

Precipitation Constellation Status

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Current Status

- ✓ **Study of conical scanning microwave imagers (MI) availability**
 - ❑ Prepared final report following receipt of Roshydromet Satellite Program information
 - ❑ Available to PC Agencies by end of June
- ✓ **Developing plans for PC data portal**
 - ❑ Completed mockup
 - ❑ Planning deployment this summer
- ✓ **CNES/ISRO M-T/GPM cooperation**
 - ❑ IA's in negotiation following completion of review by US Department of State
- ✓ **NOAA GPM cooperation**
 - ❑ Draft MOU in review
- ✓ **INPE/AEB/GPM cooperation**
 - ❑ Conducted study on joint NASA-INPE precipitation mission
 - ❑ Suspended due to deletion of GMI-2 in proposed NASA FY2012 budget
- ✓ **Progress in GPM implementation**
 - ❑ Well along in Core Spacecraft integration and test, DPR environmental testing, GMI integration
 - ❑ DPR unaffected by Great Tohoku Earthquake but some facilities damaged at Tsukuba Space Center
 - ❑ GMI and DPR instruments planned for delivery late this year
 - ❑ Held 1st NASA-JAXA Joint GPM Algorithm Panel Review
- ✓ **UNCOPUOS**
 - ❑ Provided update to report on Space-system-based Disaster Management

- ✓ **AR-09-02A: Virtual Constellations Task Sheet**
 - Provided update
- ✓ **Field Campaigns**
 - LPVEX Ground Validation experiment (NASA, FMI, Environment Canada) data now available on GPM GV website (<http://gpm.gsfc.nasa.gov/groundvalidation.html>)
 - Began Mid-Latitude Continental Convective Clouds Experiment (MC3E): NASA-DOE field campaign at DOE-ASR Central Facility in Oklahoma, Apr-May 2011
 - Planning for GPM Cold-season Precipitation Experiment (GCPEX): GPM-Environment Canada campaign on snowfall retrieval, Ontario, Canada, Jan-Feb 2012
- ✓ **CEOS Meetings/Workshops held**
 - 24th Plenary, October 12-15, 2010, Rio de Janeiro, Brazil
 - Provided PC status
 - 2911 CEOS-GEO Actions Workshop, February 16-17, 2011, Arlington, VA, USA
 - 4 CEOS-GEO Actions assigned
- ✓ **Meetings/Workshops held**
 - The 2nd GPM Asia Workshop on Precipitation Data Application Technique, September 27-29, 2010, Tokyo, Japan
 - X-Calibration Working Group (WG) (in coordination with CGMS/GSICS), October 21-22, 2010, Asheville, NC, USA
 - Precipitation Measuring Missions Science Team, November 1-4, 2010, Seattle, WA, USA (NASA)
 - 4th Joint Precipitation Science Team Meeting, November (5, 2010, Seattle, WA, USA (NASA, JAXA)
 - Precipitation Measuring Missions Science Team Meeting, December 6-9, 2010, Tokyo, Japan (JAXA)
 - X-Calibration Working Group (WG) (in coordination with CGMS/GSICS), March 1-2, 2011, College Park, MD, USA

- ✓ **Meetings/Workshops in planning**
 - 9th GPM International Planning Workshop, rescheduled to late 2011/early 2012 due to Great Tohoku Earthquake, location TBD
 - Precipitation Measuring Missions Science Team, November 7-9, 2011, Denver, CO, USA (NASA) - was rescheduled due to Great Tohoku Earthquake
 - 5th Joint Precipitation Science Team Meeting, November 10, 2011, Denver, CO, USA (NASA, JAXA)
 - 4th CEOS Precipitation Constellation Workshop, November 9, 2011, Denver, CO, USA (hosted by NASA)
 - Precipitation Measuring Missions Science Team, 2011 winter (TBD), Tokyo, Japan (JAXA)
 - The 3rd GPM Asia Workshop on Precipitation Data Application Technique, 2011 winter (TBD), Nagoya, Japan
- ✓ **Documents in draft review**
 - 2009-2010 Precipitation Constellation Accomplishments
 - 2011-2012 Precipitation Constellation Work Plan
- ✓ **CEOS Action support status**
 - PC has no specific actions
- ✓ **2011 CEOS-GEO Actions**
 - Two Category-1 Actions open
 - AR-09-02a_38, AR-09-03a_39
 - Two Category-2 Actions open
 - AR-09-02a_36, CL-09-02b_3

- *Long term plans are articulated in **CEOS Precipitation Constellation 10-year Implementation Plan***
- *Near term plans are defined in **2011-2012 Precipitation Constellation Work Plan***
 - Draft in review
 - 2011 Success Criteria derived from this document
 - To be formally confirmed at 4th CEOS PC Workshop
- *PC completing four **2011 CEOS-GEO Actions***
 - Good progress being made

- *No new requests – see p.10 for statement of current/future challenges*

Backup

Progress Against Work Plans

- ✓ **2009-2010 Precipitation Constellation Work Plan**
 - ❑ All 39 joint activities and 28 deliverables completed

- ✓ **2011-2012 Precipitation Constellation Work Plan**
 - ❑ Currently in review

- ✓ **Four 2011 CEOS-GEO Actions**
 - ❑ Two Category-1 Actions open
 - ❑ AR-09-02a_38, AR-09-03a_39
 - ❑ Two Category-2 Actions open
 - ❑ AR-09-02a_36, CL-09-02b_3

AR-09-02a_36 Conduct study of the availability of conical scanning microwave imagers (MI) in the late-GPM Phase and the Post-GPM Phase of the Precipitation Constellation.

AR-09-02a_38 Continue progress in instrument and spacecraft manufacturing and testing for GPM implementation, advancing GPM science algorithms through ground validation experiments, and partnership building with space agencies to contribute additional microwave sensors and satellites to the GPM constellation. Action is necessary to realize GPM Phase of Precipitation Constellation.

AR-09-02a_39 Continue TRMM operations through 2011. Action is necessary to support GPM Preparatory Phase of the Precipitation Constellation.

CL-09-02b_3 Evaluate and implement improved TRMM algorithm.

- *Formalizing international agreements on GPM participation*
- *Enhancing high-sensitivity light and solid precipitation measurement capability in polar latitudes*
 - *No clear path forward with rejection of ESA EE-8 Polar Precipitation Mission (PMM) proposal*
- *Enhancing precipitation measurement capability in low latitudes*
 - *To improve utility of GPM data for hydrological applications and near-realtime monitoring of hurricanes and mid-latitude storms*
 - *Necessitated by NASA's cancellation of GMI-2 and suspension of NASA-INPE joint LIO study*
- *Exploring opportunities to include additional space-based and ground assets from other nations to augment the next generation PC (e.g. the possible use of Russian or Chinese radiometers)*
 - *PC made contact with Director of SRC PLANETA, follow visit planned for October*
 - *CMA participating at working level in X-Calibration Working Group*
- *Continued support for open data sharing through either CEOS or GEO*
 - *The PC supports the CEOS SIT in the development of a specific data sharing policy/philosophy not only for CEOS but also sanctioned by GEO.*
 - *NASA and JAXA working through the GPM Data Working Group (GDaWG) to promote to potential GPM participants the advantages of open data sharing for the next-generation PC.*

Goals of the Precipitation Constellation

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')

Participation

- Study Lead Agencies:
 - Japan – JAXA: Riko Oki, oki.riko@jaxa.jp & USA – NASA: Steven Neeck, steven.neeck@nasa.gov
- Space Agency Participants:
 - France - CNES: Didier Renaut, didier.renaut@cnes.fr
 - India - ISRO: V. Hegde, vshegde@isro.gov.in
 - Brazil - INPE: Carlos Frederico Angelis, angelis@cptec.inpe.br
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 - Russia – ROSHYDROMET: Vasily Asmus, asmus@planet.ittp.ru
 - USA - NOAA: Ralph Ferraro, ralph.r.ferraro@noaa.gov
 - USA - Naval Research Laboratory: Ian Adams, ian.adams@nrl.navy.mil
 - Europe - EUMETSAT: Johannes Schmetz, Johannes.Schmetz@eumetsat.int
 - Germany - DLR: Martin Hagen, martin.hagen@dlr.de
 - Canada - Canadian Space Agency: David Kendall, Dave.Kendall@space.gc.ca

- User Community Representatives:
 - CGMS-IPWG: George Huffman, george.j.huffman@nasa.gov
 - GEWEX: Chris Kummerow, kummerow@atmos.colostate.edu
 - WCRP/IGWCO: Rick Lawford, lawford@umbc.edu
 - GCOS: Paul Mason, p.j.mason@reading.ac.uk
 - Peter Bauer, Peter.Bauer@ecmwf.int
 - Phil Arkin, 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/JPL
- Ian Adams/NRL
- Chris Kummerow/Colorado State University

- Riko Oki, JAXA
- Masahiro Kojima, JAXA
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- Toshiaki Takeshima, JAXA
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- 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

Status: **OPEN**

Action: AR-09-02a_36

Category #: 2

Point of Contact: Steven Neeck, Riko Oki

Due Date: 15/5/2011

Lead Agency: NASA, JAXA

Other Agency and Organization Participation: NOAA, EUMETSAT

CEOS Working Group and Constellation Participation: PC

Action Description

- Conduct study of the availability of conical scanning microwave imagers (MI) in the late-GPM Phase and the Post-GPM Phase of the Precipitation Constellation
- Major near-term milestones are:
 - Report to be made available to PC Agencies in June 2011 with final report provided to SIT by August 2011.

- The final report which shall include planned MI assets and their compatibilities as well as missing key MI assets (including required capabilities) will be completed by August 2011. The study shall include all possible MI assets including those from agencies not currently participating in the CEOS PC.
- Prepared final report following receipt of Roshydromet Satellite Program information. Revised milestones reflecting delays in Roshydromet information and report finalization. (May 2011)
- Deliverables and milestones are:
 - June 3, 2011: Delivery of the report to CEOS PC leads
 - June 30, 2011: Delivery of report to CEOS PC members
 - July 31, 2011: Final approval of report and submission to SIT

Status: **OPEN**

Action: AR-09-02a_38

Category #: 1

Point of Contact: Steven Neeck, Riko Oki

Due Date: 1/12/2011

Lead Agency: NASA, JAXA

Other Agency and Organization Participation: NOAA, EUMETSAT, INPE, CNES, ISRO

CEOS Working Group and Constellation Participation: PC

Action Description

- Continue progress in instrument and spacecraft manufacturing and testing for GPM implementation, advancing GPM science algorithms through ground validation experiments, and partnership building with space agencies to contribute additional microwave sensors and satellites to the GPM constellation. Action is necessary to realize GPM Phase of Precipitation Constellation.
- Major near-term milestones are:
 - Conduct MC3E Field Campaign (NASA, DOE)(2Q2011)
 - Complete GMI-1 instrument Pre Environmental Review (NASA)(3Q2011)
 - Implement a NASA-CNES-ISRO agreement on Megha Tropiques-GPM cooperation (4Q2011)
 - Implement a NASA-INPE agreement on GPM cooperation (4Q2011)
 - Hold GPM International Planning Workshop and 4th CEOS Precipitation Constellation Workshop hosted by INPE (4Q2011)
 - Ship DPR instrument (KaPR and KuPR PFMs) for integration on the Core Spacecraft (JAXA)(4Q2011)
 - Ship the GMI instrument for integration on the Core Spacecraft (NASA)(4Q2011)
 - Complete Core Spacecraft Bus integration and testing (NASA)(4Q2011)
 - Integrate DPR and GMI instruments on Core Spacecraft bus (NASA, JAXA)(4Q2011)
 - Prepare for GPM Cold-season Precipitation Experiment (GCPEX) field campaign (NASA, Environment Canada)(4Q2011)

- Began six week MC3E field campaign on April 22 in Oklahoma, USA.
- Rescheduled GMI instrument Pre-Environmental Review to July due to several development/manufacturing issues.
- NASA was given negotiating authority by the US Department of State on the NASA-CNES-ISRO agreement on Megha Tropiques-GPM cooperation. The agreements were sent to CNES and ISRO for review.
- Revised milestone date on NASA-INPE agreement on GPM cooperation reflecting continuing review by Brazil of the draft Implementing Arrangement.
- Rescheduled the GPM International Planning Workshop to TBD date and location and 4th CEOS Precipitation Constellation Workshop to November 11 in Denver, Colorado, USA due to impact of March Great Tohoku Earthquake in Japan.
- Revised DPR instrument shipment date due to impact (facilities damage) of March Great Tohoku Earthquake in Japan. (May 2011)

Status: **OPEN**

Action: AR-09-02a_39

Category #: 1

Point of Contact: Steven Neeck, Riko Oki

Due Date: 31/10/2011

Lead Agency: NASA, JAXA

CEOS Working Group and Constellation Participation : PC

Action Description

- Continue TRMM operations through 2011. Action is necessary to support GPM Preparatory Phase of the Precipitation Constellation.
- Major near-term milestones are:
 - March 4, 2011: Submission of TRMM mission extension proposal to NASA ESD Senior Review Panel – COMPLETED
 - May 3-5, 2011: 2011 Senior Review Panel Meeting – COMPLETED
 - September 1, 2011: NASA ESD Senior Review guidance on mission extension, allowing for the completion of 14 years of TRMM 3-hr, multi-satellite standard products (TMPA, 3B42), through December 31, 2011.

- The TRMM Senior Review Proposal was submitted in March and evaluated in the May 3-5 Senior Review Panel Meeting. The panel's report is being published for use in developing the NASA Earth Science Division (ESD) guidance on TRMM operations in Fiscal Year 2012 and beyond per the planned September milestone. (May 2011)

Status: **OPEN**

Action: CL-09-02b_3

Category #: 2

Point of Contact: Steven Neeck, Riko Oki

Due Date: 31/1/2011

Lead Agency: NASA, JAXA

CEOS Working Group and Constellation Participation: PC

Action Description

- Evaluate and implement improved TRMM algorithm
- Major near-term milestones are:
 - June 30, 2011 Implement Version 7 of the TRMM standard algorithms
 - July 31, 2011 Reprocessing and public release of the Version 7 standard products

Action: CL-09-02b_3 Status

- Version 7 algorithm in development (January 2009). Rescheduled deliverable milestones to reflect delays in getting final algorithm from code developers. Using test code as workaround. Some impact from Precipitation Radar anomaly (October 2009). Completed multi-month run of Version 7 in test mode (December 2009). Began Version 7 Operational Acceptance Testing (January 2010). Operational Acceptance Testing continues. Team revised milestones to permit more thorough analysis of test data (April 2010). 2A25 algorithm testing nearly complete but revisions required 2A12 algorithm cloud database updating. Revised milestones due to this and staffing conflicts with GPM PPS Build 2 upcoming review (June 2010). Completed initial testing of revised rain retrievals algorithm code for PR and TMI retrievals. Revised milestones due to this and revised schedule for multi-year product generation and detailed science analysis of products as part of Operational Acceptance Testing (September 2010). Generated six months of all data products and distributed to selected science team members and GV group (October 2010). Testing and analysis of PR product underway with completion scheduled for spring 2011 (December 2010). Operation Acceptance Test with updated algorithm began April 15 and is scheduled to complete on June 20. JAXA and NASA formal review of Version 7 algorithm for acceptance scheduled for June 21-24. Updated milestone dates to reflect algorithm update, additional acceptance testing, and JAXA/NASA formal acceptance review (May 2011).

PC Approach

- Develop a consistent framework to produce inter-calibrated precipitation sensor measurements and retrieval products
- Identify key points of agreement for space agency co-operation in order to meet the needs of both the data producer and user communities
- Results-focused, identifying what steps are necessary by space agencies (and other groups responsible for product generation, in-situ observations etc) to develop the constellation data sets and information services. CEOS PC should also encourage the development and evaluation of precipitation products produced from the constellation data. This should include inter-comparisons and validation against high quality ground data.
- Recognize the Constellation member's national plans for implementing their respective Earth observing programs (e.g. the U.S. Decadal Survey).
- Have strong collaboration with the CEOS Working Group on Calibration and Validation (WGCV) and the CEOS Working Group on Information Systems and Services (WGISS)

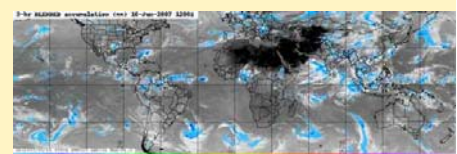
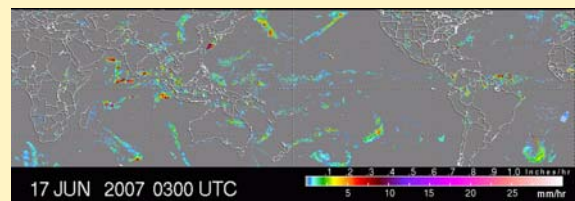
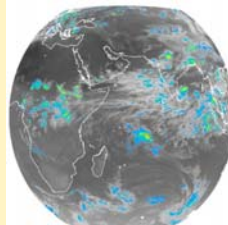
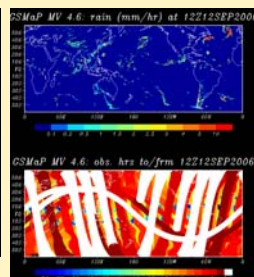
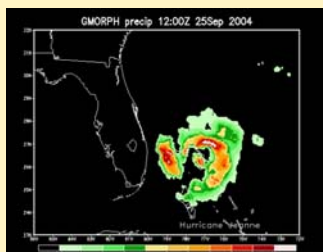
Implementation

- 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; width: fit-content; margin: auto;">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

