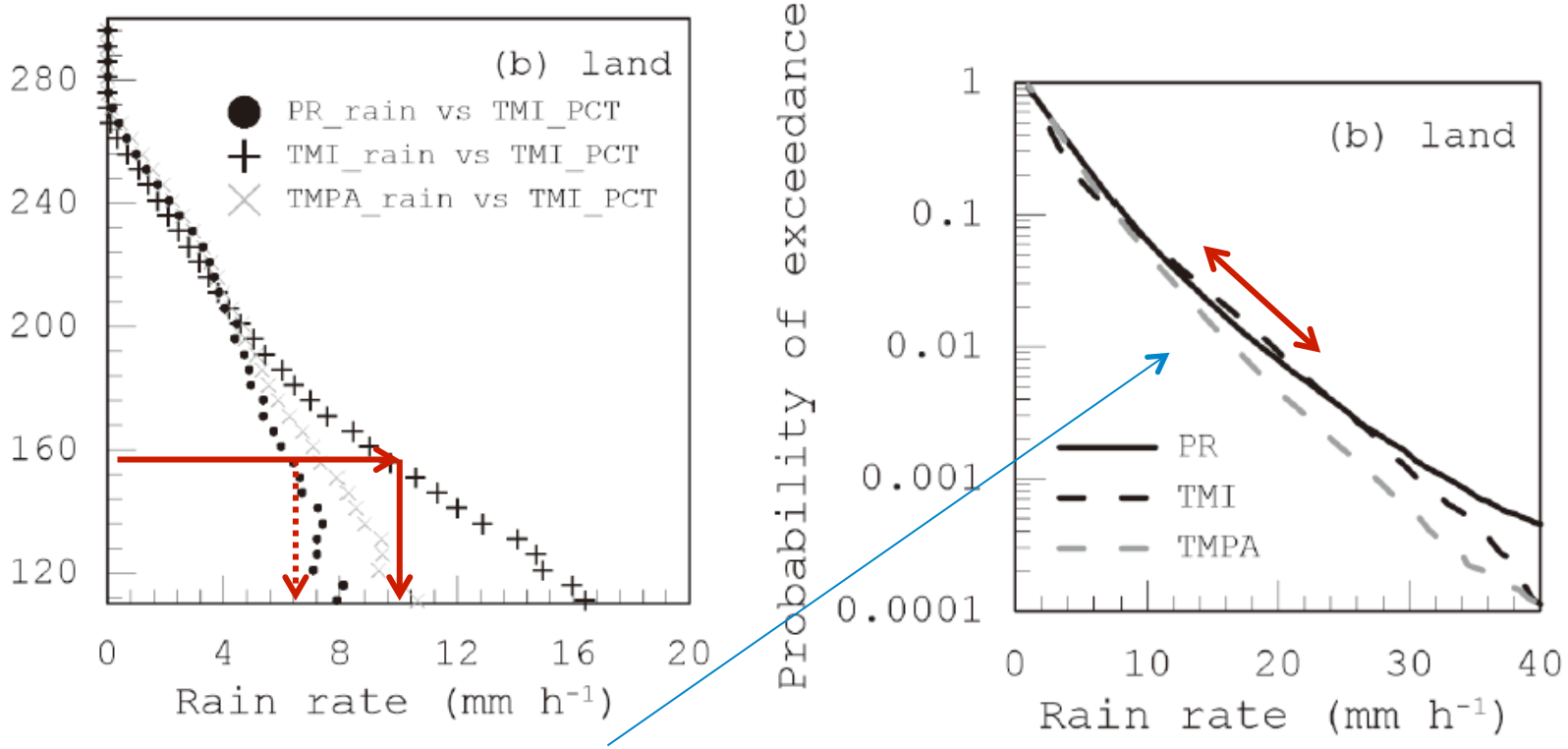
PR best captures extreme rainfall events over ocean.

TMI beats PR for a range of 10-20 mm/h over land.

Sekaranom and Masunaga (submitted to JAMC)

TRMM rains over maritime continents

- TMI 85 GHz PCT versus rainfall over land

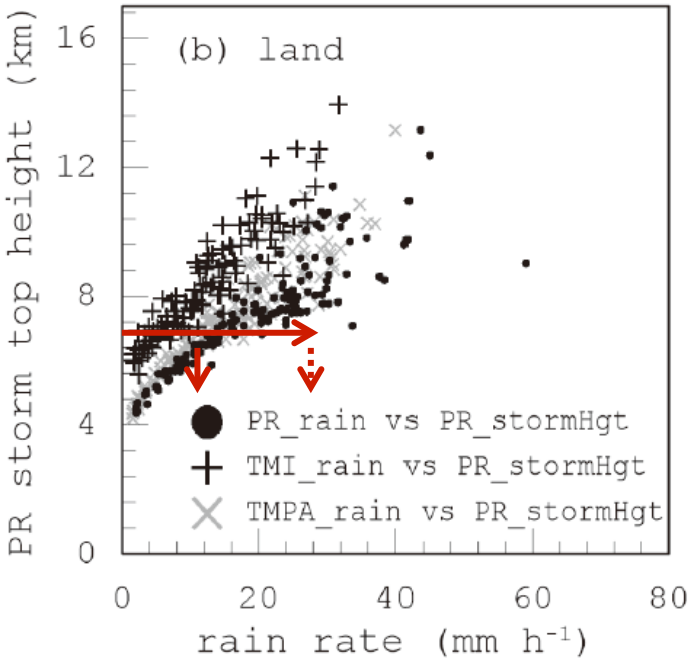


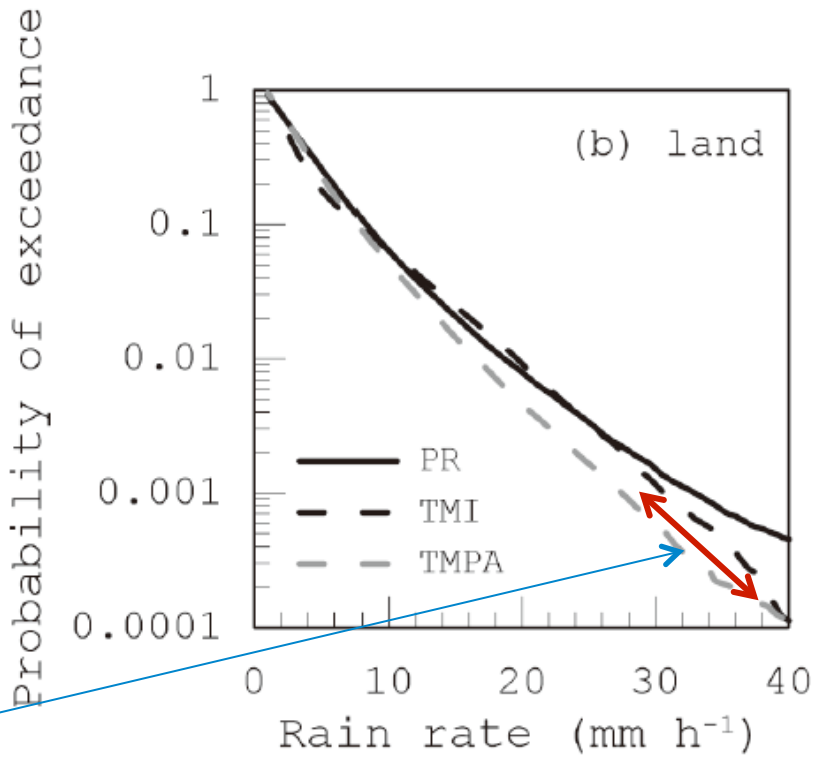
PCT is "tuned" so TMI rain is high for moderate rains.

Sekaranom and Masunaga (submitted to JAMC)

TRMM rains over maritime continents

- PR STH versus rainfall for <u>uppermost 1% extremes</u>



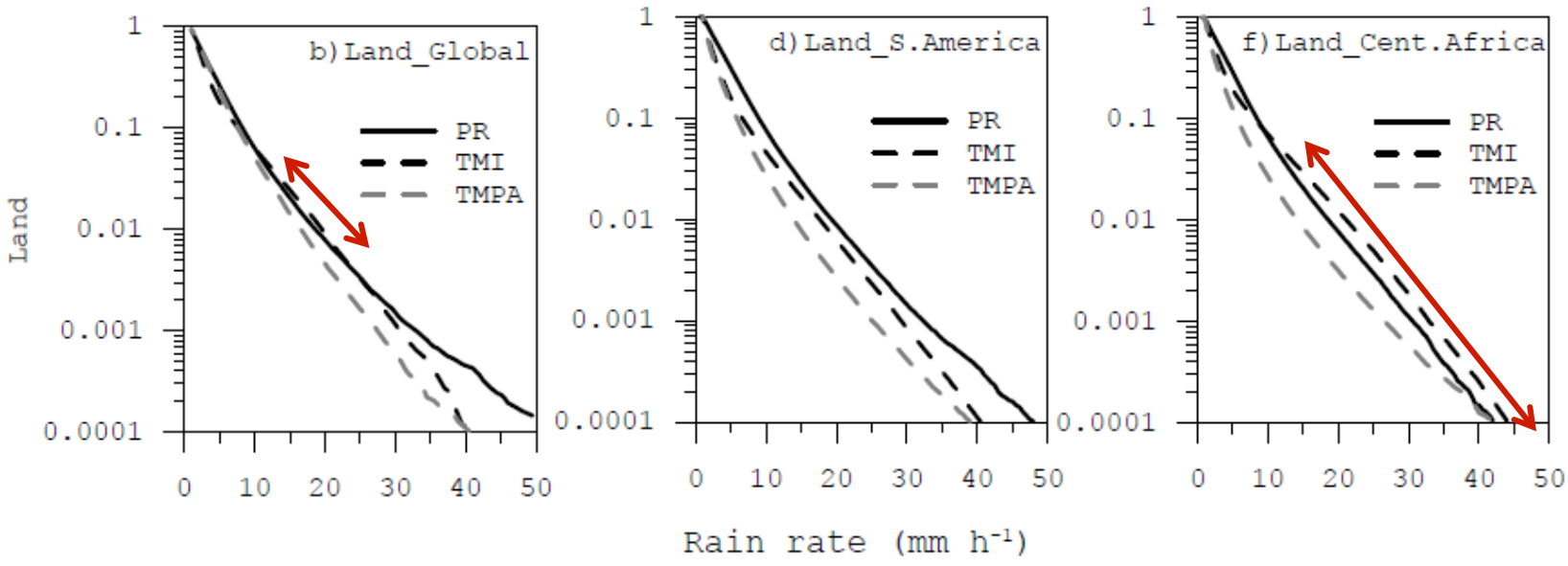


But TMI is not as high as PR for extremes (which may not have that much ice aloft). (cf, Hamada et al., 2015)

Sekaranom and Masunaga (submitted to JAMC)

TRMM rain PDFs for selected regions

- Striking regional differences

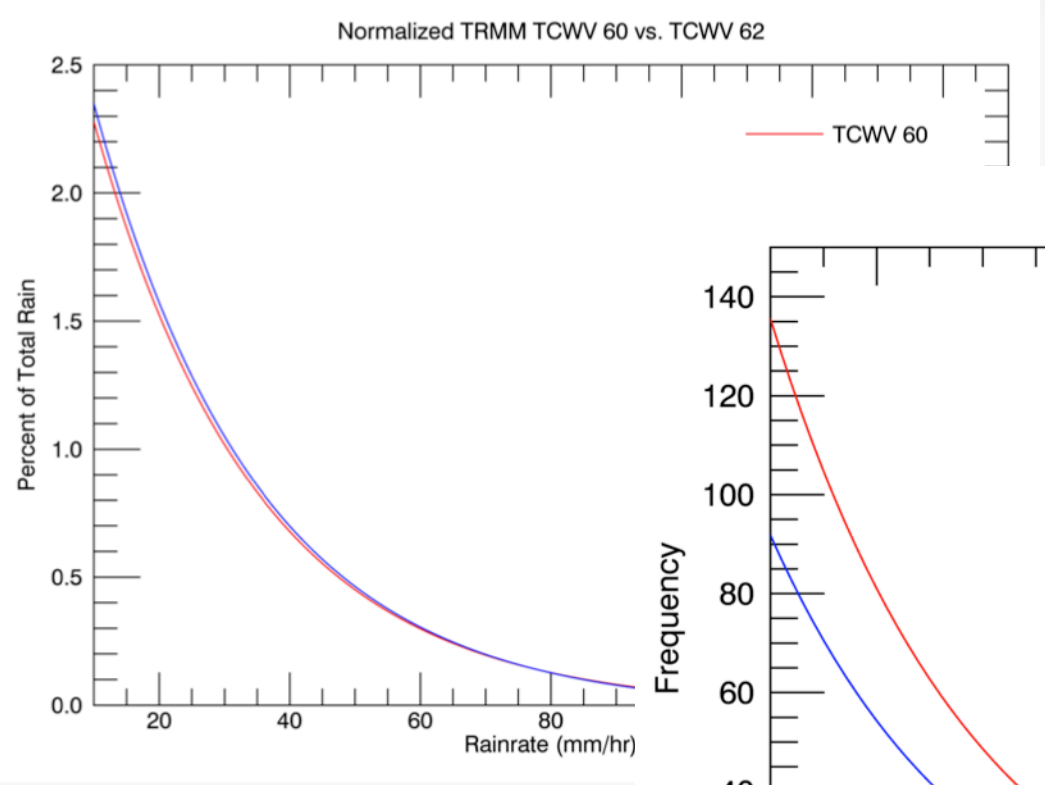


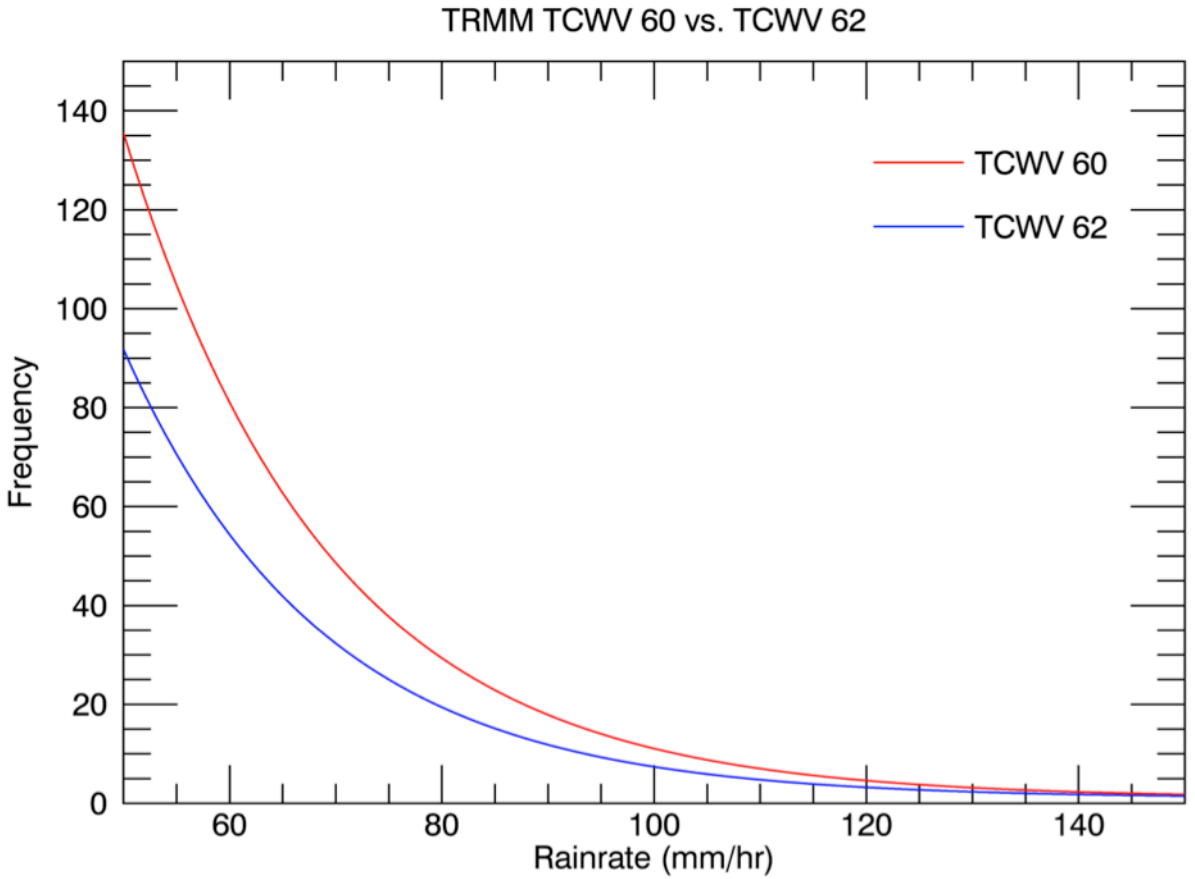
Global land is similar to MC

S. America is more like oceans, while Africa is entirely different.

Sekaranom and Masunaga (submitted to JAMC)

PDF of rain conditioned on TPW





Summary

- Intercomparison of global multi-satellite products
  - Pilot study with IMERG and GSMaP
    - MW products agree reasonably between IMERG and GSMaP.
    - When combined with IR, the discrepancy is vastly expanded.
    - And gets worse when calibrated with gauges.
- Extreme rainfall from the three TRMM products
  - PR>TMI for light and extreme rains, while TMI<PR for moderately heavy rain over land.
    - The empirical PCT-rain relation is even trickier than one might think.

Outstanding issues

- Review findings with product developers
- Test for temporal homogeneity of data sets
- Find some independent in-situ data for absolute reference to anchor results.
- Continue publishing results