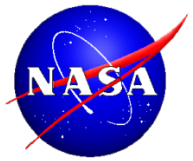

Global Precipitation Measurement (GPM) mission

Precipitation Processing System (PPS)

PMM Science Team Meeting, Nov 2011

PPS Status

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Topics

- TRMM v7 status
- GPM algorithm version 2 delivery
- PPS GPM Status
- GPM file naming convention
- GPM standard products
- PPS user product approach
- Standard format for storage

TRMM V7 Status

- **JPST authorized the start of V7 reprocessing for 1 July 2011**
- **PPS stopped processing at end of June for V6. Waited for the arrival of all required data for June 2011 Level 3**
- **PPS started the reprocessing of L1 – L3 data to V7 on 20 July 2011 and finished the 13+ years on 16 August 2011, ~29.5 days**
- **3B42/43 TMPA products have NOT been reprocessed. Algorithm not yet delivered**
  - Scheduled to arrive ~3 months after start of reprocessing
  - Some initial end to end testing
  - At request of algorithm developers the latency for availability has been increased to 2months after the month being processed
- **Latent Heating products also were to lag reprocessing**
  - PPS received the CSH algorithm and have been testing and working with algorithm developers
  - PPS received information from JAXA that SLH algorithm has been delayed by more than 30 days
  - TRAIN products have been canceled due to TRMM vs GPM priority

TRMM NRT V7 Status

- **All NRT swath algorithm code has been ported to V7**
- **NRT products are parameter subsetted products of full algorithms approved by JPST**
- **Operational AcceptanceTesting began in September 2011**
  - Anonymous ftp using name –trmmreal (rather than anonymous)
  - Password is your email as is the case for anonymous ftp
  - During OAT server is trmmrtV7.pps.eosdis.nasa.gov
- **V7 NRT will become the production version on 1 Dec 2011**
  - At that time the server will be trmmrt.gsfc.nasa.gov
  - V6 and V7 NRT will run in parallel until June 2012 because of file format, metadata and structure name changes
  - V6 server during parallel will be trmmrtV6.gsfc.nasa.gov
  - V6 NRT access will continue exactly as it is now on the new server name
  - V7 directory organization same

GPM Algorithm Deliveries

- **PPS received version 1 algorithms for L1 and L2 products as will as the L3 iMerge product on 30 November 2010**
  - Version 1 was ATBD including algorithm descriptions, ancillary files, output product description, and required inputs
  - Online a pps.gsfc.nasa.gov
- **PPS used the ATBD to create configuration files for the toolkit for each of the products**
  - Products are very large
  - Format for L1 and L2 is stable but certainly changes are expected
  - Additional ISO 9115 metadata my be required
- **File specification for GPM L1 and L2 products are available as pdf document on pps.gsfc.nasa.gov**
- **Version 2 algorithm code is to be delivered to PPS on Nov 30, 2011**
  - All ancillary data use, use toolkit for input and output, all routines must be called, all intermediate files included, for PPS at least 70% of the science processing load (for CPU sizing, cache, etc)
  - Project Science office requirement is that version 2 must deliver the same science capability as V7 TRMM
- **After PPS receives will begin testing and iterating with algorithm team**

PPS GPM Status

- **PPS algorithm status**
  - GMI L1A and B algorithm version one was delivered
  - GMI L1B and GMI L1C synthetic data are available
  - GMI L1B synthetic data reverse engineered to L1A
  - GMI L1C framework and early sensor intercalibration code has been delivered
- **PPS GPM NRT code working and able to generate to L1A**
  - When version 2 algorithms delivered and stabilized PPS will integrate into NRT
  - Need to develop NRT products based on interactions with project science team and algorithm developers
- **PPS code to process the raw data coming from the MOC is working**
  - Integrated with NRT
  - Handling anomalous cases including DPR time issue on mode switching
- **PPS production system B2 ready for algorithm integration and is being used with TRMM v7 production**
  - Needs to populate a GPM specific DB
  - Needs to test with GPM algorithms
- **PPS had a successful Build 3 review (essentially at launch system)**

PPS GPM Status (2)

- **geoTK build 2, version 2 delivered for PPS L1B GMI use and to JAXA for L1B DPR use**
- **TKIO (data product) toolkit delivered to JAXA as well as algorithm development teams-Build 2, version 2**
  - All L1 and L2 formats
  - Initial L3 formats
  - Both C and F90 usable
  - HDF5 enabled
  - TRMM v7 HDF4 is readable
  - Initial file spec: pps.gsfc.nasa.gov
- **Received initial Megha-Tropique L1B format from CNES**
  - Both SAPHIR and MADRAS
  - Currently developing the read routines so we can read the L1B and then write the L1C
  - Developing the code to produce L1C MT data (delivery in 2012)
  - Working on how to get the L1 data in both realtime and production once it becomes available.
- **Beginning study on best avenue to get NPP ATMS data (currently perhaps NOAA best route for realtime)**

GPM File Naming convention

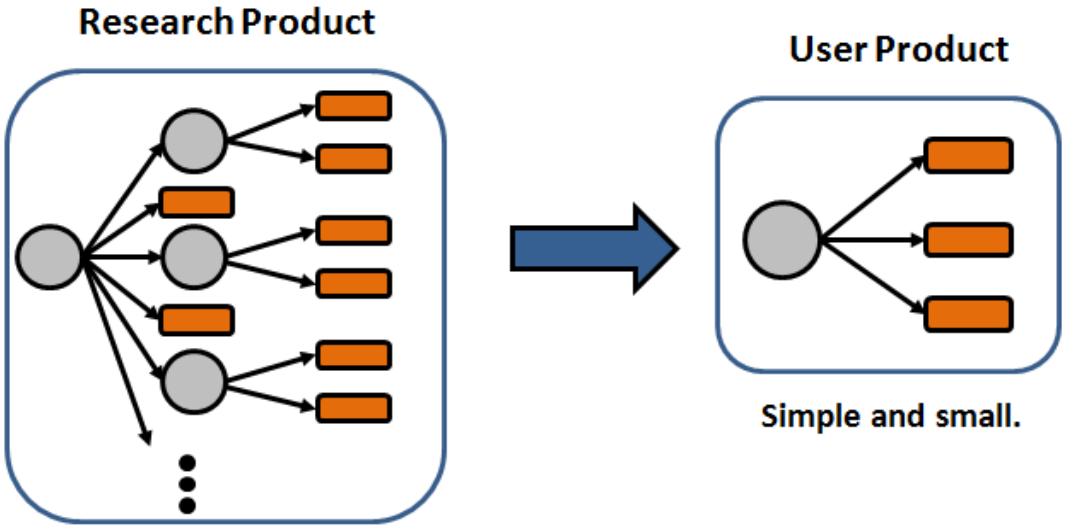
- **Reminder for TRMM v7 there is change**
  - Example: 1B11.20051028.04434.7.HDF
- **Always have the same number of fields for all levels so parsing on '.' would always return 8 fields (some fields have sub separated by '-')**
- **Generic:** dataType.satellite.instrument.algorithmName.startDate-startTime.sequenceIndicator.VdataVersion.extension
  - Sequence for swath is orbit, for monthly MM, for daily day of year DDD, for half hourly accumulation of half hours during the day
- **GPM convention**
  - L1: 1B.CORE.GMI.V11.20140131-235954.00100.01A.HDF5
  - L1C: 1C.F16.SSMIS.XCAL2007.20140101-005934.V01A.HDF5
  - L2: 2A.CORE.GMI.GPROF2014r2.20140131-235954.V01A.HDF5
  - L3: 3A-MO.CORE.GMI.M32A.20141101-000000.11.V01A.HDF5
  - L3: 3A-DAY.CORE.COMB.CMBGr5..20140201-000000.032.V01A.HDF5
  - L3: 3B-HHR.MS.MRG.iMERGEv8.2014113-013000.0090.01A.HDF5
- **All TRMM data will be converted to the new file naming convention (and HDF5) during the beginning of GPM mission and become GPM data.**
- **pps.gsfc.nasa.gov (file naming documentation)**

User Products

Algorithm created Research Products can be:

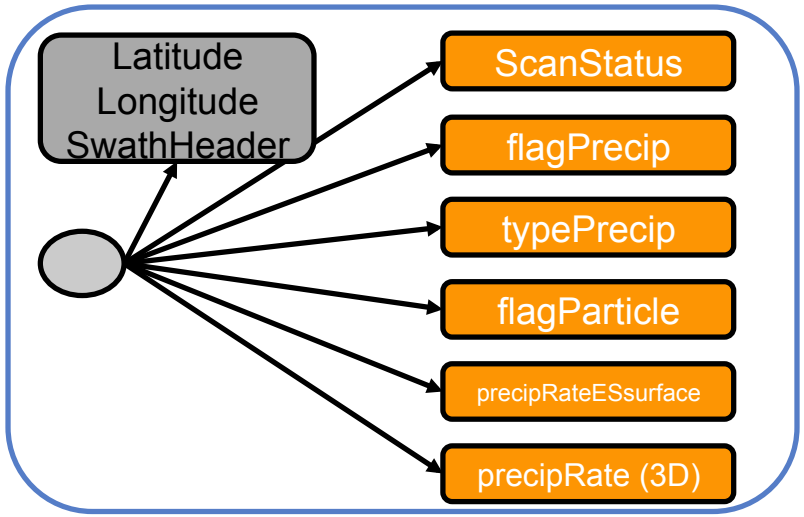
- Big (2-3GB uncompressed per orbit).
- Complicated (many nested parameters including diagnostics).
  - L2 DPR orbital product contains 99 parameters in nested structures.

PPS will routinely extract useful parameters to create simple, reformatted User Products.



PPS will initially produce User Products for L2 **GMI**, **DPR** and **Combined**.
Focused on related surface and vertical precipitation fields.
Sample products at: ftp://pps.gsfc.nasa.gov/pub/GPMsample/User
Feedback welcome: *helpdesk@pps.gsfc.nasa.gov*

User Products-Example



Sample L2 DPR User Product
Ku ifovs only.
Uncompressed sizes.
- Using TRMM data/orbit.
- Research Product ~ 1.6GB
- User Product ~ 200MB

Custom Parameter Subsetting.
Some users will not be satisfied by User Products and do not need full Research Products.
PPS provides Custom Products by Parameter Subsetting through STORM.
Users can select parameters from the Research Products using the STORM interface.
- Not all combinations of parameters will be supported.
- Some parameters are required (time, geolocation).

C and Fortran code interfaces are generated to read Custom Products.
Parameter Subsetting supports Subscriptions for future and reprocessed products.
PPS has Parameter Subsetting available for TRMM V7 data **now**.

GPM Version 1 Algorithm Delivery to PPS

- **HDF5 v1.8 chosen. Written in such a way as to allow NetCDF 4 to read the HDF files**
- **All *at launch* algorithms are due no later than Nov 30 to PPS**
- **Version 1 is a detailed ATBD and teams may ask for running of prototype code**
  - Complete description of approach with all key equations to allow validation of computational performance extrapolated from TRMM
  - Use of parallelization and means by which parallelization is done (to ensure that processors will properly support and schedule parallelized algorithm code)
  - Language to be used. (NB PPS will no longer support F77 but F90 and higher only. F77 becoming problematic in a 64 bit environment)
  - Parameters to be generated including diagnostic parameters. Sufficient detail to create the format and configuration files used by the TKIO toolkit and product format
  - Ancillary data required to allow PPS to begin negotiations to obtain the products in an automated fashion.
  - Intermediate files required and whether for granule run or across granule runs. This is for sizing purposes.
  - ATBD published on PPS home page and used for analysis by review team

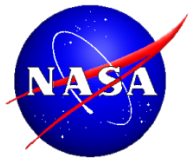
File Format

- **Current view to create a HDF5 in such a way that it is compatible with reading using a netCDF4 (HDF aware build)**
  - We can read our HDF5 files using ncdump
  - We believe there are continuing issues with scale and offset
  - We are currently writing code using netCDF to use that toolkit to read the HDF4 GPM file
  - Just started this activity
- **All files will be internally compressed using gzip**
  - This is very effective compression
  - Users don't have to know it is compressed when using toolkits, or tools like matLab and IDL that also handle transparently
- **Is there a desire that we should put out our files in netCDF4 and switch to it as the base?????**

Compression

- **An algorithm developer has suggested a additional approach that helps with compression**
  - Determine the precision that a field can scientifically justify
  - In floats set all places beyond that to 0
  - Example: Geolocation software generates pixel lat/lon of 137.48370197°E and 36. 39212734°S.
  - but we have only 1km precision so we would round to 137.4840000°E and 36.3920000°S which has 100m resolution.
  - Compressed, this reportedly saves 40% of 1B volumes that generally don't compress but would help with all floats
  - I would recommend doing this, comments???
- **Please send comments and suggests about file format and algorithm compression approach to:**

erich.f.stocker@nasa.gov



Backup Slides

GPM L1 File Size (MB)

TKIO ID	MB	Description
1AGM	58.16	GMI unpacked packet data
1BGMI	90.72	GMI Brightness Temperatures
1BKa	272.03	Ka Power
1BKu	344.47	Ku Power
1CAMSRE	110.76	Common Calibrated Brightness Temperature
1CGMI	52.51	GPM Common Calibrated Brightness Temperature
1CSSMIS	35.68	Common Calibrated Brightness Temperature
1CSSMI	11.91	Common Calibrated Brightness Temperature
1CTMI	27.31	GPM Common Calibrated Brightness Temperature
1CWIND	19.70	Common Calibrated Brightness Temperature
AMSREBASE	122.59	AMSRE base
GMIBASE	107.96	GMI Antenna Temperatures
SSMIBASE	13.27	SSMI base
1AGMI	38.37	GMI unpacked packet data
TMIBASE	26.35	TMI Antenna Temperatures
WINDBASE	53.46	Windsat base

GPM L2/L3 File Size (MB)

TKIO ID	MB	Description
2ADPRENV	2049.69	DPR environment
2ADPR	1928.56	DPR precipitation
2ADPRTMP	4301.40	DPR Temporary
2AGPROFGMI	75.23	Radiometer Profiling
2AKaENV	1244.27	Ka environment
2AKa	970.85	Ka precipitation
2AKaTMP	3896.07	Ka Temporary
2AKuENV	1644.55	Ku environment
2AKu	1254.16	Ku precipitation
2AKuTMP	5146.96	Ku Temporary
2BCMB	2970.48	Level-2 DPR and GMI Combined
3GSMAPH	129.60	GSMaP Hourly
3GSMAPM	116.64	GSMaP Monthly
3IMERGH	181.44	I-MERG 30-minute
3IMERGM	58.32	I-MERG monthly

TRMM V7 File Size (MB)

1B01	145.23	3A11	0.05
1B11	16.97	3A12	81.10
1B21	158.45	3A25	63.57
1C21	158.45	3A26	9.66
2A12	56.14	3B31	80.64
2A21	56.47	3B42	10.94
2A23	16.59	3B43	5.18
2A25	332.95	3G25	86.21
2B31	332.05	3G31	42.94
2H25	120.74	3H25	226.76
2H31	178.76	3H31	41.77

Preliminary GPM Core Algorithm Flow