Global Precipitation Measurement (GPM) mission

Precipitation Processing System (PPS)

NOAA 3rd User Workshop on GPM, April 2013

PPS Status & Products

Erich Franz Stocker

NASA/GSFC Code 610.2

Erich.F.Stocker@nasa.gov

Topics

- **PPS Architecture Overview**
- **PPS Status to Launch**
- **MT status and files**
- **GCOM status and files**
- **GPM Products**
  - production
  - near realtime
- **User products and special services**

PPS Architecture Overview

- **PPS composed of 4 *independent* subsystems/segments**
  - ***Sensor Data Processing Segment (SDPS)*** pre-processes data from GPM core satellite to scans and produces the ephemeris and attitude files for Near-realtime (NRT)
  - ***Near-realtime subsystem***-
    - process GPM core instrument data to L1/L2 swath data
    - process partner radiometer data to level 1C and L2 GPROF
    - Process NRT radiometer retrievals to merged global product
  - ***Production***
    - Produce all standard and NASA specific products (generally within 24hrs of receiving all required input)
    - General distribution to the user community via STORM interface
    - All archiving
    - Special subsetting and user product services
  - ***Algorithm code***
    - L1 GMI delivered by PPS; L1 Ku/Ka products produced and delivered by JAXA
    - L2 code delivered by PMM algorithm development teams
    - L3 code delivered by PMM algorithm development teams
- **All have different software and software architecture approaches and requirements for availability and latency**
- **Communications among three subsystems/segments is via data file transfer only.**

Status to Launch

- **Launch mid-February 2014**
- **PPS took part in GPM project end-to-end test 1, A in January 2014**
  - ETE1A used satellite , TDRSS and White Sands
  - At PPS tested the SDPS and the NRT
  - Tested production in NRT through GMI 1A (HDF5)
  - Transfer to JAXA of the SDPS processed data but no NRT
  - No transfer from JAXA to NRT
- **ETE#1, B is scheduled for April 24, 2013**
  - ETE 1B enhanced algorithm code for L1/L2 delivered March 31, 2013
  - This test will use flatSat (a satellite data simulator) not the satellite itself
  - Test will include processing through L2 combined
  - Interface with JAXA for the Ku/Ka 1B will be part of test
- **Final algorithm code delivered 30 September 2013**
- **PPS Operational Acceptance Testing begins mid-October 2013 and Operational Readiness Review (ORR) in mid November**
- **Project ETE #3 will be during the PPS OAT period. This test will verify the L1/2 latency requirements**

Megha-Tropiques Status

- **An MOU has been signed with CNES and ISRO**
- **SAPHIR data is available from CNES for public distribution but NRT not yet operational**
- **We have received MADRAS data as members of the MT science team**
- **We have been producing both base files and 1C files from the MT SAPHIR and MADRAS L1A1 – v1.05 for the XCAL team**
- **An XCAL meeting will be held in Toulouse France May 23 and 24, 2013**
  - All current sounder product analysis, especially SAPHIR, will be discussed
  - MADRAS imager data analysis will form major part of meeting discussions
  - AMSR2 analysis also presented.
- **MT 1C data will be part of the ETE 1B through ETE 3**
- **XCAL team now working on the required intercalibration tables to be used at launch**

GCOM W1 Status

- **Initially received early AMSR2 data for analysis at version 1.0 which then went public through JAXA only**
- **JAXA EORC and GCOM representatives attended XCAL meeting in Orlando in February to report on their analysis results and hear the XCAL analysis**
- **JAXA reprocessed all AMSR2 data to v1.1**
- **PPS has downloaded all v1.1 data from GCOM-W1**
- **PPS currently producing AMSR2 base and 1C files for XCAL use**
  - 1C files do not include 6 or 7GHz channels as not precip channels.
  - 1B distributed ONLY by JAXA
- **Reports by XCAL members of the v1.1 data will be part of the Toulouse meeting in May 2013**
- **XCAL is working on the at-launch intercalibration coefficients for AMSR2**

GCOM Status

- **NASA/PPS agreements with JAXA to receive GCOM-W AMSR2 data in both realtime and "climate" version**
- **Initially the data will be retrieved from the GCOM system until the JAXA GPM MOSS is online**
- **We have NO permission to redistribute to partners or affiliates**
- **We will produce a 1C product in both NRT and production and this will be generally delivered but will NOT be reversible to 1B**
- **We will product a GPROF retrieval in both NRT and production**
- **Current GCOM data policy allows users to register with GCOM project to receive data in both realtime and "climate" version.**
  - If an agreement is in place between a GPM partner or affliate then they have approval to retrieve the product from Japan
  - If the organization has been network connectivity to PPS then it might be possible to get permission from GCOM that a GCOM approved

GPM Production Products

Toolkit ID	Size in MB	Description
1AGMI	58.16	GMI unpacked counts in HDF5
1BGMI	90.72	GMI Brightness Temperatures
1CGMI	52.51	GPM Common Calibrated Brightness Temperature
GMIBASE	107.96	GMI Antenna Temperatures (not distributed)
1BKa	272.03	Ka Power
1BKu	344.47	Ku Power
2AGPROFGMI	75.23	Radiometer Precipitation/profiling
2BCMB	2970.48	L-2 Combined DPR and GMI
2ADP	1928.56	DPR precipitation
2AKa	970.85	Ka precipitation
2AKu	1254.16	Ku precipitation
3IMERGH	181.44	I-MERG 30-minute (.1 x .1 grid)
3IMERGM	58.32	I-MERGE monthly (.1 x .1 grid)

GPM NRT Products

Toolkit ID	Size in MB	Description
1CGMI	40	GPM Common Calibrated Brightness Temperature
2AGPROFGMI	50	Radiometer Precipitation/profiling-- All radiometers (imager and sounder)
2BCMB	800	Level-2 DPR and GMI Combined
3IMERGH	181.44	I-MERG 30-minute (.1 x .1 grid)

- 1C for each contributing radiometer (size depending upon instrument)

In NRT contributing radiometers will not be reorbitized

- GPROF for each contributing radiometer (size depending upon instrument)

GPM Product Formats

- **All products will be produced in HDF5 (1.8 or later)**
  - Written in compatible fashion so that a netCDF4 (compiled HDF aware) toolkit will be able to read the HDF5
  - Written using internal HDF5 gzip compression
  - Also exploring additional 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
- **Products will be orderable in other formats (under investigation)**
  - BUFR (for L3)
  - GRIB2 (for L3)
  - Binary with parameter subsetting

GPM File Naming convention

- **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.GPM.GMI.V11.20140131-S235954-E003312.00100.01A.HDF5
  - L1C: 1C.F16.SSMIS.XCAL2007.20140101-S005934-E012432.V01A.HDF5
  - L2: 2A.GPM.GMI.GPROF2014b2.20140131-S235954-E003312.V01A.HDF5
  - L3: 3A-MO.GPM.GMI.M32A.20141101.11.V01A.HDF5
  - L3: 3B-DAY.GPM.GMIDPR.CMBGr5.20140201.032.V01A.HDF5
  - L3: 3B-HHR.MS.MRG.iMERGEv8.2014113.0090.01A.HDF5
- **All TRMM data will be converted to the new file naming convention (and HDF5) sometime after GPM core launch and become GPM data.**
- **pps.gsfc.nasa.gov (file naming documentation)**

NRT Requirements/Latency

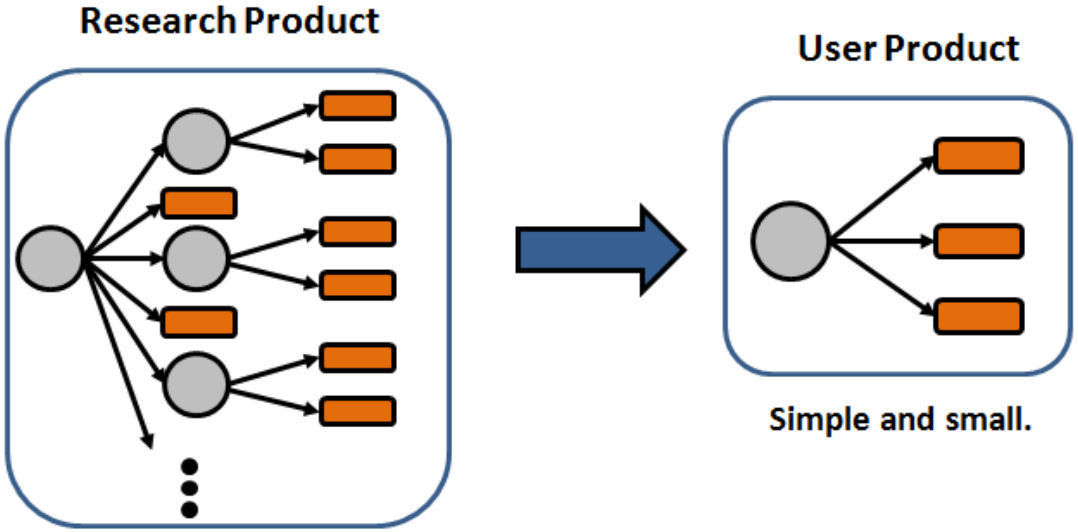
- **The Sensor Data Processing Segment (SDPS) that receives data from the MOC must have a 99.8% availability**
  - GMI data received in 5 min files in continuous MA stream from TDRSS
  - DPR data received in 5 min files received on SA stream from TDRSS
  - SDPS must build scans from the segments in the files
- **The NRT subsystem must have a 99.8% availability**
  - Have GMI 1C products available within 1 hour of data collection 90% of time (5 minute granule
  - Have GMI GPROF retrieval available within 1 hour and 10 minutes of data collection 90% of time (5 minute granules)
  - Have Combined (radar/radiometer) product available within 120 minutes 90% of the time (TDRSS contact granule ~93minutes)
  - Contributing radiometer 1C product latency is dependent upon the provider but all aiming at no more than 3 hours
  - Contributing radiometer GPROF retrieval latency is 1C latency plus 10 minutes
- **Dedicated network connection between NASA and JAXA at 20Mbps with 99.7% availability**

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*