PRECIPITATION MEASURING MISSION SCIENCE:

THE 7th RESEARCH ANNOUNCEMENT

Issued: August 9, 2012

Proposals Due: October 15, 2012

Earth Observation Research Center
Japan Aerospace Exploration Agency

Contents

1. Introduction

1.1. About the 7th Research Announcement

In this seventh Precipitation Measuring Mission (PMM) Science Research Announcement (RA,) relating to the Global Precipitation Measurement (GPM) mission and the Tropical Rainfall Measuring Mission (TRMM) satellite, the Japan Aerospace Exploration Agency (JAXA) is announcing the opportunity for research. Descriptions of the GPM and TRMM missions, satellites, and sensor systems can be found in Appendix C.

From the first to the fifth PMM RAs were implemented with a focus on research related to the TRMM satellite, which was launched in November 1997. The last RA (the sixth RA,) for the period from Japanese Fiscal Year (JFY) 20010 to 2012, focused on research themes especially those contributing to the development of GPM algorithms.

In this RA, JAXA will invite research proposals for model utilization and data assimilation as new research themes, as well as those contributing to the development and improvement of GPM algorithms (algorithm development and validation) needed for producing long-term data sets. Details of research theme will be described in section 1.2. The GPM Core Observatory is scheduled to be launched in early 2014. This RA covers a 3-year research period beginning in JFY 2013.

1.2. Research Areas of This RA

Through this RA, JAXA seeks research proposals contributing to the following research areas. Detailed technical descriptions of each area will be provided in Chapter 2.

(1) Algorithm Development

Develop or improve retrieval algorithms, which are DPR, DPR/GMI combined, Global Precipitation Map algorithms, and DPR Latent Heating algorithm, to produce JAXA GPM standard products, and improve TRMM standard algorithms.
JAXA's GPM/DPR project has set the mission success criteria based on the mission requirements (see section 1.3). Therefore, algorithm development and improvement are expected to meet the criteria to make the GPM mission successful.

(2) Validation

Acquire and analyze pre-launch and post-launch ground observation data, contributing to the development, improvement, and accuracy evaluation of JAXA GPM standard algorithms, and validate accuracy of GPM and TRMM standard products.
Effective validation activities collaborating with other science projects are expected.

(3) Application Research

Perform creation of long-term and continuous data set using GPM and TRMM products, research relating to climate and global water cycle variation, precipitation system climatology, research leading to operational data utilization, such as monitoring of wind and flood damage, research with consideration of use of precipitation maps in the Asian region and other areas where ground precipitation observation is not sufficient, research to apply GPM and TRMM data into atmospheric, climate, land, hydrological, and other models and/or data assimilation, and research relating development of new GPM research products, through new techniques such as data assimilation.

Among other areas, this RA will mainly focus on "(1) Algorithm Development" and "(2) Validation." In particular, research themes, such as the development and improvement of algorithms for the Dual-frequency Precipitation Radar (DPR) on board the GPM Core Observatory, combined algorithms for DPR and the GPM Microwave Imager (GMI), and Global Precipitation Map algorithms. In addition, improvements of standard algorithms for the Precipitation Radar (PR) on board the TRMM satellite, acquisition and analysis of basic data necessary for algorithm development, and evaluation of accuracy of standard products will be included.

The Principal Investigator (PI) of selected proposals will be a member of the Japanese Precipitation Measuring Mission (PMM) Science Team. JAXA will appoint a Lead to the PMM Science Team after the RA selection. The Lead of the PMM Science Team will also participate in the GPM Utilization Committee, who will discuss overall GPM mission objectives and requirements. JAXA's Earth Observation Research Center (EORC) will work together closely with the PMM Science Team, especially in algorithm development and validation activities.

1.3. Targets of GPM and Mission Success Criteria

GPM is an international mission led by the U.S. and Japan. The U.S. and Japan will jointly develop the GPM Core Observatory, a successor of the TRMM satellite, and collaborate with several constellation satellites, that will carry microwave radiometers and be launched by international partners.

Similar to a mission for water cycle variation observation under JAXA's Earth Environmental program, mission objectives of GPM are to continue and expand knowledge and outcomes obtained by the TRMM satellite, and to achieve the following targets:

- Highly accurate and frequent global precipitation observation for climate and water cycle change;
- Data utilization method development through distribution of near real time global precipitation maps;
- Development and demonstration of the improved precipitation retrieval method of the multi microwave radiometers (including both imager and sounder) using DPR data;
- Application demonstration for operational use, such as flood prediction, numerical weather forecast, prevention of damage from a storm and flood; and
- Demonstration of DPR technology, which will succeed and expand TRMM/PR technology, to achieve highly accurate precipitation observation.

Figure 1 shows mission requirements for the Japanese GPM mission to achieve the above objectives, and those for the international GPM mission in contrast for reference. This RA invites research to actualize these GPM targets through collaboration with JAXA. Derailed technical description for research will be described in the next chapter.

Table 1 shows targets of accuracy of each algorithm and its evaluation timing. Target accuracies of the Ku-band Radar (KuPR) and Global Precipitation Map algorithms at pre-launch and data release are almost the same as those achieved by the current TRMM/PR standard algorithm and the Global Satellite Mapping of Precipitation (GSMaP) algorithm, and correspond to minimum success. When GPM completes its designed mission period, it is required to achieve full success in Table 1 through improvement of accuracy of each algorithm.

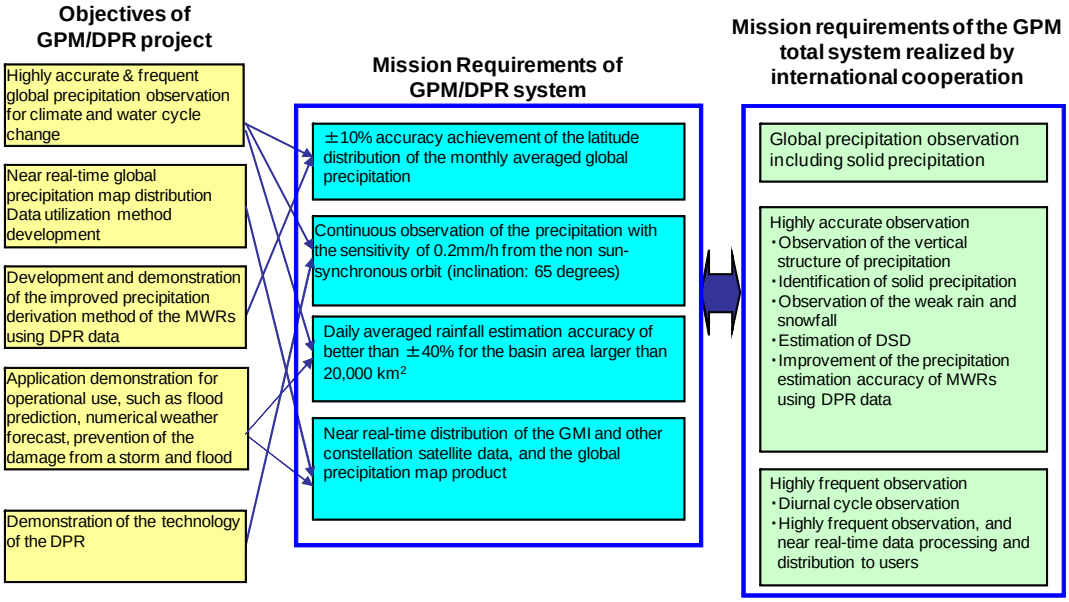

Figure 1 Objectives of JAXA's GPM/DPR Project and Mission Requirements

Table 1 Target Accuracies of JAXA GPM Standard Products

Products \ Review timing		Pre-launch target accuracy at Development Completion Review (4-months before the launch)	Post-launch target accuracy at Confirmation Review for data release (4-months after completion of initial check out)	Full success at completion of designed mission period
L1	KuPR	Output received power of L1 code using L0 simulation data as input will agree within [±0.01 dBm (TBD)] with that of L1 confirmation code. Note that confirmation code will be developed for temperature corrected received power calculation part only, and developed independently.	Calculated value of transmitted and received power of KuPR will agree within ±1 dBm with that of observed value by Active Radar Calibration experiment.	Will be evaluated by DPR Dual-frequency L2 and L3 products.
	KaPR	Same as above.	Same as above.	Same as above.
L2	KuPR	Check operation of each subroutine using L1 simulation data (simulation data for L2 operation check, and synthetic data of simulated nature). Verify distribution of histograms of rain rate, hypothesized by synthetic data of simulated nature, and that estimated by L2 algorithms, within effective rain rates [0.5 - 30 mm/h (TBD)].	Surface scattering factor of KuPR will agree within [±1 dB (TBD)] with that of PR. [for 1 week, for non-rain pixels, over the ocean, at each angle bin (TBD)]. Verify distribution of histograms of rain rate of KuPR and PR within effective rain rates [0.5 – 30 mm/h (TBD)] [for 1 week, over the ocean, within latitudes of ±35°, for all angle bins, at surface (TBD)].	Same as above.
	KaPR	Same as above, but effective rain rate will be [0.2 - 20.0 mm/h (TBD)].	Surface scattering factor of KaPR will agree within [±1 dB (TBD)] with that of PR [for 1 week, for non-rain pixels, over the ocean, at each angle bin (TBD)], but considering differences between KaPR and PR in observation frequency. Verify distribution of histograms of rain rate of KaPR and PR within effective rain rates [0.5 – 20 mm/h (TBD)] [for 1 week, over the ocean, within latitudes of ±35°, for all angle bins, at surface (TBD)].	Same as above.
	DPR Dual-frequency Precipitation	Same as above, but effective rain rate will be [0.2 - 30.0 mm/h (TBD)].	Verify distribution of histograms of rain rate of dual-frequency precipitation product and PR within effective rain rates [0.5 – 20 mm/h (TBD)] [for 1 week, over the ocean, within latitudes of ±35°, for all angle bins, at surface (TBD)].	Continuous observation of the precipitation with the sensitivity of 0.2 mm/hr by DPR, satisfying designed function and capability.
	DPR/GMI combined	Same as above, but effective rain rate will not be defined.	Same as above, but compare with rain rate histograms observed by PR and TMI.	N/A
L3	DPR Dual-frequency Precipitation	Confirmation of statistical processing.	Will be evaluated by L2 product.	Long-term averaged rainfall of DPR will agree within ±10 % accuracy with that obtained by ground-based rain gauge network worldwide. Monthly averaged zonal rainfall of DPR will agree within ±10 % accuracy with that of GMI, over the ocean.
	DPR/GMI combined	Same as above.	Same as above.	N/A
	Global Precipitation Map	Deliver latest GSMaP algorithm applying AMSR2 standard algorithm for precipitation. Check operation of algorithm for GMI using GMI simulation data provided by NASA/PPS. Compare Global Precipitation Map product to RadarAMeDAS data, averaged daily and in a 0.25° latitude-longitude grid box. [RMS will be about 0.7 mm/h on average (TBD)].	Check operation of algorithm for GMI algorithm. Verify inconsistency in horizontal distribution and zonal mean of Global Precipitation Map product, between products including or excluding GMI data. Compare Global Precipitation Map product to RadarAMeDAS data, averaged daily and in a 0.25° latitude-longitude grid box. [RMS will be about 0.7 mm/h on average (TBD)].	Daily averaged rainfall produced by GMI and other microwave radiometers (imager/sounder) will agree within 40% accuracy to that obtained from rain gauges for the larger basin areas

1.4. This RA and GPM Algorithm Development and Validation Phases

This RA covers a 3-year research period from JFY 2013 to JFY 2015 corresponding to initial and pre-launch algorithm development/evaluation and post-launch algorithm maintenance and improvement phases for algorithm development activities, and pre- and post-launch calibration/validation phases for validation activities, as shown in the schedule in Figure 2. Following this RA, we plan to conduct the eighth research announcement.

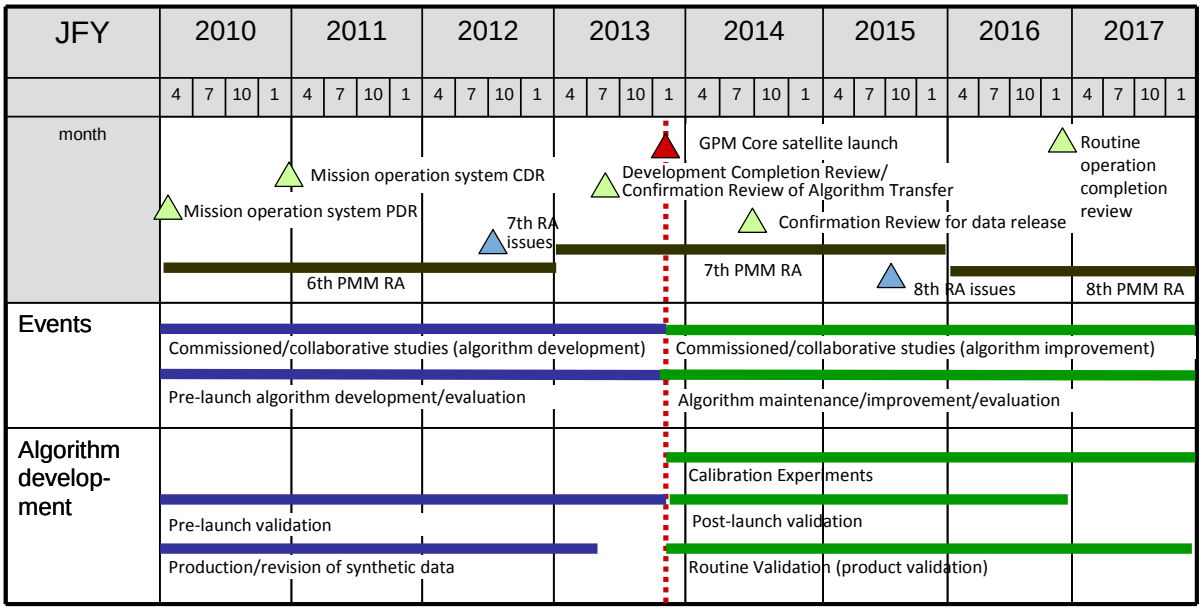

Figure 2 Schedule for RA and GPM Algorithm Development/Validation Phases

1.5. Priorities in Selection of Proposals and Budget Plan

For this RA, JAXA will give budget allocation priority to the areas of standard algorithm development and improvement, acquisition and analysis of fundamental data needed for algorithm development, and accuracy validation of standard products. If a proposal is highly expected to contribute to the GPM and/or TRMM missions, JAXA may also select funded-PIs other than priority areas.

Although it will depend on the budget situation, JAXA plans to spend 120,000,000 yen as total budget for the first fiscal year of the 7th RA .For funding research, annual budget of each proposal will vary from 1,000,000 to 10,000,000 yen approximately, and about 8 proposals will be adopted with annual budget of approximately 10,000,000 yen. For the second and third years, JAXA plans to spend at the same level as the first year, depending on plans of selected proposals.

All categories of domestic and foreign organizations with nonprofit and peaceful purposes, except students, may apply under this RA. However, funding may differ for each research category and applicant. Funding by JAXA is basically restricted to domestic PIs, although some exceptions may be made for research necessary to realize JAXA mission success.

Research proposals should be submitted to JAXA by October 15, 2012. Proposals will be selected based on a peer-review process and discussions in science/project evaluation boards. JAXA plans to announce the selection results in January 2013.

2. Technical Description

2.1. Purposes of RA

To meet the mission objectives of GPM and TRMM, which are to understand and predict global water cycle variation and to contribute to operational use, this RA seeks to conduct research necessary to generate highly accurate, long-term, uniform and stable global precipitation products, that consider effective utilization and continuous observation by GPM, TRMM and other data sources (i.e., "Algorithm Development" and "Validation") and research related to climate and water cycle variation using those products and development of new research products using techniques such as models and/or data assimilation (i.e., "Application Research") by inviting research themes from both domestic and overseas scientists.

All applicants should keep in mind that JAXA is not a general funding body for the scientific community. This RA seeks to accomplish the GPM mission's goals and to find new possibilities for utilizing GPM and TRMM data. Proposals should clearly describe plans for GPM and TRMM data usage.

2.2. Research Areas

Based on the GPM and TRMM objectives, JAXA seeks proposals in the following three research areas: algorithm development, validation, and application research. In particular, this RA emphasizes development and improvement of GPM standard algorithms and research directly contributing to it, because the period covers scheduled launch date of the GPM Core Observatory. Details are listed below.

2.2.1 Algorithm Development

As described in (1)-(5), research themes to develop and improve JAXA GPM standard algorithms and to improve previously developed TRMM standard algorithms will be adopted in this RA. In addition, JAXA and PIs will jointly evaluate the algorithms and install these in JAXA computer systems. As described in Chapter 5, this research theme is generally supported through a "Commissioned Research Agreement."

Selected PIs will belong to the Algorithm Development Team under the JAXA PMM Science Team. They are also requested to join or collaborate with the NASA-JAXA Joint Algorithm Team, whose objective is to develop NASA-JAXA joint standard algorithms (DPR, and DPR/GMI combined) for the GPM Core Observatory.

Table 2 lists JAXA standard products of the GPM mission, and Table3 is same but for near-real-time products. Table 4 shows standard products of TRMM/PR. Algorithms to produce geophysical products other than those listed in Table 2-4 will be considered research products and will be included in Theme 3 "Application Research."

To meet the GPM objectives, retrieval algorithms will require global applicability, robustness, and long-term stability. Algorithms that can be extended and applied for similar instruments (e.g., PR, and microwave radiometers on board the other satellites) and historical data records are preferable for integrated retrieval. Computationally efficient, fast-processing algorithms are important for the operational applications of the products. Products denoted in light grey in Table 3, which are Level 2 the Dual-frequency Precipitation product and the DPR/GMI combined product, and Level 3 Global Precipitation Map product, are also required to process in near real time. Each near-real-time algorithm will be developed based on the standard algorithm. All

near-real-time products in Table 3 have to be produced and distributed within 60 minutes after acquisition of observation data.

Table 2 JAXA GPM Standard Products

Level	Algorithm	Product	Major physical parameter	Unit	Coverage
1	KuPR algorithm	KuPR product	Received power profile	Orbit	245km (swath)
	KaPR algorithm	KaPR product	Received power profile	Orbit	125km (swath)
2	DPR algorithm (Japan-US joint)	KuPR product	Radar reflectivity profile, normalized radar surface cross section (σ^0), rain type, bright-band height, attenuation corrected radar reflectivity profile, rain rate profile	Orbit	245km (swath)
		KaPR product	Radar reflectivity profile, normalized radar surface cross section (σ^0), rain type, bright-band height, attenuation corrected radar reflectivity profile, rain rate profile	Orbit	125km (swath)
		Dual-frequency precipitation product	Rain rate profile, drop size distribution, precipitation status (rain/snow), attenuation profile	Orbit	245km (swath)
	DPR/GMI combined algorithm (Japan-US joint)	DPR/GMI combined product	rain rate profile, surface rain rate	Orbit	245km (swath)
	DPR latent heating algorithm	DPR latent heating product	Latent heating profile, rain type	Orbit	245km (swath)
3	DPR algorithm (Japan-US joint)	Dual-frequency precipitation product	Mean surface rainfall, time information, Ascending/Descending flag	Daily	Global
			Mean rainfall (dual), observation number, rain pixel number, mean bright-band height, storm height, rain/snow determination, time information	Daily (Asc/Dsc)	Global
			Mean rainfall (single, dual), observation number, rain pixel number, mean bright-band height, storm height, mean attenuation corrected radar reflectivity profile, mean DSD parameters, histogram	Monthly	Global
	DPR/GMI combined algorithm (Japan-US joint)	DPR/GMI combined product	Mean rainfall, observation number, rain pixel number,	Monthly	Global
	DPR latent heating algorithm	DPR latent heating product	Latent heating profile, number of latent heating pixel	Orbit	Global
				Monthly	Global
	Global precipitation map algorithm	Global precipitation map product	Mean rainfall, observation number, rain pixel number	Hourly	Global
				Monthly	Global

Table 3 JAXA GPM near-real-time products

Level	Algorithm	Product	Major Physical Parameters	Unit	Coverage
1R	Depends on each sensor	Microwave radiometer product	Brightness temperature	arbitrarily	Depends on each sensor
2R	DPR algorithm (Japan-US joint)	Dual-frequency precipitation product	Rain rate profile, drop size distribution, precipitation status (rain/snow), attenuation profile	arbitrarily	245km
	DPR/GMI combined algorithm (Japan-US joint)	DPR/GMI combined product	rain rate profile, surface rain rate	Orbit	125km
3R	Global precipitation map algorithm	Global precipitation map product	Mean rainfall, observation number, rain pixel number	Hourly	Global

Table 4 TRMM/PR Standard Product

Level	Product name	Major physical parameters	Unit	Coverage
1	1B21	Calibrated received power profile	Orbit	PR swath
	1C21	Radar reflectivity profile	Orbit	PR swath
2	2A21	normalized radar surface cross section (σ^0)	Orbit	PR swath
	2A23	PR Qualitative	Orbit	PR swath
	2A25	Rain rate profile	Orbit	PR swath
	2H25 (*1)	Latent Heating Profile	Orbit	PR swath
3	3A25	Monthly statistics of rainfall parameters	Monthly	Global (Horizontal: 5/0.5 ^{o} grid box, Vertical: 5-layer)
	3A26	Monthly rain rate using a statistical method	Monthly	Global (Horizontal: 5^o grid box)
	3G25	Gridded latent heating profile	Orbit	PR swath (Horizontal: 0.5^o grid box, Vertical: 19-layer)
	3H25	Monthly statistics of latent heating	Monthly	Global (Horizontal: 0.5^o grid box, Vertical: 19-layer)

*1 Product defined as defined almost as standard product.

(1) DPR Algorithm

This theme encompasses research to develop or improve algorithms, completely or in part, to produce the GPM Dual-frequency Precipitation Radar (DPR) Level 2 and 3 standard products shown in Table 2.

(i) Principle of Development

DPR Level 2 and 3 algorithms will be developed by the DPR Algorithm Team led by Japan (Dr. Toshio Iguchi, NICT,) which is under the NASA-JAXA Joint Algorithm Team. Therefore, PIs, who are selected for this theme, are required to play a central role in the NASA-JAXA Joint Algorithm Team.

In developing DPR algorithms, applicants should pay attention to following points;

- Base algorithms on the TRMM/PR standard algorithms to a maximum extent, and develop them utilizing dual-frequency information;
- Develop algorithms to produce Ku-band Precipitation Radar (KuPR) only products, Ka-band Precipitation Radar (KaPR) only products, and/or Dual-frequency Precipitation products using both KuPR and KaPR data, as DPR Level 2 algorithms;
- Consider one algorithm involving several modules in GPM/DPR Level 2, although TRMM/PR Level 2 standard algorithms are composed of three separate algorithms;
- Develop algorithm applicable to both PR and KuPR in order to produce long-term continuous data set; and
- Develop a near-real-time algorithm in Table 3 based on the standard algorithm for Dual-frequency precipitation products.

(ii) Function and Input/Output of Algorithms

DPR Level 2 algorithms should have the following functions;

- To estimate rain rate profiles by using received power profiles observed by Ku-band Precipitation Radar (KuPR) and Ka-band Precipitation Radar (KaPR) in a complementary style;
- To detect rain or no-rain pixels, and the height of ground clutter; and
- To estimate rain types, storm height, and bright-band height.

Regarding DPR Level 2 algorithms, KuPR product will be produced in a wide swath (about 245 km) using KuPR data only, and KaPR product in a narrow swath (about 125 km) using KaPR data only. Dual-frequency Precipitation products will be composed of narrow swath data produced by both KuPR and KaPR, and wide swath data (excluding overlap with the narrow swath) produced by KuPR and extension of information by KuPR and KaPR in a narrow swath.

DPR Level 3 algorithm will calculate statistics of each Level 2 product.

(iii) Components to be Developed

In producing KaPR and Dual-frequency Precipitation products, the following components have to be developed and evaluated:

- Utilization of KaPR data
  - ➢ Correction of attenuation in Ka-band by non-precipitation particles, such as clouds, detection of bright band in Ka-band, precipitation-type classification in

Ka-band; and

- Development of technology to estimate parameters relating to non-uniform beam filling using high-density observation in Ka-band; and
- Retrievals of solid precipitation using high-sensitive observation in Ka-band.

・ Effective utilization of dual-frequency observation

- Estimation of drop size distribution by dual-frequency observation; and
- Detection of bright band in dual-frequency observation, precipitation-type classification in dual-frequency observation; and
- Evaluation of accuracy of Surface Reference Technique in dual-frequency observation.

(2) DPR/GMI Combined Algorithm

This theme encompasses research to develop or improve algorithms, completely or in part, to produce Level 2 and 3 combined standard products of the Dual-frequency Precipitation Radar (DPR) and the GPM Microwave Imager (GMI) on board the GPM Core Observatory, shown in Table 2.

(i) Principle of Development

DPR/GMI combined Level 2 and 3 algorithms will be jointly developed by the DPR/GMI Combined Algorithm Team co-lead by U.S. and Japan (Dr. William S. Olson, NASA, and Dr. Hirohiko Masunaga, Nagoya University,) which is under the NASA-JAXA Joint Algorithm Team. Therefore, PIs, who are selected for this theme, are required to play a central role in the NASA-JAXA Joint Algorithm Team.

In developing DPR/GMI combined algorithms, applicants should pay attention to following points:

・ Emphasize physical consistency between DPR and DPR/GMI combined algorithms, and also consider utilization of DPR Level 2 algorithms, completely or in part, as a DPR component;

・ Provide database of rain rate profiles to algorithm development of Global Precipitation Map and GMI for contributing to improving their accuracy; and

・ Develop a near-real-time algorithm in Table 3 based on the standard algorithm for Level 2 products.

(ii) Function and Input/Output of Algorithms

DPR/GMI combined algorithms should have following functions:

・ To derive rain rate profiles using the DPR and the GMI in a complementary style;

・ To estimate atmospheric physical parameters, such as cloud liquid water and water vapor, which cannot be estimated by radar directly but can be estimated by microwave radiometer, and surface characteristic parameters; and

・ To produce database of rain rate profiles obtained by the DPR/GMI algorithm.

DPR/GMI combined Level 2 algorithm will use the DPR Level 1 product (received power profile) and the GMI Level 1 product (Brightness Temperature at each channel) as inputs, and produce rain rate profiles.

The DPR/GMI combined Level 3 algorithm will calculate statistics of Level 2 product.

(iii) Components to be Developed

In producing the DPR/GMI combined products, the following components have to be developed and evaluated:

- Methods for improving rainfall estimation accuracy by using GMI Brightness Temperatures; and
- Development and improvement of algorithms for estimating microwave surface emissivity over the land.

(3) Global Precipitation Map Algorithm

This theme encompasses research to develop or improve the following three algorithms, completely or in part, which compose algorithms to produce Global Precipitation Map standard products, shown in Table 2.

- Microwave imager rain retrieval algorithm (MWI algorithm)
- Microwave sounder rain retrieval algorithm (MWS algorithm)
- Microwave-Infrared (IR) combined algorithm (MVK algorithm)

(i) Principle of development

Global Precipitation Map algorithms will be developed in Japan. However, PIs, who are selected for this theme, are required to participate in the NASA-JAXA Joint Algorithm Team, and collaborate with the Radar-Enhanced Passive Microwave Radiometer (RE-PMR) Algorithm Team lead by U.S. (Dr. Chris Kummerow, Colorado State University,) who will develop the GMI standard algorithm.

In developing Global Precipitation Map algorithms, applicants should pay attention to following points:

- Develop algorithms based on outcomes from the Global Satellite Mapping for Precipitation (GSMaP) project, which was sponsored by the Japan Science and Technology Agency (JST) under the Core Research for Evolutional Science and Technology (CREST) framework between 2002 and 2007;
- Improve the MWI algorithm, which was developed as the standard algorithm for precipitation products of the Advanced Microwave Scanning Radiometer 2 (AMSR2) on board the first generation of Global Climate Change Mission – Water (GCOM-W1) satellite, "SHIZUKU" launched in May 2012, and apply it to GMI and other microwave imagers on board constellation satellites;
- Develop the MWS algorithm ensuring consistency with the MWI algorithm;
- Improve database of rain rate retrievals using TRMM/PR data, and apply its methodology to DPR data;
- Cooperate with the AMSR2 precipitation group in algorithm development and calibration and validation activities; and
- Develop a near-real-time algorithm in Table 3 based on the standard algorithm.

(ii) Function and Input/Output of Algorithm

Algorithms composing the Global Precipitation Map algorithm should have the following

functions;

- The MWI algorithm should retrieve rain rates over land and ocean using Level 1 products (Brightness Temperatures) of microwave imagers on board the GPM core and constellation satellites as inputs;
- The MWS algorithm should retrieve rain rates over land and ocean using Level 1 products (Brightness Temperatures) of microwave sounders on board constellation satellites as inputs; and
- The MVK algorithm should produce microwave and IR combined rainfall (Global Precipitation Map) using rain rate data retrieved by MWI and MWS algorithms and Geostationary IR information as inputs.

(iii) Components to be Developed

In producing Global Precipitation Map products, the following components have to be developed and evaluated:

- Smooth transition from the current PR-based database to the future DPR-based database; and
- Improvement of accuracy of rainfall over high-latitudes using high-frequency channels available in GMI and microwave sounders.
- Development and improvement of rainfall calibration method by using rain gauges, and its application to near-real-time algorithm.

(4) DPR Latent Heating Algorithm

This theme encompasses research to develop algorithms, completely or in part, to produce the DPR Latent Heating Level 2 and 3 standard products shown in Table 2. DPR Latent Heating Algorithm does not have to be released as standard product immediately after the launch of the GPM Core Observatory, but should be developed to be released as standard product during the mission period.

(i) Principle of Development

DPR Latent Heating algorithm will be developed in Japan.

In developing DPR Latent Heating algorithm, applicants should pay attention to following points;

- Use algorithms on the TRMM/PR Latent Heating standard algorithms to the extent possible; and
- Develop algorithm applicable to both PR and DPR in order to produce long-term continuous data set.

(ii) Function and Input/Output of Algorithms

DPR Latent Heating algorithm should have the following functions;

- To estimate latent heating profiles by using rain rate profiles in DPR Level 2 products (each KuPR, KaPR, and/or dual-frequency precipitation product).

(iii) Components to be Developed

In producing DPR Latent Heating products, the following components have to be developed and evaluated:

- Development of estimation method of latent heating profiles in mid- and high-latitudes;
- In the case of utilizing numerical models, evaluation of algorithms along with evaluation of reproducibility in precipitation (latent heating) profiles.

(5) TRMM/PR Standard Algorithm

This theme encompasses research to maintain and/or improve the TRMM Precipitation Radar (PR) standard algorithms shown in Table 4. Currently, PR standard algorithms are version 7 and used for processing. This RA covers research to maintain version 7 algorithms of PR, and improve them toward the GPM era (version 8.)

2.2.2 Validation

As described in (1)-(3), research themes to contribute to development of JAXA GPM standard algorithms (hereafter referred as to "algorithm validation"), research themes to prepare test sites and validation methodologies before the launch of GPM Core Observatory, research themes to evaluate accuracy of GPM and TRMM Level 2 /3 standard products, in particular, in terms of precipitation rate (hereafter referred as to "product validation"), and research themes that will be effectively implemented by collaborating with other research programs, will be adopted in this RA.

Selected PIs will belong to the Validation Team under the JAXA PMM Science Team.

Validation activities after the launch of the core satellite will be continued in the next or later RAs. As described in Chapter 5, this research theme is basically supported through a "Collaborative Research Agreement," but some research, which is supposed to be essential to fulfill the GPM mission, may be supported through a "Commissioned Research Agreement."

(1) Validation by JAXA's Ka-band Ground Radar Observation

JAXA introduced two new field-portable Ka-band ground radars for JAXA GPM Ground Validation (GV). The radars will be utilized for validating physical parameters, such as attenuation by precipitation particles, raindrop size distribution, and drop velocity and density of snowfall, which are involved in satellite-based precipitation retrieval algorithms and direct comparison with GPM/DPR observations after the launch. When the two Ka-band radars observe precipitation system in the same line but from opposite sides, (called as "dual Ka radar measurement"), it is possible to calculate radar attenuation characteristics of precipitation particles in Ka-band bi-directionally. When the radar is placed to face an upper direction (called as "upward measurement"), it can observe a detailed vertical structure of precipitation systems, especially for the melting layer where precipitation particles change from solid to liquid. It is also possible to observe simultaneously with the DPR on-orbit to make direct comparison with DPR observation.

Applicants have to collect observation data targeting the following themes using ground-based instruments, such as Ka-band ground radars provided by JAXA and other instruments prepared by them, compiling database for contribution to development or improvement of the GPM standard algorithms, and evaluating accuracy of the standard products after the launch:

(i) Observation of Precipitation Profile

A research theme for validation of a precipitation profile in the GPM/DPR product is expected.

Examples of research include the following:

- Validation to compare observation by ground-based instruments (2DVD, meteorological instruments, a ground-based microwave imager, etc.), multi-band ground-based radars (JAXA Ka-band ground radars, etc.), and precipitation profiles retrieved by the GPM/DPR algorithms.

(ii) Observation of Snowfall

A research theme for observation of snowfall, which is challenge of GPM algorithm development, is expected.

Examples of research includes the following:

- From intensive observations using ground-based radars (JAXA Ka-band ground radars, etc.), calculating radar scattering and attenuation characteristics of precipitation particles for Ka-band by the dual Ka radar measurement, making direct comparisons between the DPR and the ground radars in snowfall by the upward measurement, and observing and summarizing feature of scattering and attenuation from the solid to liquid phase during multi-seasons by combining ground-based instruments; and
- Understanding characteristics of snowfall particles for the algorithm development, by long-term operational observation using ground-based instruments (radar, 2DVD, meteorological instruments, ground-based microwave imager, etc.) and validating estimation by the GPM algorithms; and
- Consolidating ground-based observation data in terms of Z-R relations, Z-M relations, drop size distribution, drop velocity, volume distribution, and mean density of snowflakes, hail, and sleet particles, compiling a database and providing them to the JAXA Algorithm Development Team.

(iii) Observation of Melting Layer

A research theme for observation of precipitation layers (snowfall, melting, and rainfall layers) to understand radar scattering and attenuation characteristics of KaPR, which are essential in developing and improving precipitation retrieval algorithms, is expected. JAXA is now planning an observation experiment for a melting layer, and research proposals connected to it will be recommended. Please inquire the PMM RA Office when you need details of the JAXA plan.

Examples of research includes the following:

- Observing precipitation layers (snowfall, melting, and rainfall layers) bi-directionally by the dual Ka radar measurement, placing one radar on high altitude and the other on low altitude; and
- Analyzing observation data focused on radar attenuation characteristics of Ka-band radar through a melting layer, compiling a database, providing results to the JAXA Algorithm Development Team to contribute to the determination of parameters in radar attenuation correction of the precipitation retrieval algorithms for the KaPR.

(2) Product Validation

This theme encompasses research contributing to validation of GPM and TRMM Level 2 / 3 standard products. Especially, evaluating accuracy of the precipitation rate from viewpoint of the target accuracies described in Table 1, verification of the products using ground instrument (rain gauge, radar, and etc) network worldwide such as in Asian countries, validation from hydrological aspects will be recommended.

Examples of research includes the following:

- Collecting long-term and widely distributed ground operational observations by rain gauge and radar, and validating the GPM and TRMM products by instantaneous and statistical values such as averages, trends, and histograms; and
- Validating GPM and TRMM products using the ground instruments for detection of heavy precipitation, in particular, in extreme precipitation events; and
- Comparing river runoff rates when the GPM and TRMM products are used as inputs in hydrologic models, with actual river runoff rates.

(3) Other Validation Activities and Data Collection

Research themes related to other validation activities and data collection and preparation other than above (1)-(2) will also be adopted. Research that will be effectively implemented by collaborating with other research programs, or research that will contribute to validation of GPM and TRMM standard products will be recommended.

2.2.3 Application Research

Research themes related to application research to utilize satellite-based precipitation observation data, such as GPM and TRMM data, will be adopted in this RA. For example, following research themes are included;

- creation of long-term and continuous data set using GPM and TRMM products
- research contributing to climate and global water cycle variation and precipitation system climatology using long-term satellite data, necessarily including GPM and TRMM data;
- operational utilization research leading to societal benefits at present and in the future GPM era, for example, flood prediction, water resource management, weather forecast, agricultural field, etc.;
- data utilization research in Asia, Africa and other areas, where ground precipitation observation is not sufficient;
- research to utilize GPM and TRMM data into atmospheric, climate, land, hydrological, and other models, and/or by data assimilation; and
- development and evaluation of new research products, such as data assimilation using GPM and TRMM data, or combination of other satellites and/or sensors with them.

As described in Chapter 5, this research theme will generally be implemented through a “Collaborative Research Agreement.”

3. Instructions for Responding to this RA

3.1. Qualifications

If a proposal is for peaceful purposes and has non-commercial objectives, researchers from all categories of domestic and foreign organizations including educational institutions, government offices, public companies, private enterprises and the other groups can apply for this RA.

3.2. Research Agreement Conclusion

After the proposals are selected, a research agreement should be made between JAXA and the organization to which the PI belongs, using associated terms and conditions to be prepared by JAXA. All applicants should carefully read Section 5, which describes detailed information on contract matters, and associated terms and conditions of the research agreement attached as Appendix D.

3.3. Research Period

The total research period of this RA will be 3 years from JFY 2013. However, performance will be evaluated based on an interim report at the end of each Japanese fiscal year in order to verify and decide whether the research is to be continued the following year.

3.4. Resources

(1) Funding

JAXA will reserve funds to support selected proposals. The basic policy for funding is as follows.

A) Based on the purpose of this RA, funding will be available within JAXA's budget limitation.

B) JAXA funding is restricted to domestic PIs, although some exceptions may be made for research that is necessary for GPM mission success.

C) JAXA funding is restricted to the direct cost of research ("Direct Cost") and does not bear any overhead costs, indirect costs, general costs, or whatsoever ("Overhead Cost") of the organization to which an applicant belongs. However, if this is impossible or requires special procedures, an applicant may fill in the prescribed remarks column of the Resource Requirement (Appendix B) as such.

D) If funding is not available for an applicant, the applicant may be selected as a non-funded PI upon consultation with JAXA.

(2) Earth observation satellite data by JAXA

Earth observation satellite data necessary for conducting research and owned by JAXA will be provided free of charge within the limitations of distribution capability of JAXA. Available data are listed in APPENDIX .B. Those who receive Earth observation satellite data shall comply with terms and conditions described in the chapter titled "Providing of Earth Observation Satellite Data by JAXA" in the research agreement.

3.5. Obligations

PIs have different obligations depending on the funding status.

(1) Funded PIs shall submit to JAXA an interim report on the results at the end of each JFY and a final report at the end of the 3-year research period. Funded PIs are also required to participate in the accomplishment debriefing meeting organized by JAXA once a year and present Research Progress. PIs must cover necessary travel expenses for participating in this meeting using funds provided by this RA.
(2) Non-funded PIs shall also submit an interim report and a final report at the end of the 3-year research period. However, such reports can be substituted with papers published during the term. PIs shall also report research progress ("Research Progress") either in presentation at the workshops and meetings which JAXA holds or in writing. Support of travel expenses will be decided by JAXA on a case by case basis depending on the research content, results, and its progress.

3.6. Selection

Selection of proposals will be based on a peer-review process and discussions in science/project evaluation boards. JAXA selection officials make the final decisions. The principal elements considered in evaluating a proposal are its relevance to the objectives, intrinsic merit and cost. Evaluation of its intrinsic merit includes consideration of the following equally important factors:

(1) Overall scientific and technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal;

(2) Proposer's capabilities, related experience, facilities, techniques, or unique combinations of these that are integral factors for achieving the proposal objectives;

(3) The qualifications, capabilities, and experience of the proposed PI and CI; and

(4) Overall standing among similar proposals and/or evaluation against state-of-the-art techniques.

3.7. Late Proposals

Proposals or modifications received after the date specified in this RA may be considered if the selecting official deems them to offer JAXA a significant scientific and/or technical advantage or cost reduction.

3.8. Withdrawal of Proposal

Proposals may be withdrawn by the applicant at any time but before research agreement conclusion. To withdraw a proposal, however, the applicant should immediately notify JAXA. After research agreement conclusion, procedure in response to research agreement will be needed to withdraw a proposal.

3.9. Cancellation and Postponement

JAXA reserves the right to cancel this RA upon notice delivered by JAXA. In addition, JAXA assumes no liability for canceling this RA or for postponing the RA schedule.

3.10. Important Dates

August 9, 2012	Research Announcement issued
October 15, 2012	**Proposal Due Date**
January, 2012	Notification of Selection Results

3.11. Proposal Submission and Contact Point

Proposals with complete sets of attachments, such as reprints of papers, should be converted to **PDF and sent via E-mail** to the PMM RA Office. The maximum file size acceptable by E-mail is 10MB.

E-mail address of PMM RA Office: PMM_RA @ jaxa.jp

In case of difficulty sending via E-mail, five copies of both proposals and the complete set of attachments should be sent via postal mail to:

Mr. Kazuhide Yamamoto (PMM RA Office)
Earth Observation Research Center (EORC)
Tsukuba Space Center
Japan Aerospace Exploration Agency
2-1-1, Sengen, Tsukuba, Ibaraki, 305-8505, Japan

The point of contact is:

Mr. Kazuhide Yamamoto (PMM RA Office)
Earth Observation Research Center
Tel: +81-50-3362-6270
Fax: +81-29-868-2961
E-mail address: PMM_RA @ jaxa.jp

4. Instructions for Proposal Contents

4.1. General

(1) Proposals received in response to this RA will be used only for evaluation purposes.
(2) The following types of proposals are not acceptable.
  A) Proposals that include restrictions or patents from other institutions.
  B) Proposals that are restricted when distributed or published.
(3) Proposals will not be returned to applicants.

4.2. Format

(1) It is highly recommended that applicants send their proposals and complete sets of all attachments, such as reprints of papers, in **PDF via E-mail.**
(2) Forms for cover sheet, work plan, and resource requirements can be found in Appendices A and B. No mandatory formats are applied to other parts of the proposal except the following.
  A) The page or paper size should be A4 size.
  B) The page number must appear at the middle of the bottom of each page, and the name of the applicant must appear in the upper right corner.
  C) Proposals should be word-processing documents in Japanese or English, with a font size not smaller than 12 points.
(3) Proposals should be brief and to the point, concentrating on substantive materials. The main body of the proposals should not exceed 20 pages in length. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments must accompany each copy of a proposal when submitting via postal mail.

4.3. Proposal Contents

(1) Cover sheet

A) Research title

State your research title precisely and clearly. The title should be brief, reflecting an especially valid project intelligible to a science-literate reader and suitable for use in the public process.

B) Research category

Choose the relevant category to which the proposal belongs.

D) Information of applicants

- Identifying information of PI.
  State the name, job title, organization, address, E-mail address, and telephone and facsimile numbers of the PI.
- Identifying information of Co-investigator.
  State the name, organization, telephone number, and E-mail address of each Co-investigator (CI). One research team should consist of only one PI, or one PI and several CIs.

E) Budget

Provide a 3-year budget broken down by year and the 3-year total amount in Japanese Yen (from JFY 2013 through 2015).

F) Endorsement

Signature of a responsible official or authorized representative of the proposing organization, or any other person authorized to legally bind the organization.

(2) Abstract

Include a concise, one-page abstract describing the objective, significance, method of approach, and anticipated results.

(3) Description of proposal

This is the main body of the proposal and it should not exceed 20 pages in length. This main body shall be a detailed statement of the work to be undertaken, including its objectives and significance, relation to the present state of knowledge, and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experiment methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the RA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(4) Work plan (Research schedule)

The research schedule should be outlined in the form indicated in Appendix A.

(5) Management approach

For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) Personnel

A) Biographical information, experience, papers in related fields
   A short biographical sketch, a list of publications, experiences related to this RA, and professional qualifications of the PI should be included. Also provide similar biographical information on each CI.

B) Role of CI
   The PI is responsible for supervising the work and CIs in the research. State each CI's role in the proposed research.

(7) Resource requirements

Resource requirements should be described in the form indicated in Appendix B. Information of required resources will be considered during the selection process. After deciding the total amount of funding for each PI, JAXA will send more detailed forms for resource requirements to selected PIs for the final adjustment of funding. Before beginning the second and third years, JAXA will send the same forms for resource requirements again. Instructions for the budget summary and data request are also included in Appendix B.

5. Description of Research Agreement

5.1. Contractual Procedure

(1) After selecting the proposal and the PI, JAXA will send the PI guidelines and an application form for making an agreement. Please note that JAXA will make an agreement with the organization to which the PI belongs ("the Research Organization"), not with the PI or CI.
(2) A research agreement will be made in accordance with 'associated terms and conditions' attached herein as Appendix D. The Research Organization shall submit the application form with necessary documents according to the guidelines within the submission due date. The submission of the application form will be regarded as definite intention of making an agreement with JAXA in full consent to all of the terms and conditions stipulated in Appendix D, and the agreement will be effective upon issuance of the confirmation sheet by JAXA.
(3) If JAXA determines that an extension of a research project is justified by the interim report at the end of the Japanese Fiscal Year (JFY), the research agreement will be extended for 1 year, but no later than March 31, 2015. Funded organizations should submit the continuing agreement application form to JAXA at the beginning of every JFY.
(4) The Research Organization shall comply with the terms and conditions defined in the research agreement.

5.2. Research Agreement Summary

There are two types of associated terms and conditions of research agreements based on the applicable category of research: Commissioned Research Agreement and Collaborative Research Agreement. There are also two types of agreements for Collaborative Research Agreement: funded or not funded by JAXA.

(1) Commissioned Research Agreement (Funded)

- In principle, the Commissioned Research Agreement will be applied to research in the development or improvement of algorithms and some research in the validation category. The Research Organization shall conduct the research according to the Statement of Work provided by JAXA.
- JAXA will provide to the Research Organization the funds and the data sets necessary to conduct the research as described in the Statement of Work.
- JAXA will own research results that the Research Organization shall deliver to JAXA in accordance with the Statement of Work (Deliverable Research Results). However, JAXA will own all Program/Data Copyrights in principle.
- JAXA will retain royalty-free rights to use all of the results derived from these research activities other than Deliverable Research Results only for its own research and development purposes.
- In the event JAXA provides prior written consent, the Research Organization may use Deliverable Research Results for its own research and development purposes.
- If the Agreement is terminated, the Research Organization shall refund to JAXA any unexpended research funds that have already been paid by JAXA.

(2) Collaborative Research Agreement (Funded/Non-funded)

- In principle, the Collaborative Research Agreement will be applied to research in the "Validation"

and "Application Research" categories.

- JAXA will provide to the Research Organization funds the finds (for funded cases) and the data sets necessary to conduct the research.
- In principle, the research results will be jointly owned by the parties: the share of which shall be determined in proportion to the contribution of the parties.
- JAXA will retain the right to use all results including results belonging to the Research Organization (if any), and the Research Organization will retain the right to use jointly-owned research results, only for each party's own research and development purposes, without prior consent of the other.

The difference between funded agreement and non-funded agreements:

- Collaborative Research Agreement (Funded)
  JAXA provides part of the research funds and the data sets. The Research Organization shall submit an interim report and a final report to JAXA, and shall participate in the workshops to report research progress. If this agreement is canceled or terminated, the Research Organization shall refund to JAXA any unexpended funds that have already been paid by JAXA.
- Collaborative Research Agreement (Non-funded)
  JAXA provides only the data sets. The Research Organization shall submit an interim report and a final report to JAXA. However, such reports can be substituted with papers published during the research term. Participation in the workshops is highly recommended, but not mandatory.

(3) Publication of results

A PI who wishes to release his or her research results derived from these research activities to a third party shall

- Provide JAXA with a copy of the publication before release,
- State in the publication that he or she obtained the results through participating in this RA research, and
- Grant JAXA an irrevocable and royalty-free right to use the provided publications, unless an academic society responsible for its publication requires the PI to transfer the copyright to it.

APPENDIX A

PROPOSAL COVER SHEET AND SCHEDULE

Proposal Cover Sheet
JAXA PMM Research Announcement

Proposal No.	_____ (Leave Blank for JAXA Use)		
Title			
Research category (check one)	**(1)Algorithm**	**(2)Validation**	**(3)Application**
	☐	☐	☐

Principal Investigator

Name		**Job Title**	
Department			
Institution			
Address			
Country			
E-mail			
Telephone			
Facsimile			

Co-Investigator

Name	Institution	Telephone	E-mail

Budget (yen in thousands) (Direct Cost only)

JFY2013	JFY2014	JFY2015	TOTAL

(Leave Blank for JAXA Use)

Authorizing Official: _____ _____
(Name and Title) (Institution)

Research Schedule

JFY	2013				2014				2015			
Month	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3
Milestone												
Activities												

APPENDIX B

RESOURCE REQUIREMENTS

BUDGET SUMMARY

Direct Cost only

1. Personnel Expenses **(unit: yen in thousands)**

	2013	2014	2015	Total

2. Purchases

2.1 Computers / Peripheral Equipment **(unit: yen in thousands)**

ITEM	2013	2014	2015	Total

2.2 Software **(unit: yen in thousands)**

ITEM	2013	2014	2015	Total

2.3 Expendable Materials and Supplies **(unit: yen in thousands)**

ITEM	2013	2014	2015	Total

3. Subcontracts **(unit: yen in thousands)**

ITEM	2013	2014	2015	Total

4. Travel Expenses **(unit: days / times or days / travelers)**

Departure Point – Destination	2013	2014	2015

5. Observation Equipment **(unit: yen in thousands)**

ITEM	2013	2014	2015	Total

6. Satellite Data **(unit: yen in thousands)**

Name of Satellite / Sensors	Distributor	Purpose	Cost			
			2013	2014	2015	Total

7. Other Data **(unit: yen in thousands)**

Name of Data Sets	Distributor	Purpose	Cost			
			2013	2014	2015	Total

8. Others **(unit: yen in thousands)**

ITEM	2013	2014	2015	Total

TOTAL (unit: yen in thousands) (Except "4.Travel Expenses")				

*** Remarks "Overhead Cost" (q.v. 3.4(1)C) of this RA)**

Please check either of the following boxes:

☐ **Unnecessary**

☐ **Deductible with special procedures (e.g. submission of certain application form from JAXA)**

☐ **Indispensable (Reason(s):**)

BUDGET SUMMARY (***EXAMPLE***)

1. Personnel Expenses **(unit: yen in thousands)**

	2013	2014	2015	Total
Part-time job for DSD data analysis	*320 (40x8)*	*160 (20x8)*	*800 (100x8)*	*1280*

2. Purchases

2.1 Computers / Peripheral Equipment **(unit: yen in thousands)**

ITEM	2013	2014	2015	Total

2.2 Software **(unit: yen in thousand)**

ITEM	2013	2014	2015	Total

2.3 Expendable Materials and Supplies **(unit: yen in thousands)**

ITEM	2013	2014	2015	Total
8mm tape (112m)	*50*	*50*	*50*	*150*
CD-R	*100*	*120*	*120*	*340*
MO (640MB)	*15*	*10*	*10*	*35*
A4 Paper (package of 500 sheets)	*2*	*1*	*1*	*4*
CD-RW Drive	*50*			*50*

3. Subcontracts **(unit: yen in thousands)**

ITEM	2013	2014	2015	Total
Software development for DSD data analysis	*1,500*	*600*	*600*	*2,700*

4. Travel Expenses **(unit: days / times or days / travelers)**

Departure Point – Destination	2013	2014	2015
Tokyo - Washington, D.C.	*7/1*		
Tokyo - Paris	*5/1*	*8/1*	
Tokyo - Paris		*6/1*	*6/1*
Tokyo - Osaka			*3/1*

5. Observation Equipment **(unit: yen in thousands)**

ITEM	2013	2014	2015	Total
Micro Rain Radar	*1,500*			*1,500*

6. Satellite Data **(unit: yen in thousands)**

Name of Satellite / Sensors	Distributor	Purpose	Cost			
			2013	2014	2015	Total

7. Other Data **(unit: yen in thousands)**

Name of Data Sets	Distributor	Purpose	Cost			
			2013	2014	2015	Total

8. Others **(unit: yen in thousands)**

ITEM	2013	2014	2015	Total

TOTAL (unit: yen in thousands) (Except "4.Travel Expenses")	*3,537*	*941*	*1,581*	*6,059*

JAXA DATA REQUIREMENTS

1. JAXA-Archived Satellite Data Sets

(JERS, ADEOS, TRMM, Aqua, ADEOS-II, GOSAT, GCOM-W1, ALOS)

Name of Satellite / Sensor	Quantity (scenes)	Purpose

B.1 Instructions for Budget Summary

Provide a budget summary by cost element (Personnel Expenses, Computers/Peripheral Equipment, Software, Expendable Materials and Supplies, Subcontracts, Travel Expenses, Observation Equipment, Satellite Data, Other Data, and Others), sorted by Japanese fiscal year as in the example attached to this form. An annual summary budget should also appear on the last line.

(1) Personnel Expenses
Enter expenses for part-time workers here as the total cost calculated by multiplying the unit cost per day by the number of days. For part-time workers, use your own cost estimates.

(2) Computers/Peripheral Equipment/Software
Enter the lease and rental cost of computers and/or peripheral equipment. Note that JAXA has the right to change specifications of all equipment. Also enter the cost of software here.

(3) Expendable Materials and Supplies
Enter the quantity of each item, following the example.

(4) Subcontracts
Provide the cost of subcontracts to outside companies or organizations here.

(5) Travel Expenses
Describe proposed domestic and/or international travel including information on destination and number of days/number of times (or travelers).

(6) Observation Equipment
Enter costs of observation equipment including installation cost.

(7) Satellite Data
Investigators requesting satellite data other than JAXA-owned or archived data (listed in the next section) should provide cost information here.

(8) Other Data
Enter costs for data other than satellite data.

(9) Others
Enter costs for publication and others here.

B.2 Instructions for Data Requirements

JAXA-owned satellite data includes TRMM data and other satellite data listed below. JAXA will provide requested data judged necessary for the proposed research, subject to availability of data processing.

- Japanese Earth Resources Satellite (JERS) (global)
- Advanced Earth Observing Satellite (ADEOS)
- Tropical Rainfall Measuring Mission (TRMM)
- Advanced Microwave Scanning Radiometer for EOS (AMSR-E) aboard EOS-Aqua Satellite
- Advanced Earth Observing Satellite-II (ADEOS-II)
- Greenhouse Gases Observing Satellite (GOSAT)
- Global Change Observation Mission 1st - Water (GCOM-W1)
- Advanced Land Observing Satellite (ALOS) (10 scenes from JAXA archives)

Data availability can be checked on JAXA's Earth Observation Satellite Data Distribution Service (linked from EORC website, http://www.eorc.jaxa.jp/en/about/distribution/index.html).

APPENDIX C

OVERVIEW OF THE GLOBAL PRECIPITATION MEASUREMENT (GPM) AND THE TROPICAL RAINFALL MEASURING MISSION (TRMM)

1. Introduction

"Precipitation" is one of most important environmental parameters. Changes in its amount and distribution may affect our everyday life, and they may cause serious damages to human lives and properties. Too much precipitation causes floods, and too less of it causes droughts. Agricultural production depends on precipitation. It is one of the three foremost weather prediction variables along with temperature and wind. Precipitation is a true global variable that determines the general circulation through latent heating, which is an "engine" for circumglobal winds, and reflects climate changes. It is a key component of air-sea interaction and eco-hydrometeorological modeling.

Although there is no doubt that precipitation is such an important component of our environment, it is one of the least known physics components of cloud, weather and climate prediction models. Because of its large variability in space and time, its distribution over the globe is not accurately known. Knowledge of the spatial and temporal distribution of global precipitation is a key to improving our understanding of weather and climate systems.

The Tropical Rainfall Measuring Mission (TRMM) satellite, which is still flying and archiving tropical/subtropical rainfall data more than 11 years, is a joint Japan-US mission. TRMM, launched in the end of November 1997 by the Japanese H-II rocket, focuses on measuring tropical/subtropical rainfall and their diurnal variations, and covers latitude from 35S to 35N. TRMM has three precipitation sensors: the Precipitation Radar (PR), the world first space-borne precipitation radar developed by Japan, and the TRMM Microwave Imager (TMI) and the Visible Infrared Scanner (VIRS) developed by the U.S., which enables observation of rainfall structures by multiple sensors, simultaneously.

Because of the success of the TRMM satellite, several requirements for the successor mission emerged from the science and operational user community. The Global Precipitation Measurement (GPM) mission was proposed to fulfill those requirements. GPM is a satellite program to measure the global distribution of precipitation accurately in a sufficient frequency so that the information provided by this program can drastically improve weather predictions, climate modeling, and understanding of water cycles. Its feasibility has been studied at Goddard Space Flight Center of the National Aeronautics and Space Administration (NASA) and the Japan Aerospace Exploration Agency (JAXA). Accurate measurement of precipitation will be achieved using the Dual-frequency Precipitation Radar (DPR) installed on the GPM Core Observatory. The DPR on the GPM Core Observatory is being developed by JAXA and the National Institute of Information and Communications Technology (NICT).

2. The Tropical Rainfall Measuring Mission (TRMM)

The Tropical Rainfall Measuring Mission (TRMM) satellite (Figure 1) was launched by H-II rocket No. 6 in November 1997, and continues its observation more than 14 years later.

Major characteristics of the TRMM satellite are described in Table 1. TRMM is joint mission between Japan (JAXA (former NASDA) and NICT (former CRL)) and the U.S. (NASA). The major objective of TRMM is to determine accurate rainfall amount associated with tropical convective activities, which is a drive source of global atmospheric circulation. To this purpose, the TRMM satellite focuses on rainfall observation, and carries the world's first satellite-borne Precipitation Radar (PR) developed by Japan, in addition to conventional instruments such as infrared imager and microwave imager (TRMM Microwave Imager: TMI). The combination use of PR and TMI has greatly improved the estimation of rainfall amount and has succeeded in observing climate changes, as with El Niño and La Niña. Since the three-dimensional structure of rainfall over the land and ocean can be derived from PR, TRMM has also revealed the three-dimensional structure of typhoons over the ocean, which was rarely observed before TRMM. The success of TRMM shows the potential of satellite remote sensing contributions for understanding the water cycle on Earth and improving weather forecasts.

The TRMM satellite also targets rainfall observation in the tropics and sub-tropics. In order to measure

tropical rainfall that has large diurnal variation, it flies in non-sun-synchronous orbit with an inclination angle of 35°. Although the designed lifetime of the satellite was about 3 years, the satellite altitude was boosted from 350 km to 402.5 km in August 2001 to extend the lifetime by reducing atmospheric drag. In March 2009, more than 11 years after the satellite's launch, it continues its excellent observation and provides valuable meteorological and climatological data relating to precipitation, through long-term observation of the current status of rainfall in the tropics and sub-tropics, for understanding water cycle mechanisms.

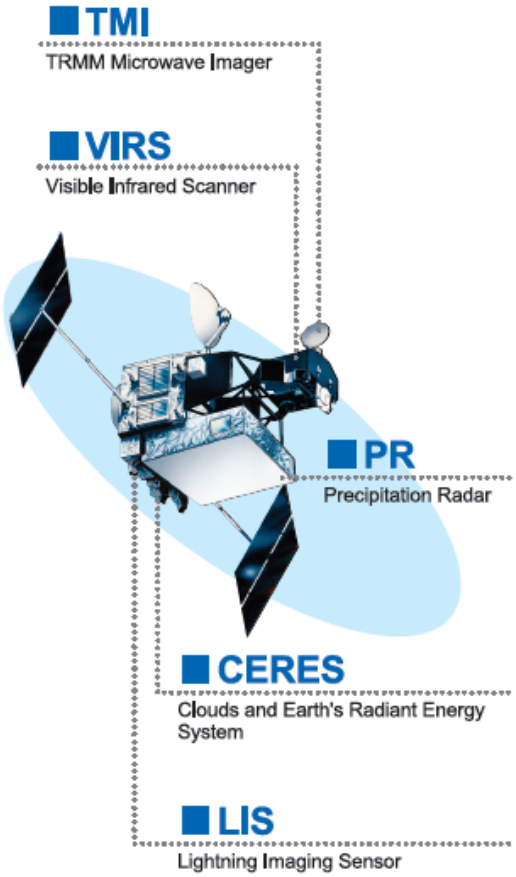

Figure 1 Overview of the TRMM Satellite and the Five on board Sensors

Table 1 Major Characteristics of the TRMM Satellite

Launch weight	Approx. 3.62 ton
Launcher	H-II rocket
Launch date	November 28, 1997 6:54 AM (JST)
Altitude	Approx. 350 km (402.5 km since August 24, 2001)
Orbit	Circular orbit (Non-sun-synchronous)
Inclination	Approx. 35 degrees
Shape	At lift-off: 5.1 m (length), 3.7 m (diameter) In orbit: 5.1 m (length), 14.6 m (in paddle direction)
Weight	Total: 3,524 kg Fuel: 890 kg Dry weight: 2,634 kg
Power	Ave. 850 W Attitude control Zero momentum three-axis stabilized
Attitude control	Zero momentum three-axis stabilized
Data transmission	Via TDRS 32 Kbps (real time), 2 Mbps (play back)
Design life	3 years and 2 months
Mission instrument	Precipitation Radar (PR) TRMM Microwave Imager (TMI) Visible Infrared Scanner (VIRS) Clouds and Earth's Radiant Energy System(CERES)

3. The Global Rainfall Measurement (GPM)

3.1 From TRMM to GPM

As accuracy of satellite precipitation estimates improves and observation frequency increases, application of those data to societal benefit areas, such as weather forecasts and flood predictions, is expected, in addition to research of precipitation climatology to analyze precipitation systems. There is, however, limitation on single satellite observation in coverage and frequency. Currently, the Global Precipitation Measurement (GPM) mission is scheduled under international collaboration to fulfill various user requirements that cannot be achieved by the single TRMM satellite.

One major characteristic of GPM as follow-on and expansion of TRMM is to operate the GPM Core Observatory, which will carry an active precipitation radar and a passive microwave radiometer, with a non-sun-synchronous orbit as a calibrator to other satellites. The other is a collaboration with a constellation of several satellites developed by each international partner (space agency) that will carry passive microwave radiometers and/or microwave sounders, to increase observation frequency. Although the TRMM satellite focused on observation of the tropics, the GPM mission covers broader areas, including high latitudes.

3.2 Concept of the GPM Mission

TRMM is single satellite mission for scientific research. On the other hand, the GPM mission (Fig. 2) is an international mission to achieve high-accurate and high-frequent rainfall observation over a global area. GPM is composed of a TRMM-like non-sun-synchronous orbit satellite (GPM Core Observatory) and multi-satellites carrying microwave radiometer instruments (constellation satellites). The GPM Core Observatory carries the Dual-frequency Precipitation Radar (DPR), which is being developed by JAXA

and NICT, and the GPM Microwave Imager (GMI) provided by NASA, and will achieve more accurate but narrower observation as a calibrator to other constellation satellites. Constellation satellites, which carry a microwave imager and/or sounder and are planned to be launched around 2014 by each partner agency for its own purpose, and will contribute to extending coverage and increasing frequency.

To take over the results that have been achieved by TRMM and to facilitate development of those results, the GPM mission is planned to meet user requirements that cannot be achieved by TRMM or are expected to be improved in GPM: 1) expansion of observation coverage; 2) increase of observation frequency; and 3) improvement of observation accuracy.

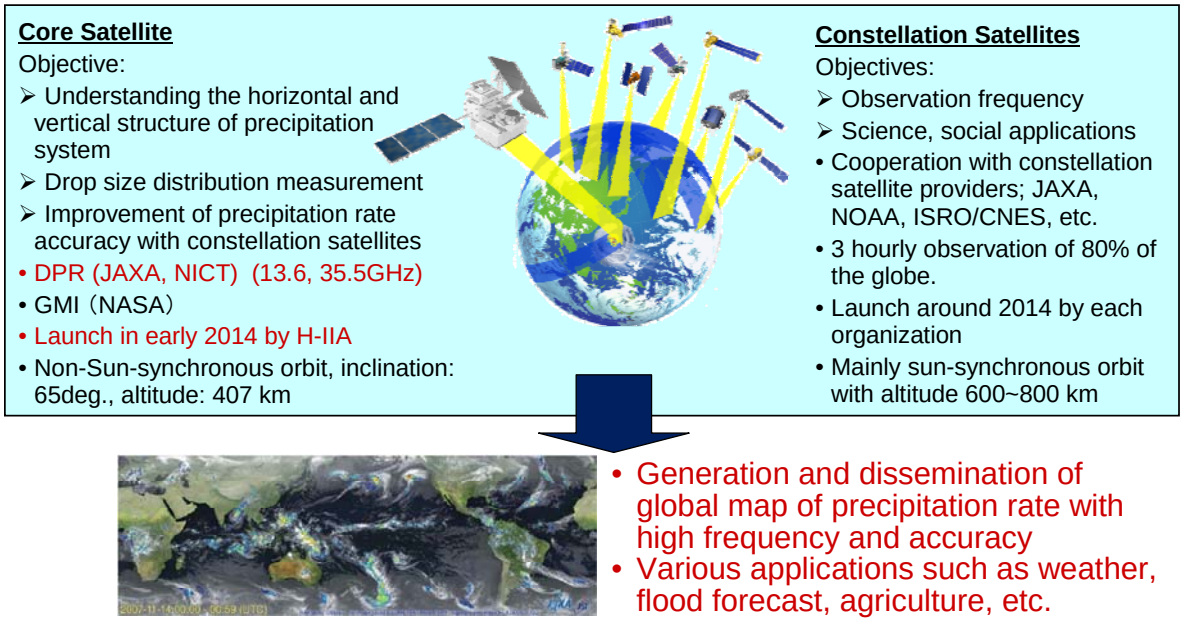

Figure 2 Overview of the GPM Mission

3.3 **Overview of the GPM Core Observatory**

The GPM Core Observatory (Table 2 and Figure 3), which is being jointly developed by Japan and the U.S., is scheduled to be launched in early 2014. The core satellite carries a Dual-frequency Precipitation Radar (DPR) developed by Japan, and a GPM Microwave Imager (GMI) developed by U.S. The orbit of the core satellite is non-sun-synchronous with an inclination angle of 65°. This orbit was selected to meet certain requirements, such as to measure diurnal variation of rainfall in mid- and high-latitudes as well as the tropics for around 2 months.

Table 2 Major Characteristics of the GPM Core Observatory

Orbit	Non-sun-synchronous
Inclination	65degrees
Altitude	407 km
Mission instrument	Dual-frequency Precipitation Radar (DPR) GPM Microwave Imager (GMI)
Mission life	3 years (target: 5 years)
Launch date	early 2014

The Dual-frequency Precipitation Radar (DPR) on board the GPM Core Observatory is composed of two radars: a Ku-band (13.6-GHz) Precipitation Radar (KuPR) and a Ka-band (35.5-GHz) Precipitation Radar (KaPR). KaPR aims at sensitive observation, and can detect weaker rainfall and snowfall that cannot be measured by KuPR. Since KuPR can detect heavier rainfall, simultaneous observation of KaPR and KuPR will enable accurate measurement of precipitation from heavy rainfall in the tropics to weak snowfall in high latitudes. Rain echo is affected by precipitation attenuation, and its amount depends on radar frequency and raindrop size. By matching position of radar beams and timing of transmitted pulses for KuPR and KaPR, and measuring precipitation particles at the same place simultaneously by dual-frequency, size of precipitation particles (raindrop size distribution) can be estimated by differences in precipitation attenuation. This information cannot be obtained by single-frequency radar, such as TRMM's PR, and will improve accuracy of precipitation estimation. It is also expected to identify rainfall and snowfall by using differences in precipitation attenuation for dual-frequency.

The GPM Microwave Imager (GMI) instrument on board the GPM Core Observatory is a multi-channel conical-scanning microwave radiometer developed by NASA, and it is based on the TMI on board the TRMM satellite. The major role of the GMI is to improve accuracy of rainfall/snowfall estimates by simultaneous observation with the DPR, and to work as a bridge between highly accurate observation by the core satellite and frequent observations by the constellation satellites. GMI is also expected to serve as a 'radiometric standard' for the other microwave radiometers on board the GPM constellation satellites, and to reduce differences in rain rate estimation arising from biases of instruments. The GMI is characterized by thirteen microwave channels ranging in frequency from 10 GHz to 183 GHz. In addition to carrying channels similar to those on the TRMM Microwave Imager (TMI), the GMI carries four high frequency, millimeter-wave, channels of about 166-GHz ('window' channel) and 183-GHz (water vapor channel). Addition of those high frequency channels is expected to contribute to improvements in accuracy of weak rainfall and snowfall estimates, especially over the ocean and land in high-latitudes. With a 1.2 m diameter antenna, the GMI will provide significantly improved spatial resolution over TMI.

The roles of the GPM primary satellite are to collect as much microphysical information as possible for accurate rain estimation by performing synchronous observation with the GMI and the DPR and to provide calibration standards for the other microwave radiometers on the constellation satellites.

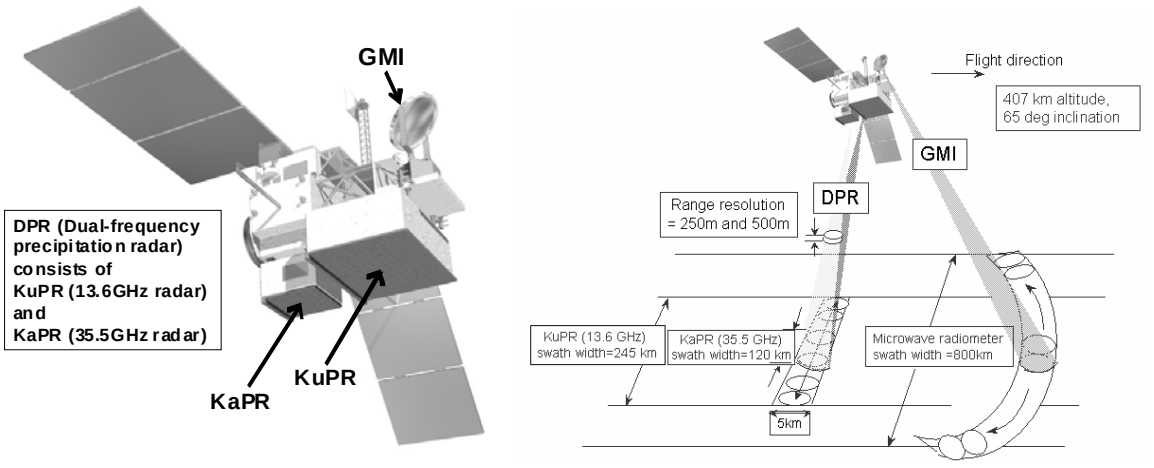

Figure 3 Overview of the GPM Core Satellite and Concept of Precipitation Observation

3.4 Collaboration with Constellation Satellites

In the case of low orbital satellites, such as TRMM and Aqua, single-satellite cannot observe frequently at each local point. To overcome this weakness and achieve frequent observation, the GPM mission will work with other satellite missions in the world. Figure 4 shows how the observation area covered in 3 hours by microwave radiometers on polar-orbiting satellites increases with the number of satellites. As the number increases, the coverage for a given time increases, and hence the sampling interval at a given point decreases. In the GPM era, eight sun-synchronous polar-orbiting satellites enable global observation of precipitation every 3 hours. In the GPM era, one primary satellite and eight constellation satellites will produce 3-hour global precipitation maps that will be delivered to users in near real time.

Constellation of several satellites developed by each international partner (space agency) will carry passive microwave radiometers and/or microwave sounders and be in operation around 2014. The DPR and GMI instruments on board the core satellite will serve as a 'calibrator' for data obtained by constellation satellites.

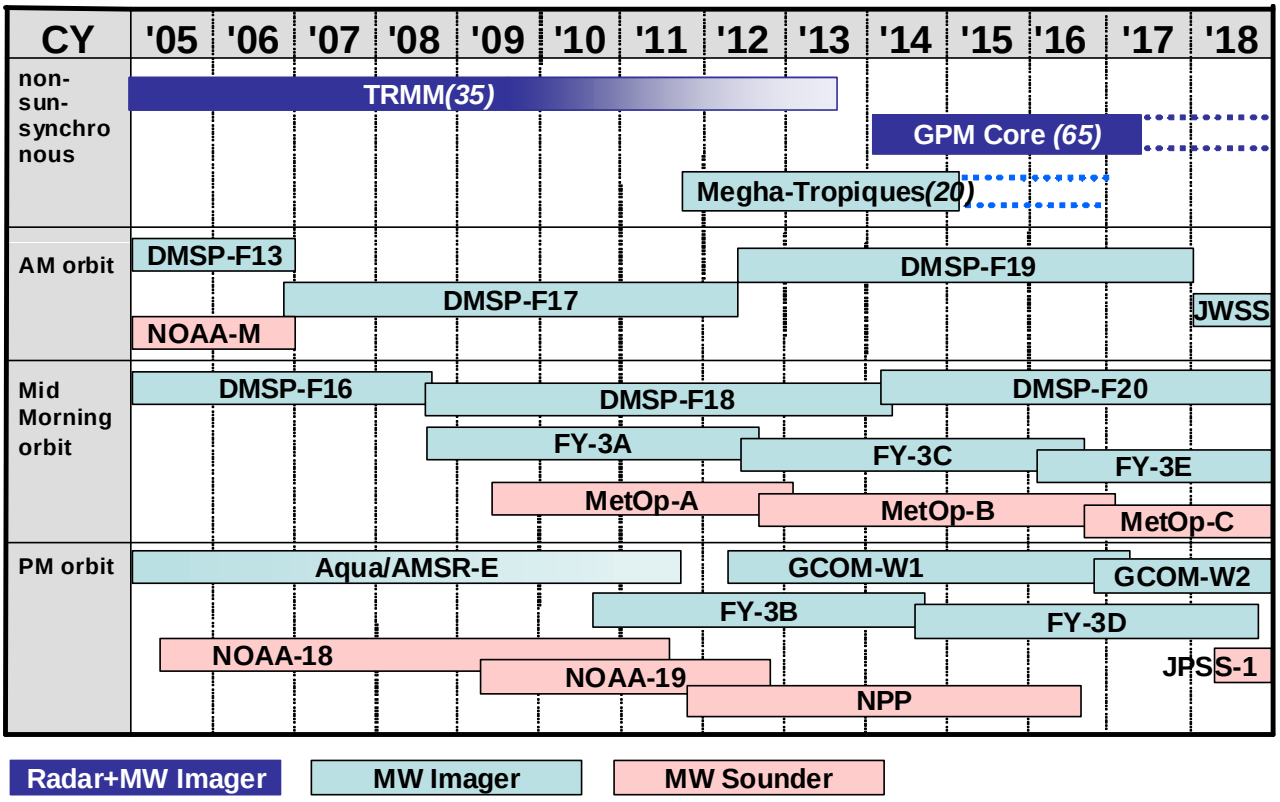

Figure 4 Worldwide Missions for Satellite Precipitation Observation (2005-2018) as of July 2012

APPENDIX D

ASSOCIATED TERMS AND CONDITIONS OF RESEARCH AGREEMENTS

(FOR THE 7TH PMM SCIENCE RESEACH ANNOUNCEMENT)

COMMISSIONED RESEARCH AGREEMENT

FOR

THE 7TH PRECIPITATION MEASURING MISSION

BETWEEN

THE JAPAN AEROSPACE EXPLORATION AGENCY (JAXA)

AND

THE RESEARCH ORGANIZATION

(FOR THE RESERACH ANNOUNCEMENT)

JAPAN AEROSPACE EXPLORATION AGENCY

7th PMM SCIENCE RESEARCH ANNOUCEMENT
COMMISSIONED RESEARCH AGREEMENT

The Japan Aerospace Exploration Agency ("JAXA") announces the PMM Science Research Announcement ("RA") in the field regarding the algorithm development, calibration verification and data utilization verification of the Precipitation Measuring Mission (PMM) and accepts a proposal, which has an exceptional quality from the submitted proposals. In accordance with each article below, the PMM Commissioned Research Agreement ("Agreement") is concluded between JAXA and the Research Organization ("RO") to which the Principal Investigator ("PI") of the accepted proposal affiliates.

Article 1. Definition

1. The following capitalized terms in this Agreement shall have the following meanings.

(1) "Research Results" means the technical results and scientific knowledge derived from the implementation of the Research Projects pursuant to this Agreement, including all inventions, ideas, designs, literary works, algorithms (e.g. Technological development accompanied by Program/Data to embody such algorithms), and technical know-how.

(2) "Industrial Property Rights" means all domestic and foreign patents, utility models and industrial designs.

(3) "Commissioned Research Plan" means the plan described in Attachment 1 of the Application Form for the PMM Research Announcement Commissioned Research Agreement (hereinafter "Application Form").

(4) "Research Period" means the research period as described in the Commissioned Research Plan. In accordance with the provisions of this Agreement, in the event that the Agreement ended prior to the completion date of the research originally set, the date the Agreement ends shall be read as the research period.

(5) "Annual Evaluation" means JAXA's annual review, which is carried out by JAXA before the end of the Japanese fiscal year during which the Agreement was concluded. At the end of each fiscal year, the review is conducted through the RO's presentation at workshops and meetings as well as based on the Progress Report.

(6) "Earth Observation Satellite Data" means data sets obtained from satellites, which are retained by JAXA at the time of execution of this Agreement. The available data sets including names of satellites or sensors, observation period that can be offered, and observation areas listed in the Attachment of this Agreement.

(7) "Meteorological Data" means the data provided by the Japanese Meteorological Agency.

2. In this Agreement, “Invention etc.” contains multiple meanings: When it is a subject of patent rights it refers to an invention; when it is a subject of a utility model it refers to an idea; when it is a subject of the rights for industrial design, literary work of program and database, it refers to a creation; when it is a subject of algorithm and technological know-how it refers to proposition.
3. In this Agreement, “utilization” of Industrial Property Rights and Research Results refer to the acts specified in paragraph 3 of Article 2 of the Patent Act, paragraph 2 of Article 3 of the Utility Model Act, paragraph 3 of Article 2 of the Design Act, and Article 21 and 27 of the Copyright Act (including the use of the secondary publication created by JAXA), as well as the use of algorithm and technical know-how.
4. In this Agreement, “PI” (Principal Investigator) refers to the person who submitted the research proposal to this Research Announcement and who is also the RO employee selected to be responsible for the implementation of the accepted Research Project. “CI” means “Co-Investigator” who supports the research activities represented by the PI. Name of the PT and CI (hereinafter “Commissioned Researchers”) and their affiliated organization will be show in the “Commissioned Research Plan”.

Article 2. Purpose and Scope of Research Projects

The RO shall implement the following tasks.

(1) The RO shall conduct the research activities (“Research Projects”) in accordance with the Statement of Work issued by JAXA (“Statement of Work”) and the Commissioned Research Plan.
(2) The RO shall respond to requests from JAXA and attend required meetings hosted by JAXA such as the workshop at the end of each fiscal year.
(3) The RO shall report the Research Results and progress of the research at the annual workshops and meetings hosted by JAXA.
(4) Each year before the end of the Agreement Period, the RO shall deliver JAXA the Research Results acquired during the effective term of the Agreement in the form of a Progress Report in accordance with the Statement of Work. The Progress Report shall contain the deliverable Research Results specified in the Statement of Work. In addition, upon the completion of the research period, the RO shall deliver JAXA the Progress Report regarding the Research Results acquired during the whole of the commissioned research period. In such a case, the RO will not be required to deliver another Progress Report for the final year of the Agreement.

Article 3. Effective Term and Renewal

The Agreement shall be concluded upon the acceptance through the issuance of the Confirmation Sheet by JAXA for the application submitted by the RO using the application form, and the

Agreement shall become effective as per the date prescribed on the Confirmation Sheet issued by JAXA and shall continue to be in effect until the end of the present Japanese fiscal year ("Agreement Term"). However, the Agreement Term shall be renewed for one Fiscal Year provided that JAXA approves an extension of the research period in the Annual Evaluation; provided, however, that the Parties mutually agree upon the amount to be paid by JAXA for the extended period; further provided, however, the RO shall submit a renewal Application Form to JAXA and JAXA shall approve by issuing a new Confirmation Sheet. Thereafter the procedure shall be the same as above.

Article 4. Annual Evaluation

1. JAXA shall conduct an Annual Evaluation regarding the contents of the Agreement fairly at the end of the Agreement Term.
2. In the event that the results of the evaluation was a fail in the Annual Evaluation, the provisions in Article 29 ("Incompleteness of Performance") shall be applied.

Article 5. Commissioned Researchers

1. The RO shall let the researchers listed in the Commissioned Research Plan engage in this commissioned research.
2. The RO shall undertake necessary measures to ensure that all the commissioned researchers comply with the contents of the Agreement.
3. In the event that the RO intends to add new CIs, the RO shall obtain prior written consent from JAXA and the RO shall undertake necessary measures to ensure that such personnel comply with the contents of the Agreement.
4. In the event that the PI dies, retires from the RO, takes a leave of absence from work, or can no longer engaged in the RO for any other reasons, JAXA may terminate this Agreement. Provided, however, if the RO designates a researcher who belongs to the RO as the PI's successor and JAXA approves the succession, the parties may amend this Agreement, with the succeeding researcher being a new PI. The terms and conditions of the amendment to this Agreement shall be determined separately upon mutual consultation and consent.

Article 6. Prohibition of Re-commission

1. The RO shall not commission the whole Research Projects to a third party (hereinafter "Subcontract"). The RO may, however, subcontract part of it upon prior written application to JAXA and approval from JAXA. Should there be a case where subcontractors further re-commission the Research Projects to a third party, the company name, address and scope of business of such third party are required to be submitted to the RO in writing.
2. If the RO subcontracts the Research Projects in accordance with the preceding paragraph, any

act of all the third parties involved in the subcontract, which includes a contractor and commissioned party of the RO, re-commissioned party, subcontractor and supplier at any tier, in connection with the subcontractor shall be deemed to be an act of the RO and the RO shall be responsible therefor.

3. In the event that the RO subcontract part of the Agreement, the RO shall enter an agreement with the subcontractor regarding the items necessary for the RO to comply with the contents of the Agreement as well as the items specified by JAXA.

Article 7. Research Funding

1. JAXA shall make advance payment of the "Research Funding" stated in the Confirmation Sheet or Continuous Confirmation Sheet, which is issued in accordance with Article 3, to the RO as a necessary research expense to carry out the Agreement.
2. JAXA shall, within thirty (30) days from the date when they receive an invoice duly issued by the RO, make payment for the Research Funding described in the previous paragraph. If JAXA fails to pay the RO within the above period, JAXA shall pay to the RO default interest of six (6) percent per annum (calculation on a daily basis) on the unpaid amount.
3. If the interest on late payment calculated following the preceding paragraph is less than 10,000 Japanese yen, JAXA shall be exempt from payment of such interest. Where there is a fraction of that amount and if it is less than 1,000 yen, such a fraction shall be omitted.
4. The RO shall report to JAXA if there is a need to reallocate the budget, which is listed in the Budget Summary within the Commissioned Work Plan, between Expense Item Categories of Budget Summary. However, if the RO wishes to conduct the reallocation between Expense Item Categories with an increase in the personnel cost, or with items including the one with an amount that has more than 30% increase or decrease (500,000 Japanese yen in case the amount of 30% is less that 500,000 Japanese yen), the RO shall obtain an approval from JAXA in advance.
5. In order to clarify the status of accounting concerning the Research Funding stated in paragraph 1 above, the RO shall maintain books to record expenses according to items and types as well as logically storing documents to prove such expenses. In addition, the RO shall keep all the accounting documents for five (5) years after the end of the research period and starting the next fiscal year. JAXA may request the RO to submit a copy of such books and the document to prove the expenses, and the RO shall respond to such a request from JAXA.

Article 8. Submission of Completion Notice and Performance Report

1. Upon the completion of the tasks stipulated in Article 2, the RO shall create a completion notice and submit it to JAXA before the end of the Agreement Period.

2. In the event that the research expenses, stated in paragraph 1 of the previous Article, exceed one (1) million Japanese yen, the RO shall submit a Performance Report containing the expenses breakdown to JAXA before one of the earlier dates, which are either prior to 30 days after the end of the Agreement Period or 10 April of the next fiscal year.

Article 9. Determining the Contract Amount

1. Upon the receipt of the Performance Report stipulated in paragraph 2 in the previous Article, JAXA and the RO adjust the expenses within the limit of the original contract amount in accordance with the present Article, Article 10 (Investigation of Actual Expenses) and Article 11 (Return of Paid Research Funding), and determine the final contract amount.
2. JAXA will notify the final contract amount determined by the adjustment procedure stipulated in the previous paragraph to the RO.
3. In the calculation of the actual expenses, the general administrative expenses ratio shall be calculated by using the ratio applied at the time the contract was concluded.

Article 10. Investigation of Actual Expenses

In determining the contract amount stipulated in paragraph 1 in the previous Article, JAXA shall investigate whether the actual expenses conform with the contents of the contract and accompanied conditions, and if necessary, request that the RO submit reports or materials to be referenced, or provide consent for JAXA to enter the RO's office to inspect the books and relevant documents.

Article 11. Return of Paid Research Funding

1. After the payment by the method stipulated in paragraph 1 and 2 of Article 7, if the amount already paid exceeds the final contract amount determined through the process stipulated in paragraph 1 of Article 9, JAXA shall reclaim the excess amount from the RO.
2. In the case of the previous paragraph, the RO shall remit such funds within thirty (30) days from the date when the RO receives an invoice issued by JAXA with regard to such funds.
3. In the event there is no return made by the RO within the set time limit as described in the preceding paragraph, the provisions of paragraph 2 and 3 of Article 7 shall be applied.

Article 12. Ownership of the Rights to the Acquired Equipment

1. The ownership of the equipment acquired with the Research Funding in accordance with paragraph 1 of Article 7 shall be retained by JAXA. However, upon mutual agreement between JAXA and the RO the ownership of the equipment may be transferred to the RO.
2. The RO shall create a ledger for the equipment mentioned in the previous paragraph and manage the equipment with the care of a good manager. When the contract ends, the RO must submit to

JAXA a list of acquired property.

Article 13. Providing of the Earth Observation Satellite Data and Rights

1. JAXA will provide the RO with the Earth Observation Satellite Data necessary for the implementation of the Agreement free of charge.

(1) JAXA may not provide all of the Earth Observation Satellite Data, which the RO may request due to limitations on the capacity of the JAXA equipment or resources; Amongst the Earth Observation Satellite Data, which the RO may request JAXA, there is a limit of ten scenes in total within one fiscal year regarding the data collected from the Advanced Land Observing Satellite (ALOS);

(2) JAXA does not guarantee a specific quality or the timely provisions of the Earth Observation Satellite Data and will not be liable for any deterioration of quality and delay in providing the Data;

(3) JAXA will not be liable for any situation whereby the Earth Observation Satellite Data cannot be supplied to the RO due to faults relating to the satellites, limitations on their operations, or for any other reason.

2. With respect to the handling of the Earth Observation Satellite Data provided by JAXA, the RO shall follow the conditions below:

(1) RO may not duplicate the Earth Observation Satellite Data for any purpose other than creating a backup. However, this excludes the duplication to provide for the collaborating research organizations stated in Article 5 and the re-commissioned party (hereinafter “PI etc.”) stated in Article 6 that are necessary for the implementation of the Agreement;

(2) The RO may not disclose the Earth Observation Satellite Data, which is restorable to its primary data, to any third party, except the PI etc.

(3) The RO shall use the provided the Earth Observation Satellite Data solely for the purpose stipulated in the Agreement;

(4) The RO shall return or otherwise appropriately keep the Earth Observation Satellite Data in accordance with the instruction of JAXA upon the termination of this Agreement.

3. The right concerning the Earth Observation Satellite Data provided by JAXA shall not be transferred to the RO through the supply. In addition, for the handling of the Data, the RO will follow the instruction of JAXA.

4. Regardless of the preceding paragraphs, if value-added products, which refers to highly processed products that cannot be restored to the primary Earth Observation Satellite Data, are developed in the course of executing the Agreement, the ownership of such products shall be determined upon mutual agreement between the Parties, taking into consideration the degree of contribution by JAXA and the RO.

Article 14. Providing of Meteorological Data and Rights

1. JAXA will provide the RO with the Meteorological Data necessary for the implementation of the Agreement free of charge.
2. The rights concerning the Meteorological Data provided by JAXA shall not be transferred to the RO through the supply. In addition, for the handling of the Data, the RO will follow the instruction of JAXA.
3. The RO may not disclose the provided Meteorological Data to any third party.
4. The RO shall use the provided Meteorological DATA solely for the purpose of the Agreement.
5. The RO shall return or otherwise appropriately keep the Meteorological Data in accordance with the instruction of JAXA upon the termination of this Agreement.

Article 15. Providing of Technical Data

1. JAXA will provide the RO with the technical data such as satellite operation data and ground verification data owned by JAXA as well as Program/Data, excluding the Earth Observation Satellite Data and the Meteorological Data (hereinafter "Technical Data") that are necessary for the implementation of the Agreement free of charge, allow the RO to use it, and provide advice when required.
2. The RO shall not use the Technical Data provided by JAXA for any other purpose than to fulfill the purpose of the Agreement, and must not disclose it to anyone but the PI etc.
3. After the completion of the research period, the RO shall return or otherwise dispose of the Technical Data provided by JAXA following the instruction from JAXA.

Article 16. Ownership of the Research Results

1. Of the Research Results that the RO acquired through the implementation of the Agreement, the ownership of the Research Results specified by JAXA in the Statement of Work shall belong to JAXA. Such Research Results do not include the data that is proved to have had been possessed by the RO at the time of concluding this Agreement.
2. The copyright of the documents, which include the rights regulated in Article 27 and 28 of the Copyright Act, that JAXA specified to be delivered by the RO shall be transferred to JAXA at the point of delivery. In this case, the RO shall not exercise the moral rights.
3. In addition to paragraph 1, for the purpose of confirming the progress of the Research Projects, JAXA may demand to show all the Research Results acquired through the implementation of the Agreement.
4. JAXA shall obtain the prior written consent of the RO in case JAXA plans to disclose the Research Results (excluding the delivered Research Results) that was presented or submitted by

the RO.

5. The RO shall obtain the prior written consent of JAXA if the RO plans to disclose the Research Results, the ownership of which belongs to JAXA, to a third party.

Article 17. Usage of the Research Results

1. Of the Research Results acquired through the implementation of the Agreement, JAXA may use the Research Results other than the one specified in paragraph 1 of the previous Article free of charge only for the purpose of its research development including the case for allowing a third party, which includes partners of joint research projects, to use the Research Results for its own purpose, as well as for its own peaceful and non-commercial purposes.
2. Of the Research Results acquired through the implementation of the Agreement, the RO may use the Research Results other than those delivered in accordance with paragraph 1 of the previous Article free of charge only for the purpose of its research development including the case for allowing a third party to use the Research Results for its own purpose, as well as for its own peaceful and non-commercial purposes, upon the prior consent of JAXA.

Article 18. Industrial Property Rights

1. The RO shall report the existence of Potential Industrial Property Rights generated in the course of the Research Projects, if any, and submit a document with such information to JAXA without delay, as well as taking a procedure to apply for its Industrial Property Rights following JAXA's instructions. If the RO is successfully granted such Industrial Property Rights, it shall notify JAXA without delay.
2. The RO shall consult JAXA each time regarding important matters concerning the application procedure for the Industrial Property Rights described in the previous Article.
3. The expense incurred in applying to the Industrial Property Rights as described in paragraph 1 shall be JAXA's responsibility.
4. In the event the invention etc. that are generated by the commissioned researchers stipulated in Article 5 are properties subject to registration for the Industrial Property Rights under the name of the duty of the commissioned researchers, the RO concludes the Agreement that stipulates the right to apply for the Industrial Property Rights concerning such invention belongs to the RO shall be concluded with the commissioned researcher, or set the rules for regulating the duties of the employees regarding such a matter.
5. If the technology developed by the RO due to the implementation of the Research Projects is recognized as an invention, JAXA, if necessary, may succeed the right to apply for the Industrial Property Rights from the RO and make an application for such Potential Industrial Property Rights to be registered Industrial Property Rights in JAXA's name, after receiving the materials

required for the application from the RO.

Article 19. Foreign Application for Industrial Property Rights

The provisions of the previous Article shall be applied to the application for Industrial Property Rights abroad and the preservation of rights.

Article 20. Ownership of Industrial Property Rights

1. The RO shall transfer the Industrial Property Rights obtained in compliance paragraph1 of Article 18. In this case, the cost for the transfer shall be included in the Research Funding stipulated in paragraph1 of Article 7.
2. If the RO requests a license to use the Industrial Property Rights assigned to JAXA under the preceding paragraph, JAXA will grant the RO such a license unless it is reasonable for it to be deemed to be inappropriate. The conditions for the approval shall be determined by mutual agreement between the Parties as necessary.
3. With regard to the Industrial Property Rights stipulated in paragraph 1 of Article 18, if the RO, before obtaining the Rights, wishes to use it for any purpose other than that of the Agreement, or wishes to grant its use to a third party, shall consult JAXA as necessary.
4. In accordance with the provisions in paragraph 1, JAXA, based on the criteria determined by JAXA, shall bear the total or a portion of the costs, which the RO should pay the commissioned researcher who created the technology, which is subject to the Industrial Property Rights transferred from the RO and the Right to receive the transferred Industrial Property Rights from the RO stipulated in paragraph 5 of Article 18.

Article 21. Ownership of Program/Data Copyrights

1. Upon the completion of the Agreement, the RO shall notify JAXA without delay in the event that the RO creates a program and/or database (hereinafter “Program/Data”) that may potentially constitute the Program/Data copyrights. In this case, the Program/Data that the Statement of Work specifies its delivery shall be excluded from the notification stipulated in this Article.
2. The RO shall transfer the copyrights of the Program/Data, including the rights stipulated in Article 27 and 28 of the Copyrights Act, acquired through the implementation of this Agreement to JAXA. The cost for this transfer shall be included in the Research Funding stipulated in paragraph 1 of Article 7. Regarding the Program/Data of which the RO already had its rights prior to the conclusion of the Agreement as well as among the know-how, routine, subroutine and modules that are commonly used by similar program the RO specified, copyrights of such products are retained by the RO but not transferred to JAXA.
3. In the event that the RO transfer copyrights to JAXA, if the product subject to the copyright is

created by the RO, the RO waives any related moral rights. If it is created by a third party but not by the RO, the RO shall take measures to prevent the third party from using any related moral rights.

4. If the RO requests a license to use the Program/Data copyrights assigned to JAXA, JAXA will grant the RO such a license unless it is reasonable for it to be deemed to be inappropriate. The conditions for the approval shall be determined by mutual agreement between the Parties as necessary.
5. In the event that programs are modified/adapted not by JAXA or the RO but by a third party, JAXA shall bear the responsibility related to the use of such programs and the RO shall not be responsible for any liability caused by such programs.
6. With regard to the know-how, routine, subroutine and modules utilized commonly by similar programs, the copyrights of which are retained by the RO in accordance with paragraph 2 of this Article, the RO shall approve JAXA of a royalty-free right to use such products in the form of the program acquired through the implementation of the Agreement without consent from the RO. Such used by JAXA shall include the right of JAXA to grant a third party the right to use the know-how, routine, subroutine and modules without paying any royalties to the RO.

Article 22. Use of Facilities

1. The RO may use JAXA's facilities and equipment (hereinafter "Facilities") free of charge upon the prior consent of JAXA if there is a necessity for the implementation of the Agreement.
2. In the event of using JAXA's Facilities, the RO shall use the Facilities in compliance with all the regulations stipulated by JAXA.

Article 23. Bringing in Instruments

If necessary for the implementation of the Agreement, the RO may bring instruments and other items into JAXA's facilities with the prior consent of JAXA. In such a case the RO shall be in compliance with all the regulations stipulated by JAXA.

Article 24. Delivery of Rental Items, Storage and Return

1. If required to implement the Agreement, JAXA shall lend the RO any instruments and other items owned by JAXA.
2. At the time of delivery of the instruments and items for lending (hereinafter "Rental Items") in accordance with the preceding paragraph, JAXA shall submit a delivery note to the RO and the RO shall submit a receipt to JAXA.
3. In the event that the RO received the delivery of the Rental Items, the RO shall confirm the presence of any abnormality regarding the list of articles and numbers. If a lack of quantity or

abnormality including inappropriate quality and standard for use, with the Rental Items is found, the RO shall notify JAXA of the matter immediately and seek further instruction.

4. The RO shall manage and use the Rental Items delivered with the care of a good manager and shall use items solely for the purpose of the Agreement.
5. The RO shall maintain books of receipts and shipment as well as management regarding the Rental Items delivered, record and organize the receipts, and always make the situation of the Rental Items clear.
6. In the event that the Rental Items are lost or damaged, the RO shall report this to the lender without delay.
7. In the event that all or part of the Rental Items become unnecessary due to the completion of the whole or part of the Agreement as well as of any amendment or termination of the Agreement, the RO shall notify JAXA and undertake a procedure to return the Rental Items in compliance with JAXA's instruction without delay.

Article 25. Confidentiality

1. In this Agreement, "Confidentiality Information" means those that are applicable to any of the following items.

(1) Amongst the outcome as a result of the Agreement, any documents with an indication of confidential notice, tangible objects such as samples, or regardless of its form in tangible or intangible, any items that have been confirmed in writing as Confidential Information by JAXA and the RO.

(2) Any information that a party discloses or presents as confidential in the forms of document, drawing, photograph, test piece, sample, magnetic tape, and floppy disk.

2. JAXA and the RO must manage Confidential Information properly and may not leak or disclose to anyone other than those involved in the Agreement. However, any information that is applicable to any of the following items may be an exception:

(1) Information that is already known to the public when disclosed by the disclosing party;

(2) Information that becomes known to the public after the disclosure by the disclosing party without intentional misconduct of the receiving party;

(3) Information that the receiving party already had before the disclosure by the disclosing party and that is able to verify this fact;

(4) Information with proof that the receiving party acquires legally from a duly authorized third party not subject to confidentiality obligations;

(5) Information and materials that the receiving party independently acquire without utilizing information obtained from the disclosing party and that are able to verify this fact;

(6) Information with written consent from the disclosing party for the disclosure and the

publication; or

(7) Information that is required to be disclosed by applicable laws, judgment or order of a competent court. In this case, the receiving party shall promptly notify the disclosing party of the necessity of disclosure.

3. The confidentiality obligation under paragraph 2 shall remain effective for a period of five (5) years after the termination of the Agreement. However, this period of keeping confidentiality may be extended or shortened by mutual agreement between JAXA and the RO.

Article 26. Publication of Research Results

1. The RO shall be able to present or publish the Research Results, which were acquired through the implementation of the Agreement and delivered in accordance with paragraph 1 of Article 16; provided, however, in compliance with the obligation of Confidentiality Information stated in Article 25 (hereinafter "publication of Research Results").
2. In the case of the preceding paragraph, the RO shall notify JAXA with a written document and obtain written consent from JAXA prior to the publication of Research Results. JAXA will not unreasonably withhold consent from the publishing party's request.
3. When JAXA receives the notification mentioned in the previous paragraph, if the judgment that the notification contains contents, which potentially cause a loss of anticipated benefit by being published, JAXA shall notify the RO in writing, and the RO shall consult with JAXA. The RO may not publish the part that has been notified as contents, which potentially cause a loss of anticipated benefit by being published as described in this paragraph without consent from JAXA.
4. The RO shall state in the publication of the Research Results that such results have been obtained pursuant to this Agreement and identify the owner of the rights to the Earth Observation Satellite Data and Meteorological Data used in such publication.
5. After disclosing or publishing the Research Results that belong to the RO, the RO shall provide JAXA with a copy of the publication as soon as possible. JAXA is entitled to a royalty-free right to use, photocopy and distribute the provided publications unless the copyright of such publication is owned by an academic society.

Article 27. Security

Upon the implementation of the Agreement, the RO shall take security measures in accordance with the JAXA's regulations and must follow JAXA's instruction.

Article 28. Impossibility of Performance

1. In the event it becomes impossible for the RO to carry out all or any part of the Agreement due

to reasons attributable to the RO, JAXA may terminate all or any part of the Agreement.

2. In the case of the termination of the Agreement following the previous paragraph, JAXA shall apply the provisions in paragraph 1 of Article 11 mutatis mutandis and demand the restitution of the disused amount.
3. In the case of the termination of the Agreement in accordance with Article 1, JAXA, based on paragraph 3 of Article 31, shall be able to demand the RO incur a penalty.

Article 29. Incompleteness of Performance

1. If the performance of the RO for the Agreement is confirmed not to be following the purpose of the Agreement due to the liability of the RO, JAXA may claim the RO subsequent completion by setting an appropriate period.
2. In the event that there is no prospect of the completion of the performance by the RO in accordance with the Agreement despite the claim made for the subsequent completion stipulated in paragraph 1, JAXA may terminate all or part of this Agreement.
3. In case the termination of the Agreement is performed in accordance with the preceding paragraph, JAXA shall apply the provisions in paragraph 1 of Article 11 and claim a return of the amount of Research Funding that becomes unnecessary.
4. In case the termination of the Agreement is performed in accordance with paragraph 2 above, JAXA may claim the RO incur a penalty in accordance with paragraph 3 of Article 31.

Article 30. Extension of the Delivery Deadline

1. In case there is an acceptable reason for not fulfilling the obligation until the delivery deadline, the RO may in advance propose JAXA such a reason and planned delivery date and apply for an extension to the delivery deadline in writing. In this case, if the extension of the delivery deadline is approved as not to hinder the achievement of the objective of the Agreement, JAXA may approve the extension.
2. In the event the RO does not fulfill the obligation by the scheduled delivery date, JAXA may terminate all or any part of the Agreement.
3. If the Agreement is terminated as set forth in the preceding paragraph, JAXA shall apply the provisions of paragraph 1 of Article 11 and claim a refund of any unexpended Research Funding.
4. If the Agreement is terminated as set forth in paragraph 2, JAXA in compliance with paragraph 3 of Article 31 shall claim the RO incur a penalty.

Article 31. Termination of the Agreement

1. In the event of any of the following conditions, JAXA and the RO may terminate the

Agreement.

(1) Upon the consent of both JAXA and the RO.

(2) When the other party commits a dishonest or inequitable act and the breaching party fails to offer any satisfactory remedial measures within seven (7) days after receiving demands for corrective action.

(3) When the other party violates any of the terms and conditions of this Agreement provided that the breaching party fails to offer any satisfactory remedial measures within seven (7) days after receiving demands for corrective action.

(4) When the events stipulated in paragraph 5 (transfer of the PI) of Article 4 occurs and there is no one who engages in this joint research project at the RO.

(5) When unavoidable circumstances occur such as natural disasters

2. Upon the termination of the Agreement, the RO shall submit to JAXA all work in progress and completed work based on the research carried out prior to the termination.

3. In the event that the Agreement is terminated in accordance with number 2 or 3 of paragraph 1, JAXA and the RO may claim the other party a penalty equivalent to 10% of the Research Funding stipulated in paragraph 1 of Article 7, which corresponds to the contents of the termination above. However, if the amount of the penalty is less than 10,000 Japanese yen, the payment of such penalty is not required. Where there is a fraction of that amount and if it is less than 1,000 yen, such a fraction shall be omitted.

4. Neither JAXA nor the RO shall claim any compensation in case the termination of the Agreement is exercised in accordance with number 5 of paragraph 1 of the present Article.

Article 32. Effective Term of the Agreement

1. Effective Term of the Agreement shall be the period stipulated in Article 3.

2. Even after the end of the Effective Term of the Agreement stipulated in the previous paragraph, provisions in paragraph 2 to 4 of Article 13 (Providing of the Earth Observation Satellite Data and Rights), paragraph 2 to 5 of Article 14 (Providing of Meteorological Data and Rights), Article 15 (Providing of Technical Data), Article 17 (Usage of the Research Results) to 21 (Ownership of the Copyrights of Program/Data), and Article 26 (Publication of Research Results) continues to be effective for the duration of the continuance of the rights stated in the present Article. Provisions of Article 25 (Confidentiality) and Article 26 (Publication of Research Results) posses the terms effect stipulated in the present Article.

Article 33. Amendment of the Agreement

1. JAXA can amend the contents of this Agreement. In such a case, JAXA announces the amended contents by posting it to the website operated by JAXA, and thereafter the Agreement is handled

based on the amended contents.

2. In the case the RO has a legitimate reason for not agreeing with the amendment of the previous paragraph, the RO may terminate the Agreement by notifying JAXA in writing within thirty (30) days from the date the amended contents were posted on the website.

Article 34. Consultation

In the event that any doubt arises with regard to provisions that are not included in the Agreement and those stipulated in the Agreement, it shall be resolved upon mutual agreement between JAXA and the RO as necessary.

Attachment “Earth Observation Satellite Data”

Name of Satellite or Sensor	Observation Period (YYYY/MM/DD)	Observable Area
JERS (Japanese Earth Observation Satellite)	1992/09/01~1998/10/11	Global
ADEOS (Advanced Earth Observation Satellite)	1996/10/15~1997/06/29	Global
ADEOS-II (Advanced Earth Observing Satellite-II)	2003/01~2003/10	Global
ALOS (Advanced Land Observing Satellite)	2006/05/16~2011/04/22	Global
GCOM-W1 (The Global Change Observation Mission 1st-Water)	2012 Fiscal Year~	Global
TRMM (Tropical Rainfall Measuring Mission)	1997/12~	Global (PR: Approximately 36°S-36°N. TMI and VIRS: Approximately 38°S-38°N)
AMSR-E (Advanced Microwave Scanning Radiometer for EOS-Aqua satellite)	2002/06/19~2011/10/04	Global
GOSAT (Greenhouse Gases Observing Satellite)	2009/04/23~	Global

* Regarding GPM/DPR, it is planned to be added when the dataset becomes available upon the modification to the Agreement in accordance with Article 33.

COLLABORATIVE RESEARCH AGREEMENT (FUNDED)
FOR THE
7TH PRECIPITATION MEASURING MISSION
BETWEEN THE
JAPAN AEROSPACE EXPLORATION AGENCY (JAXA)
AND
THE RESEARCH ORGANIZATION
(FOR THE RESEARCH ANNOUNCEMENT)

JAPAN AEROSPACE EXPLORATION AGENCY

7th PMM SCIENCE RESEARCH ANNOUCEMENT

COLLABORATIVE RESEARCH AGREEMENT

This agreement ("Agreement") is entered into between the Japan Aerospace Exploration Agency, established under the provisions of the Law Concerning the Japan Aerospace Exploration Agency on October 1, 2003, represented by its President and having its principal office at 7-44-1 Higashimachi, Jindaiji, Choufu-shi, Tokyo, Japan ("JAXA") and a research organization ("Research Organization") that submitted an application form for the below described research activities to JAXA, hereinafter collectively referred to as "the Parties."

WITNESSETH

WHEREAS, JAXA issued the Research Announcement ("RA") to engage in collaborative research activities directly related to retrieval algorithms for geophysical products, product validation, and data application of Precipitation Measuring Mission (“PMM”), and the Research Organization applied pursuant to such RA;

WHEREAS, JAXA accepted the Research Organization's proposal that was in response to the RA, delivered the confirmation sheet to the Research Organization and JAXA further desires to utilize such proposal in JAXA's project; and

WHEREAS, JAXA desires to engage in the above research activities in collaboration with the Research Organization.

NOW, THEREFORE, in consideration of the mutual agreements hereinafter set forth, and for other good and reasonable consideration, the receipt and adequacy of which are hereby acknowledged, the Parties hereby agree as follows:

Article 1. Definitions

1. The following capitalized terms shall have the following meanings:

(1) "Research Results" means the technical results and scientific knowledge derived from the implementation of the Research Projects pursuant to this Agreement, including all inventions, ideas, designs, literary works, algorithms, and technological developments, such as programs,

that can execute the algorithm(s).

(2) "Intellectual Property Rights" generated in the course of implementation of the Agreement means the following:

(i) Industrial Property Rights (as defined below);

(ii) Potential Industrial Property Rights (as defined below); and

(iii) Program/Data Copyrights (as defined below).

"Industrial Property Rights" means all domestic and foreign patents, utility models, and industrial designs.

"Potential Industrial Property Rights" means all domestic and foreign application rights for patents, utility models, or industrial designs.

"Program/Data Copyrights" means all domestic and foreign copyrights related to computer programs, software and databases.

(3) "Collaborative Research Plan" means the plan described in the Application for Collaborative Research Agreement for the PMM (“Application”).

(4) “Research Period” means a period described in the Collaborative Research Plan. Based on the regulations of this Agreement, in case this Agreement is terminated before the completion date of the Research Period, such date of termination of the Agreement shall be the final date of the Research Period.

(5) "Annual Evaluation" means evaluation by JAXA for the results achieved within the year in which this Agreement was concluded. JAXA evaluates the results by reports presented at the research presentation meeting by the Research Organization and Research Results Report (as defined below).

(6) "Earth Observation Satellite Data" means data sets obtained from satellites which are retained by JAXA at the time of execution of this Agreement. The available data sets (including names of satellites, sensors, observation period that can be offered, and observation areas) are listed in Attachment A of this Agreement.

(7) “Meteorological Data” means data sets provided by the Japan Meteorological Agency pursuant

to the agreement between JAXA and the Japan Meteorological Agency.

2. In this Agreement, “Invention, etc.” means an invention in terms of a subject of patent rights, a utility model in terms of a subject of utility model rights, a creation in terms of a subject of copyrights such as design rights and programs, and ideas in terms of a subject of algorithm and know-how.
3. In this Agreement, “utilization” of the intellectual property rights and Research Results means act defined in Article 2, Paragraph 3 of the Patent Act, act defined in Article 2, Paragraph 3 of the Utility Model Act, act defined in Article 2, Paragraph 3 of the Design Act, enforcement of right defined in Articles 21 and 27 of Copyright Act (including utilization of secondary work created by JAXA or the Research Organization), and use of algorithm and know-how.
4. In this Agreement, “Principal Investigator” ("PI") means the Research Organization employee who submitted the proposal in response to the RA and was selected to be responsible for the Research Projects. "Co-Investigator" ("CI") means a person who supports the PI in performing the Research Projects with approval by JAXA. Names, affiliation, and other information concerning PI and CI (collectively “Collaborative Researchers”) shall be described on the Collaborative Research Plan.

Article 2. JAXA's Performance for Research Projects and the Research Organization's General Responsibilities for Research Projects

1. JAXA shall make reasonable efforts to perform the following tasks related to the Research Projects:

a) Deliver the Earth Observation Satellite Data and Meteorological Data required for performing the Collaborative Research to the Research Organization free of charge;
b) Hold research presentation meetings for checking progress of the research and other necessary meetings;
c) Evaluate the Research Result Report submitted at the end of fiscal year for the Annual Evaluation.

2. For the purpose of ensuring the Research Organization's performance of the above obligations, the Research Organization shall perform certain actions including, but not limited to:

a) The Research Organization shall conduct and complete the Research Projects in accordance with the Collaborative Research Plan.
b) Participate in necessary workshops and meetings for the Research Projects such as the research presentation meeting hosted by JAXA at the end of the fiscal year;
c) Participate in the research presentation meeting hosted by JAXA every year to report on the the Research Results and progress of research to JAXA; and

d) Deliver the reports as a report of all the Research Results obtained during the fiscal year by the end of such fiscal year to JAXA. Furthermore, at the completion of the research period, the Research Organization shall report all the Research Results obtained throughout the entire period of the Collaborative Research in the Final Report and submit it to JAXA. In this case, the Research Organization does not need to separately submit an annual report for the final year of the term.

Article 3. Finalization and Renewal of the Contract

The Agreement shall become effective as of the date of the issuance of the Confirmation Sheet prescribed by JAXA in response to an application by the Research Organization. Period of the Agreement shall be the period described in the Confirmation Sheet issued by JAXA. However, provided that JAXA approves an extension of the research period in the Annual Evaluation and the Parties mutually agree upon the amount to be paid by JAXA for such extended period; further provided, however, the Research Organization shall submit a renewal Application Form to JAXA and JAXA shall issue a new Confirmation Sheet; the Research Organization may renew the Agreement by one fiscal year and the same shall apply thereafter.

Article 4. Researchers

1. The Research Organization shall cause the Collaborative Researchers listed on the Collaborative Research Plan to participate in the Collaborative Research.
2. JAXA shall allow those who are listed on the Collaborative Research Plan to participate in the Research Projects.
3. The Research Organization shall ensure all the Collaborative Researchers engaging in the Research Projects act in accordance with the terms and conditions of the Agreement.
4. In the event that the Research Organization intends to newly select or add CIs, the Research Organization shall first notify to JAXA by a written form in advance and obtain the consent of JAXA for such personnel. The Research Organization shall take necessary measures to cause such CI to follow the Collaborative Research Agreement.
5. In the event that the PI dies, retires from the Research Organization, takes a leave absent from work, or come to be no longer engaged in the Research Projects, the Research Organization shall immediately notify to JAXA as such and JAXA may at its sole discretion terminate this Agreement; provided however, if the Research Organization designates a researcher who belongs to the Research Organization as the PI's successor and JAXA approves the succession, the Parties may amend this Agreement, with the succeeding researcher being a new PI. The terms and conditions of the amendment to this Agreement shall be determined upon mutual consultation and consent.

Article 5. Subcontract

1. The Research Organization shall not re-commission the whole Research Projects to a third party ("Subcontract"). Provided, however, that the Research Organization may re-commission part of it upon a written prior application to JAXA and a prior written approval of JAXA. Should there be a case where subcontractors re-commission part of the Research Projects to a third party, the company name, address and scope of business of such third party are required to be submitted to the Research Organization in writing.
2. If the Research Organization re-commissions the Research Projects to a third party at any tier (contractor or subcontractor, including any company of any stage of the Projects in connection with the subcontract) of the Research Organization, act of such subcontractor, or, any act of such third party in connection with the subcontract shall be deemed to be an act of the Research Organization and the Research Organization shall be fully responsible therefor.
3. If the Research Organization re-commissions part of the Research Projects to a third party, the Research Organization shall conclude an agreement with the subcontractor on issues necessary for the Research Organization to comply with the Agreement and on issues designated by JAXA.

Article 6. Research Funding

1. The Confirmation Sheet issued on the basis of Article 3 identifies the amount of funding to be provided by JAXA to the Research Organization for the Research Projects ("Research Funding") and JAXA shall pay such amount to the Research Organization in advance.
2. JAXA shall, within thirty (30) days from the date when JAXA receives an invoice duly issued by the Research Organization, make payment for the Research Funding. If JAXA fails to pay the Research Funding within the above period, JAXA shall pay to the Research Organization default interest of six (6) percent per annum on such unpaid amount for the period from the immediately succeeding day of due date for payment to the date of actual payment.
3. If the interest on late payment is less than 10,000 yen, JAXA shall be exempt from payment of such interest and if there is any amount less than 1,000 yen, such amount shall be rounded off.
4. The Research Organization shall submit Budget Summary as attachment of Commissioned Work Plan at the beginning of every Japanese fiscal year. The Research Organization shall report to JAXA in advance if there is a need to reallocate the budget between Expense Item Categories of Budget Summary. For the reallocation in the amount of Expense Item Categories for over 30%, or 500,000 Japanese yen, in case the amount of 30% is less than 500,000 Japanese yen, or increase in the personnel cost, the Research Organization shall resubmit the revised Budget Summary to JAXA for approval in advance.
5. Throughout the performance of the Agreement, the Research Organization shall maintain books,

records, logs, documents and other evidence sufficient to record all actions taken with respect to the funding in Paragraph 1. The Research Organization shall agree to allow JAXA to inspect, copy, and audit such books, records, documents and other evidence at any reasonable time. The Research Organization shall keep all the accounting documents for 5 (five) years after the end of the research period.

Article 7. Submission of Financial Statement

If the original funding amount stipulated in Paragraph 1 of the previous Article is one (1) million Japanese yen or more, the Research Organization shall submit fiscal Financial Statement on either the 30th day following the date of termination of the Agreement, or on April 10 of the fiscal year following the year in which the Agreement was terminated, whichever comes earlier.

Article 8. Determination of Contract Amount

1. If the Parties receive the Financial Statement regulated in the previous Article, the Parties shall settle the funding, setting the contract amount as the upper limit, in accordance with the stipulation in Articles 8 and 9 (Checking of Funding Spent) and 10 (Refund) to determine the contract amount.
2. JAXA shall notify the contract amount determined by the settlement in the previous Paragraph to the Research Organization
3. In the calculation of the amount, ratio of general and administrative expenses shall be calculated based on the ratio applied upon conclusion of the Agreement.

Article 9. Checking of Funding Spent

For determination of contract amount stipulated in Paragraph 1 of the previous Article, JAXA shall check whether the amount spent matches the content and conditions of the Agreement. If necessary, JAXA requests the Research Organization to submit reference materials or report, or to investigate books and relevant documents in the offices of the Research Organization.

Article 10. Refund

1. Provided that the payment by the method stipulated in Paragraphs 1 and 2 of Article 6 has been made and such paid amount exceeds the amount determined by the method stipulated in Paragraph 1 of Article 8, JAXA requests refund of the exceeding portion of the paid amount.
2. In the case of the previous Paragraph, the Research Organization shall refund the exceeding portion within thirty (30) days from the date when Research Organization receives an invoice duly issued by JAXA.
3. In the event that the Research Organization does not refund the exceeding amount within the

days stipulated in the previous Paragraph, regulations set forth in Paragraphs 2 and 3 of Article 6 shall apply.

Article 11. Ownership of the Rights to the Acquired Equipments

1. The Research Organization shall transfer, upon the expiration of this Agreement, all rights and ownership in the equipment acquired by the Research Organization with the Research Funding paid according to Article 5, Paragraph 1; provided, however, that JAXA and the Research Organization may determine through mutual agreement that any or all such rights and ownership will be retained by the Research Organization.
2. The Research Organization shall manage the equipment acquired with the Research Funding (if any) with the care of a good manager. Such equipment shall be listed in a "List of Property" which should be submitted to JAXA upon termination of the Agreement.

Article 12. Providing of Earth Observation Satellite Data by JAXA

1. JAXA will provide the Research Organization with the Earth Observation Satellite Data for the Research Projects free of charge in accordance with Article 2, Paragraph 1, Item 2 subject to the following conditions:

a) The Research Organization agrees and accepts that JAXA may not provide all the Earth Observation Satellite Data which the Research Organization may request due to restrictions in the allowance range of JAXA's equipment and in resources.
Note that the Advance Land Observing Satellite data, which is one portion of the Earth Observation Satellite Data required by the Research Organization and is to be provided to the Research Organization, shall be limited to ten scenes every fiscal year;

b) JAXA does not guarantee a specific quality or the timely provisions of the Earth Observation Satellite Data and does not take responsibility for quality and delay of provisions of such data; and

c) JAXA reserves the right to curtail or suspend Earth Observation Satellite Data supply to the Research Organization due to faults or difficulties relating to the satellites, limitations on their operations, or any other reasons and JAXA shall be exempt from any responsibility for such curtailing and for suspension

2. With respect to the Earth Observation Satellite Data provided by JAXA, the Research Organization shall:

a) Not duplicate the Earth Observation Satellite Data except for the purpose of backup. However, this excludes duplication for distributing to authorized Collaborative Researchers stipulated in Article 4 and subcontractors stipulated in Article 5 ("PIs, etc." collectively) which are necessary for the Collaborative Research Project.

b) Not provide or disclose the Earth Observation Satellite Data which can be converted back to the primary Earth Observation Satellite Data except to PI;

c) Only use the Earth Observation Satellite Data for the singular purpose of advancing the efforts of the Research Projects; and

d) Return or otherwise appropriately manage the Earth Observation Satellite Data upon completion of this Agreement, according to the directives of JAXA.

3. Any rights regarding the Earth Observation Satellite Data provided by JAXA shall conform to the following:

a) Any rights relating to the Earth Observation Satellite Data provided by JAXA to the Research Organization shall not be transferred to the Research Organization by such provisions. In terms of the intellectual property rights of the data, the Research Organization shall follow instructions of JAXA.

b) If value-added products, which mean highly processed products that do not retain the original pixel structure and that cannot be converted back to the primary Earth Observation Satellite Data, are developed in the course of executing the Research Projects, the ownership of such products shall be determined upon mutual agreement between the Parties, taking into consideration the degrees of contribution by JAXA and the Research Organization.

Article 13. Providing of Meteorological Data by JAXA

1. For the purpose of performing the Research Projects, JAXA will attempt to provide the Research Organization with the Meteorological Data based on Article 2, Paragraph 1, Item 1.
2. Any rights relating to the Meteorological Data provided by JAXA to the Research Organization shall not be transferred to the Research Organization by such provisions. In terms of the intellectual property rights of the data, the Research Organization shall follow instructions of JAXA.
3. The Research Organization may not disclose the provided Meteorological Data to any third party except for PIs, etc.
4. The Research Organization shall use the provided Meteorological Data solely for the purpose of conducting the Research Projects.
5. The Research Organization shall return or otherwise appropriately keep the Meteorological Data in accordance with the instructions of JAXA upon the termination of this Agreement.

Article 14. Disclosure of Technical Data

1. To the extent feasible, each party shall disclose and allow use of all necessary technical information, programs, etc. ("Technical Data"), which does not include the Earth Observation Satellite Data and the Meteorological Data, necessary for performing the Collaborative Research

free of charge. The Parties will undertake to handle expeditiously any request for the Technical Data presented by the other party.

2. The Technical Data shall be used by the receiving party only for the purpose of fulfilling the receiving party's responsibilities under this Agreement and shall not be disclosed to any third party except for PIs, etc.
3. According to directives of the furnishing party, the receiving party shall return or otherwise dispose of Technical Data provided under the Agreement upon completion of the activities under the Agreement.

Article 15. Usage of Research Results

1. All Research Results obtained through the course of the Collaborative Research may be used for non-commercial and peaceful purposes by the Parties (or by the third party including for JAXA or the Research Organization) ("Jointly-Owned Research Results") without consent of the Research Organization.
2. With regard to copyrights in the Final Reports submitted by the Research Organization to JAXA, JAXA may freely use, edit, copy, and distribute such reports. In this case, the Collaborative Researchers shall waive any related moral rights to the copyrights in the Final Reports.

Article 16. Ownership of Research Results

1. Both Parties shall solely own the rights of the Research Results if JAXA or the Research Organization solely generates such Research Results in the course of the Research Projects.
2. The Parties shall jointly own the rights to the Research Results obtained through the course of the Collaborative Research and the ownership of such results shall be determined upon mutual agreement between the Parties, taking into consideration the degrees of contribution by JAXA and the Research Organization.

Article 17. Application etc. of Intellectual Property Rights

1. JAXA or the Research Organization shall give the other party prompt written notice of Intellectual Property Rights generated, such as the Invention, Utility Model, and Creation, in the course of the Collaborative Research and discuss the ownership of such generated Intellectual Property Rights, as well as whether it is necessary to submit an application for registration of such Intellectual Property Rights.
2. JAXA and/or Research Organization shall take any necessary procedures for any Industrial Property Rights owned by and/or held by each Collaborative Researchers (including invention etc. jointly generated by such Joint Researcher and JAXA or the Research Organization) to be transferred by such Joint Researcher to JAXA or the Research Organization.

3. If JAXA or the Research Organization solely generates Potential Intellectual Property Rights in the course of the Research Projects ("Solely-Owned Intellectual Property Rights"), the party may take steps to apply for the registration of the resulting Intellectual Property Rights as solely-owned ones, provided that it shall obtain prior confirmation of the other party. In this case, expenses for application and rights preservation shall be borne by the party solely holding the Intellectual Property Rights.
4. In the event that the Parties jointly generate an invention etc., and submit an application for Intellectual Property Rights to such invention, the Parties shall enter into a separate joint ownership agreement ("Joint Ownership Agreement") and jointly perform submission of the application and other procedures according to the Joint Ownership Agreement. In this case, expenses for application and rights preservation shall be borne by the both JAXA and the Research Organization depending on the degree of ownership.

Article 18. Application of Intellectual Property Rights Overseas

1. Regulations of the previous Article shall apply to the case of application and rights preservation of the Intellectual Property Rights in foreign countries.
2. In the event of an application of the Intellectual Property Rights jointly owned by the Parties pursuant to Paragraph 4 of the previous Article, the Parties shall discuss whether it is necessary to submit an application for registration of such Intellectual Property Rights.

Article 19. Utilization of Jointly-Owned Intellectual Property Rights

In case either of the Parties utilizes the Jointly-Owned Intellectual Property Rights, such party shall obtain a consent from the other party in advance and pay utilization fee as set forth in a separate utilization agreement, except for the case stipulated in Article 15.

Article 20. License of Utilization of Jointly-Owned Intellectual Property Rights to Third Party

1. The Parties may grant to any third party a license to use the Jointly-Owned Intellectual Property Rights, provided, however that the relevant party shall obtain the written prior consent of the other party, and determine the licensing terms after discussion with the other party.
2. In the case of granting a license to use the Jointly-Owned Intellectual Property Rights to a third party as in the previous Paragraph, the relevant party shall collect the usage fee from such third party as set forth in the separate usage agreement. The usage fee to be collected from the third party shall be distributed between the Parties pro rata in proportion to their respective interests in those rights.

Article 21. Transfer of Interests to Jointly-Owned Intellectual Property Rights

1. The Parties may transfer their respective interests to the Jointly-Owned Intellectual Property Rights generated in the course of the Collaborative Research only to their respective designees after discussion between the Parties. Such transfer may be carried out pursuant to a separate transfer agreement. In this event, the Parties shall cause its designee to succeed to all of its rights and obligations with respect to those Intellectual Property Rights.
2. If JAXA or the Research Organization disclaims its interests in the Jointly-Owned Intellectual Property Rights, the relevant party shall give the other party prior notice thereof and transfer its interests to the other party, only if the other party wishes to acquire it.

Article 22. Improved Invention

If JAXA or the Research Organization alters or improves the Jointly-Owned Intellectual Property within one (1) year from the application for registration of the original Jointly-Owned Intellectual Property Rights, the party shall provide a written notice without delay to the other party describing the alterations or improvements. Ownership and other issues of the Intellectual Property Rights concerning the altered or improved invention shall be determined through discussion between the Parties.

Article 23. Designation of Know-How

1. After mutual agreement by the Parties, JAXA and the Research Organization shall promptly designate as know-how the Research Results which are appropriately to be treated as know-how ("Know-How").
2. For designation of Know-how, a period during which the Research Results are designated to be Know-How shall be specified.
3. After designating the Know-How, such Know-How shall be kept in confidence in principle, for five (5) years commencing on the day immediately following the date of the completion of this Agreement; provided, however, that JAXA and the Research Organization may extend or shorten that period upon mutual agreement.

Article 24. Utilization of Facilities, etc.

1. The Parties may use facilities and equipment (“Facilities”) of the other party free of charge with a prior consent from the other party if it is necessary for implementation of the Research Projects.
2. The Parties shall follow rules and regulations of the other party in case of using the Facilities of the other party.

Article 25. Installation of Equipment

1. The Parties may, if necessary for implementation of the Research Projects, install necessary equipment and other materials into the facility of the other party with a prior consent from the other party. In this case, the party which installs such equipment shall follow the rules and regulations of the other party.
2. In the event that JAXA or the Research Organization uses the material etc. installed by the other party (Installed Material), such party shall obtain a prior consent of the other party and shall not use the Installed Material for other purposes than the Research Projects.
3. In the event that JAXA or the Research Organization loses or damages the Installed Material, such party should immediately notify the other party such fact irrespective of the reason.

Article 26. Delivery, Storage, and Returning of Lent Equipment

1. The Parties may lend machinery or other material to the other party if it is required for implementation of the Research Projects.
2. Upon delivery of the machinery or other material (“Lent Equipment”) lent in accordance with the previous Paragraph, owner of the Lent Equipment (“Lessor”) shall submit the other party a Note of Delivery and the other party shall submit the Lessor a receipt.
3. The Parties shall confirm items, amount, etc. of the Lent Equipment upon delivery of the Lent Equipment and if there is a shortage in the amount or any defect (including ones whose quality and/or specification does not meet the requirement), JAXA or the Research Organization shall notify such fact to the Lessor and receive an instruction from the Lessor.
4. JAXA and the Research Organization shall manage and use the Lent Equipment with the care of a good manager and should not use the Lent Equipment for the purposes other than the Research Projects.
5. JAXA and the Research Organization shall keep the record of usage and management of the Lent Equipment to record delivery, usage, and returning of the Lent Equipment for the purpose of clarifying the condition of the Lent Equipment.
6. In the case of loss or damage to the Lent Equipment, JAXA and the Research Organization shall immediately notify the fact to the Lessor without delay.
7. The party shall notify the Lessor if any of the Lent Equipment becomes unnecessary due to the reasons such as completion, change, or termination of whole or part of the Research Projects and shall take returning procedures according to the instruction from the Lessor.

Article 27. Confidentiality

1. In this Agreement, "Confidential Information" means any information that corresponds to any of the following:

(1) Any information that includes documents classified “Confidential”, any material object such as a sample, or any information, either material or immaterial, which JAXA and the Research Organization agreed to handle as the Confidential Information by a written agreement, obtained in the course of these Research Projects; and

(2) Any information disclosed or distributed to the other party as Confidential Information in the form of a document, a drawing, a photograph, a specimen, a sample, a magnetic tape, a floppy disk, or the like for the purpose of the Research Projects.

2. The Parties shall appropriately keep the Confidential Information secret, and shall not disclose or divulge any Confidential Information to any party other than those who engage in the Research Projects; provided, however, that any information which corresponds to any of the following is not included in the Confidential Information.

a) Information that is already known to the public when disclosed by the disclosing party;

b) Information that becomes known to the public after the disclosure by the disclosing party without intentional misconduct or negligence of the receiving party;

c) Information that the receiving party already had before the disclosure by the disclosing party;

d) Information that the receiving party acquires from a dully authorized third party not subject to confidentiality obligations;

e) Information that the receiving party independently develops without utilizing information obtained from the disclosing party;

f) Information with a prior written consent of the disclosing party for the disclosure and the publication; or

g) Information that is required to be disclosed by applicable laws, judgment or order of a competent court. In this case, the receiving party shall promptly notify the disclosing party of the necessity of disclosure.

3. The confidentiality obligation under this Article shall remain effective for a period of five (5) years after the termination of the Agreement. However this period of keeping confidentiality may be extended or shortened by mutual agreement between JAXA and the Research Organization.

Article 28. Publication of Research Results

1. The Parties may disclose or publish the Research Results obtained in the course of the Research Projects (Publication of Research Results”) provided that such publishing party follows the obligations stipulated in Article 27.

2. In the case of the previous Paragraph, before publishing, JAXA or the Research Organization (“the publishing party”) shall provide the other party with a written document regarding the description of the subjected Research Results to be published and request a written consent of

the other party. The other party will not unreasonably withhold consent from the publishing party's request for such publication.

3. The other party, upon receiving the notice, will request correction of the content of the publication in a written form if it is judged that such content includes a portion which may lead to the loss of the future interest of the other party and the publishing party shall consult with the other party about such portion. The publishing party may not publish the portion which the other party notified as having possibility of resulting in the loss of the future interest of the other party without consent of the other party.
4. The Research Organization shall state in the publication that such Research Results have been obtained pursuant to this Agreement and identify the owner of the rights to the Earth Observation Satellite Data and Meteorological Data used in such publication.
5. The period during which the notification pursuant to Paragraph 2 is required shall be one (1) year from the day following the day of termination of the Agreement. However this period may be extended or shortened by mutual agreement between JAXA and the Research Organization.
6. JAXA and the Research Organization shall provide the other party with a copy of the publication immediately after the disclosure or publishing of such publication. Each party is entitled to an irrevocable and royalty-free right to use the provided publications, unless the copyright of such publication is owned or held by an academic society.

Article 29. Security

In the course of the Collaborative Research, the Parties shall take necessary procedures for maintaining an order in the areas managed by each party, ensuring appropriate and smooth operation of the research, and ensuring protection of important assets and information (security).

Article 30. Termination of the Contract

1. The Parties may terminate the Agreement in any case that corresponds to any one of the following. In such a case, the Parties agree to waive any claim against the other.

(1) Upon the consent of both JAXA and the Research Organization;

(2) When the other party commits a dishonest and/or inequitable act; provided, that breaching party fails to offer any effective and satisfactory remedial measures within seven (7) days after receiving demands for corrective action from the harmed party;

(3) When the other party breaches the Agreement; provided, that breaching party fails to offer any effective and satisfactory remedial measures within seven (7) days after receiving demands for corrective action from the harmed party;

(4) When the Research Organization loses a person who engages in the Research Projects due to the reasons described in Paragraph 5 of Article 4 such as transfer of the PI; and

(5) When an inevitable reason such as the natural disaster arises.

2. In a case where the Agreement is terminated due to the reasons described in the previous Paragraph, JAXA shall request refund of the funding which is no longer necessary pursuant to Paragraph 1 of Article 8.
3. The Parties shall waive any claim against the other if the Agreement is terminated pursuant to Paragraph 1, Item 5 of this Article.
4. Upon the termination of the Agreement, the Research Organization shall promptly deliver to JAXA all work including, but not limited to, all works in progress and all work that is completed and otherwise ready for delivery.

Article 31. Effective Term

1. The effective term of the Agreement shall be the period set forth in Article 3.
2. Termination of this Agreement shall not affect a Party's continuing obligation under Paragraph 2 and 3 of Article 12 (Providing and Rights of Earth Observation Satellite Data by JAXA), Paragraph 2 to 5 of Article 13 (Providing and Rights of Meteorological Data by JAXA), Paragraph 3 of Article 14 (Exchange of Technical Information etc.), and Article 15 (Usage of Research Results) through Article 21 (Transfer of interests to Jointly-Owned Intellectual Property Rights) during the effective period of rights set forth in each Article and Paragraph while Article 22 (Improved Invention), Article 23 (Designation of Know-How), Article 27 (Confidentiality) and Article 28 (Publication of Research Results) shall be effective during the period set forth in each Article.

Article 32. Changes

1. JAXA may change the content of the Agreement. In such a case, JAXA shall notify the changes by posting such changes on the website of JAXA and subsequently shall follow the changed Agreement.
2. The Research Organization may terminate the Agreement, if the Research Organization has justifiable grounds, by notifying JAXA such intent by a written notification within thirty (30) day from the date of posting of the change on the website of JAXA.

Article 33. Consultation

1. Any matter not stipulated herein or any question arising out of, or in connection with, this Agreement shall be settled each time upon consultation between JAXA and the Research Organization.

Attachment “Earth Observation Satellite Data”

Name of Satellite or Sensor	Observation Period (YYYY/MM/DD)	Observable Area
JERS (Japanese Earth Observation Satellite)	1992/09/01~1998/10/11	Global
ADEOS (Advanced Earth Observation Satellite)	1996/10/15~1997/06/29	Global
ADEOS-II (Advanced Earth Observing Satellite-II)	2003/01~2003/10	Global
ALOS (Advanced Land Observing Satellite)	2006/05/16~2011/04/22	Global
GCOM-W1 (The Global Change Observation Mission 1st-Water)	2012 Fiscal Year~	Global
TRMM (Tropical Rainfall Measuring Mission)	1997/12~	Global (PR: Approximately 36°S-36°N. TMI and VIRS: Approximately 38°S-38°N)
AMSR-E (Advanced Microwave Scanning Radiometer for EOS-Aqua satellite)	2002/06/19~2011/10/04	Global
GOSAT (Greenhouse Gases Observing Satellite)	2009/04/23~	Global

* GPM/DPR will be added by revision of the Agreement pursuant to Article 32 when provisions of data becomes available

COLLABORATIVE RESEARCH AGREEMENT (NON-FUNDED)

FOR THE

7TH PRECIPITATION MEASURING MISSION

BETWEEN THE

JAPAN AEROSPACE EXPLORATION AGENCY (JAXA)

AND

THE RESEARCH ORGANIZATION

(FOR THE RESEARCH ANNOUNCEMENT)

JAPAN AEROSPACE EXPLORATION AGENCY

7th PMM SCIENCE RESEARCH ANNOUCEMENT

COLLABORATIVE RESEARCH AGREEMENT

This agreement ("Agreement") is entered into between the Japan Aerospace Exploration Agency, established under the provisions of the Law Concerning the Japan Aerospace Exploration Agency on October 1, 2003, represented by its President and having its principal office at 7-44-1 Higashimachi, Jindaiji, Choufu-shi, Tokyo, Japan ("JAXA") and a research organization ("Research Organization") that submitted an application form for the below described research activities to JAXA, hereinafter collectively referred to as "the Parties."

WITNESSETH

WHEREAS, JAXA issued the Research Announcement ("RA") to engage in collaborative research activities directly related to retrieval algorithms for geophysical products, product validation, and data application of the Precipitation Measuring Mission ("PMM"), and the Research Organization applied pursuant to such RA;

WHEREAS, JAXA accepted the Research Organization's proposal that was submitted in response to the RA, delivered the confirmation sheet to the Research Organization and JAXA further desires to utilize such proposal in JAXA's project; and

WHEREAS, JAXA desires to engage in the above research activities in collaboration with the Research Organization.

NOW, THEREFORE, in consideration of the mutual agreements hereinafter set forth, and for other good and reasonable consideration, the receipt and adequacy of which are hereby acknowledged, the Parties hereby agree as follows:

Article 1. Definitions

1. The following capitalized terms shall have the following meanings:

(1) "Research Results" means the technical results and scientific knowledge derived from the implementation of the Research Projects pursuant to this Agreement, including all inventions, ideas, designs, literary works, algorithms, and technological developments, such as programs,

that can execute the algorithm(s).

(2) "Intellectual Property Rights" generated in the course of implementation of the Agreement means the following:

(i) Industrial Property Rights (as defined below);

(ii) Potential Industrial Property Rights (as defined below); and

(iii) Program/Data Copyrights (as defined below).

"Industrial Property Rights" means all domestic and foreign patents, utility models, and industrial designs.

"Potential Industrial Property Rights" means all domestic and foreign application rights for patents, utility models, or industrial designs.

"Program/Data Copyrights" means all domestic and foreign copyrights related to computer programs, software and databases.

(3) "Collaborative Research Plan" means the plan described in the Application for Collaborative Research Agreement for the PMM ("Application").

(4) "Research Period" means a three-year period from the beginning of fiscal year 2013 to the end of fiscal year 2015. Based on the regulations of this Agreement, in case this Agreement is terminated before the completion date of the Research Period, such date of termination of the Agreement shall be the final date of the Research Period.

(5) "Annual Evaluation" means evaluation by JAXA of the research results achieved at the end of each Japanese fiscal year, in order to assess the progress of the research.

(6) "Earth Observation Satellite Data" means data sets obtained from satellites which are retained by JAXA at the time of execution of this Agreement. The available data sets (including names of satellites, sensors, observation periods that can be offered, and observation areas) are listed in Attachment A of this Agreement.

(7) "Meteorological Data" means data sets provided by the Japan Meteorological Agency pursuant to the agreement between JAXA and the Japan Meteorological Agency.

2. In this Agreement, "Invention, etc." means inventions in terms of items subject to patent rights, utility models in terms of items subject to utility model rights, creations in terms of items subject to copyrights such as design rights and programs, and ideas in terms of items subject to

algorithms and know-how.

3. In this Agreement, "utilization" of the intellectual property rights and Research Results means activities defined in Article 2, Paragraph 3 of the Patent Act, activities defined in Article 2, Paragraph 3 of the Utility Model Act, activities defined in Article 2, Paragraph 3 of the Design Act, enforcement of rights defined in Articles 21 and 27 of the Copyright Act (including utilization of secondary work created by JAXA or the Research Organization), and use of algorithms and know-how.
4. In this Agreement, "Principal Investigator" ("PI") means the Research Organization employee who submitted the proposal in response to the RA and was selected to be responsible for the Research Projects. "Co-Investigator" ("CI") means a person who supports the PI in performing the Research Projects with approval by JAXA. Names, affiliation, and other information concerning the PI and CI (collectively "Collaborative Researchers") shall be described in the Collaborative Research Plan.

Article 2. JAXA's Performance for Research Projects and the Research Organization's General Responsibilities for Research Projects

1. JAXA shall make reasonable efforts to perform the following tasks related to the Research Projects:

a) Deliver the Earth Observation Satellite Data and Meteorological Data required for performing the Collaborative Research to the Research Organization free of charge;
b) Hold research presentation meetings (Research Presentation Meeting) to check progress of the research and other necessary meetings;
c) Carry out an Annual Evaluation based on the report made in the Research Presentation Meeting stipulated in the previous Paragraph, or written reports similar to the one stipulated therein.

2. For the purpose of ensuring the Research Organization's performance of the above obligations, the Research Organization shall perform certain actions including, but not limited to:

a) Conduct and complete the Research Projects in accordance with the Collaborative Research Plan.
b) Participate in the Research Presentation Meeting hosted by JAXA every fiscal year in response to the request from JAXA;
c) Report on the Research Results and progress of research in the Research Presentation Meeting stipulated in the previous Paragraph, or submit in a written form to JAXA by the day before the Annual Evaluation that JAXA implements every fiscal year;
d) Deliver the reports as a report of all the Research Results obtained during the fiscal year by the end of such fiscal year to JAXA. Furthermore, upon completion of the research period, the Research Organization shall report all the Research Results obtained throughout the entire

period of the Collaborative Research in the Final Report and submit it to JAXA. In this case, the Research Organization does not need to separately submit an annual report for the final year of the term; and

e) Alternatively may substitute the submission of a thesis published during the Research Period for the submission of the report of Research Results.

Article 3. Finalization of the Contract

The Agreement shall become effective as of the date of the issuance of the Confirmation Sheet prescribed by JAXA in response to an application by the Research Organization. The period of the Agreement shall be the period described in the Confirmation Sheet issued by JAXA.

Article 4. Researchers

1. The Research Organization shall ensure that the Collaborative Researchers listed in the Collaborative Research Plan to participate in the Collaborative Research.
2. JAXA shall allow those who are listed in the Collaborative Research Plan to participate in the Research Projects.
3. The Research Organization shall ensure that all the Collaborative Researchers engaging in the Research Projects act in accordance with the terms and conditions of the Agreement.
4. In the event that the Research Organization intends to newly select or add CIs, the Research Organization shall first notify JAXA in written form in advance and obtain the consent of JAXA for such personnel. The Research Organization shall take necessary measures to cause such CI to follow the Collaborative Research Agreement.
5. In the event that the PI dies, retires from the Research Organization, takes a leave of absence from work, or comes to be no longer engaged in the Research Projects, the Research Organization shall immediately notify JAXA as such and JAXA may at its sole discretion terminate this Agreement; provided however, that if the Research Organization designates a researcher who belongs to the Research Organization as the PI's successor and JAXA approves the succession, the Parties may amend this Agreement, with the succeeding researcher being a new PI. The terms and conditions of the amendment to this Agreement shall be determined upon mutual consultation and consent.

Article 5. Research Funding

Each party shall bear the necessary costs of fulfilling its own responsibilities under this agreement.

Article 6. Ownership of the Rights to the Acquired Equipment

Equipment acquired by each party in the course of the Research Projects shall be owned by the party

who purchased such equipment.

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Article 7. Providing of Earth Observation Satellite Data by JAXA

1. JAXA will provide the Research Organization with the Earth Observation Satellite Data for the Research Projects free of charge in accordance with Article 2, Paragraph 1, a) subject to the following conditions:

a) The Research Organization agrees and accepts that JAXA may not provide all the Earth Observation Satellite Data which the Research Organization may request due to rights restrictions of JAXA's equipment and resource limitations.

Note that the Advanced Land Observing Satellite data, which is one portion of the Earth Observation Satellite Data required by the Research Organization and to be provided to the Research Organization, shall be limited to ten scenes every fiscal year;

b) JAXA does not guarantee a specific quality or the timely provision of the Earth Observation Satellite Data and does not take responsibility for the quality or any delay of provision of such data; and

c) JAXA reserves the right to curtail or suspend Earth Observation Satellite Data supply to the Research Organization due to faults or difficulties relating to the satellites, limitations on their operations, or any other reasons, and JAXA shall be exempt from any responsibility for such curtailing or suspension.

2. With respect to the Earth Observation Satellite Data provided by JAXA, the Research Organization shall:

a) Not duplicate the Earth Observation Satellite Data except for the purpose of backup. However, this excludes duplication for distributing to authorized researchers engaged in the Research Project as stipulated in Article 4 and subcontractors stipulated in Article 4 ("Collaborative Researchers" collectively) which are necessary for the Collaborative Research Project.

b) Not provide or disclose the Earth Observation Satellite Data which can be converted back to the primary Earth Observation Satellite Data except to the PI;

c) Only use the Earth Observation Satellite Data for the singular purpose of advancing the efforts of the Research Projects; and

d) Return or otherwise appropriately manage the Earth Observation Satellite Data upon completion of this Agreement, according to the directives of JAXA.

3. Any rights regarding the Earth Observation Satellite Data provided by JAXA shall conform to the following:

a) Any rights relating to the Earth Observation Satellite Data provided by JAXA to the Research Organization shall not be transferred to the Research Organization by such provisions. In terms of the intellectual property rights of the data, the Research Organization shall follow instructions

of JAXA.

b) If value-added products, which mean highly processed products that do not retain the original pixel structure and that cannot be converted back to the primary Earth Observation Satellite Data, are developed in the course of executing the Research Projects, the ownership of such products shall be determined upon mutual agreement between the Parties, taking into consideration the degrees of contribution by JAXA and the Research Organization.

Article 8. Providing of Meteorological Data by JAXA

1. For the purpose of performing the Research Projects, JAXA will attempt to provide the Research Organization with the Meteorological Data based on Article 2, Paragraph 1, a).
2. Any rights relating to the Meteorological Data provided by JAXA to the Research Organization shall not be transferred to the Research Organization by such provisions. In terms of the intellectual property rights of the data, the Research Organization shall follow the instructions of JAXA.
3. The Research Organization may not disclose the provided Meteorological Data to any third party except for Collaborative Researchers.
4. The Research Organization shall use the provided Meteorological Data solely for the purpose of conducting the Research Projects.
5. The Research Organization shall return or otherwise appropriately keep the Meteorological Data in accordance with the instructions of JAXA upon the termination of this Agreement.

Article 9. Disclosure of Technical Data

1. For the purpose of performing the Research Projects, JAXA will attempt to provide the Research Organization with the meteorological data provided by the Japan Meteorological Agency pursuant to the agreement between JAXA and the Japan Meteorological Agency ("Meteorological Data"). The Research Organization agrees that JAXA's provision of the Meteorological Data may be limited or otherwise affected by the fact that some rights to the Meteorological Data belong to the Japan Meteorological Agency.
2. The Research Organization shall use the provided Meteorological Data solely for the purpose of conducting the Research Projects. The Research Organization may not disclose the provided Meteorological Data to any third party.
3. The Research Organization shall return or otherwise appropriately keep the Meteorological Data in accordance with the instructions of JAXA upon the termination of this Agreement.

Article 10. Usage of Research Results

1. All Research Results obtained through the course of the Collaborative Research ("Jointly-Owned Research Results") may be used for non-commercial and peaceful purposes by the Parties (or by a third party including for JAXA or the Research Organization) without prior consent of the other party.
2. With regard to copyrights in the Final Reports submitted by the Research Organization to JAXA, JAXA may freely use, edit, copy, and distribute such reports. In this case, the Collaborative Researchers shall waive any related moral rights to the copyrights in the Final Reports.

Article 11. Ownership of Research Results

1. Both Parties shall solely own the rights of the Research Results only if JAXA or the Research Organization solely generates such Research Results in the course of Research Projects.
2. The Parties shall jointly own the rights to the Research Results obtained through the course of the Collaborative Research and the ownership of such results shall be determined upon mutual agreement between the Parties, taking into consideration the degrees of contribution by JAXA and the Research Organization.

Article 12. Application, etc., of Intellectual Property Rights

1. JAXA or the Research Organization shall give the other party prompt written notice of Intellectual Property Rights generated in the course of the Collaborative Research, such as Inventions, Utility Models, and Creations, and discuss the ownership of such generated Intellectual Property Rights, as well as whether it is necessary to submit an application for registration of such Intellectual Property Rights.
2. JAXA and/or the Research Organization shall take any necessary procedures for any Industrial Property Rights owned by and/or held by each Collaborative Researcher (including inventions, etc., jointly generated by such Joint Researcher and JAXA or the Research Organization) to be transferred by such Joint Researcher to JAXA or the Research Organization.
3. If JAXA or the Research Organization solely generates Potential Intellectual Property Rights in the course of the Research Projects ("Solely-Owned Intellectual Property Rights"), the party may take steps to apply for the registration of the resulting Intellectual Property Rights as solely-owned ones, provided that it shall obtain prior confirmation of the other party. In this case, expenses for application and rights preservation shall be borne by the party solely holding the Intellectual Property Rights.
4. In the event that the Parties jointly generate an invention, etc., and submit an application for Intellectual Property Rights to such invention, the Parties shall enter into a separate joint ownership agreement ("Joint Ownership Agreement") and jointly perform submission of the

application and other procedures according to the Joint Ownership Agreement. In this case, expenses for application and rights preservation shall be borne by both JAXA and the Research Organization in accordance with the degree of ownership.

Article 13. Application of Intellectual Property Rights Overseas

1. Regulations of the previous Article shall apply to the case of application and rights preservation of the Intellectual Property Rights in foreign countries.
2. In the event of an application of the Intellectual Property Rights jointly owned by the Parties pursuant to Paragraph 4 of the previous Article, the Parties shall discuss whether it is necessary to submit an application for registration of such Intellectual Property Rights.

Article 14. Utilization of Jointly-Owned Intellectual Property Rights

In case either of the Parties utilizes the Jointly-Owned Intellectual Property Rights, such party shall obtain the consent of the other party in advance and pay a utilization fee as set forth in the separate utilization agreement, except for the case stipulated in Article 10.

Article 15. License of Utilization of Jointly-Owned Intellectual Property Rights to Third Party

1. The Parties may grant to any third party a license to use the Jointly-Owned Intellectual Property Rights, provided, however that the relevant party shall obtain the written prior consent of the other party, and determine the licensing terms after discussion with the other party.
2. In the case of granting a license to use the Jointly-Owned Intellectual Property Rights to a third party as in the previous Paragraph, the relevant party shall collect the usage fee from such third party as set forth in the separate usage agreement. The usage fee to be collected from the third party shall be distributed between the Parties pro rata in proportion to their respective interests in those rights.

Article 16. Transfer of Interests to Jointly-Owned Intellectual Property Rights

1. The Parties may transfer their respective interests to the Jointly-Owned Intellectual Property Rights generated in the course of the Collaborative Research only to their respective designees after discussion between the Parties. Such transfer may be carried out pursuant to a separate transfer agreement. In this event, the Parties shall cause its designee to succeed to all of its rights and obligations with respect to those Intellectual Property Rights.
2. If JAXA or the Research Organization disclaims its interests in the Jointly-Owned Intellectual Property Rights, the relevant party shall give the other party prior notice thereof and transfer its interests to the other party, only if the other party wishes to acquire it.

Article 17. Improved Invention

If JAXA or the Research Organization alters or improves the Jointly-Owned Intellectual Property within one (1) year from the application for registration of the original Jointly-Owned Intellectual Property Rights, the party shall provide a written notice without delay to the other party describing the alterations or improvements. Ownership and other issues of the Intellectual Property Rights concerning the altered or improved invention shall be determined through discussion between the Parties.

Article 18. Designation of Know-How

1. After mutual agreement by the Parties, JAXA and the Research Organization shall promptly designate as know-how the Research Results which are appropriately to be treated as know-how ("Know-How").
2. For designation of Know-How, a period during which the Research Results are designated to be Know-How shall be specified.
3. After designating the Know-How, such Know-How shall be kept in confidence in principle, for five (5) years commencing on the day immediately following the date of the completion of this Agreement; provided, however, that JAXA and the Research Organization may extend or shorten that period upon mutual agreement.

Article 19. Utilization of Facilities, etc.

1. The Parties may use facilities and equipment ("Facilities") of the other party free of charge with the prior consent of the other party if it is necessary for implementation of the Research Projects.
2. The Parties shall follow the rules and regulations of the other party in case of using the Facilities of the other party.

Article 20. Installation of Equipment

1. The Parties may, if necessary for implementation of the Research Projects, install necessary equipment and other materials into the facility of the other party with the prior consent of the other party. In this case, the party which installs such equipment shall follow the rules and regulations of the other party.
2. In the event that JAXA or the Research Organization uses the materials, etc., installed by the other party (Installed Material), such party shall obtain the prior consent of the other party and shall not use the Installed Material for other purposes than the Research Projects.
3. In the event that JAXA or the Research Organization loses or damages the Installed Material, such party should immediately notify the other party of such fact irrespective of the reason.

Article 21. Delivery, Storage, and Returning of Lent Equipment

1. The Parties may lend machinery or other materials to the other party if it is required for implementation of the Research Projects.
2. Upon delivery of the machinery or other materials ("Lent Equipment") lent in accordance with the previous Paragraph, the owner of the Lent Equipment ("Lessor") shall submit to the other party a Note of Delivery and the other party shall submit to the Lessor a receipt.
3. The Parties shall confirm the items, amount, etc. of the Lent Equipment upon delivery of the Lent Equipment and if there is a shortage in the amount or any defect (including ones whose quality and/or specification does not meet the requirements), JAXA or the Research Organization shall notify such fact to the Lessor and receive an instruction from the Lessor.
4. JAXA and the Research Organization shall manage and use the Lent Equipment with the care of a good manager and should not use the Lent Equipment for purposes other than the Research Projects.
5. JAXA and the Research Organization shall keep a record of usage and management of the Lent Equipment to record the delivery, usage, and returning of the Lent Equipment for the purpose of clarifying the condition of the Lent Equipment.
6. In the case of loss or damage to the Lent Equipment, JAXA and the Research Organization shall immediately notify the fact to the Lessor without delay.
7. The receiving party shall notify the Lessor if any of the Lent Equipment becomes unnecessary due to reasons such as completion, change, or termination of whole or part of the Research Projects and shall take procedures to return the Lent Equipment according to the instructions of the Lessor.

Article 22. Confidentiality

1. In this Agreement, "Confidential Information" means any information that corresponds to any of the following:

(1) Any information that includes documents classified "Confidential", any material object such as a sample, or any information, either material or immaterial, which JAXA and the Research Organization agreed to handle as Confidential Information by a written agreement, obtained in the course of these Research Projects; and

(2) Any information disclosed or distributed to the other party as Confidential Information in the form of a document, a drawing, a photograph, a specimen, a sample, a magnetic tape, a floppy disk, or the like for the purpose of the Research Projects.

2. The Parties shall appropriately keep the Confidential Information secret, and shall not disclose or divulge any Confidential Information to any party other than those who engage in the Research Projects; provided, however, that any information which corresponds to any of the

following is not included in the Confidential Information.

a) Information that is already known to the public when disclosed by the disclosing party;
b) Information that becomes known to the public after the disclosure by the disclosing party without intentional misconduct or negligence of the receiving party;
c) Information that the receiving party already had before the disclosure by the disclosing party;
d) Information that the receiving party acquires from a duly authorized third party not subject to confidentiality obligations;
e) Information that the receiving party independently develops without utilizing information obtained from the disclosing party;
f) Information with prior written consent of the disclosing party for disclosure or publication; or
g) Information that is required to be disclosed by applicable laws, judgment or order of a competent court. In this case, the receiving party shall promptly notify the disclosing party of the necessity of disclosure.

3. The confidentiality obligation under this Article shall remain effective for a period of five (5) years after the termination of the Agreement. However this period of maintaining confidentiality may be extended or shortened by mutual agreement between JAXA and the Research Organization.

Article 23. Publication of Research Results

1. The Parties may disclose or publish the Research Results obtained in the course of the Research Projects ("Publication of Research Results") provided that such publishing party follows the confidentiality obligations stipulated in Article 22.
2. In the case of the previous Paragraph, before publishing, JAXA or the Research Organization ("the publishing party") shall provide the other party with a written document regarding the description of the Research Results to be published and request the written consent of the other party. The other party will not unreasonably withhold consent from the publishing party's request for such publication.
3. The other party, upon receiving the notice, will request correction of the content of the publication in written form if it is judged that such content includes a portion which may lead to the loss of the future interest of the other party and the publishing party shall consult with the other party about such portion. The publishing party may not publish the portion which the other party has notified as having the possibility of resulting in the loss of the future interest of the other party without the consent of the other party.
4. The Research Organization shall state in the publication that such Research Results have been obtained pursuant to this Agreement and identify the owner of the rights to the Earth Observation Satellite Data and Meteorological Data used in such publication.

5. The period during which the notification pursuant to Paragraph 2 is required shall be one (1) year from the day following the day of termination of the Agreement. However this period may be extended or shortened by mutual agreement between JAXA and the Research Organization.
6. JAXA and the Research Organization shall provide the other party with a copy of the publication immediately after the disclosure or publishing of such publication. Each party is entitled to an irrevocable and royalty-free right to use the provided publications, unless the copyright of such publication is owned or held by an academic society.

Article 24. Security

In the course of the Collaborative Research, the Parties shall take necessary procedures for maintaining order in the areas managed by each party, ensuring appropriate and smooth operation of the research, and ensuring the protection (security) of important assets and information.

Article 25. Termination of the Contract

1. The Parties may terminate the Agreement in any case that corresponds to any one of the following. In such a case, the Parties agree to waive any claim against the other.

(1) Upon the consent of both JAXA and the Research Organization;

(2) When the other party commits a dishonest and/or inequitable act; provided that the breaching party fails to offer any effective and satisfactory remedial measures within seven (7) days after receiving demands for corrective action from the harmed party;

(3) When the other party breaches the Agreement; provided that the breaching party fails to offer any effective and satisfactory remedial measures within seven (7) days after receiving demands for corrective action from the harmed party;

(4) When JAXA determines that it cannot continue the Research Projects with the Research Organization as a result of the Annual Evaluation stipulated in Article 2, Paragraph 1, c).

(5) When the Research Organization loses a person who is engaged in the Research Projects due to the reasons described in Paragraph 5 of Article 4, such as transfer of the PI; and

(6) Due to an unavoidable occurrence such as a natural disaster.

2. Upon the termination of the Agreement, the Research Organization shall promptly deliver to JAXA all work including, but not limited to, all works in progress and all work that is completed and otherwise ready for delivery.
3. The Parties shall waive any claim against the other if the Agreement is terminated pursuant to Paragraph 1, Item 6 of this Article.

Article 26. Effective Term

1. The effective term of the Agreement shall be the period set forth in Article 3.
2. Termination of this Agreement shall not affect a Party's continuing obligation under Paragraph 2 and 3 of Article 7 (Providing and Rights of Earth Observation Satellite Data by JAXA), Paragraph 2 to 5 of Article 8 (Providing and Rights of Meteorological Data by JAXA), Paragraph 3 of Article 9 (Exchange of Technical Information etc.), and Article 10 (Usage of Research Results) through Article 16 (Transfer of interests to Jointly-Owned Intellectual Property Rights) during the effective period of rights set forth in each Article and Paragraph while Article 17 (Improved Invention), Article 18 (Designation of Know-How), Article 22 (Confidentiality) and Article 23 (Publication of Research Results) shall be effective during the period set forth in each Article.

Article 27. Changes

1. JAXA may change the content of the Agreement. In such case, JAXA shall notify the changes by posting such changes on the website of JAXA and subsequently shall follow the changed Agreement.
2. The Research Organization may terminate the Agreement, if the Research Organization has justifiable grounds, by notifying JAXA of such intent in writing within thirty (30) days from the date of posting of the change on the website of JAXA.

Article 28. Consultation

Any matter not stipulated herein or any question arising out of, or in connection with, this Agreement shall be settled each time upon consultation between JAXA and the Research Organization.

Attachment “Earth Observation Satellite Data”

Name of Satellite or Sensor	Observation Period (YYYY/MM/DD)	Observable Area
JERS (Japanese Earth Observation Satellite)	1992/09/01~1998/10/11	Global
ADEOS (Advanced Earth Observation Satellite)	1996/10/15~1997/06/29	Global
ADEOS-II (Advanced Earth Observing Satellite-II)	2003/01~2003/10	Global
ALOS (Advanced Land Observing Satellite)	2006/05/16~2011/04/22	Global
GCOM-W1 (The Global Change Observation Mission 1st-Water)	2012 Fiscal Year~	Global
TRMM (Tropical Rainfall Measuring Mission)	1997/12~	Global (PR: Approximately 36°S-36°N. TMI and VIRS: Approximately 38°S-38°N)
AMSR-E (Advanced Microwave Scanning Radiometer for EOS-Aqua satellite)	2002/06/19~2011/10/04	Global
GOSAT (Greenhouse Gases Observing Satellite)	2009/04/23~	Global

* GPM/DPR will be added by revision of the Agreement pursuant to Article 27 when provision of the data becomes available.