

# Precipitation Constellation (PC)

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# Progress since 22<sup>nd</sup> Plenary

## ✓ **Meetings/Workshops held**

- Precipitation and All-Weather Temperature and Humidity (PATH) Mission Town Hall Meeting, AGU Fall Meeting, December 18, 2008, San Francisco, CA, USA (NASA)
- JAXA Precipitation Measuring Missions Science Team Meeting, January 26-30, 2009, Tokyo, Japan, (JAXA)

## ✓ **CEOS SIT Chair Tag Up, 26 January 2009**

- Provided PC status to SIT Chair

## ✓ **2<sup>nd</sup> CEOS-GEO Remapping Workshop, 27-29 January 2009**

- Six new/extended PC CEOS Action Questionnaires submitted

## ✓ **Supplied GPM Ground Validation Network (Version 1) software to Institute of Environmental Sciences (ICAM), University of Castilla-La Mancha (UCLM), Toledo, Spain (Dr. Francisco Tapiador)**

- For evaluation and use

## ✓ **Plans and reports prepared**

- CEOS PC 2008 Final Report (draft)
- CEOS PC 2009 Work Plan (draft)

# Progress since 22<sup>nd</sup> Plenary (cont.)

- ✓ **Moving GPM from formulation to implementation phase at NASA and JAXA**
  - GPM DPR (JAXA) PDR (1Q2008) **COMPLETED**
  - GPM DPR (JAXA) Delta PDR (2Q2008) **COMPLETED**
  - GPM Mission (NASA) PDR (4Q2008) **COMPLETED**
  - GPM Mission (NASA) KDP-C (2Q2009)
  - GPM GMI (NASA) CDR (2Q2009)
  - GPM DPR (JAXA) CDR (3Q2009)
  - GPM Mission (NASA) CDR (4Q2009)
  
- ✓ **Meetings/Workshops in planning**
  - International Conference on Megha-Tropiques Science and Applications, March 23-25, 2009, Bangalore, India (ISRO, CNES)
  - X-Calibration Working Group (WG) (in coordination with WMO CGMS/GSICS), May 2009, Ann Arbor, MI, USA
  - 8th GPM International Planning Workshop, June 16-18, 2009, Paris, France
    - Hosted by CNES and CNRS
    - Will highlight upcoming Megha-Tropiques launch
  - U.S.–Japan PC Study Team Meeting, June 19, 2009, Paris, France
    - Coordination meeting for 2009 PC activities
  - 3rd CEOS Precipitation Constellation Workshop, October 2009, Salt Lake City, UT, USA
  - Precipitation Measuring Missions Science Team, October 2009, Salt Lake City, UT, USA (NASA)
  - 2nd Joint Precipitation Science Team Meeting, October 2009, Salt Lake City, UT, USA (NASA, JAXA)
  
- ✓ **2008 CEOS-GEO Actions**
  - All 4 CEOS Category-1 Actions **COMPLETED**
  - 4 of 6 CEOS Category-2 Actions **COMPLETED**
    - Uncompleted actions converted to 2009 actions
  - 1 of 1 CEOS Category-4 Actions **COMPLETED**

# SIT and GEO-Related Activities

- ✓ **At CEOS SIT Chair Tag-Up reviewed PC status, PC process within CEOS and GEO, and GEO Task AR-09-02a – Virtual Constellations: Draft Task Sheet**
  
- ✓ **Six Questionnaire Inputs submitted for 2<sup>nd</sup> CEOS-GEO Remapping Workshop resulting in six 2009 CEOS-GEO Actions**
  - AR-09-02a: Virtual Constellations - 3
  - AR-09-02c: Global Observing System (GOS) - 2
  - CL-06-01c: Key Climate Data from Satellite Systems - 1
  
- ✓ **Two designated CEOS Category-1 Actions of which one is COMPLETED**
  - AR-09-02a\_20, AR-09-03d\_9
  
- ✓ **Four designated CEOS Category-2 Actions**
  - AR-09-02a\_10, AR-09-02a\_25, AR-09-03d\_8, CL-06-01c\_22

# 2009 Candidate CEOS “Threads” for GEOSS-Related Gap Assessments

- ✓ **Thread #3: Water**
- ✓ **General: Is the global water cycle accelerating and what parameters are most significant?**

*The Precipitation Constellation (PC) provides critical observational data pertinent to increasing our understanding of how global precipitation, evaporation, and the cycling of water are changing.*

*In the GPM Era, the PC’s 3 hour temporal resolution global precipitation measurements will enable further insight into global and regional scale water cycle processes and their interaction with climate variability, hydrology, hydrometeorology, and the marine boundary layer.*

***Several PC 2009 CEOS-GEO Actions directly support this thread:  
e.g. AR-09-02a\_10 , AR-09-02a\_25, and AR-09-03d\_9***

## Specific Agency Requests

- NRSCC/NSMC to identify PC POC and make available to the PC radiometer data from the recently launched FY-3 MWRI and MWHS imager and sounders
  - *Addressed in SIT 22-8 Action – No change in status*
  
- ROSHYDROMET to identify PC POC and make available to the PC radiometric data from the MTVZA sounder/imagers
  - *Addressed in SIT 22-7 Action – No change in status*
  
- CNES/ISRO to confirm approach to obtain capability to acquire Megha-Tropiques data in near-real time
  - *Additional ground station at Kourou*
  - *Existing ground stations in Kourou and South Africa*

# Backup

## Goal of the PC

*To establish an international framework to guide, facilitate, and coordinate the continued advancements of multi-satellite global precipitation missions*

- 1) To provide a framework for implementation and monitoring of GEO task AR-06-10

*Advocate and facilitate the timely implementation of the Global Precipitation Measurement (GPM) mission and encourage more nations to contribute to the GPM constellation*

- 2) To sustain and enhance an accurate and timely global precipitation data record including a Fundamental Climate Data Record essential for understanding the integrated weather/climate/ecological system, managing freshwater resources, and monitoring and predicting high-impact natural hazard events.

*This data record should be fit for the purpose specified by GCOS for the monitoring of Precipitation as an essential climate variable (ECV) (as defined in the recent GCOS document 'Systematic Observation Requirements for Satellite-based Products for Climate')*



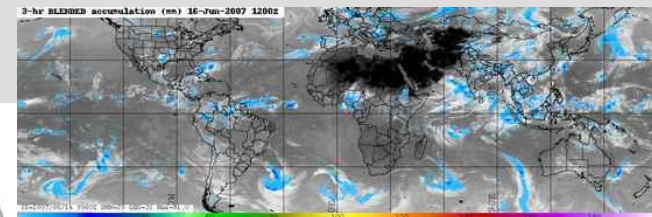
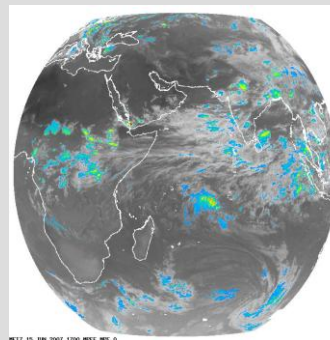
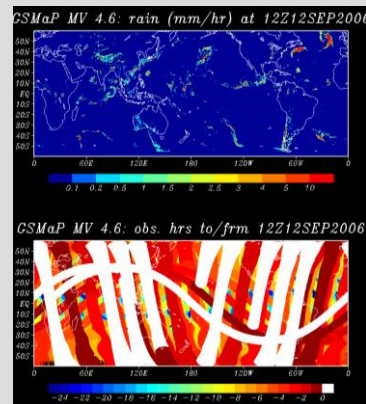
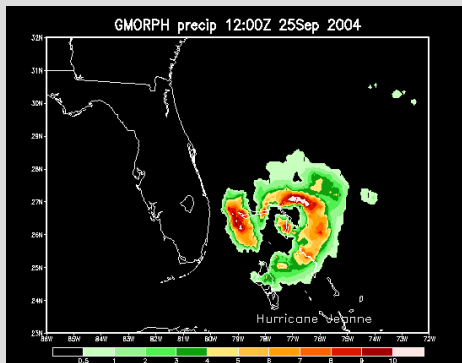
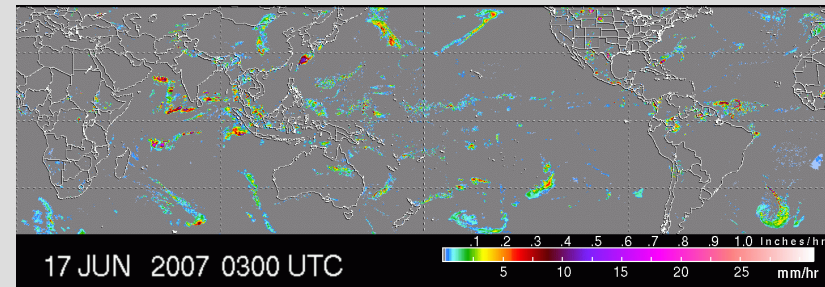
# Implementation

- The implementation of CEOS PC is in four phases

year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
phase	study phase	GPM preparatory phase					GPM phase					post -GPM phase	
							<div style="border: 1px dashed black; padding: 10px; text-align: center;">                     GPM                 </div>						

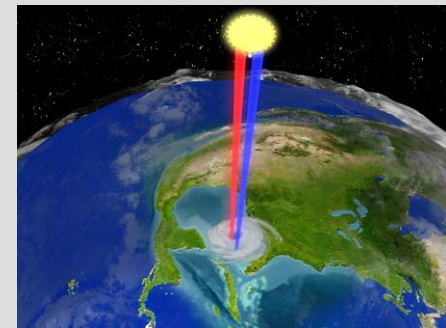
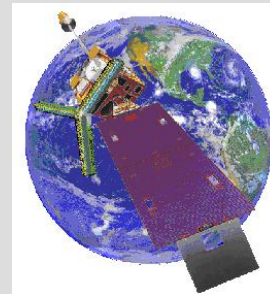
# Phase Descriptions

- Objectives are articulated for four phases
  - Study Phase (2007)
    - Study key items which should be achieved to formulate the CEOS PC, and produce the initial Implementation Plan
    - Identify the key points of agreement for space agency co-operation in order to meet the needs of both the data producer and user communities
    - Study the existing multi-sensor activities undertaken by PC team members
      - NASA TRMM 3B42 standard product
      - JAXA GSMaP prototype product
      - NOAA CMORPH/QMORPH products
      - NRL products
      - EUMETSAT MPE product (TBC)



## Phase Descriptions (cont.)

- GPM preparatory phase (2008-2012)
  - Comparison of different methods of inter-calibration for generating uniform precipitation estimates from diverse types of precipitation sensors
  - Evaluation of different multi-sensor precipitation products
  - The prototyping of uses of merged data products from multiple sensors as well as evaluation of tools to support such use
  - Establishing the standard merged precipitation products desired
  
- GPM phase (2013-2017)
  - Launch and operation of GPM, the first constellation-focused mission that will improve precipitation estimates through extensive intercalibration and the use of a reference standard
  
- Post-GPM phase (after 2017)
  - Beyond timeframe of GEOSS 10-Year Implementation Plan
  - Activities during this phase will not be specified clearly in an early stage
  - Lessons learned from GPM and other PC activities will serve to guide the planning and further evolution of CEOS PC



# Participation

- **CEOS SIT Liaison:**

- USA - NOAA: Mary Kicza, [Mary.Kicza@noaa.gov](mailto:Mary.Kicza@noaa.gov)

- **Study Lead Agencies:**

- Japan – JAXA: Riko Oki, [oki.riko@jaxa.jp](mailto:oki.riko@jaxa.jp) & USA – NASA: Steven Neeck, [steven.neeck@nasa.gov](mailto:steven.neeck@nasa.gov)

- **Space Agency Participants:**

- France - CNES: Didier Renaut, [didier.renaut@cnes.fr](mailto:didier.renaut@cnes.fr)
- India - ISRO: contacted
- Brazil - INPE: Carlos Frederico Angelis, [angelis@cptec.inpe.br](mailto:angelis@cptec.inpe.br)
- Europe - ESA: Einar-Arland Herland, [einar-arland.herland@esa.int](mailto:einar-arland.herland@esa.int)
- China - CAST/NRSCC: contacted
- Russia – ROSHYDROMET: contacted
- USA - NOAA: Ralph Ferraro, [ralph.r.ferraro@noaa.gov](mailto:ralph.r.ferraro@noaa.gov)
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- Germany - DLR: Martin Hagen, [martin.hagen@dlr.de](mailto:martin.hagen@dlr.de)
- Canada - Canadian Space Agency: David Kendall, [Dave.Kendall@space.gc.ca](mailto:Dave.Kendall@space.gc.ca)

## Participation (cont.)

- **User Community Representatives:**
  - CGMS-IPWG: Ralph Ferraro, [ralph.r.ferraro@noaa.gov](mailto:ralph.r.ferraro@noaa.gov)
  - GEWEX: Chris Kummerow, [kummerow@atmos.colostate.edu](mailto:kummerow@atmos.colostate.edu)
  - WCRP/IGWCO: Rick Lawford, [lawford@umbc.edu](mailto:lawford@umbc.edu)
  - GCOS: Paul Mason, [p.j.mason@reading.ac.uk](mailto:p.j.mason@reading.ac.uk)
  - Peter Bauer, [Peter.Bauer@ecmwf.int](mailto:Peter.Bauer@ecmwf.int)
  - Phil Arkin, [parkin@essic.umd.edu](mailto:parkin@essic.umd.edu)

## U.S. Study Team

- Steven Neeck/NASA HQ
- Ramesh Kakar/NASA HQ
- Arthur Hou/NASA GSFC
- Bob Adler/ UMBC
- Erich Stocker/NASA GSFC (SEO POC)
- Scott Braun/NASA GSFC (Visualization POC)
- Ralph Ferraro/NOAA
- Joe Turk/NRL
- Chris Kummerow/Colorado State University

## Japan Study Team

- Riko Oki, JAXA
- Masahiro Kojima, JAXA
- Kinji Furukawa, JAXA (SEO POC)
- Keizo Nakagawa, JAXA
- Chu Ishida, JAXA
- Misako Kachi, JAXA (Visualization POC)
- Toshiaki Takeshima, JAXA
- Kengo Aizawa, JAXA
- Keiji Imaoka, JAXA
- Kazuo Umezawa, JAXA
- Kenji Nakamura, Nagoya University
- Toshio Iguchi, NICT
- Ken'ichi Okamoto, Osaka Prefecture University
- Toshio Koike, University of Tokyo
- Jun Matsumoto, Tokyo Metropolitan University
- Kazuhiko Fukami Public Works Research Institute
- Yoshiaki Takeuchi, Japan Meteorological Agency
- Yoshiyuki Chihara, Ministry of Education, Culture, Sports, Science and Technology

## Requested SIT and CEOS Support

1. To urge ISRO/CNES to acquire the capability to make Megha Tropiques data available in real-time, which is important for the CEOS constellation to meet the needs of the application communities such as NWP and hydrological prediction. The SIT should assist in locating a ground station in the Southern Hemisphere to enable ISRO/CNES to collect data more than three times a day.
2. To urge Russia to make available to the PC the radiometric measurements from the ROSHYDROMET MTVZA sounder/imagers.
3. To urge China to make available to the PC the radiometer measurements from the FY-3 MWRI and MWHS imager and sounders.
4. To urge ESA and JAXA to implement a high-sensitivity light and solid precipitation measurement capability in EarthCARE.
5. To urge NASA and JAXA to commit resources for the timely implementation of the Global Precipitation Measurement (GPM) mission and encourage more space agencies to contribute to the GPM constellation.
6. To take the lead to convince all PC contributors to adopt an open data sharing philosophy through an explicit agreement that all data should be freely and openly available to all requestors.
7. To adopt policies and approaches that recognize the unique status of the individual prototype constellations in different stages of development and their needs to be engineered differently.



## Action: AR-09-02a\_20 Description

Status: **OPEN**

Action: AR-09-02a\_20

Category #: 1

Primary SBA Area: Transverse

NASA Point of Contact: Steven Neeck

Due Date: 1/6/2009

Participating Organizations: NASA, JAXA, CNES, ISRO, INPE, ESA, CAST/NRSCC, NOAA, NRL, EUMETSAT, DLR, CSA, Universities from the U.S. and Asia (Korea)

Participating CEOS groups: PC, WGCV (invited)

### **Action Description**

- Improve PC radiometer intercalibration through new methodologies developed by the Precipitation Measurement Missions (PMM) Science Team intercalibration working group in coordination with the CGMS/GSICS.
  - Implement improved correction algorithm developed in initial phase of the first intercalibration study (see DA-07-03\_1) for TRMM Level 1B brightness temperature product (May 30, 2009)

## Action: AR-09-02a\_20 Status

- Precipitation Measurement Missions (PMM) Science Team intercalibration working group is developing radiometer correction software based on sun angle information provided by the Precipitation Processing System (PPS) project.

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## Action: AR-09-03d\_9 Description

Status: **CLOSED**

Action: AR-09-03d\_9

Category #: 1

Primary SBA Area: Weather

NASA Point of Contact: Steven Neeck

Due Date: 2/1/2009

Participating Organizations: NASA

Participating CEOS groups: PC

### **Action Description**

- Production of Merged TRMM Multi-satellite Precipitation Products.
- Make the Version 6 merged realtime algorithm the production version.

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## Action: AR-09-03d\_9 Status

- Version 6 development and testing completed. Switch over to production version implemented and products available for users at <ftp://trmmopen.gsfc.nasa.gov/pub/merged>

## Action: AR-09-02a\_10 Description

Status: **OPEN**

Action: AR-09-02a\_10

Category #: 2

Primary SBA Area: Transverse

NASA Point of Contact: Steven Neeck, Riko Oki

Due Date: 31/12/2009

Participating Organizations: NASA, JAXA

Participating CEOS groups: PC

### **Action Description**

- Continued progress on moving the Global Precipitation Measurement (GPM) mission from formulation to implementation phase at NASA and JAXA.
- Major near-term milestones are:
  - GPM Core Spacecraft/Mission (NASA) PDR (4Q2008)
  - GPM Mission (NASA) Confirmation (2Q2009)
  - GPM GMI (NASA) CDR (2Q2009)
  - 8th GPM International Planning Workshop (NASA,JAXA,CNES) (2Q2009)
  - GPM DPR (JAXA) CDR (3Q2009)
  - GPM Mission (NASA) CDR (4Q2009)

## Action: AR-09-02a\_10 Status

- The following major near-term milestone has been completed:
  - GPM Core Spacecraft/Mission (NASA) PDR
- Preparations are underway for the:
  - GPM (NASA) Mission Confirmation (KDP-C)
  - GPM GMI (NASA) CDR (2Q2009)
  - 8th GPM International Planning Workshop (NASA,JAXA,CNES) (2Q2009)

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## Action: AR-09-02a\_25 Description

Status: **OPEN**

Action: AR-09-02a\_25

Category #: 2

Primary SBA Area: Transverse

NASA Point of Contact: Steven Neeck, Riko Oki

Due Date: 31/12/2009

Participating Organizations: NASA, JAXA

Participating CEOS groups: PC

### **Action Description**

- Continue TRMM operations through 2009. Action is necessary to support GPM Preparatory Phase of PC.
- Complete of 12 years of TRMM 3-hr, multi-satellite standard products (TMPA, 3B42).

## Action: AR-09-02a\_25 Status

- TRMM flight operations and data processing fully funded through September 2009 (preliminarily through September 2011). Preparing NASA Senior Review proposal for further mission extension. Spacecraft and instruments remain in good health with robust consumables.



## Action: AR-09-03d\_8 Description

Status: **OPEN**

Action: AR-09-03d\_8

Category #: 2

Primary SBA Area: Weather

NASA Point of Contact: Steven Neeck

Due Date: 31/12/2009

Participating Organizations: NASA

Participating CEOS groups: PC

### **Action Description**

- Prototype flood monitoring and landslide warning products from Tropical Rainfall Measuring Mission (TRMM) data will be improved and made available operationally.
  - Improved (Version 6) prototype flood and landslide products publicly available (1Q2009)
  - Integration of the Global Flood Potential Model into Pacific Disaster Center (PDC) decision support system and related applications (3Q2009)
  - TRMM-derived flood monitoring and landslide warning products publicly available from PDC (4Q2009)

## Action: AR-09-03d\_8 Status

- Planning for operationalization continues with the Pacific Disaster Center (PDC), Maui, Hawaii. Received letter of intent from PDC. Submitted proposal for funding of testing of algorithms and transfer of execution activities in 2009 and 2010.

## Action: CL-06-01c\_22 Description

Status: **OPEN**

Action: CL-06-01c\_22

Category #: 2

Primary SBA Area: Climate

NASA Point of Contact: Steven Neeck

Due Date: 3/1/2010

Participating Organizations: NASA

Participating CEOS groups: PC

### **Action Description**

- Evaluate and implement improved TRMM algorithm
  - Implement Version 7 of the TRMM standard algorithms (December 31, 2009)
  - Reprocessing and public release of the Version 7 standard products (January 31, 2010)

## Action: CL-06-01c\_22 Status

- The Version 7 algorithm is in development.