

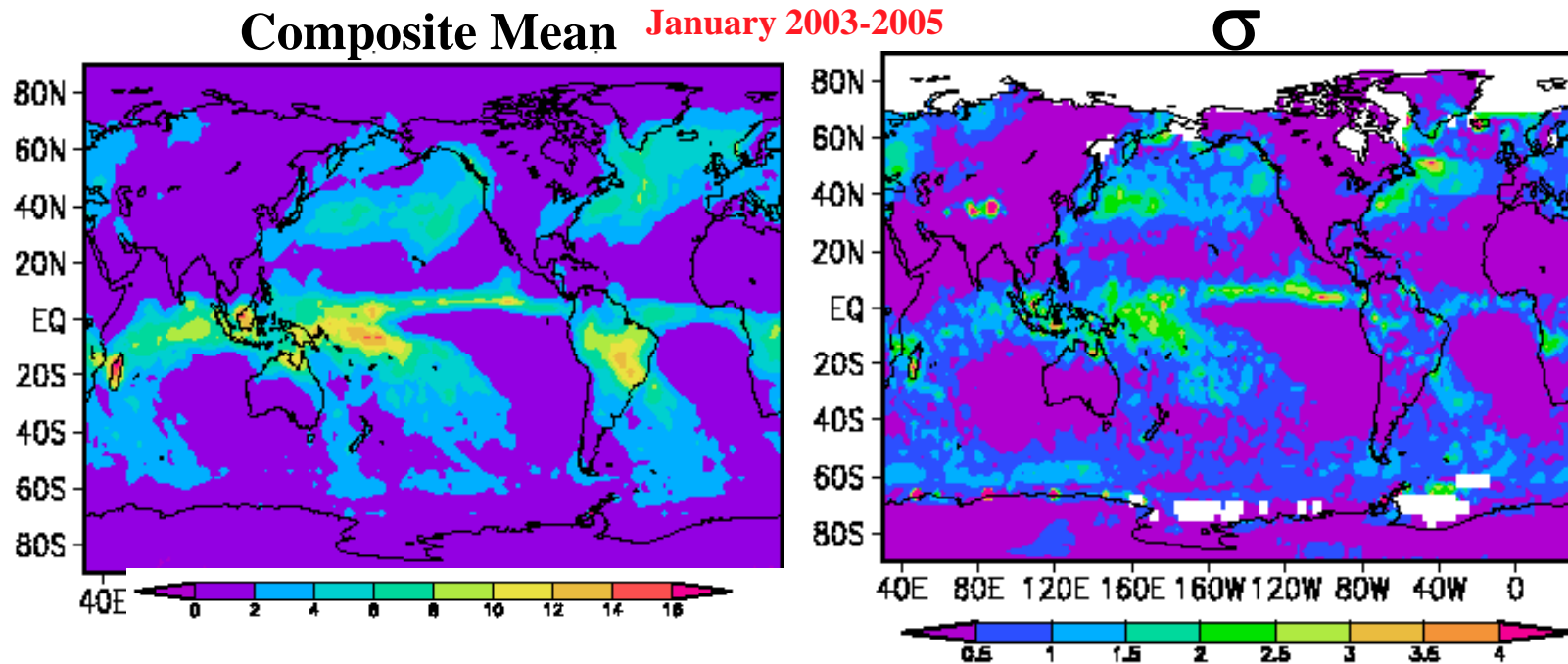
Estimates of Mean Climatological Precipitation and Bias Errors

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Motivation

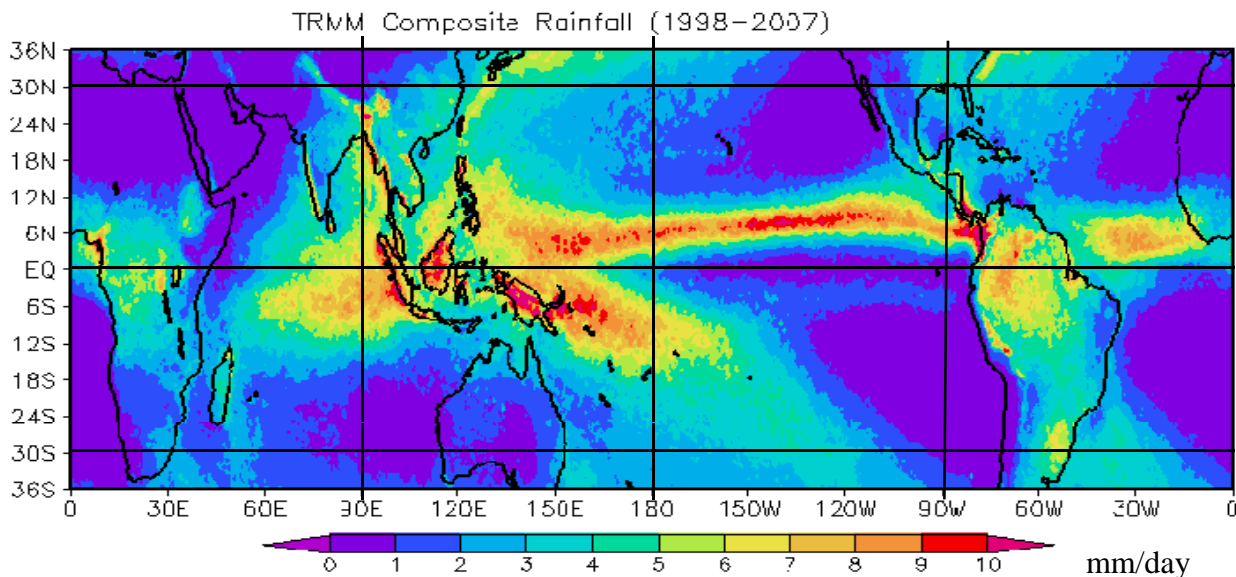
- Provide estimates of mean global and large regional-scale precipitation on monthly to 30-year scales (and bias error estimates) for water budget calculations (NASA NEWS study)
- Provide bias error estimates for GPCP monthly product

Issues

- Which estimates to include--some are known to have biases or problems in certain regions, e.g., high latitude ocean, over land in warm season
- How to estimate bias “error”

But first let's us go off on a little tangent--to the Tropics

Ten-year TRMM Composite Climatology (TCC) from Multiple Products

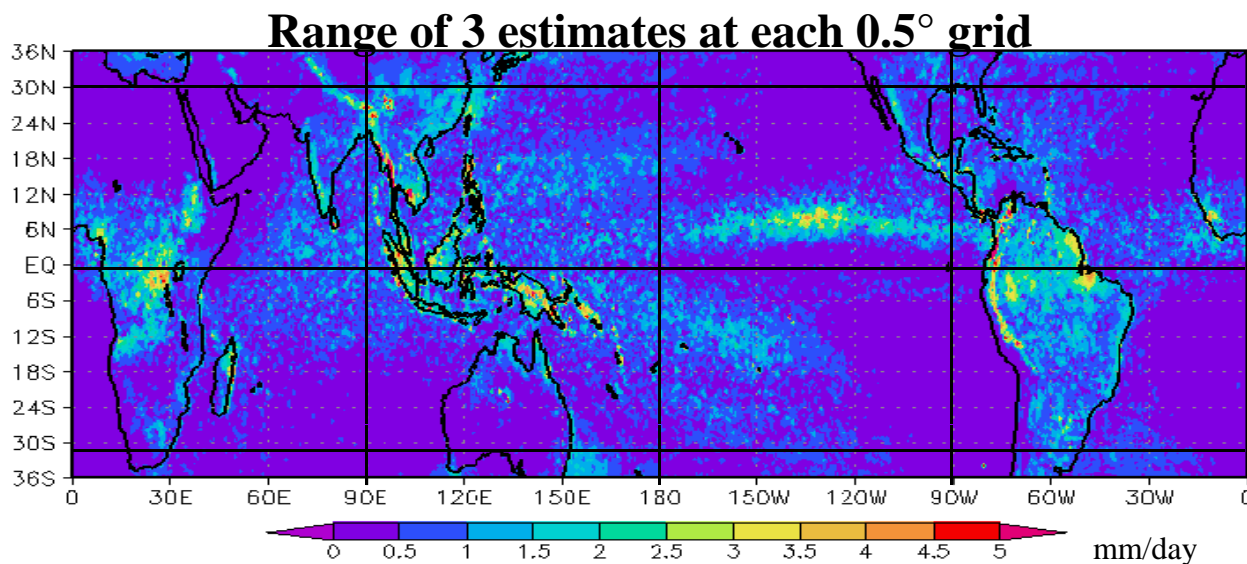


Ocean-- Mean of:

- 1) Passive microwave (2A12)
- 2) Radar (2A25--near surface)
- 3) Combined (2B31)

Land-- Mean of:

- 1) Radar (2A25--near surface)
- 2) Combined (2B31)
- 3) Multi-satellite with gauges (3B43)



Mean Tropical Rain (35N-35S):

2.68 mm/d +/- 3%

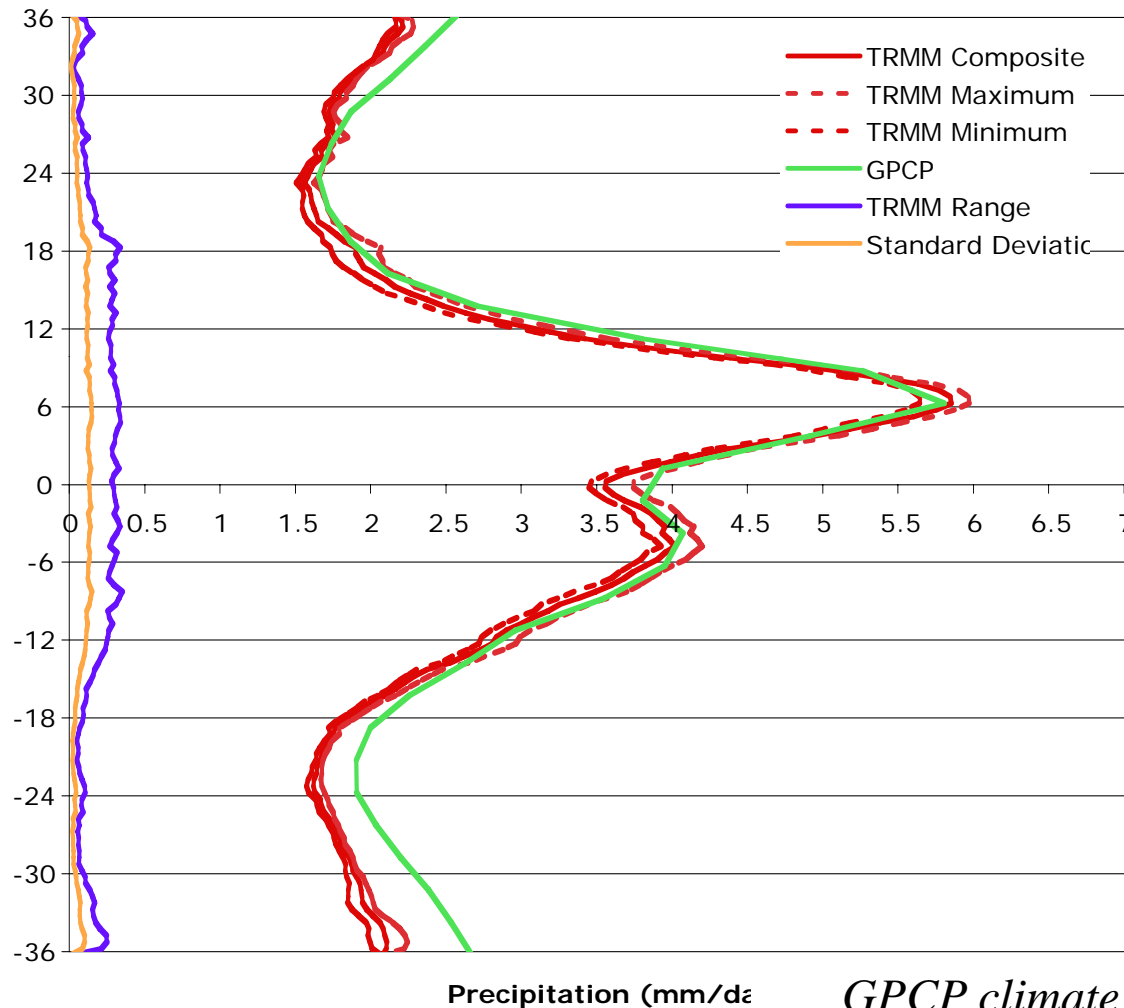
2.73 (ocean) +/- 2.5%

2.54 (land) +/- 4%

*Estimate of error =
range/2*

TCC Zonal Means and Comparison to GPCP Over Ocean

TRMM [2A12 (TMI)/3B43, 2A25 (PR), and 2B31(TM)
vs. GPCP Rainfall (Ocean+Land Zonal Mean, 1998-:



Zonal mean at peak (7°N)

6.5 mm/d +/- 3%

Zonal mean at 6°S

3.6 mm/d +/-

5.5%

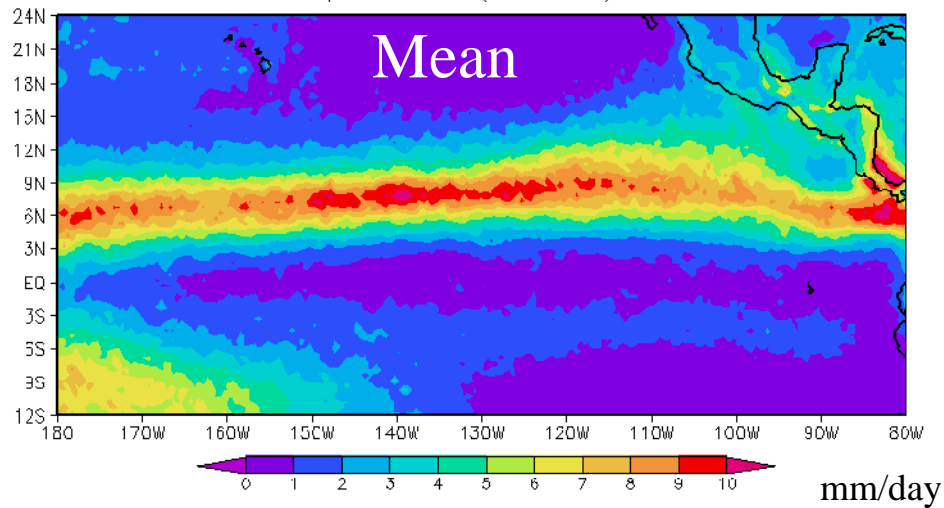
Zonal mean at 23°N

1.7 mm/d +/- 9%

TCC ocean climatology
confirms GPCP values
in deep Tropics;
indicates difference in
sub-tropics into mid-
latitudes

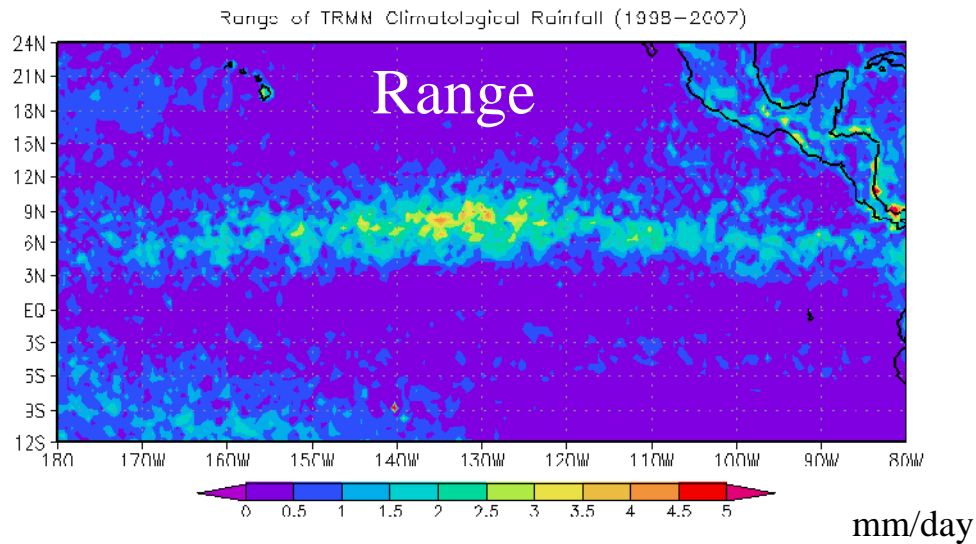
*GPCP climate values over ocean driven by
Chiu/Chang/Wilheit estimates using SSM/I*

Eastern Pacific Ocean



Ocean-- Mean of:

- 1) Passive microwave (2A12)
- 2) Radar (2A25)
- 3) Combined (2B31)



Rainfall Peak in E. Pac.

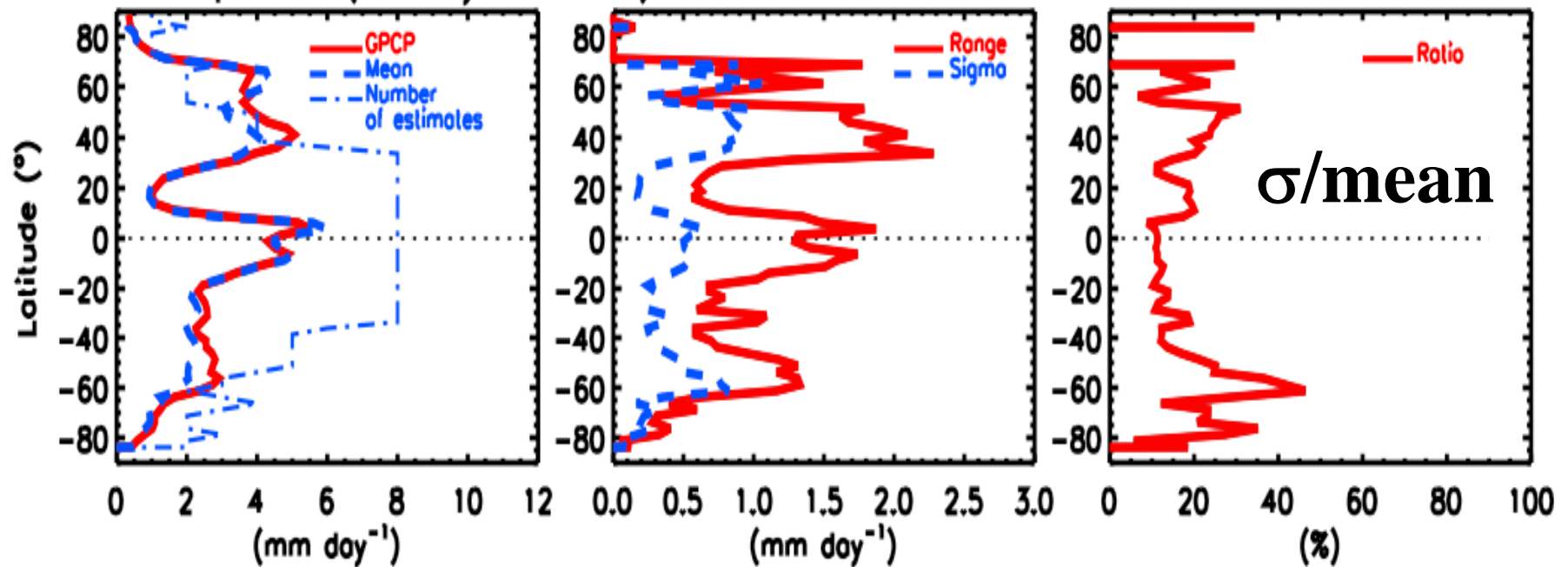
**9+ mm/d +/- ~ 1.5 mm/d
(~ +/- 15%)**

Outline of Method for Global Mean and Bias Error Calculation

- Potential input products: GPCP, CMAP, GPROF (ocean), RSS (ocean), HOAPS (ocean), TRMM [PMW(ocean), Radar (land & ocean), Combined (land & ocean)].
- Selection of products to be included uses a zonal mean test (land and ocean separate) on individual months
- *GPCP is used as “first guess”; only products with zonal means (for individual months) +/- 50% of GPCP included in remainder of analysis*
- Global composite estimate for each month: estimate is mean of remaining products, dispersion (bias error estimate?) is σ of products

Global Composite (Ocean) for 2003-2005 [January]

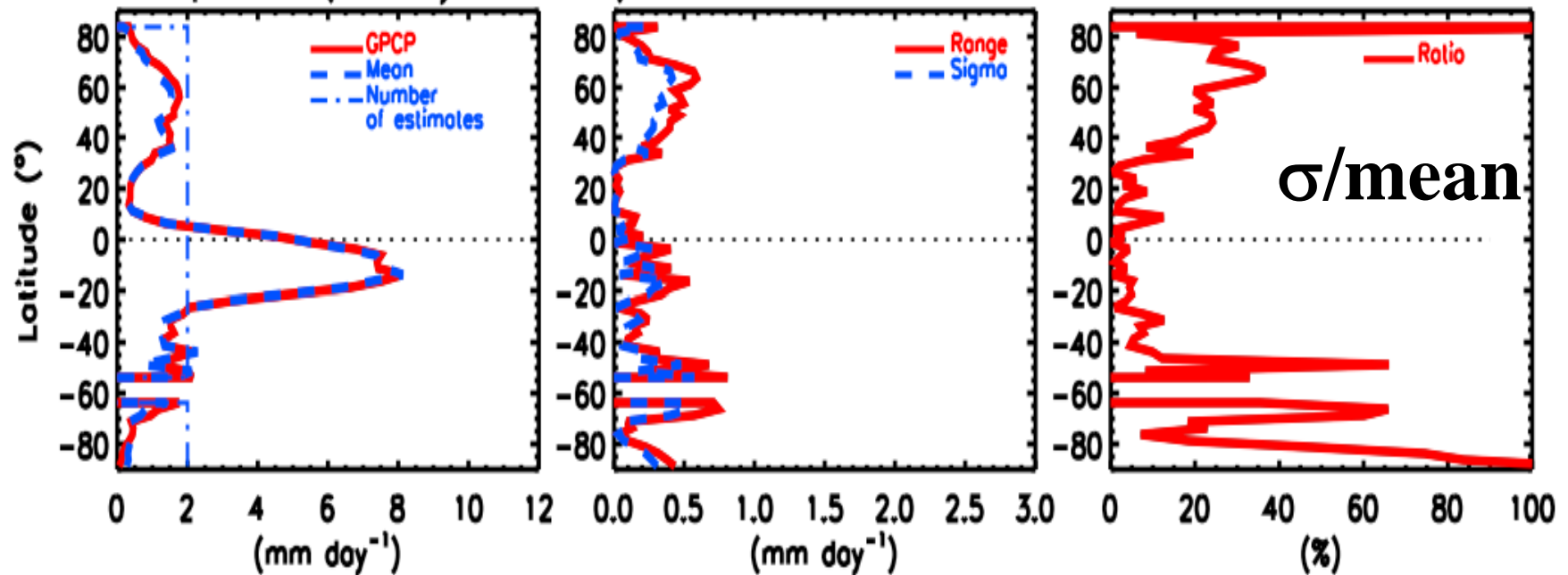
Oceanic Precipitation (January 2003-05)



- GPCP close to Global Composite, except in 30-60° lat.
- $\sigma \sim 0.5$ range; σ/mean varies 10-30% with peaks in mid-lat.
- Uncertainty less in Tropics--seems sensible

Global Composite (Land) for 2003-2005 [January]

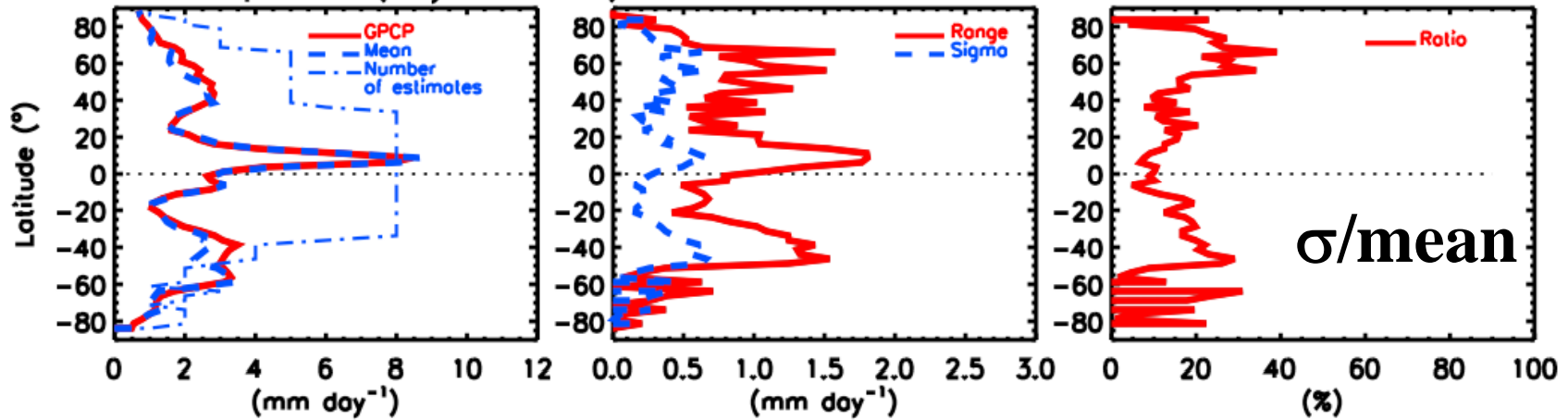
Land Precipitation (January 2003-05)



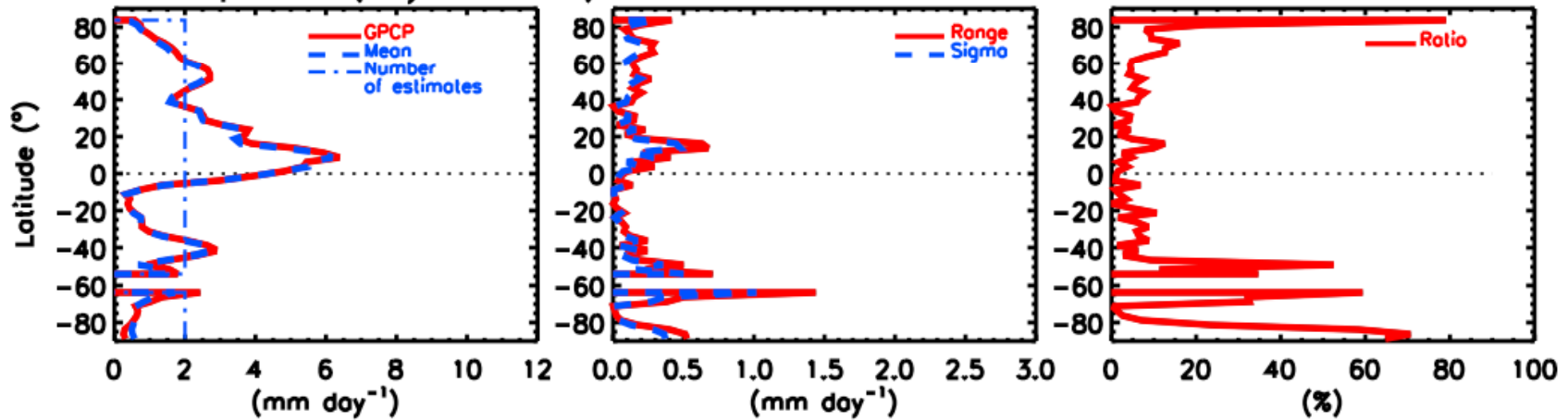
- Only two products right now--GPCP and CMAP; will add TRMM products in tropics, others?
- Difference in mid-latitudes mainly wind loss correction
- Uncertainty also less in Tropics over land--also seems sensible

Global Composite (Ocean and Land) for 2003-2005 [July]

Oceanic Precipitation (July 2003-05)

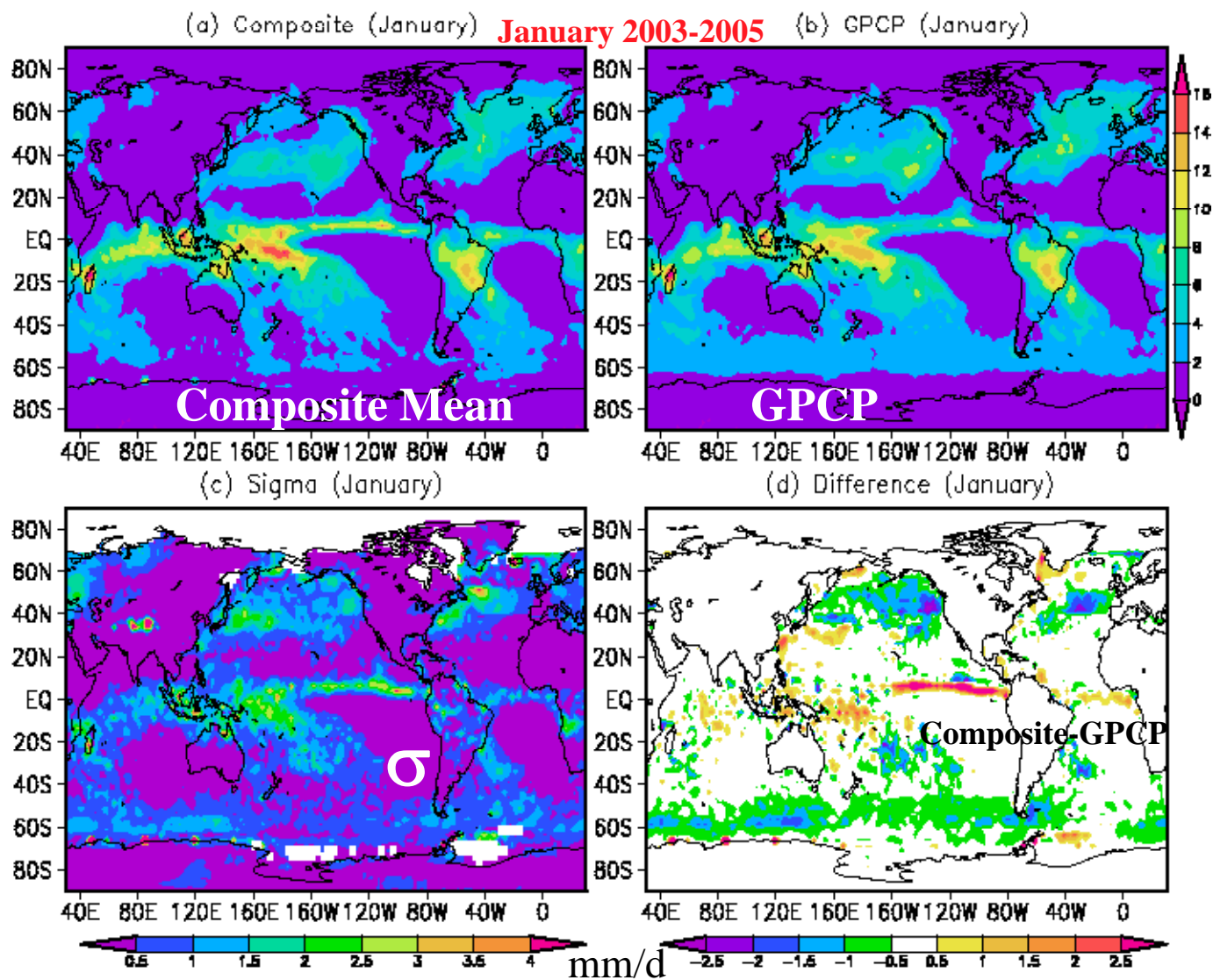


Land Precipitation (July 2003-05)



Global Composite Map with Bias Error (January)

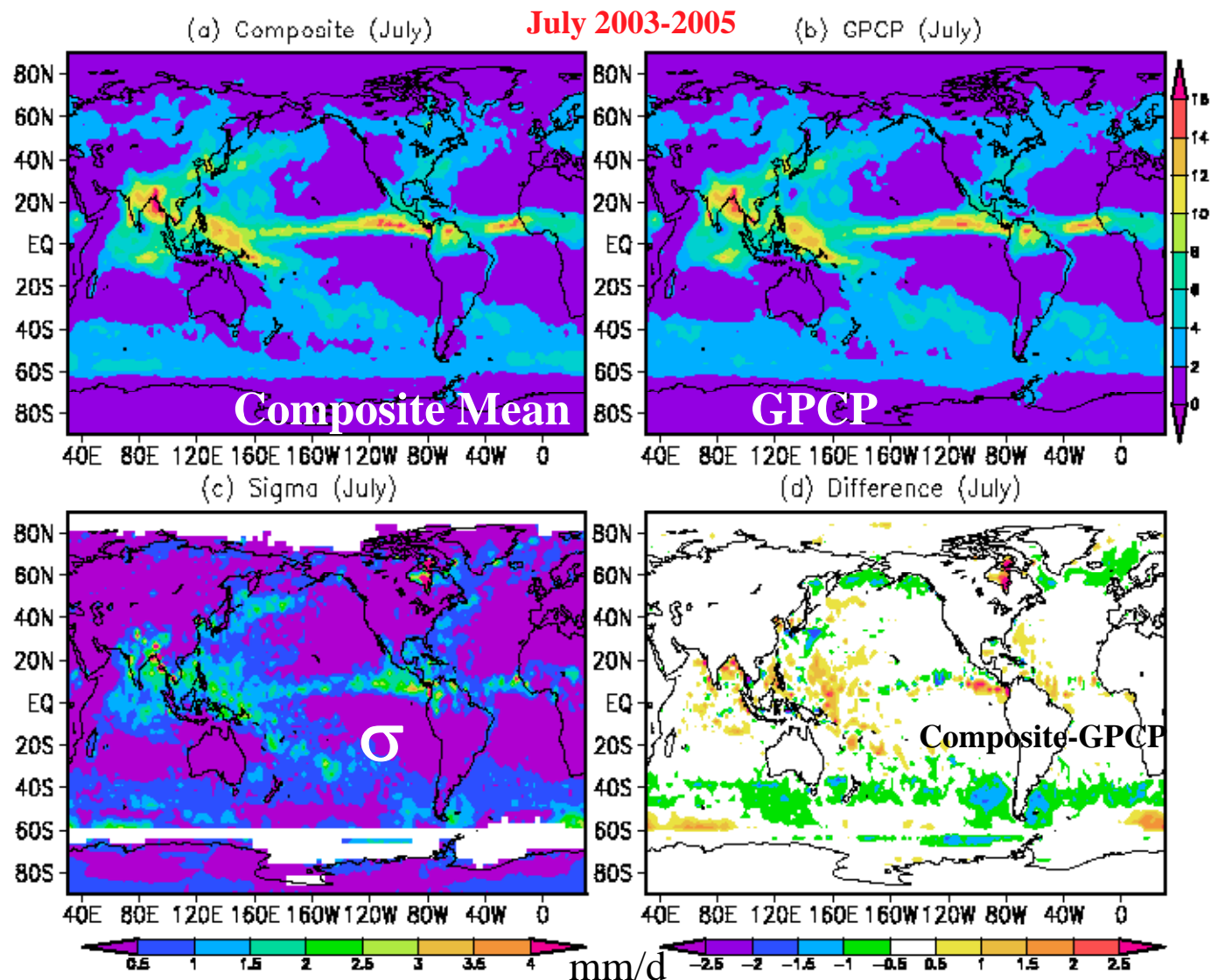
From 2-8 input products depending on location; mean similar to GPCP, but higher in E. Pac./SPCZ and lower in mid-latitude storm tracks



Sigma (σ) is measure of bias error

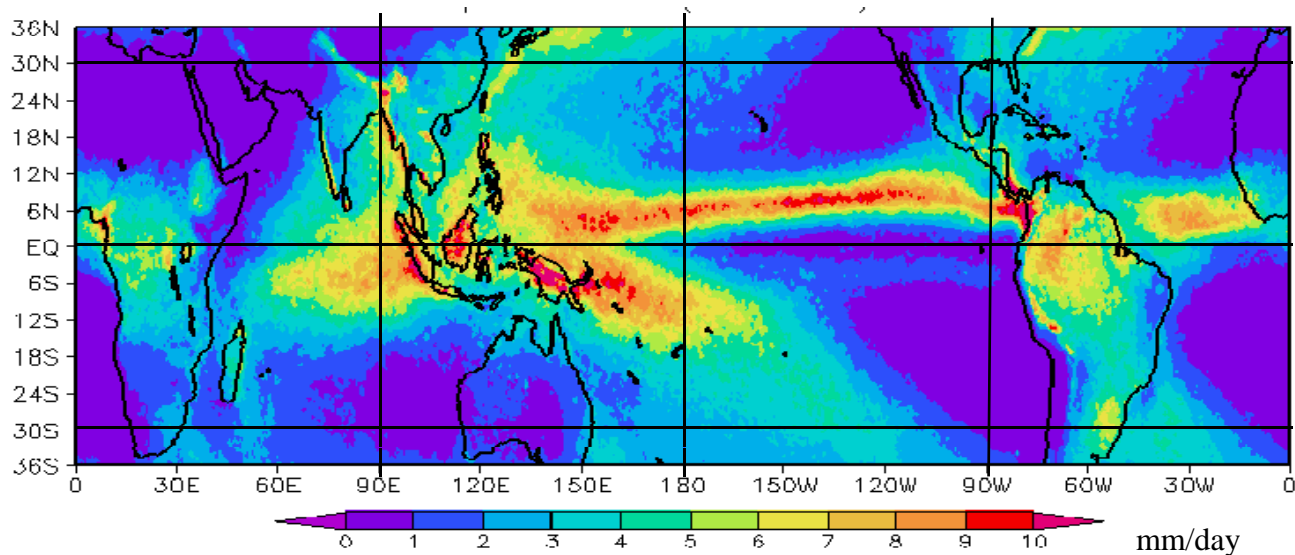
Global Composite Map with Bias Error (July)

From 2-8 input products depending on location; mean similar to GPCP, but higher in W. Pac., and again lower in mid-latitude storm tracks



Sigma (σ) is measure of bias error

Large Area Bias Estimate--Tropical Ocean Example



Mean Tropical Ocean Rain All Months 2003-2005 (35N-35S):

TRMM Composite: (3 products) 2.73 mm/d +/- 2.5% (range/2)

Global Composite: (8 products) 2.96 mm/d +/- 8% ($\sigma = 0.24$, $\sigma/\mu = .08$)

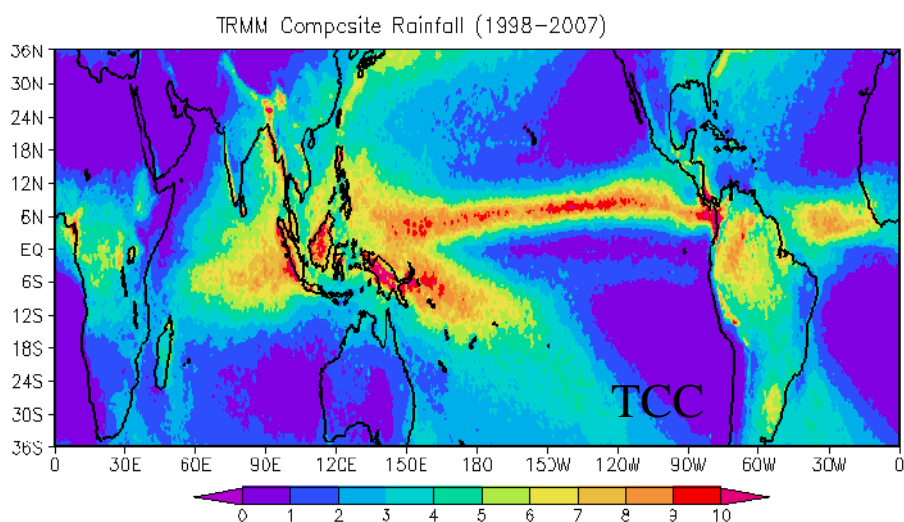
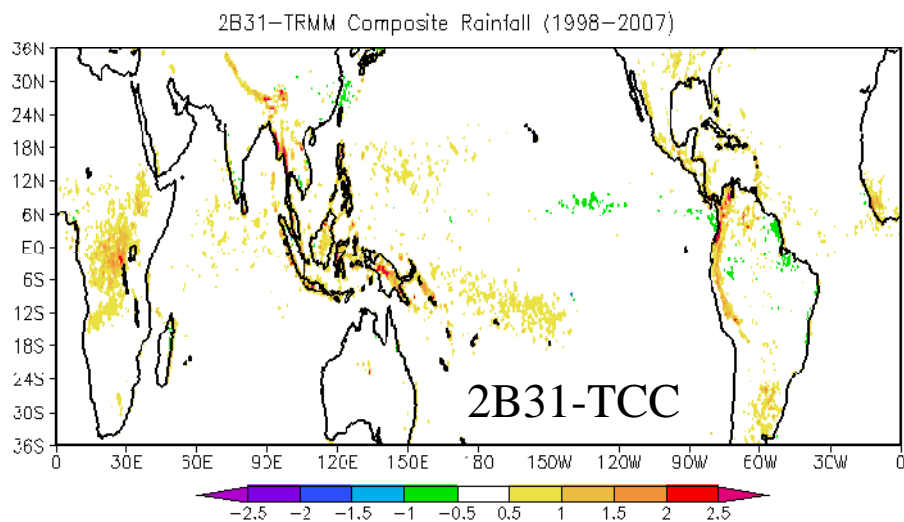
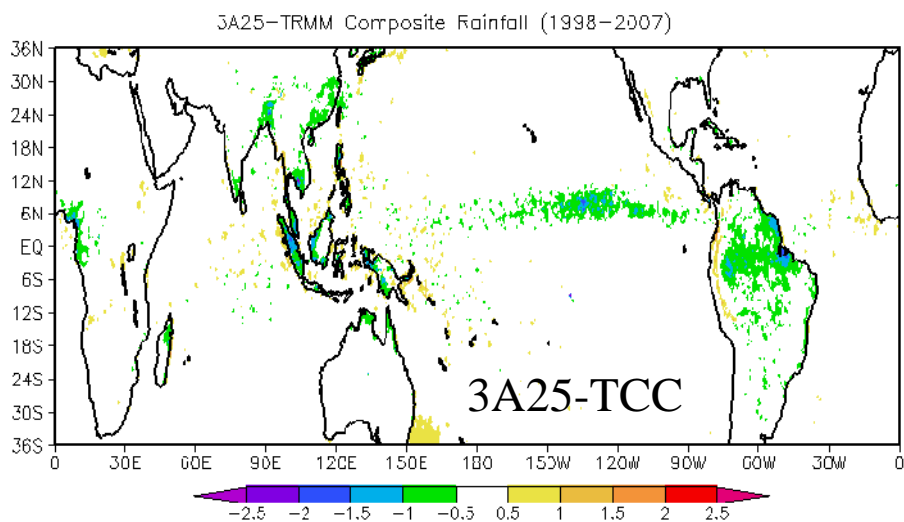
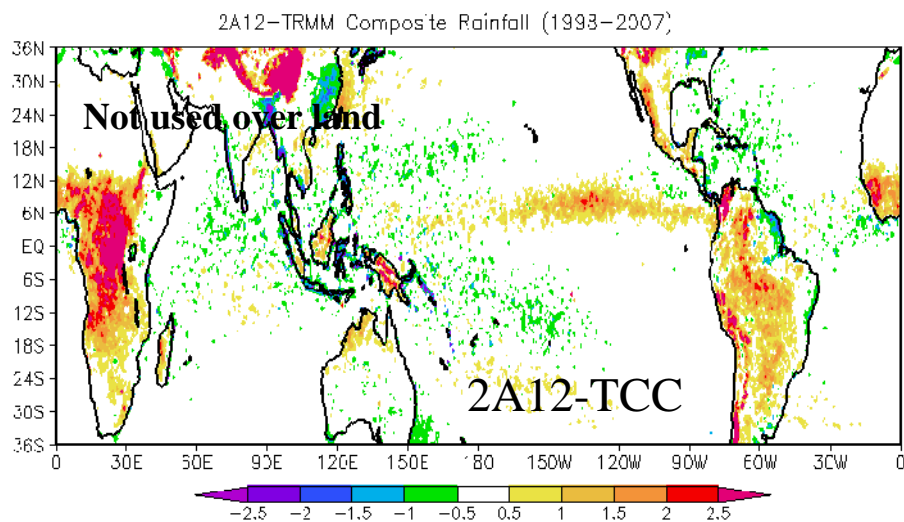
GPCP 3.02 mm/d +/- 8%?? (GPCP bias estimate?)

Doing global bias estimates or other areas where number of products varies is more complicated--research continues

Conclusions

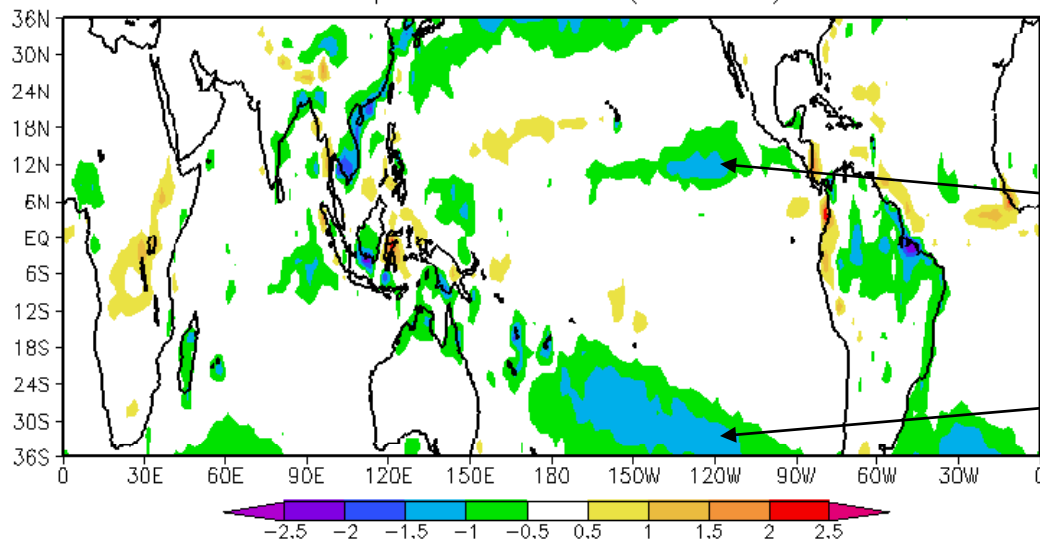
- A TRMM Composite Climatology (TCC) of surface rainfall is nearing completion, with range of estimates (or other statistic) used as measure of dispersion (and bias error)
- TRMM (TCC) estimate for tropical rain is 2.69 mm/d +/- 3% (2.5% over ocean), 3-9% for zonal means (ocean), up to 15% in E. Pac. maximum.
- A Global Composite Climatology (GCC) procedure has been developed using multiple precipitation estimates to estimate a new mean global map, compare to GPCP and use the dispersion of estimates as a measure of bias error--either for the new composite estimate or for GPCP
- Three-year global total of composite is 2.52 mm/d compared to GPCP of 2.65 mm/d for 2003-2005 (all months).
- Tropical ocean value for new composite (8 products) is 2.96 mm/d +/- 8% ($\sigma = 0.24$, $\sigma/\mu=.08$) for all months, 2003-2005
- Conversion of σ maps to global or large-area error estimates is work in progress

Comparison of Inputs to TCC



TCC Compared to GPCP

TRMM Composite-GPCP Rainfall (1998-2007)



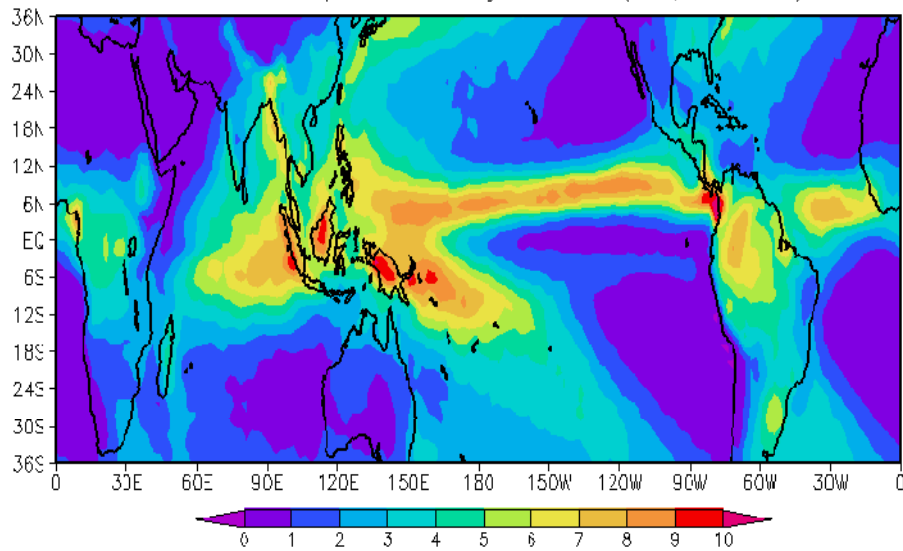
TCC-GPCP

1 mm/d out of ~6 mm/d

1.5 mm/d out of ~5 mm/d (30%)

TCC (smoothed to 2.5°)

TRMM Composite Climatological Rainfall (2.5d, 1998-2007)



GPCP

GPCP Climatological Rainfall (1998-2007)

