Global Precipitation Climatology Project (GPCP)

Robert Adler
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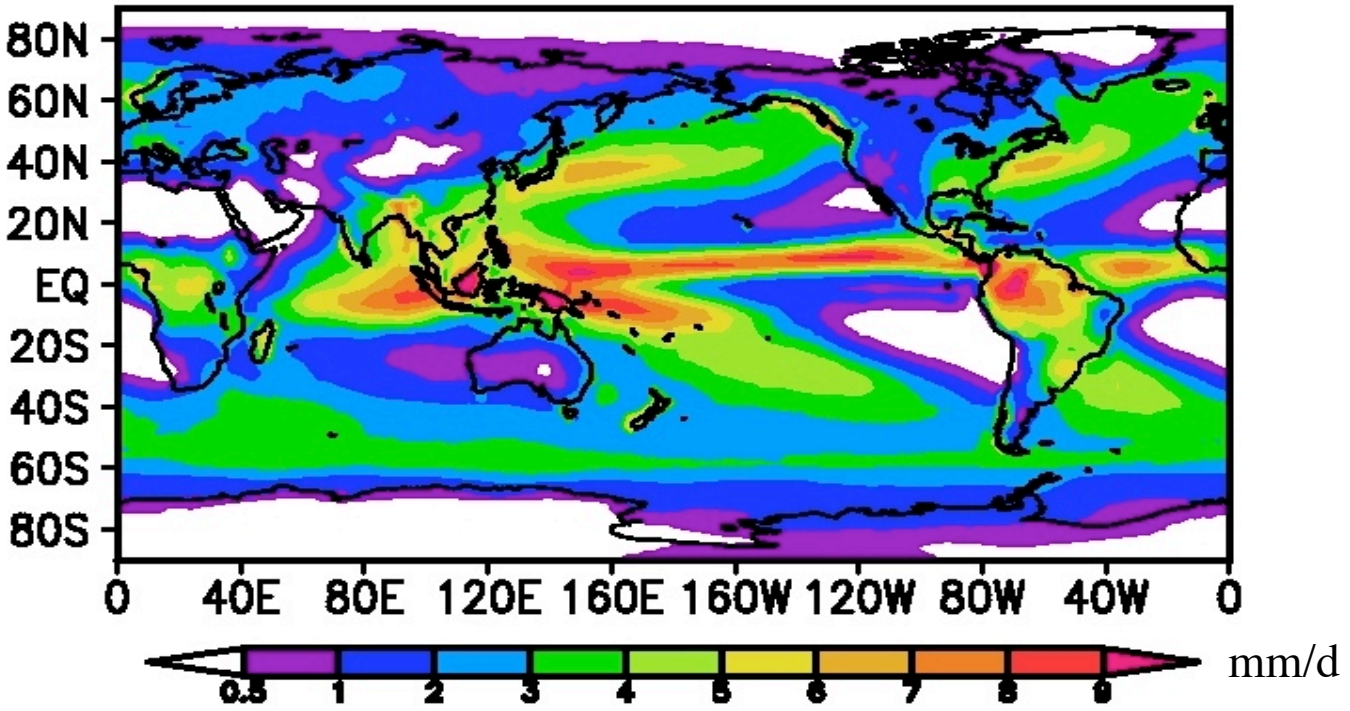


GPCP is an often-used analysis based on satellite and gauge data (1979-near present).

No TRMM, GPM or Cloudsat data are in the current GPCP.

Adler et al., 2003 J. Hydromet

Huffman et al., 2009 GRL

GPCP Global Precipitation Products

Version 2.3

NASA, NOAA, DWD, UMD, GMU, others

- Monthly, 2.5° Merged Analysis (1979-present)
  Adler et al. (2003), J. Hydromet.

  Huffman et al. (2009) GRL
- Pentad, 2.5° Merged Analysis (1979-present)
  Xie et al. (2003) J. Climate
- Daily, 1° Merged Analysis (1997-present)
  Huffman et al. (2001) J. Hydromet.

[although produced using different data sets and algorithms, products are integrated,i.e. they add up]

normally produced ~ 3 months after observation time

GPCP People

R. Adler (GPCP Coordinator) U. of Maryland

- Huffman/Bolvin, NASA Goddard (AIRS estimates from Susskind/Iredell)
- Adler/Wang/Sapiano, U. of Maryland
- GPCC—Schneider, Becker, German Weather Service, Global Precipitation Climatology Center (GPCC)
- Ferraro, NOAA NESDIS
- Chiu, George Mason U.
- Xie, NOAA/NWS/CPC

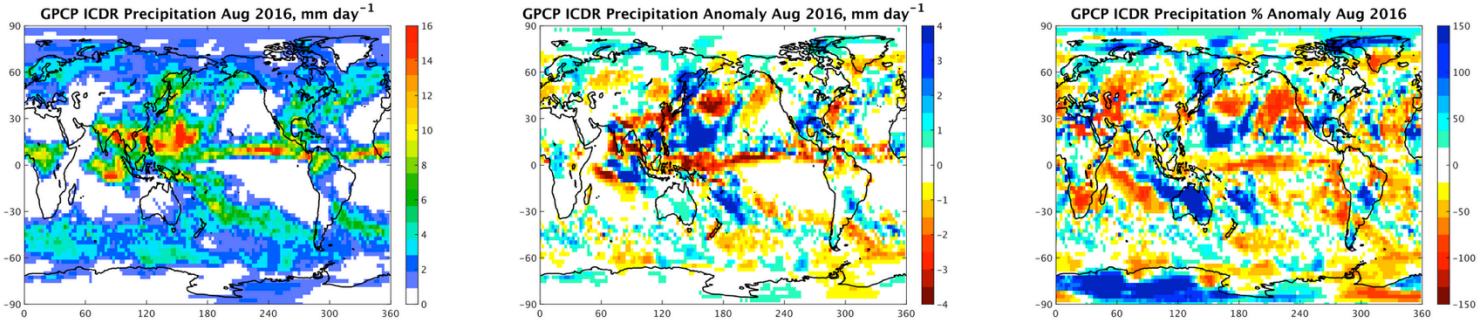
Web Address for Current GPCP products: GPCP.umd.edu

Global Precipitation Climatology Project (GPCP)

University of Maryland College Park
Earth System Science Interdisciplinary Center (ESSIC) and Cooperative Institute for Climate and Satellites (CICS)

GPCP Monthly Analysis (GPCP-Interim)--Latest Month

Interim GPCP estimates are provisional estimates of GPCP available ~10 days after the end of the month. They can be used for the most recent months for which GPCP is unavailable.



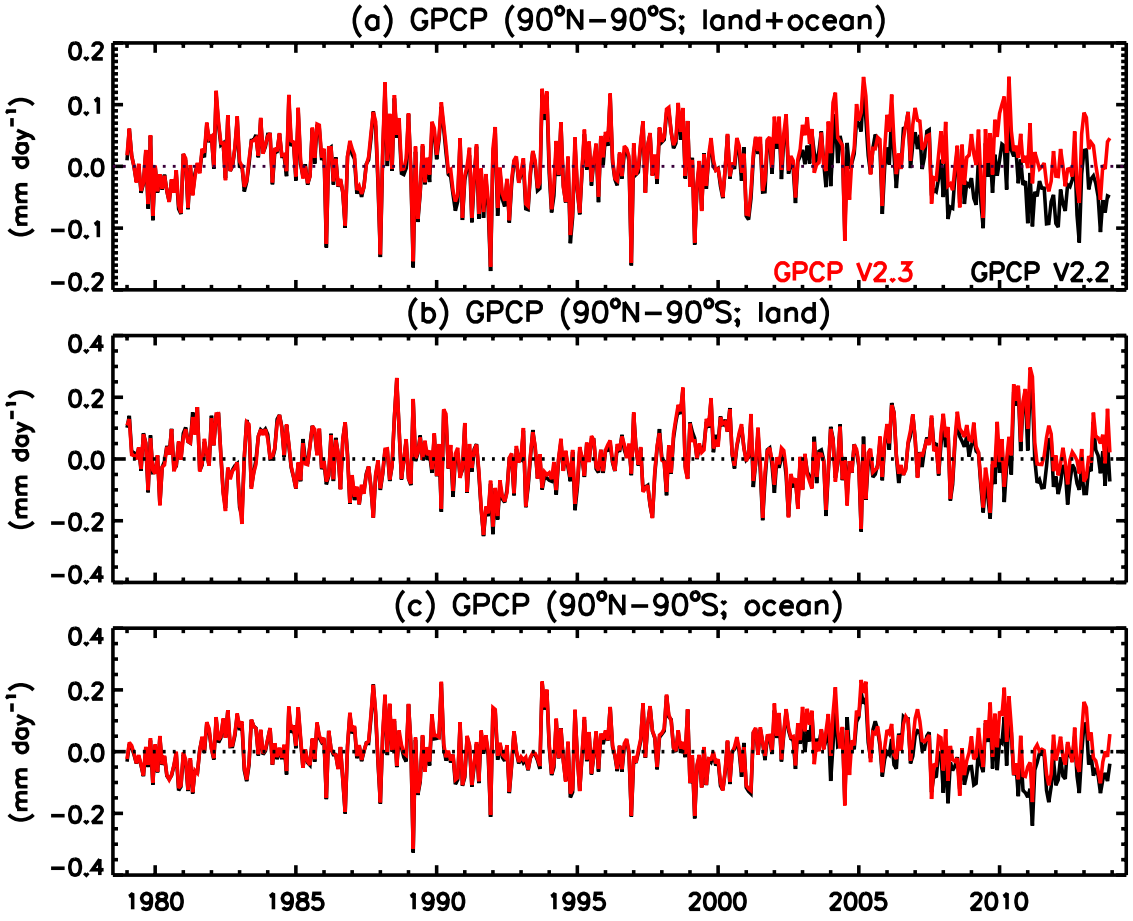
GPCP Background
Description

GPCP V2.3 Monthly
Description & Download

GPCP-Interim V2.3 Monthly
Description & Download

- **New GPCP Monthly (V2.3) being produced at UMD for NOAA's Climate Data Record (CDR) program**
- **Final analysis available a few months after time; Interim CDR (ICDR) available ~10 days after end of month for real-time climate analysis**
- **V2.3 Daily and Pentad products under development**

GPCP New V2.3 vs. V2.2



Land + Ocean

Land

Ocean

- Differences due to cross-calibration errors (SSMI to SSMIS and TOVS to AIRS) over ocean and use of new GPCC "Full" gauge analysis
- Biggest difference after 2009 (~ 1.8% over ocean)
- Regionally biggest difference 40-60N over ocean

Absolute Magnitude of Global Precipitation

	Ocean	Land	Ocean + Land
Precipitation	2.90 mm/d	2.24 mm/d	2.69 mm/d

*

Current GPCP global long-term number is **2.69 mm/d +/- ~7%**

With the error based on variations among different estimates (including TRMM)
(Adler et al. 2012 JAMC)

These global numbers and continental-scale values fit well with large-scale water and energy budget studies (e.g., Rodell et al. 2015 J. Clim.)

But, how well do these very large-scale precipitation numbers compare with TRMM, GPM and CloudSat?

* New values based on GPCP V2.3

How do TRMM-based estimates fit with GPCP?

Tropical Mean (Ocean) Rainfall Estimates

mm/d	TRMM Radar (2A25 NS--adjusted)	TRMM Composite Climatology (TCC)*	GPCP	TRMM PR + CloudSat**
35N-35S (ocean)	2.9	2.9	2.9	3.0 (3 years)

TRMM-based mean tropical ocean values agree well with GPCP and with TRMM PR/CloudSat value.

*Adler et al. 2009 JMSJ

**Behrangi et al., 2014 JClim

Global Mean (Ocean) Rainfall Estimates

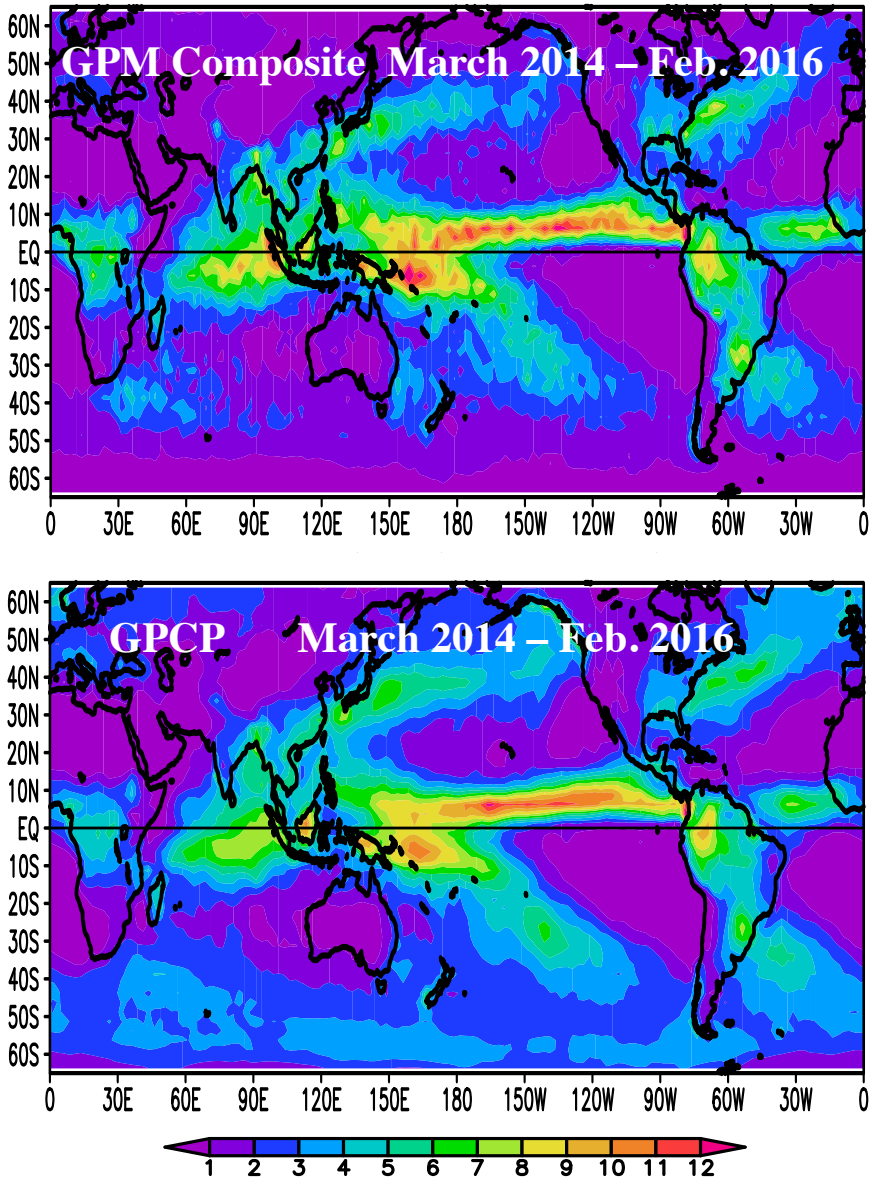
	GPCP	**PR + CloudSat; AMSR + CloudSat** Behrangi et al. 2014 JClim
60N-60S (ocean)	3.04 mm/d	3.13 *[GPCP + ~ 3%]*

GPCP global ocean number still seems reasonable.

If there are faults in the GPCP global precipitation magnitude (e.g., underestimation) it probably doesn't have to do with light rain or snow, but perhaps with ***intense convective rainfall*** *in the tropics.*

GPM Two-Year Precipitation

Version 4 of GPM Products

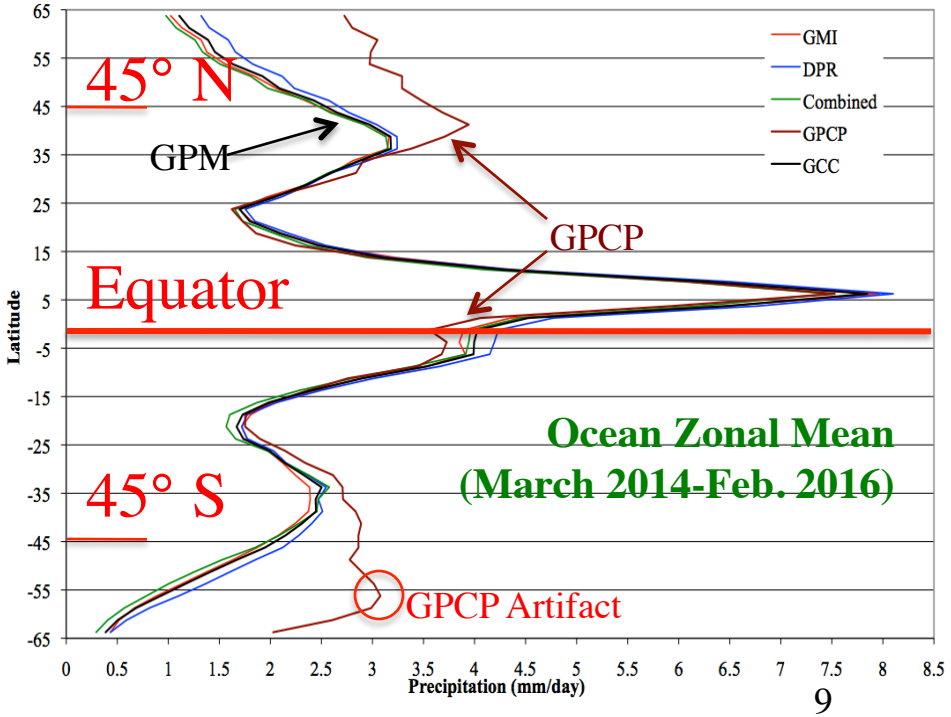


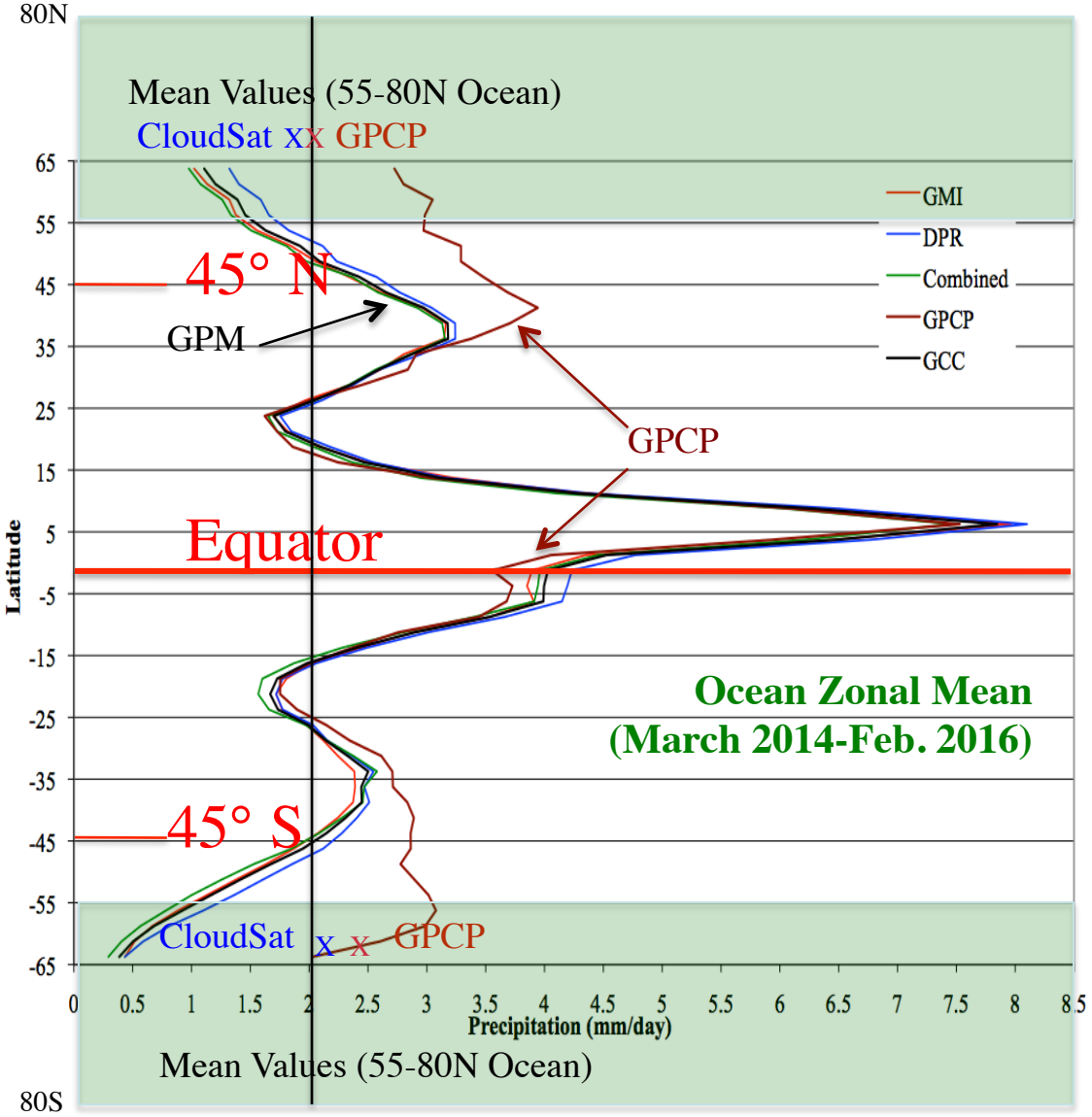
Ocean

GPM

mm/d	PMW	Radar	Comb	GPCP
25N-25S	3.50	3.63	3.37	3.33
65N-65S	2.70	2.83	2.63	3.07

- *GPM somewhat higher than GPCP in tropics*
- *GPM lower in extra-tropics*





CloudSat High Latitude Study

Behrangi et al, (2016) JGR

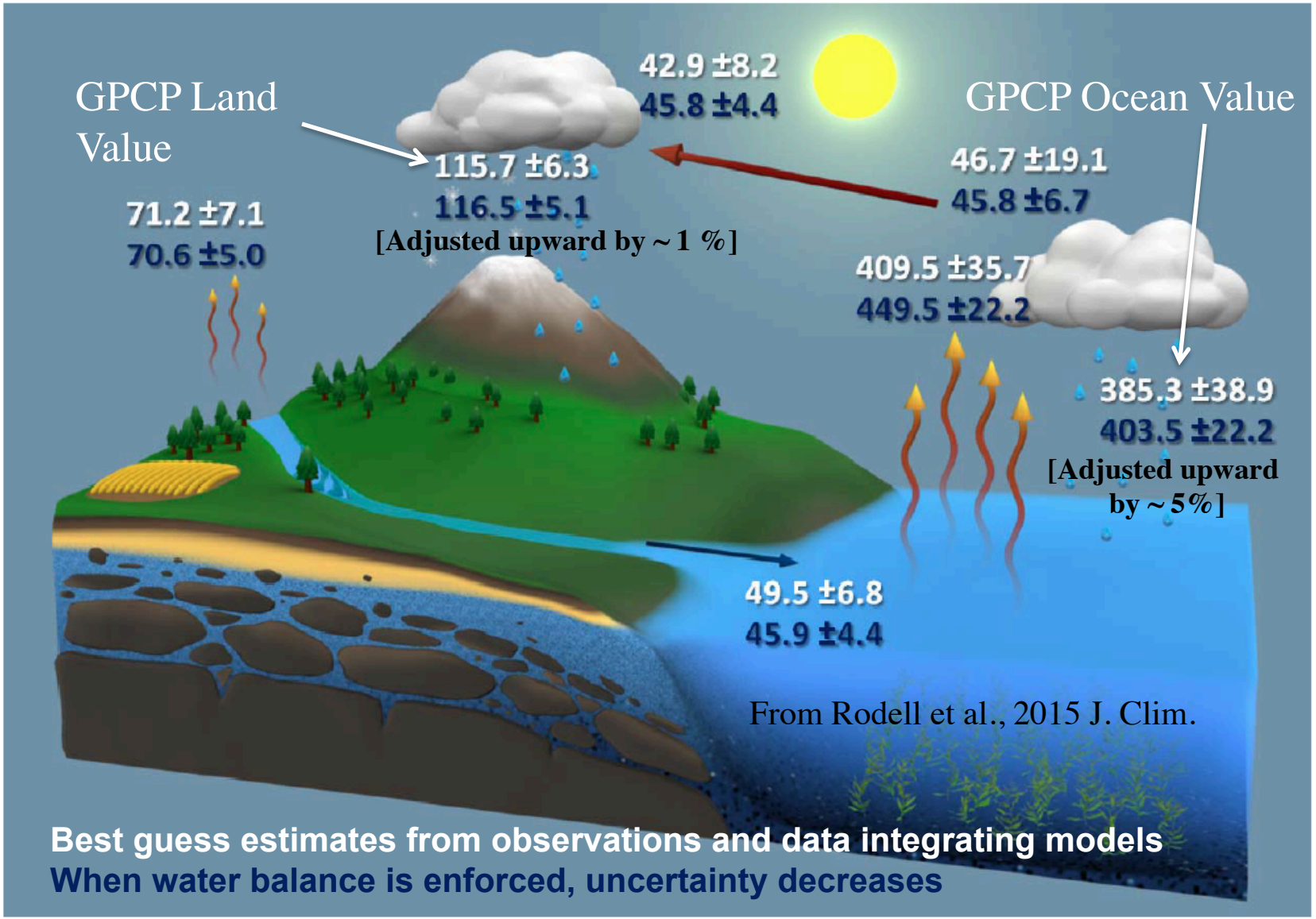
Mean values of precipitation (rain plus snow) over five years, 55-80° latitude:

CloudSat-based estimates agree closely with GPCP means (over ocean and land); both higher than GPM

GPM and CloudSat should be the Standards to which GPCP is tuned!

Global Mean Annual Water Cycle

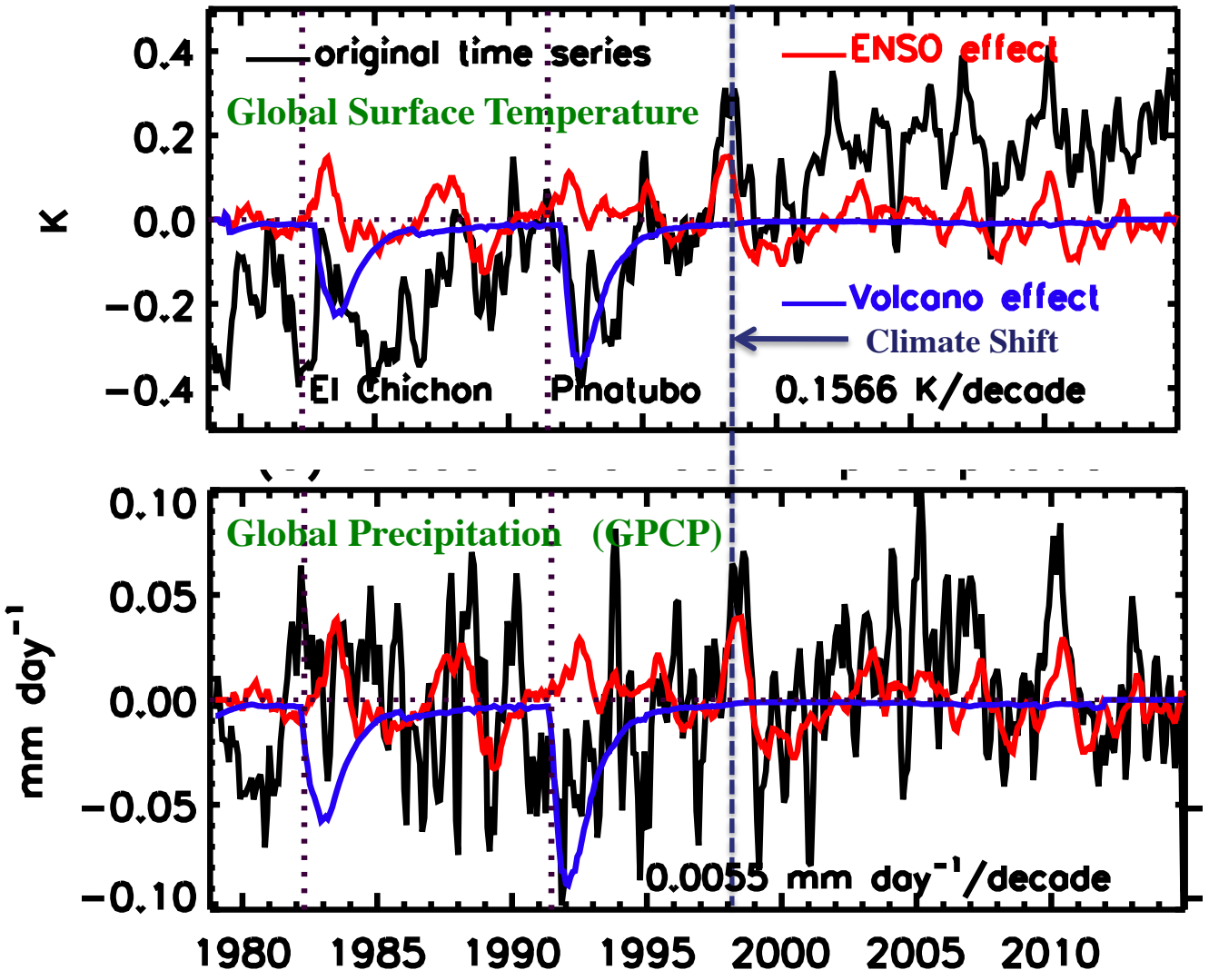
Global mean water fluxes (1,000 km³/yr) at the start of the 21st century



GPCP land value above is nearly identical with GPCC gauge-based climatology (Schneider et al., 2014, Theor. Appl. Climatology)

Variations in Global Surface Temperature and Precipitation

Trends, Inter-decadal Shifts and ENSO and Volcano Effects



Surface Temperature:

Trend: .15 C/ decade

ENSO: 0.2C amplitude

Volcano: 0.4C amplitude

Precipitation:

Trend: ~ zero

ENSO: .05 mm/d (2%) amplitude

9%/K

Volcano: .09 mm/d (3%) amplitude

8%/K

GPCP Status

- Version 2.3 monthly and daily was in routine production with products typically produced about 2-3 months after end of month. ICDR Monthly was being produced within 10 days of end of month.
- AIRS precipitation processing affected by end of AMSU in September 2016, resulting in GPCP production stoppage—last month is August 2016.
- We are beginning to examine using AIRS-only precipitation estimates instead of AIRS/AMSU. First indications are small differences. Cross-calibrations of AIRS-only to AIRS-AMSU estimates possible. Estimate to go back to routine production—May 2017.
- NOAA/NCEI momentarily ready to make GPCP Monthly (V2.3) an official CDR with archive there (data would also be available from UMD). Daily and Pentad products are in process toward same status—in about a year.
- Article prepared for GEWEX Newsletter re. V2.3, changes from V2.2

- Version 3 GPCP work proceeding (George Huffman is PI)

GPCP Version 3

(being developed under NASA support; PI: Huffman)

New GPCP Version 3 will have:

* Monthly--0.5° resolution, GPROF microwave algorithm applied to SSMI, SSMIS data as satellite calibrator (1979-present) Other components (e.g., gauge) similar to current (V2) procedure.

* Daily—0.5° resolution (1998-present). Pentad for whole 1979-present period. Daily possible back to ~1983 using PERSIANN (IR-based).

* 3-hr—0.25° (1998-present) to match with ISCCP and SRB products (using GPM IMERG)

IMERG is GPM multi-satellite analysis

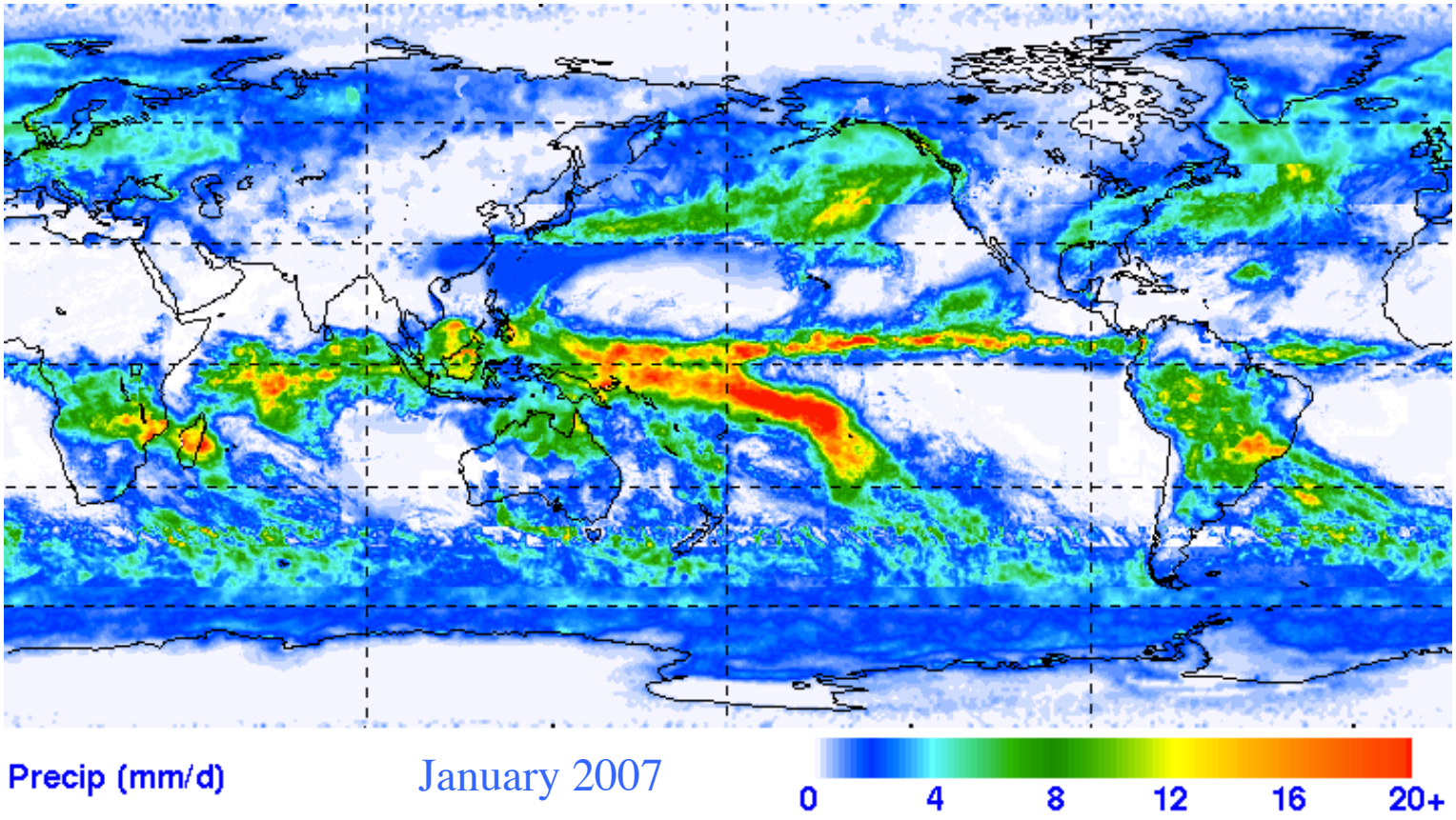
GPCP (Version 3) cont.

- New passive microwave algorithm (GPROF)
- Integration of high time/space resolution period with longer period with coarser time/space resolution
- Rain/snow discrimination (by temperature and humidity)
- Geo-IR data (B1) being used by U. Cal. Irvine to do daily precipitation estimates before 1998.
- Use of TRMM, Cloudsat and GPM information/ climatologies as restraint on mean values

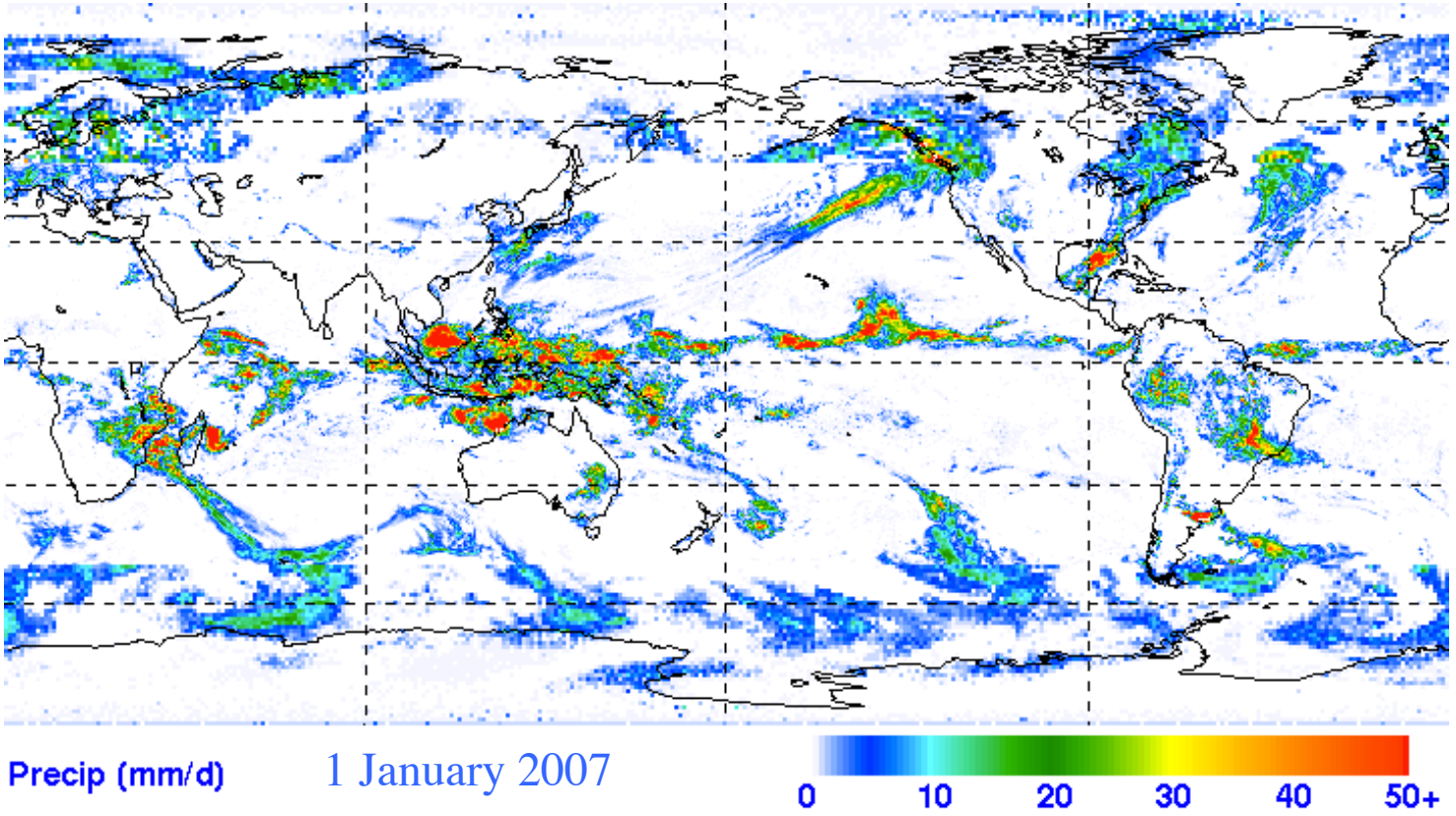
Extra Slides

Integrated Product from GPCP V2

Example Integrated Product Input from GPCP--Monthly Analysis
(1° Latitude-Longitude)

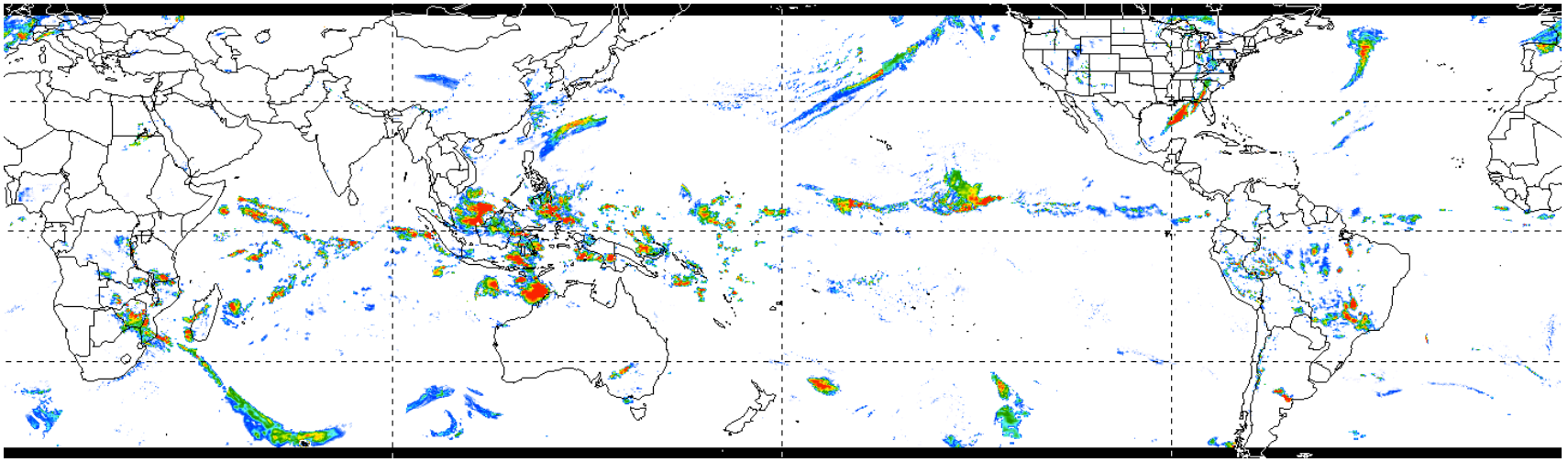


Example Integrated Product Input from GPCP--Daily Analysis (1° Latitude-Longitude)

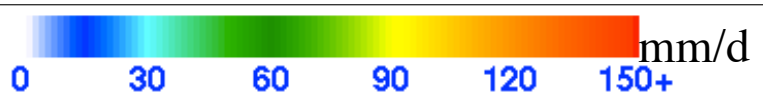


Example Integrated Product Input from GPCP—3-hr Analysis
(1° Latitude-Longitude 50N-50S)

At higher latitudes it will be filled in with daily estimated repeated



January 1, 2007 00 GMT



GPCP input to "integrated product" consists of current version 2.2 Daily disaggregated by TMPA 3-hr product. Possible 1998-present time span.