Highlights of the Version 7 TRMM Multi-satellite Precipitation Analysis (TMPA)

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INTRODUCTION – MOVING FROM VERSION 6 TO VERSION 7

Version 7 of the 3B42/43 product suite is intended to
- Provide important evolutionary changes that build on the lessons learned in Version 6
- Keep pace with the changing complement of algorithms and platforms in the international constellation of precipitation-relevant satellites
- Build on feedback from users

Version 6 provided the first-generation 0.25° 3-hr multi-satellite production precipitation datasets in TRMM. Some important lessons were learned:
- Detailed intermediate fields must be an integral part of the products
- Code must be set up to accept future satellites with minimal disturbance
- Automated Quality Control is needed for input and output data

Version 6 was based on a fixed set of input data. Since its inception in April 2005
- All DMSP SSMI sensors (F13, F14, and F15) failed or became unusable
- All DMSP SSMIS sensors (F16, F17, and F18) currently lack a "production" precipitation algorithm
- Algorithm for the AMSU-B (NOAA-15,-16 and -17) changed in 2007, creating a discontinuity in the record
- NOAA-18,-19, and MetOp-A MHS sensors came online
- NCDC GriSat-B1 IR data became available
- GPCC released improved versions of their gauge analyses

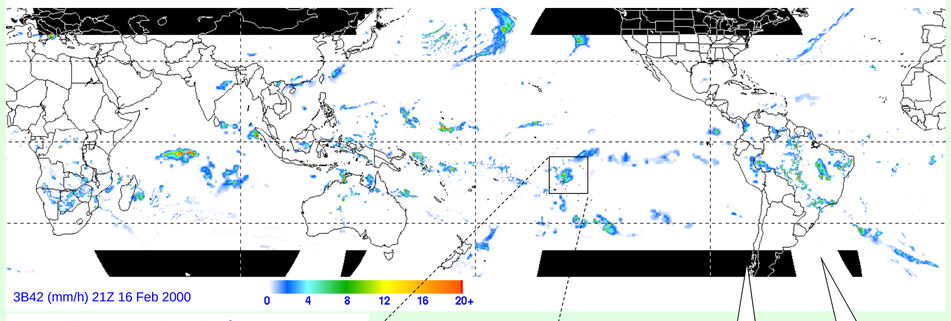
UPGRADING 1998-1999 IR WITH THE B1 IR DATA

The first two years of Version 6 (1998 – 1999) use the GPCP 1° 24-class histograms of IR Tb data
- 1° grid – must be interpolated to 0.25°
- Only covers 40° N-S
- 3-hourly

Most of the Version 6 record (2000 – present) uses the CPC 4-km Merged Geo-IR Tb data
- 4-km grid – averaged to 0.25°
- Covers 60° N-S – only need 50° N-S
- Half-hourly

Thus, 3B42/3B43 statistics outside 40° N-S in the first two years are somewhat problematic

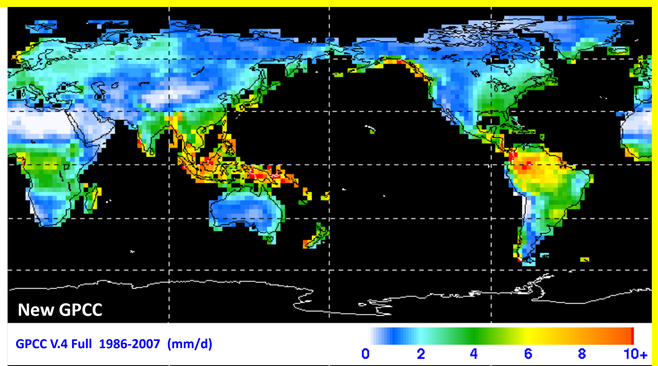
Recently, the NCDC GridSat-B1 dataset has been developed
- Harmonizes and merges ISCCP B1 geo data, including IR
- Uses ISCCP satellite intercalibration, zenith-angle correction, parallax correction
- 10-km subsample of geo pixels, including IR, gridded to 0.07°
- Covers 70° N-S
- 3-hourly
- Used to compute 0.25° -avg Tb 50° N-S for the first two years in Version 7, consistent with CPC 4-km data



IMPROVING DATASET CONSISTENCY – GAUGE and AMSU-B

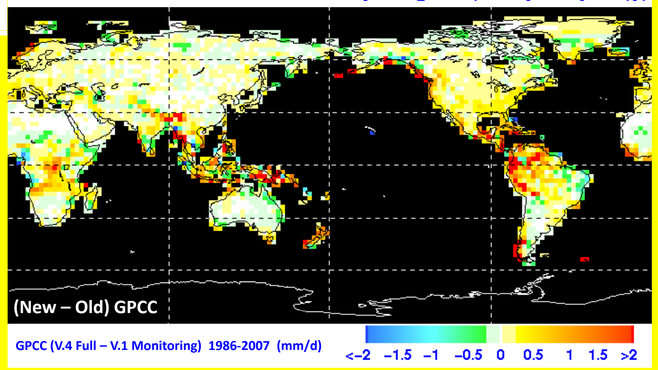
Version 6 uses two different sources of gauge analyses
- CAMS for "initial processing"
- Previous GPCC Monitoring gauge analysis for "retrospective processing"
- CAMS is more timely – 1 week vs. 2 months for GPCC
- CAMS and GPCC appeared consistent in initial testing, but turned out not to be over time

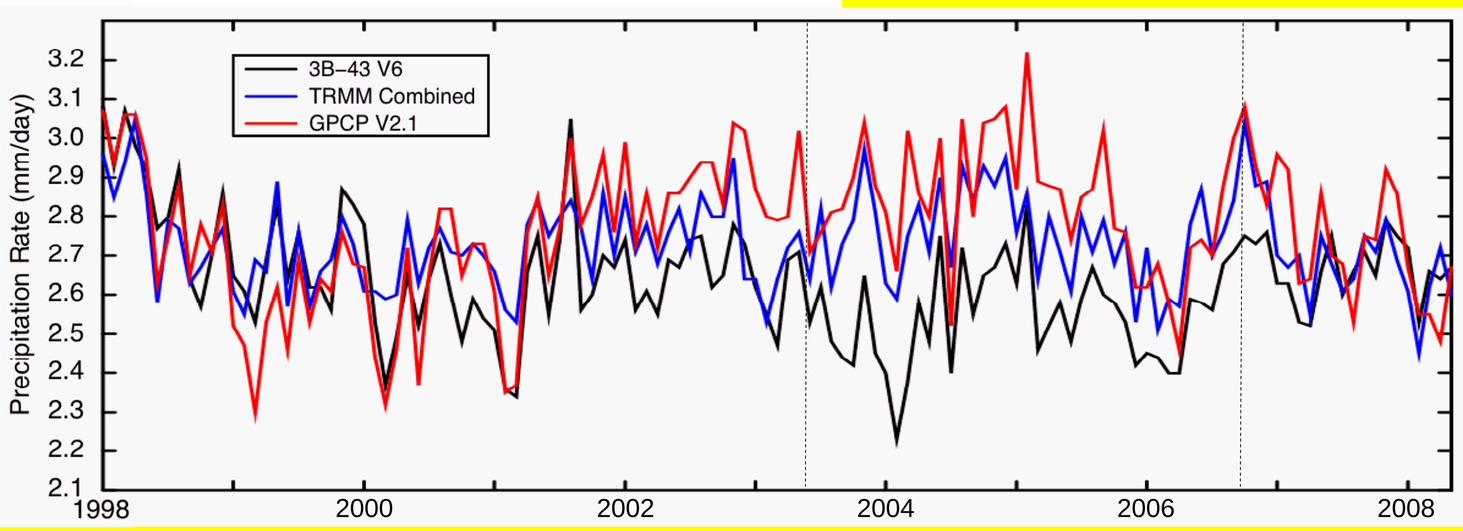
In 2008 GPCC shifted to an improved climatology/anomaly analysis
- Better than previous GPCC or CAMS, particularly in complex terrain
- Differs even more from CAMS
- Has three streams
  - "Full" analysis, several years after observation
  - "Monitoring" analysis, 2.5 months after observation
  - "First Guess" analysis, a few days after the end of the month, and relatively crude in initial testing
- Plan to use the higher quality and consistency of the GPCC Full analysis when available, and the Monitoring product thereafter, meaning *the latency for 3B42/43 will increase from 0.5 to 2.5 months*
- Another major upgrade to all GPCC products due Fall 2010



The AMSU precipitation product experienced two upgrades in the Version 6 record:
- First occurred in 2003, before Version 6 started, and was partially mitigated with separate calibrations
  - all AMSU versions have a low bias that becomes more important for the oceans as more AMSU satellites are launched, starting in 2000
- The second upgrade occurred in 2007 and included reprocessing
  - better results, but
  - Version 6 frozen, so didn't use reprocessed data before mid-2007
- Version 7 will use the reprocessed results throughout

Over the oceans in the band 30° N-S, 3B43 (black) and its calibrator (blue, TRMM Combined) are close before 2000 and after the second upgrade





OTHER ITEMS CRITICAL FOR IMPROVEMENT

In Version 6 the conically scanning microwave instruments are handled with a variety of GPROF versions from before GPROF 2008:
- Includes TMI, AMSR-E, SSM/I
- All conically scanned microwave data will be processed with GPROF2008 in Version 7
- Anticipated that biases in F15 SSM/I and in the SSMIS instruments will be accommodated in GPROF2008

In Version 6 the (precip) calibration standard is the TRMM Combined Instrument (TCI):
- Version 6 PR amounts were considered too low over ocean to be used as a standard
- Choice between TCI and PR will be revisited after the PR Version 7 test months settle down

All instruments are calibrated to TMI with climatological schemes, then use a time/space varying TCI/TMI calibration to approximately calibrate to TCI:
- This scheme accommodates the highly sparse match-ups of TCI with instruments other than TMI
- Climatological calibrations must be recomputed after the Version 7 test months settle down

Following the new PPS standards:
- PPS toolkit differs from the TSDIS toolkit
- Input standard has shifted to <parm>=<value>

The 3B42/43 system will benefit from further "hardening" against accident and circumstance:
- Individual input data sets require quality control to avoid "gotcha's" that we've observed
- Output data sets require quality-control diagnostics to increase the probability that problems will be trapped during production
- System is being given additional, initially empty slots for input data with associated dummy calibration sets so that new satellites can be added without recoding

ADDITIONAL OUTPUT FIELDS

The Version 6 fields were kept to a minimum to conserve space

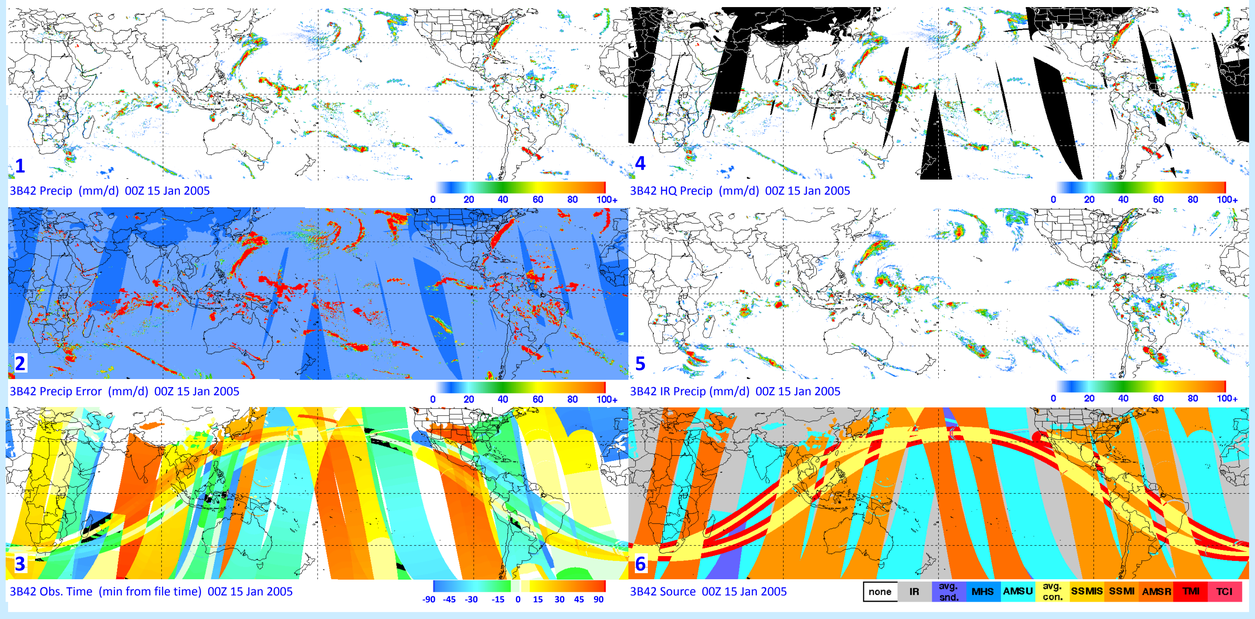
1 Precipitation

2 Precipitation Error

But, both the developers and users really wanted more information

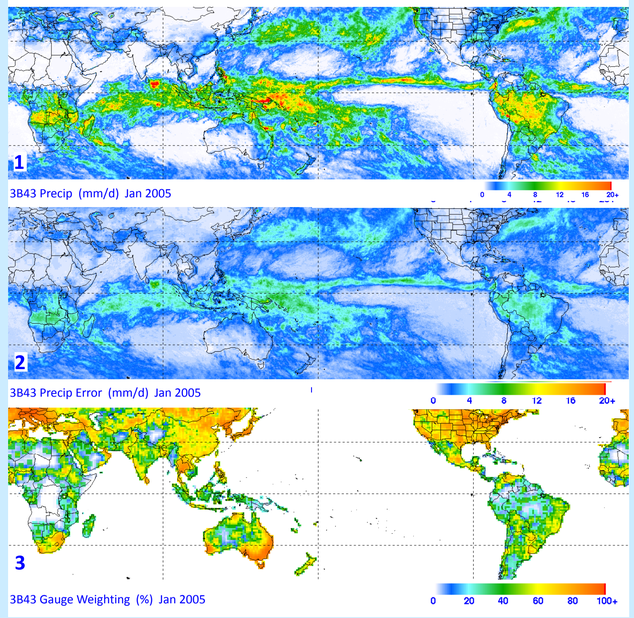
The Version 7 (3-hourly) 3B42 data file includes

1 Precipitation
2 Precipitation Error
3 Satellite Observation Time
4 HQ Precipitation
5 IR Precipitation
6 Sat Precipitation Source



The Version 7 (monthly) 3B43 data file includes

1 Sat-Gauge Precipitation
2 Sat-Gauge Precipitation Error
3 Gauge Relative Weighting



REFRESHING THE SATELLITE CONSTELLATION

This is the golden age of microwave, but it's only useful if the combination products keep up:
- Version 6 was set up with a static selection of satellites ("+")
- Since then, MHS and SSMIS sensors have come online ("x")
- Version 7 will include these sensors
- As noted in "Other Items", below, Version 7 is being built to accept future sensors
- But, new sensors can't be extended back in time without reprocessing