NASA GPM Program Status

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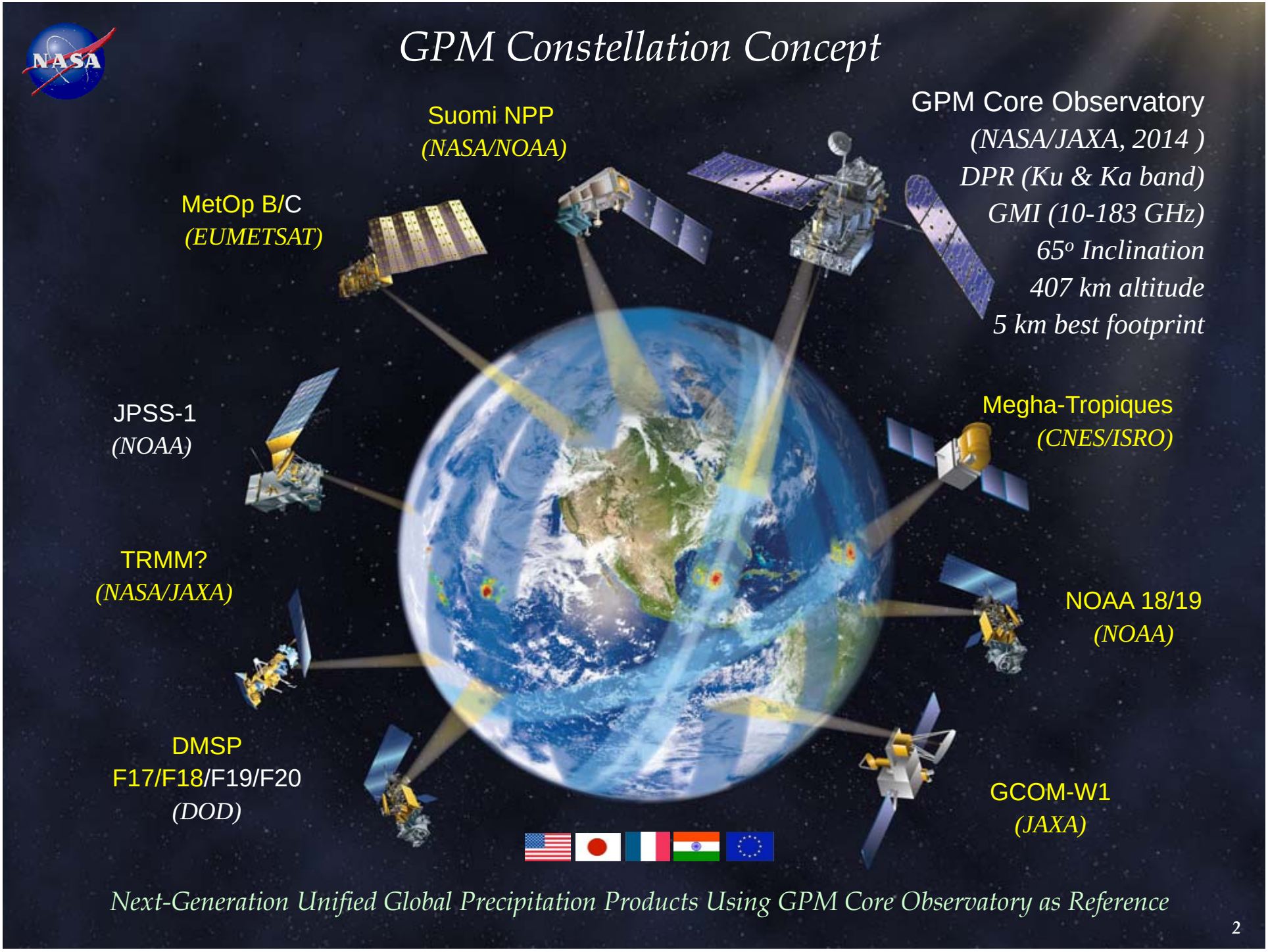
NOAA GPM User Workshop

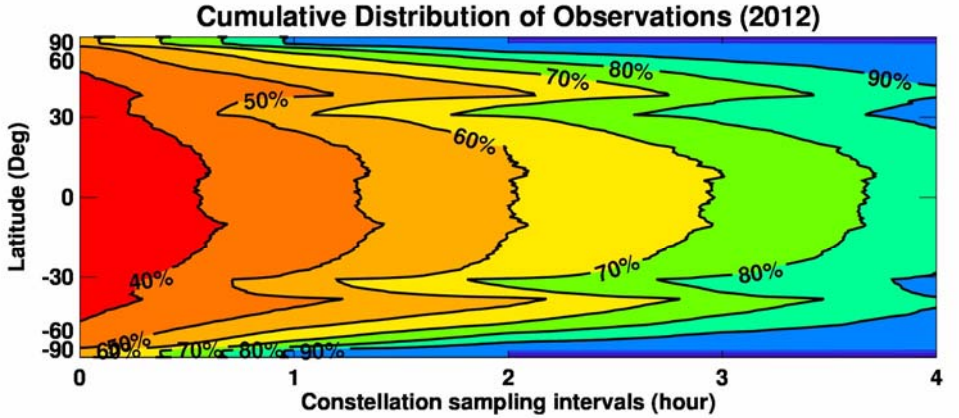
April 2-4, 2013

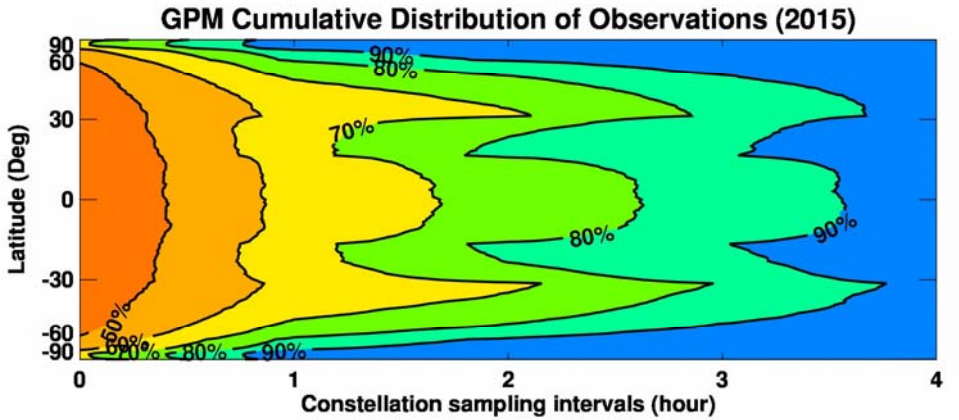
GPM Constellation Concept

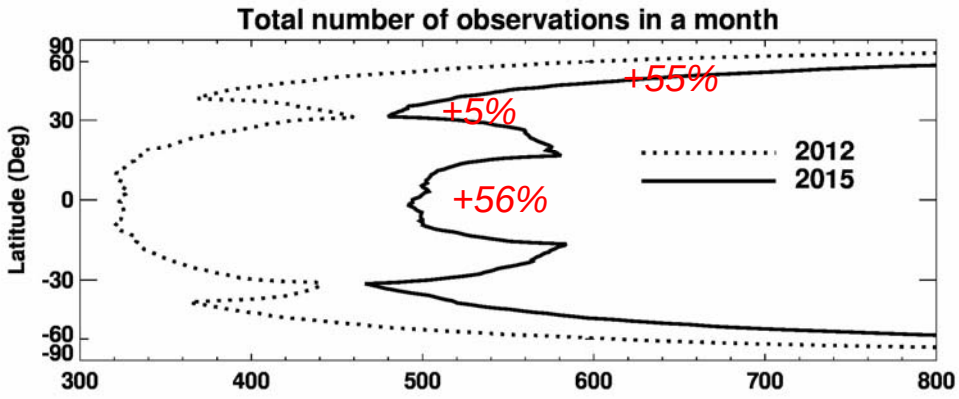


Next-Generation Unified Global Precipitation Products Using GPM Core Observatory as Reference

GPM Constellation Sampling Relative to Current Capability







Current (2012)

- Less than 50% of observations are less than 1 hr apart
- 70-80% are less than 3 hr apart

GPM (2015)

- More than 60% of observations less than 1 hr apart
- 80-90% are less than 3 hrs apart at all latitudes

- Greater number of observations relative to 2012

2012: TRMM, F16, F17, F18, NOAA-18, NOAA-19, MetOp-A

2015: GPM Core, F17, F18, F19, MT, GCOM-W1, NPP, NOAA-18, NOAA-19, MetOp-B

Science Team Members and Affiliates

Key Milestones for Science

- New US Science team selected Dec 2012, 56 Principal Investigators
  - Science team meeting, Annapolis, MD, March 18-21.
- International Partners: 22 active PMM projects in 14 countries

- GPM algorithm delivery on schedule for early 2014 launch:
  - At-launch codes delivered in Nov. 2012 for Operational Acceptance Testing (OAT) in 2013. Two additional deliveries for PPS End to End (ETE) Testing

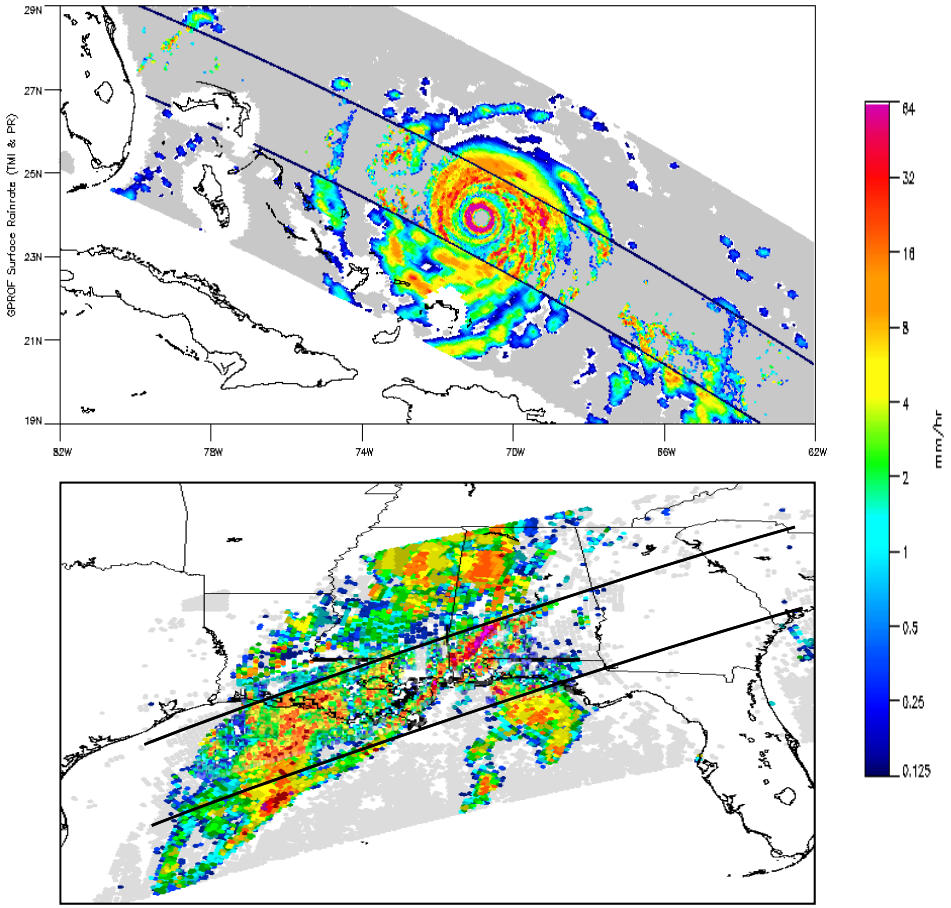
- Next Intersatellite Calibration WG meeting to be hosted by CNES/CNRS:
  - May 23-24, 2013, Toulouse, France.
- 6th International Workshop for GPM Ground Validation to be hosted by CNR/ISAC:
  - November 4-8, 2013, Rome, Italy.

Prototype GPM Radar-Enhanced Radiometer Retrieval

- Unified radiometer rainfall retrieval using a common *a priori* hydrometeor database consistent with combined DPR+GMI measurements.
- Proof-of-concept demonstration using TRMM PR and TMI:

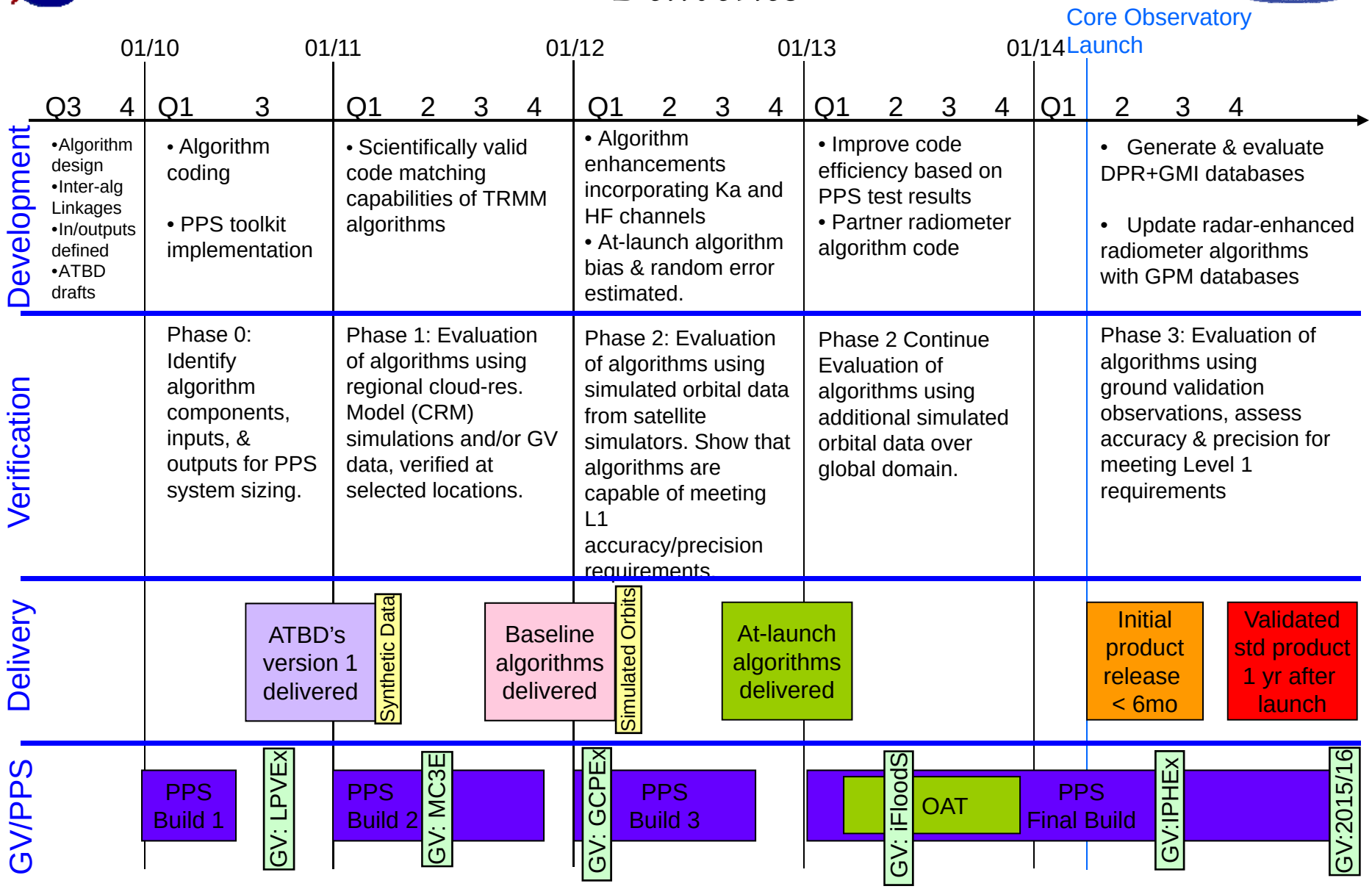
  - Outer Swath: TMI rainfall retrieval using an *a-priori* cloud database derived from PR reflectivity and TMI radiances within the inner swath.

  - Inner Swath: PR rainfall retrieval (at different spatial resolution)



Kummerow et al.

Integrated Schedule of PMM Science Development & Deliveries



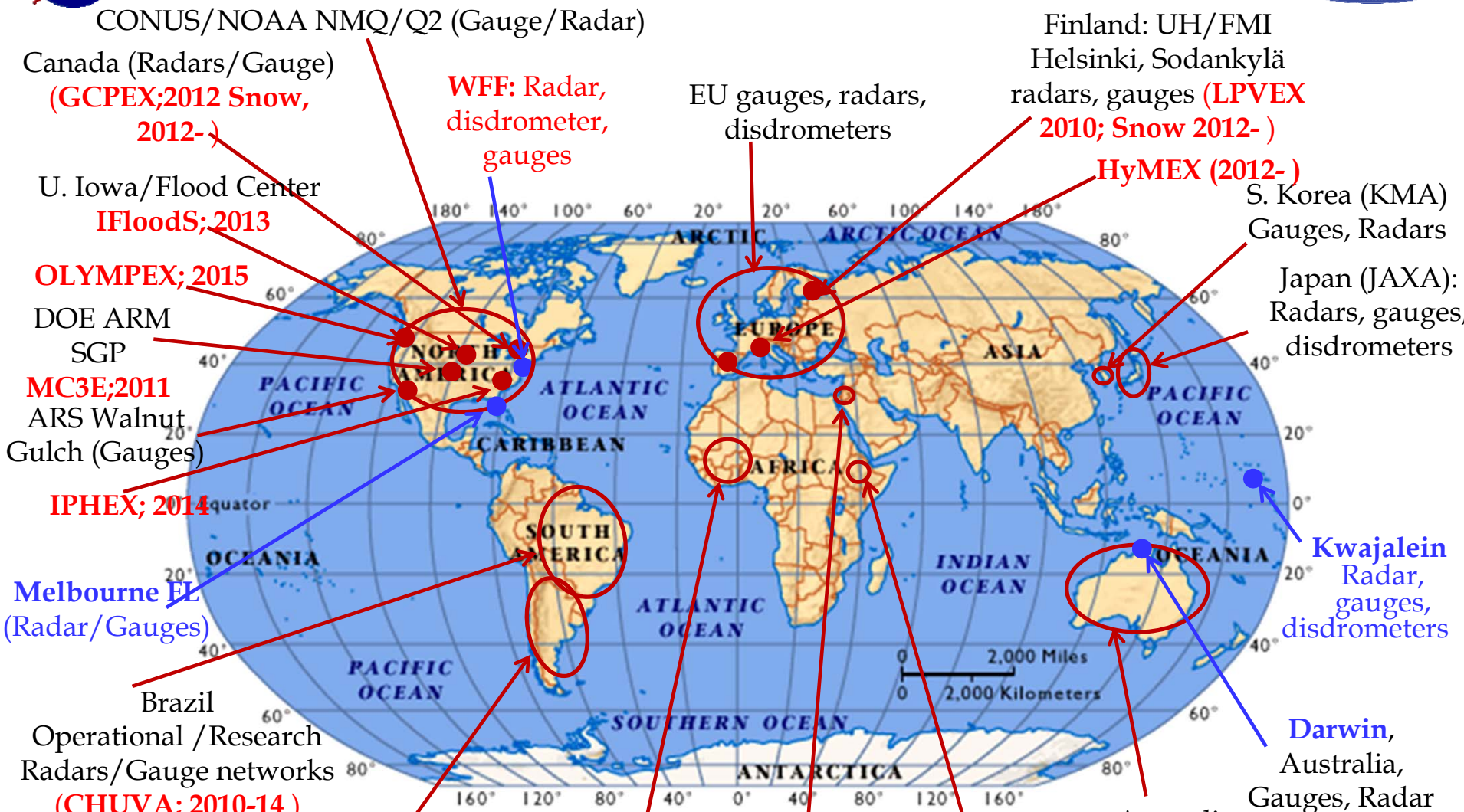
Key Milestones of GV Status

- Completed six successful campaigns for physical validation:
  - 2 major GPM field campaigns: MC3E (Apr-Jun 2011) & GCPEx (Jan-Feb 2012).
  - 2 leveraged partner campaigns: C3VP (Jan 2007) & LPVEx (Sep-Oct 2010).
  - Contributions to 2 partner efforts: Pre-CHUVA (Mar 2010) & HyMeX (Sep-Oct 2012).

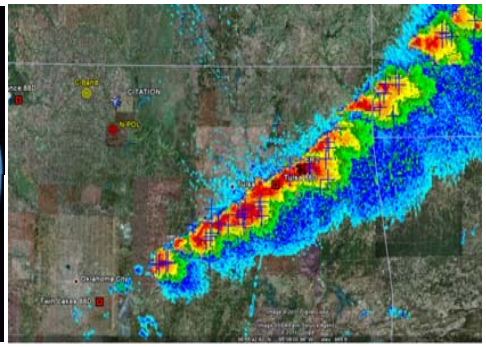
  ** Campaign data being used by algorithm developer and sat-simulator modelers.*
- Upcoming integrated hydrological validation campaigns:
  - Iowa Flood Studies (IFloodS): Apr-Jun 2013
  - Integrated Precipitation and Hydrology Experiment (IPHEX): May-Jun 2014
- Direct validation:
  - Established a Precipitation GV Research Facility at WFF, now fully operational.
  - Operational Validation Network (VN) providing ground radar and coincident satellite overpass data over CONUS. The VN software being used by international partners.
  - Automated NMQ rain rate data stream for L2/L3 product validation in testing phase.

  ** NMQ database being used for radiometer algorithm development over land.*
- New international collaborations:
  - New agreement with Environment Canada to operate GV instruments at 3 Canadian WMO Solid Precipitation Inter-comparison Experiment (SPICE) sites.
  - New agreement with the Finnish Meteorological Institute to operate GV instruments at the Sodankyla Snowfall Observatory in northern Finland (~70N).
  - Implementation agreement with S. Korea on GV data exchange.
  - Pending collaboration with EUMETSAT H-SAF.

GPM Ground Validation: A Global Effort



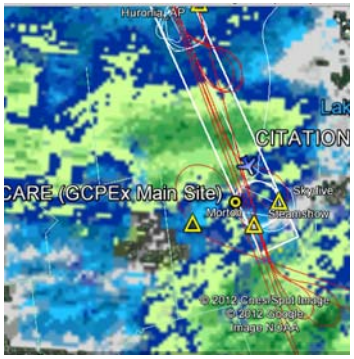
NASA-DOE MC3E (April 22 – June 6, 2011)


- 70 ER-2 and 45 Citation flight hours including 8 ER-2/Citation coordinated missions
- 3 ER-2 emissivity missions
- Citation microphysics and cloud missions
- Continuous sampling by 5-7 ground radars
- Launch of ~1200 radiosondes

NASA-EC GCPEx (January 17 – February 28, 2012)

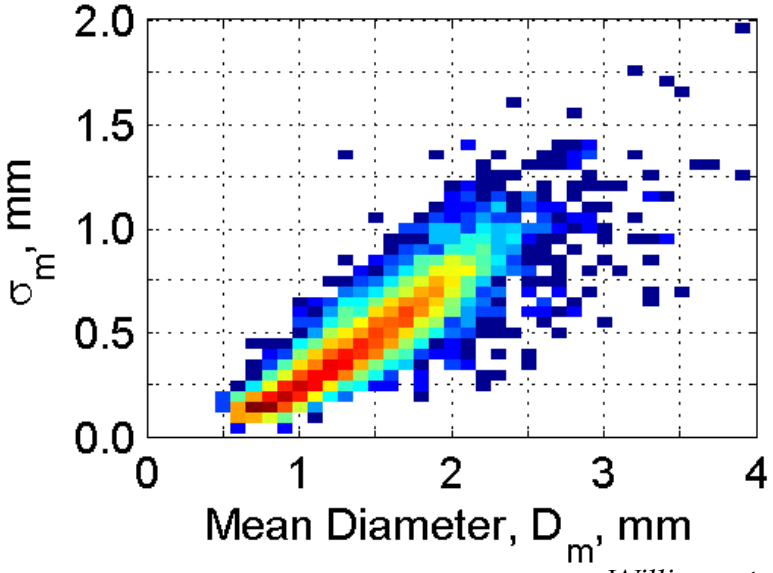




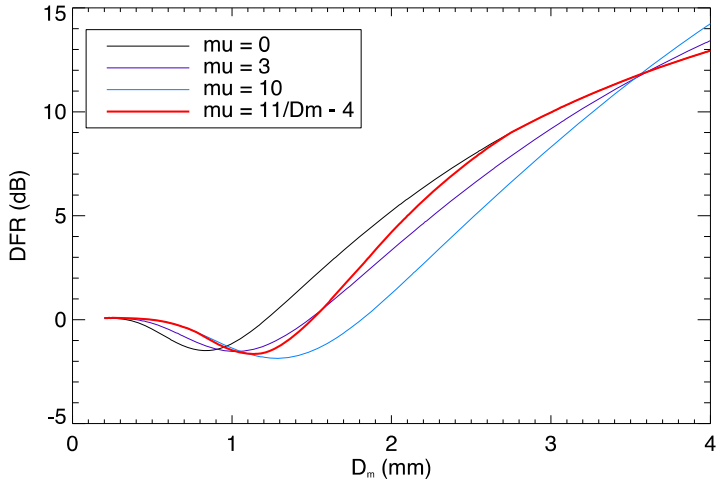
- 80 ER-2, 40 Citation, 20 C580 flight hours with 3 triple aircraft missions
- 2 DC-8 emissivity missions
- Citation and C580 microphysics and cloud missions
- Continuous sampling by 4 ground radars (W, Ka/Ku, X, C-Band)
- 25 Events sampled

Refining Algorithm Assumptions Using GV Data

Constrain DSD parameters using disdrometer measurements



Williams et al.



J. Munchak

- The gamma distribution, used to represent the rain DSD, has three free parameters:
  - Concentration (N_0 or N_w)
  - Characteristic size (D_0 or D_m)
  - Spread (μ or σ_m)
- These parameters, as measured by disdrometer, are not statistically independent (orthogonal)
- Dual-frequency radar can only solve for two parameters at each range gate
- Relationships between parameters can be used to constrain the dual-frequency radar solution (better than assuming μ=constant)

Use GV data to refine scattering tables for improved precipitation retrieval

Education & Public Outreach Highlights

- Education:

  - Master Teachers Program to develop lesson plans for Middle School science classrooms focusing on GPM science themes.

  - Informal outdoor education by teachers in the Outdoor Environmental Education Program in Montgomery County.

  - Beta testing a new Student Ambassadors program for colleges students to develop materials, games, and hands-on activities to be used for workshops, conferences, and classroom visits.

- Outreach:

  - New GPM education website at http://pmm.nasa.gov/education

  - Social media: Twitter account @NASA_Rain and Facebook page @NASA.Rain

  - Contests: Completed 2 photo contests on "Extreme Weather" and "Let It Snow". "GPM Anime Character Challenge" contest underway for students (age 13+) and adults to develop anime character based on GPM science themes.

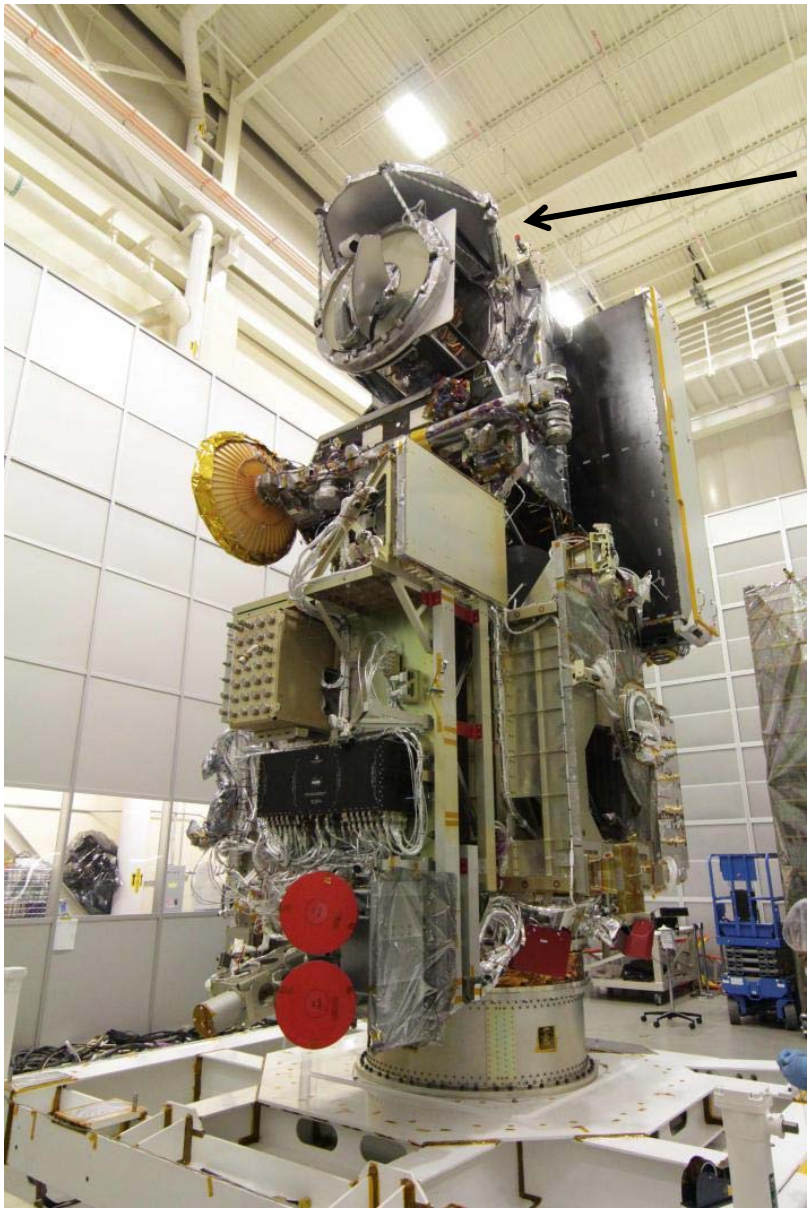
  - GPM Science On a Sphere (SOS) entitled "WATER FALLS" to be premiered in Oct. 2013.

GPM Core Observatory Spacecraft Key Milestones

- ***Mission Operations Review completed August 2012***
- ***Core Observatory Pre-Environmental Comprehensive Performance Test completed October 2012***
- ***Core Observatory Pre-Environmental Review completed October 2012***
- ***Thermal Vacuum Testing completed Jan 2013***

- ***Complete Environmental Test Program: June 2013***
- ***Complete Pre-Ship testing and operations: September 2013***
- ***Ship GPM Core Observatory to Tanegashima, Japan: October 2013***
- ***Launch: Early 2014***

Core Observatory Integration & Testing at NASA/GSFC



GPM Engineering Team at NASA/GSFC

Summary

- GPM Core Observatory status:
  - Observatory integration and test is progressing on schedule
  - Launch Readiness Date: Early 2014
- GPM Science status:
  - GPM at-launch algorithm delivery on schedule
  - NASA conducting joint field campaigns with international and domestic partners supporting pre-launch algorithm development and post-launch product evaluation
  - NASA Precipitation Science Team has 56 new US Principal Investigators
  - NASA Precipitation Science Team currently has 22 International Principal Investigators from 14 nations
  - CNR/ISAC of Italy will host the 6th International GPM GV Workshop in Rome, Nov 4-8, 2013.

Website: gpm.nasa.gov, Twitter account: @NASA_Rain
Facebook page: @NASA.Rain