

# **PRECIPITATION MEASURING MISSION SCIENCE: THE 8<sup>th</sup> RESEARCH ANNOUNCEMENT**

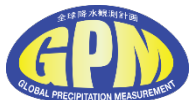
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**Earth Observation Research Center  
Space Technology Directorate I  
Japan Aerospace Exploration Agency**

## Contents

<b>1.</b>	<b>Introduction .....</b>	<b>1</b>
1.1.	About the 8 <sup>th</sup> Research Announcement .....	1
1.2.	Research Areas of This RA .....	1
1.3.	Targets of GPM and Mission Success Criteria .....	2
1.4.	This RA and GPM Algorithm Development and Validation Phases.....	5
1.5.	Priorities in Selection of Proposals and Budget Plan .....	5
<b>2.</b>	<b><i>Technical Description.....</i></b>	<b>7</b>
2.1.	Purposes of RA .....	7
2.2.	Research Areas .....	7
<b>3.</b>	<b><i>Instructions for Responding to this RA .....</i></b>	<b>16</b>
3.1.	Qualifications.....	16
3.2.	Research Agreement Conclusion .....	16
3.3.	Research Period.....	16
3.4.	Resources .....	16
3.5.	Obligations.....	17
3.6.	Selection .....	17
3.7.	Late Proposals .....	17
3.8.	Withdrawal of Proposal.....	17
3.9.	Cancellation and Postponement.....	18
3.10.	Important Dates .....	18
3.11.	Proposal Submission and Contact Point .....	18
<b>4.</b>	<b><i>Instructions for Proposal Contents.....</i></b>	<b>19</b>
4.1.	General.....	19
4.2.	Format.....	19
4.3.	Proposal Contents .....	19
<b>5.</b>	<b><i>Description of Research Agreement .....</i></b>	<b>21</b>
5.1.	Contractual Procedure .....	21
5.2.	Research Agreement Summary.....	21



<b>Appendix A PROPOSAL COVER SHEET AND SCHEDULE.....</b>	<b>A-1</b>
<b>Appendix B RESOURCE REQUIREMENTS .....</b>	<b>B-1</b>
<b>Appendix C OVERVIEW OF THE GLOBAL PRECIPITATION MEASUREMENT AND THE TROPICAL RAINFALL MEASURING MISSION.....</b>	<b>C-1</b>
<b>Appendix D ASSOCIATED TERMS AND CONDITIONS OF RESEARCH AGREEMENTS</b>	
<b>(FOR THE 8<sup>TH</sup> PMM SCIENCE RESEARCH ANNOUNCEMENT).....</b>	<b>D-1</b>

## **1. Introduction**

### **1.1. About the 8<sup>th</sup> Research Announcement**

In this eighth 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 two RAs (the sixth and seventh RAs,) for the period from Japanese Fiscal Year (JFY) 2010 to 2012 (for the sixth) and from 2012 to 2015 (for the seventh,) 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 needed for producing long-term data sets. Details of research theme will be described in Section 1.2. Since the GPM Core Observatory was launched in February 2014, this RA covers a 3-year research period beginning in JFY 2016, which will cover the most of its routine operation period of the GPM Core Observatory. Since the TRMM satellite completed its mission operation in April 2015, research theme related to the TRMM satellite will be limited to the Application Research.

JAXA is conducting cross-cutting application researches in order to enhance synthetic use of multiple satellite data. The purposes of the cross-cutting application researches includes generation of valuable products integrated by multiple satellite data and satellite-model integrated use (data assimilation etc.,) development of the prediction schemes using a model, and enhancement of operational and public use. The current subjects of the cross-cutting application researches are "water cycle and resources," "ecosystem monitoring," "climate system radiation process," "marine environment monitoring," "atmospheric environment monitoring," "infrastructure monitoring," "agriculture," and "public health." In this RA, proposals which contribute to these researches mainly using GPM and TRMM data are also recommended.

### **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. Please see Section 1.5 for priorities in selection of proposal.

#### **(1) Algorithm Development**

Researches to develop or improve retrieval algorithms, which are the Dual-frequency Precipitation Radar (DPR), the DPR and GPM Microwave Imager (GMI) combined, the Global Precipitation Map (GSMaP) algorithms, and develop the DPR Latent Heating algorithm, to produce the JAXA GPM standard products.

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

Researches to acquire and analyze ground observation data, which are contributed to the development, improvement, and accuracy evaluation of the JAXA GPM standard algorithms, conduct inter-comparison of precipitation datasets, and validate accuracy of GPM standard products.

Effective validation activities collaborating with other science projects are expected.

## (3) Application Research

Researches to apply GPM and TRMM data into atmospheric, climate, land, hydrological, and other models and/or data assimilation, to develop of new GPM research products, through new techniques such as data assimilation, to create long-term and continuous data set using GPM and TRMM products, to analyze climate and global water cycle variation, precipitation system climatology, to conduct operational data utilization, such as monitoring of wind and flood damage, to utilize the GPM Global Rainfall Map in the Asian region and other areas where ground precipitation observation is not sufficient, and to contribute EORC's cross-cutting application researches (see Section 1.1) mainly using GPM and TRMM data.

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 TRMM/PR standard algorithm Ver.7 and the Global Satellite Mapping of Precipitation (GSMaP) algorithm Ver.5 before the launch of GPM Core Observatory, and correspond to minimum success. When GPM completes its routine operation period at around May 2017, it is required to achieve full success in Table 1 through improvement of accuracy of each algorithm.

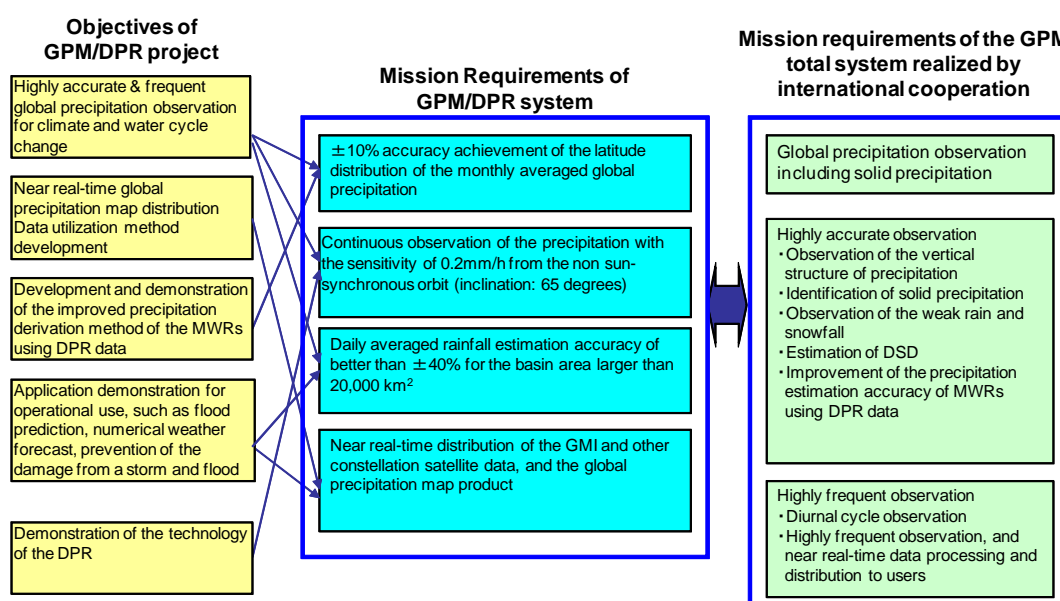


Figure 1 Objectives of JAXA's GPM/DPR Project and Mission Requirements

Table 1 Target Accuracies of JAXA GPM Standard Products

Review timing Products		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 routine operation period
L1	KuPR	Output received power of L1 code using L0 simulation data as input will agree within $\pm 0.01$ dBm 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 $\pm 1$ 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). Rain rate that hypothesized by synthetic data of simulated nature will agree with that estimated by L2 algorithms within about $\pm 50\%$ within effective rain rates 0.7 - 30 mm/h.	Surface scattering factor of KuPR will agree within $\pm 2$ dB with that of PR. for 1-month, for non-rain & least wind speed affected angle bin.. Rain rate of KuPR will agree within $\pm 50\%$ with that of PR within effective rain rates 0.7 - 30 mm/hr for 2-month, over the ocean, within latitudes of $\pm 30^\circ$ , for all angle bins, at surface/	Same as above.
	KaPR	Same as above, but effective rain rate will be 0.7 - 10.0 mm/h.	Surface scattering factor of KaPR will agree within $\pm 2$ dB with that of PR for 1 month, for non-rain pixels, over the ocean, at no-rain & least wind speed affected & least wind speed affected angle bin, but considering differences between KaPR and PR in observation frequency. Rain rate of KaPR will agree with that of PR within $\pm 50\%$ within effective rain rates 0.7 - 10 mm/h for 2 months, over the ocean, within latitudes of $\pm 30^\circ$ , for all angle bins, at surface.	Same as above.
	DPR Dual-frequency Precipitation	Same as above, but effective rain rate will be 0.7 - 30.0 mm/h.	Rain rate of dual-frequency precipitation product will agree with that of PR within $\pm 50\%$ within effective rain rates 0.7 - 30 mm/h for 2 months, over the ocean, within latitudes of $\pm 30^\circ$ , for all angle bins, at surface.	Continuous observation of the precipitation with the sensitivity of 0.2 mm/h by DPR, satisfying designed function and capability.
	DPR/GMI combined	Error of surface rain rate is 50% at 1 mm/h, and 25% at 10 mm/h, for horizontal resolution of 50km.	Error of surface rain rate is 50% at 1 mm/h and 25% at 10 mm/h, for horizontal resolution of 50km.	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 $\pm 10\%$ accuracy with that obtained by ground-based rain gauge network worldwide. Monthly averaged zonal rainfall of DPR will agree within $\pm 10\%$ accuracy with that of GMI, over the ocean.
	DPR/GMI combined	Same as above.	Same as above.	N/A
	Global Precipitation Map	Compare the Global Precipitation Map product (without GMI) to the RadarAMeDAS data, averaged daily and in a $0.25^\circ$ latitude-longitude grid box. RMS will be within 0.7 mm/h on average.	Verify inconsistency in horizontal distribution and zonal mean of Global Precipitation Map product, between products including or excluding GMI data. Compare the Global Precipitation Map product to the RadarAMeDAS data, averaged daily and in a $0.25^\circ$ latitude-longitude grid box. RMS will be within 0.7 mm/h on average.	Daily averaged rainfall produced by GMI and other microwave radiometers (imager/sounder) will agree within $\pm 40\%$ 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 2016 to JFY 2018 corresponding to post-launch algorithm maintenance and improvement phases for algorithm development activities, 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 ninth research announcement.

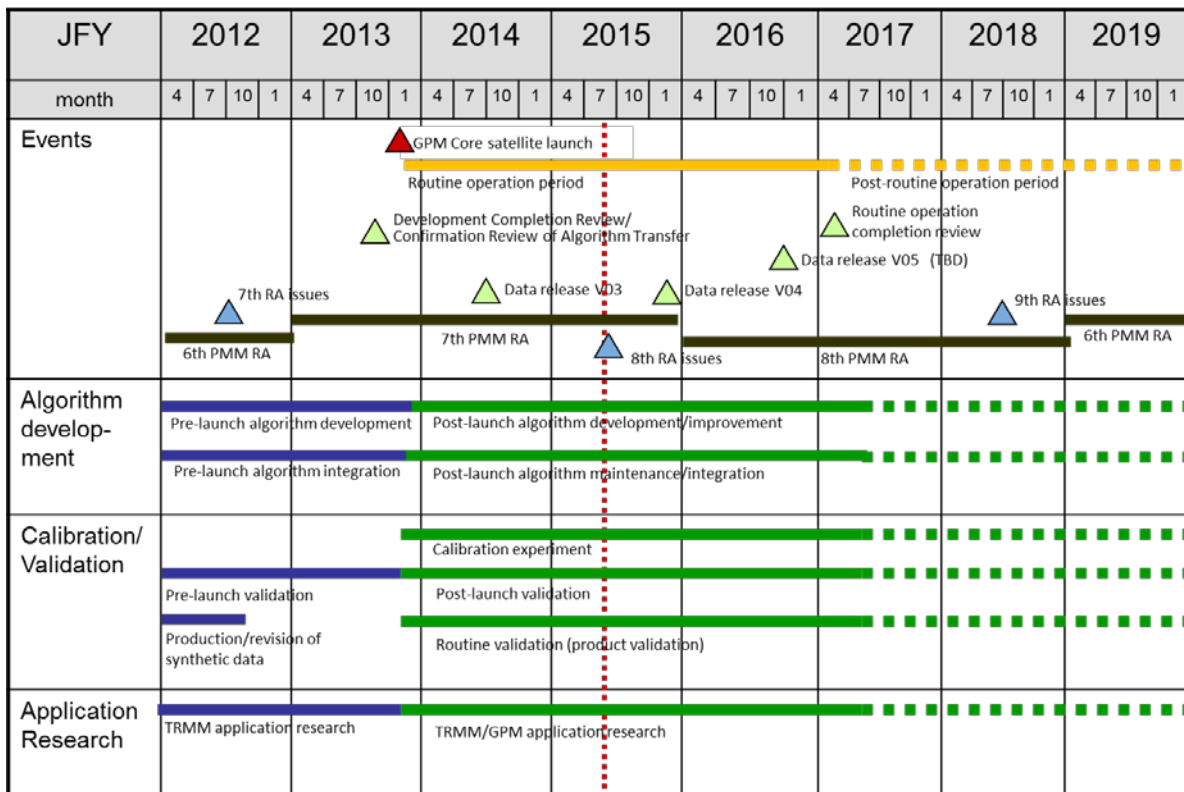


Figure 2 Schedule for RA and GPM Algorithm Development/Validation Phases

#### 1.5. Priorities in Selection of Proposals and Budget Plan

In this RA, JAXA will give priority to the following research themes;

- Development and improvement of the DPR and GSMaP algorithms, and development of the DPR Latent Heating algorithm;
- In-situ observations and validation of precipitation parameters that contribute to development and improvement of the algorithms;
- Inter-comparison of precipitation datasets with a central focus on GPM, TRMM and GSMaP; and
- Model utilization or data assimilation of the DPR and GSMaP data.

If a proposal is highly expected to contribute to the GPM and/or TRMM missions, JAXA may also select funded-PIs other than priority themes.

Although it will depend on the budget situation, JAXA plans to spend 120,000,000 yen as total budget for the Japanese Fiscal Year (JFY, period from April 1 to March 31) 2016 and 2017, and 95,000,000 yen as total budget for JFY 2018. For funding research, annual budget of each proposal will vary from 1,000,000 to 10,000,000 yen approximately, and about 5 proposals will be adopted with annual budget of approximately 10,000,000 yen.



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 November 1, 2015. 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 2016.

## **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. Please see Section 1.5 for priorities in selection of proposal. Details are described in Sections 2.2.1 to 2.2.3.

#### **2.2.1 Algorithm Development**

As described in (1)-(4) below, research themes to develop and improve JAXA GPM 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 (the 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. Algorithms to produce geophysical products other than those listed in Tables 2-3 will be considered new products and will be included in Theme 3 “Application Research.”

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 ( $\sigma^0$ ), 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 ( $\sigma^0$ ), 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	125km/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
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
Global precipitation map algorithm		Global precipitation map product	Mean rainfall, observation number, rain pixel number	Monthly	Global
				Hourly	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/245km
3R	Global precipitation map algorithm	Global precipitation map product	Mean rainfall, observation number, rain pixel number	Hourly	Global

## (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.

The 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.

The 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 the 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.

The DPR Level 3 algorithm will calculate statistics of each Level 2 product. Furthermore, algorithm development will include following components and their evaluation.

- Utilization of KaPR data;
  - Development and improvement in correction of attenuation in Ka-band by non-precipitation particles, such as clouds, and detection of bright band in Ka-band, precipitation-type classification in Ka-band;
  - Development and improvement 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
  - Development and improvement in detection of bright band in dual-frequency observation, and 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.

The 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.

The 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.

The 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.

Furthermore, algorithm development will include following components and their evaluation;

- 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 five algorithms, completely or in part, which compose algorithms to produce the Global Precipitation Map standard products, shown in Table 2;

- Microwave imager rain retrieval algorithm (MWI algorithm);
- Microwave sounder rain retrieval algorithm (MWS algorithm) ;
- Microwave imager/sounder rain retrieval algorithm (MWIS algorithm);
- Microwave-Infrared (IR) combined algorithm (MVK algorithm); and
- Rain gauge correction algorithm (Gauge 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;

- The MWIS algorithm should retrieve rain rates over land and ocean using Level 1 products (Brightness Temperatures) of microwave imager/sounders on board constellation satellites as inputs;
- The MVK algorithm should produce microwave and IR combined rainfall (Global Precipitation Map) using rain rate data retrieved by MWI, MWS and MWIS algorithms and Geostationary IR information as inputs; and
- The Gauge algorithm should produce ground-based gauge corrected rainfall (Gauge-corrected Global Precipitation Map) using the Global Precipitation Map produced by the MVK algorithm.

Furthermore, algorithm development will include following components and their evaluation;

- Development and improvement of the DPR-based precipitation physics databases;
- Development and improvement of accuracy of solid precipitation over high-latitudes using high-frequency channels available in GMI and microwave sounders; and
- Development and improvement of the near-real-time Gauge algorithm applying rainfall correction method by using rain gauges.

#### **(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.

The DPR Latent Heating algorithm will be developed in Japan.

In developing the 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.

The DPR Latent Heating algorithm should have the following functions;

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

Furthermore, the following components have to be developed and evaluated to produce the DPR Latent Heating products,;

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

### **2.2.2 Validation**

As described in (1)-(4) below, research themes to contribute to development and improvement of the 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 the GPM and TRMM Level 2 and 3 standard products, in particular, in terms of precipitation rate (hereafter referred as to “Product Validation”), research themes to conduct inter-comparisons of precipitation datasets, 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) Algorithm Validation

This theme encompasses researches related to validation of the algorithm to produce the DPR Level 2 standard product (DPR algorithm). Particularly, researches to compare and evaluate models and parameters relating precipitation estimates in the algorithm using ground observations will be recommended. In addition, since observation of solid precipitation is one of major target of the GPM mission, which covers latitude of 65 degree, researches to propose knowledge obtained by ground observation of snowfall to algorithm developers.

Applicants have to acquire and analyze data obtained by observation experiments combining ground-based instruments, and creating databases that contribute to development or improvement of the GPM standard algorithms.

JAXA can rental some ground observation instruments (\*) owned by JAXA to selected PIs. Please contact to the PMM RA Office for further details. (\*: Two field-portable Ka-band ground radars, two Optical Rain Gauges, two Laser-Optical Present Weather Sensors, etc.)

Examples of research include the following;

- Validation to compare observation by ground-based instruments (2DVD, meteorological instruments, sondes, etc.) and multi-band ground-based radars (JAXA Ka-band ground radars and/or other radars) with precipitation profiles retrieved by the GPM/DPR algorithms;
- Examination of adequacy of the DPR algorithms by consolidating and analyzing existing data;
- Routine observations of snowfalls and melting layers by ground observation instruments (radars, 2DVD, meteorological instruments, microwave radiometers, etc.) understanding characteristics of snow and melting particles by them, and comparisons with profiles estimated by DPR; and
- Collecting observation data of various parameters related to precipitation rate estimate algorithms, especially related to snowfall, such as Z-R relationship, Z-M relationship, drop size distribution (DSD,) fall velocity, volumetric distribution, mean density, and shapes of snowflake, hail and sleet, consolidating observation data of various parameters related to precipitation rate, especially snowfall, estimate algorithms, creating databases using them to contribute to algorithm development and/or improvement, and providing those

databases to the Algorithm Development Teams.

## **(2) Product Validation**

This theme encompasses researches contributing to validation of parameters, such as precipitation, precipitation profile, rain/snow specification, precipitation type, etc., included in the GPM Level 2 and 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.

Followings are examples of research to evaluate accuracy of precipitation;

- 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;
- Validating the 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) Inter-comparison of Precipitation Datasets**

This theme encompasses researches conducting inter-comparison of various precipitation datasets, which are produced by using satellite and/or ground observations, with a central focuses on the GPM, TRMM and GSMaP, and contributing to improvement of the GSMaP products.

## **(4) Other Validation Activities and Data Collection**

Research themes related to other validation activities and data collection and preparation other than above (1)-(3) will also be adopted. Research that will be effectively implemented by collaborating with other research programs, or research that will contribute to validation of the GPM 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 the GPM and TRMM data, will be adopted in this RA. For example, following research themes are included;

- research to utilize the GPM and TRMM data into atmospheric, climate, land, hydrological, and other models, and/or by data assimilation;
- development and evaluation of new research products, such as data assimilation using the GPM and TRMM data, or combination of other satellites and/or sensors with them;
- creation of long-term and continuous data set using the GPM and TRMM products;
- research contributing to climate and global water cycle variation and precipitation system climatology using long-term satellite data, necessarily including the 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; and
- research contributing EORC's cross-cutting research themes (see Section 1.1) mainly using GPM and TRMM data

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 three years from JFY 2016. 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, provided however that, if this is not acceptable to the research organization due to its regulation, it may not be applied when an applicant fills in the prescribed remarks column of the Resource Requirement (Appendix B) as such and presents an evidential document, such as a copy of the regulation, for justification. In addition, JAXA does not approve the research organization to provide JAXA funding for other PI ("Other PI") selected through JAXA's RA, with exception that such Other PI acts as a CI under a research project of the research organization.
- 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 their 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 their 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 31, 2015	Research Announcement issued
<b><u>November 1, 2015</u></b>	<b><u>Proposal Due Date</u></b>
January, 2016	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 including cover sheet 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.

##### C) 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. JAXA doesn't use provided personal information except for purposes relating to this research announcement.

##### D) Budget

Provide a 3-year budget broken down by year and the 3-year total amount in Japanese Yen (from JFY 2016 through 2018.)

##### E) 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 JFY, the research agreement will be extended for 1 year, but no later than March 31, 2018. 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 is as follows.

- 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

<b>Proposal No.</b>	_____ (Leave Blank for JAXA Use)		
<b>Title</b>			
<b>Research category (check one)</b>	<b>(1)Algorithm</b>	<b>(2)Validation</b>	<b>(3)Application</b>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Principal Investigator**

<b>Name</b>		<b>Job Title</b>	
<b>Department</b>			
<b>Institution</b>			
<b>Address</b>			
<b>Country</b>			
<b>E-mail</b>			
<b>Telephone</b>			
<b>Facsimile</b>			

**Co-Investigator**

Name	Institution	Telephone	E-mail

**Budget (yen in thousands) (Direct Cost only)**

JFY2016	JFY2017	JFY2018	TOTAL

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(Leave Blank for JAXA Use)

**Authorizing Official:** \_\_\_\_\_  
(Name and Title)
(Institution)

# Research Schedule

JFY	2016				2017				2018			
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)

	2016	2017	2018	Total

#### 2. Purchases

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

ITEM	2016	2017	2018	Total

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

ITEM	2016	2017	2018	Total

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

ITEM	2016	2017	2018	Total

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

ITEM	2016	2017	2018	Total

**4. Travel Expenses** (unit: yen in thousands)

Departure Point – Destination (number of travelers)	2016	2017	2018	Total

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

ITEM	2016	2017	2018	Total

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

Name of Satellite / Sensors	Distributor	Purpose	Cost			
			2016	2017	2018	Total

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

Name of Data Sets	Distributor	Purpose	Cost			
			2016	2017	2018	Total

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

ITEM	2016	2017	2018	Total

<b>TOTAL (unit: yen in thousands)</b>				
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\* 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*)

### Direct Cost only

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

	2016	2017	2018	Total
<i>Part-time job for DSD data analysis</i>	320 (40x8)	160 (20x8)	800 (100x8)	1280

#### 2. Purchases

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

ITEM	2016	2017	2018	Total

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

ITEM	2016	2017	2018	Total

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

ITEM	2016	2017	2018	Total
<i>8mm tape (112m)</i>	50	50	50	150
<i>CD-R</i>	100	120	120	340
<i>MO (640MB)</i>	15	10	10	35
<i>A4 Paper (package of 500 sheets)</i>	2	1	1	4
<i>CD-RW Drive</i>	50			50

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

ITEM	2016	2017	2018	Total
<i>Software development for DSD data analysis</i>	1,500	600	600	2,700

**4. Travel Expenses (unit: yen in thousands)**

Departure Point – Destination (number of travelers)	2016	2017	2018	Total
Tokyo – Washington, D.C. (1 person)	600			600
Tokyo – Paris (1 person)	650	650		1,300
Tokyo – Paris (1 person)		650	650	1,300
Tokyo – Osaka (1 person)			35	35

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

ITEM	2016	2017	2018	Total
Micro Rain Radar	1,500			1,500

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

Name of Satellite / Sensors	Distributor	Purpose	Cost			
			2016	2017	2018	Total

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

Name of Data Sets	Distributor	Purpose	Cost			
			2016	2017	2018	Total

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

ITEM	2016	2017	2018	Total

<b>TOTAL (unit: yen in thousands)</b>	4,787	2,241	2,266	9,294
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## JAXA DATA REQUIREMENTS

### 1. JAXA-Archived Satellite Data Sets

(JERS, ADEOS, TRMM, GPM, Aqua, ADEOS-II, GOSAT, GCOM-W, GCOM-C, ALOS, ALOS-2)

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)
- Global Precipitation Measurement (GPM)
- 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 - Water (GCOM-W)
- Global Change Observation Mission - Climate (GCOM-C)
- Advanced Land Observing Satellite (ALOS) (50 scenes per year from JAXA archives)
- Advanced Land Observing Satellite-2 (ALOS-2) (50 scenes per year 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 completed its mission in April 2015.

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  $35^{\circ}$ . 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.

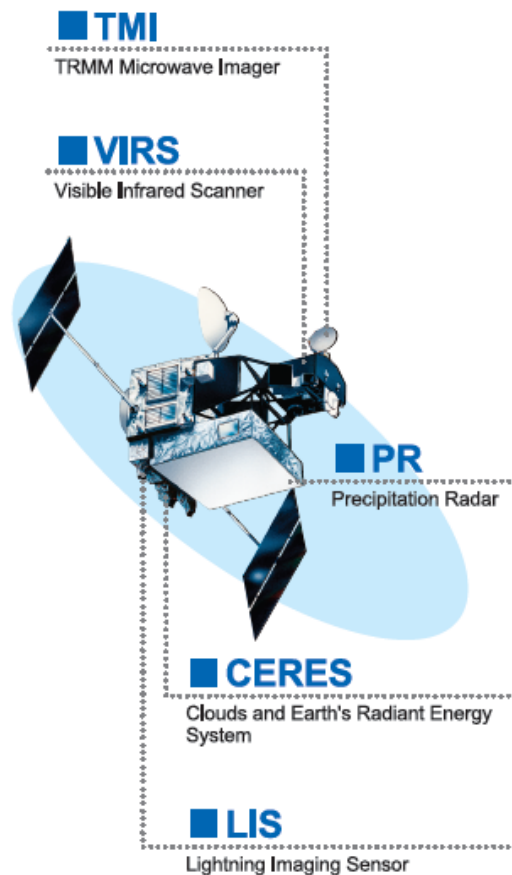


Figure 1 Overview of the TRMM Satellite and the Five on board Sensors

Table 1 Major Characteristics of the TRMM Satellite

Orbit	Non-sun-synchronous circular orbit
Inclination	35 degrees
Altitude	350 km (402.5 km since August 24, 2001)
Launch date	November 28, 1997 6:54 AM (JST)
Design life	3 years and 2 months
Mission instrument	Precipitation Radar (PR) TRMM Microwave Imager (TMI) Visible Infrared Scanner (VIRS) Lightning Imaging Sensor (LIS) 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. Therefore, the Global Precipitation Measurement (GPM) mission was proposed 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 carries 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 carries 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 2014-2018 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.

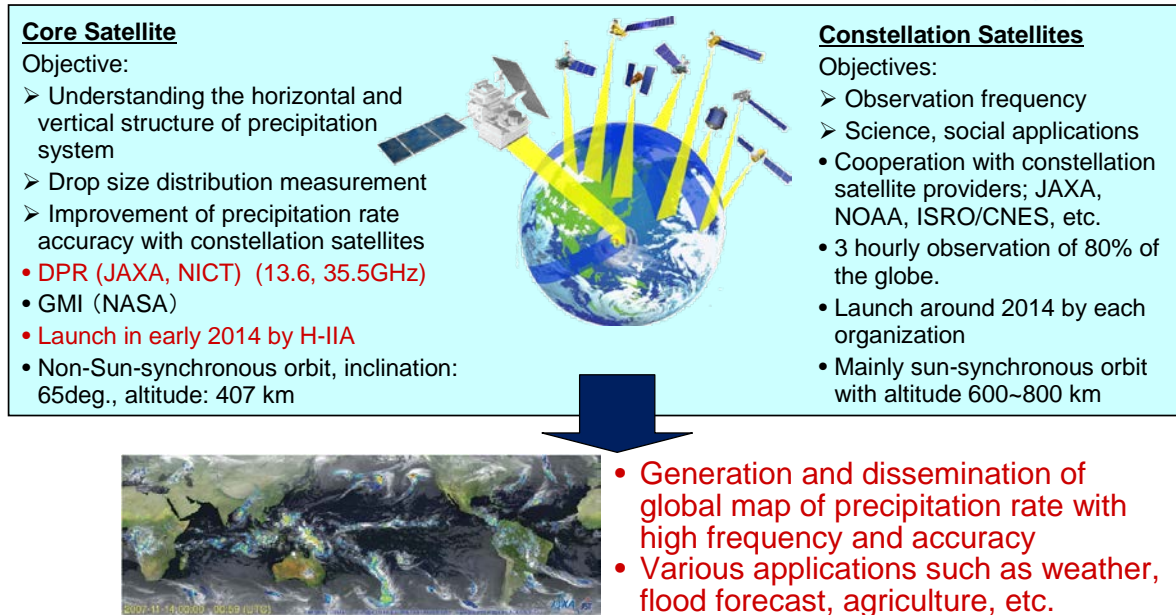


Figure 2 Overview of the GPM Mission

### 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., was launched in February 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	65 degrees
Altitude	407 km
Launch date	February 28, 2014 03:36 AM (JST)
Mission life	3 years (target: 5 years)
Mission instrument	Dual-frequency Precipitation Radar (DPR) GPM Microwave Imager (GMI)

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.

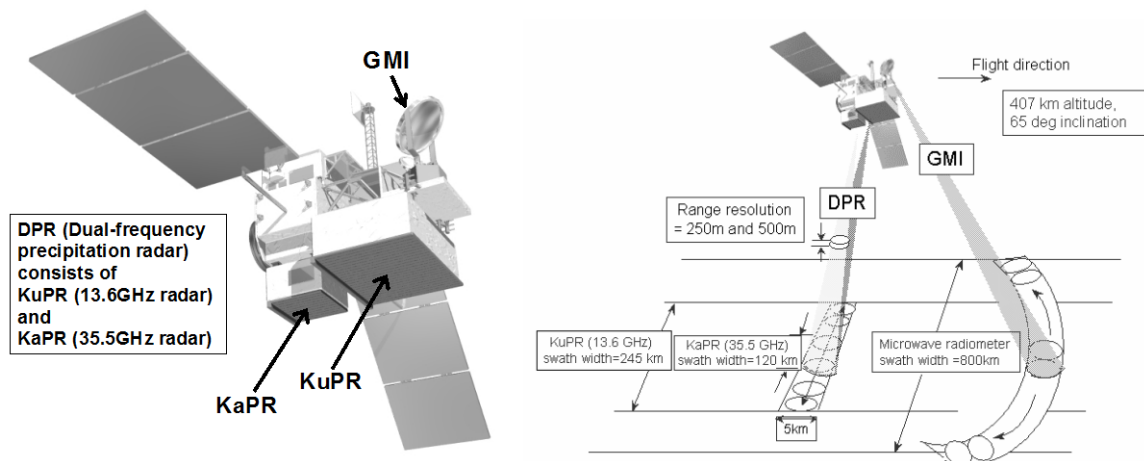


Figure 3 Overview of the GPM Core Satellite and Concept of Precipitation Observation

### 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 2014-2018. The DPR and GMI instruments on board the core satellite will serve as a ‘calibrator’ for data obtained by constellation satellites.

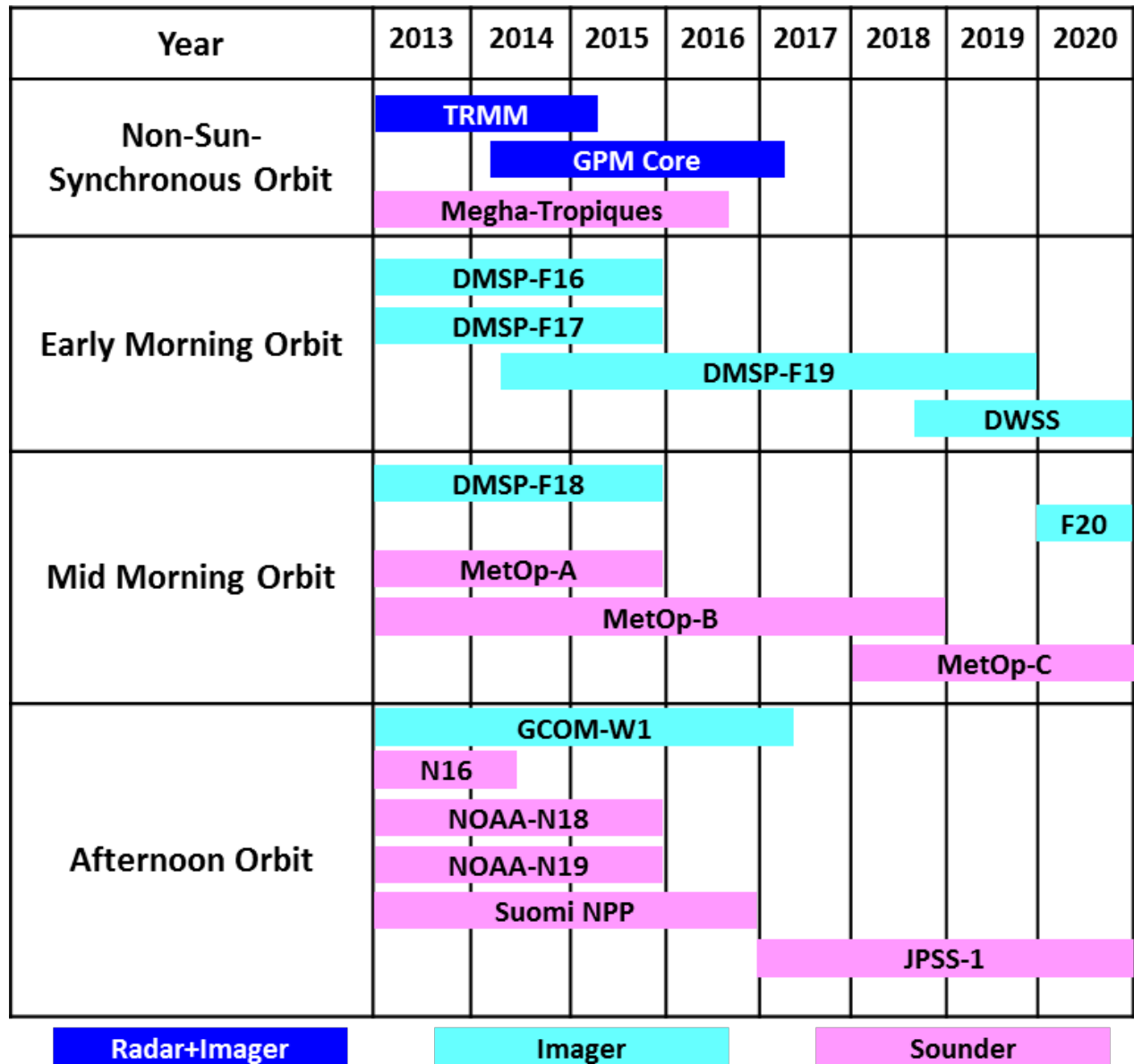


Figure 4 Worldwide Missions for Satellite Precipitation Observation (2013-2020) as of April 2015.



## **APPENDIX D**

### **ASSOCIATED TERMS AND CONDITIONS OF RESEARCH AGREEMENTS**

#### **(FOR THE 8<sup>TH</sup> PMM SCIENCE RESEACH ANNOUNCEMENT)**

COMMISSIONED RESEARCH AGREEMENT FOR THE PRECIPITATION MEASURING MISSION  
BETWEEN THE JAPAN AEROSPACE EXPLORATION AGENCY AND THE RESEARCH  
ORGANIZATION (D-2 ~ D-19)

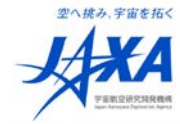
COLLABORATIVE RESEARCH AGREEMENT (FUNDED) FOR THE PRECIPITATION MEASURING  
MISSION BETWEEN THE JAPAN AEROSPACE EXPLORATION AGENCY AND THE RESEARCH  
ORGANIZATION (D-20 ~ D-36)

COLLABORATIVE RESEARCH AGREEMENT (NON-FUNDED) FOR THE PRECIPITATION  
MEASURING MISSION BETWEEN THE JAPAN AEROSPACE EXPLORATION AGENCY AND THE  
RESEARCH ORGANIZATION (D-37 ~ D-51)



COMMISSIONED RESEARCH AGREEMENT  
FOR THE PRECIPITATION MEASURING MISSION  
BETWEEN  
THE JAPAN AEROSPACE EXPLORATION AGENCY (JAXA)  
AND  
THE RESEARCH ORGANIZATION  
(FOR THE RESERACH ANNOUNCEMENT)

JAPAN AEROSPACE EXPLORATION AGENCY



## 8th PMM SCIENCE RESEARCH ANNOUNCEMENT COMMISSIONED RESEARCH AGREEMENT

This agreement ("Agreement") is entered into between the Japan Aerospace Exploration Agency, established under the provision 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 and JAXA further desires to utilize such proposal in JAXA's project; and

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

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. 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) "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) "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 Intellectual 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**

1. 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”). In case of a conflict between the Confirmation Sheet and this Agreement, the terms and conditions stipulated in the Confirmation Sheet will supersede this Agreement.
2. 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.

3. In case that the RO wishes to conduct the reallocation of budget, which is listed in the Budget Summary within the Commissioned Work Plan, 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 than 500,000 Japanese yen), the RO shall obtain an approval from JAXA in advance.
4. Provided, however, that the RO shall not conduct the reallocation of budget between the general administrative expenses and the direct expenses.
5. 5. In case that JAXA fails to pay the Research Funding within the above period, the RO may request JAXA to pay 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.
6. 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.

#### **Article 8. Accounting**

In order to clarify the status of accounting concerning the Research Funding stated in paragraph 1 of the previous Article, 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 9. 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 Article 7, exceed one (1) million Japanese yen, the RO shall submit a Performance Report containing the expenses breakdown to JAXA before one of the earliest dates, which are either prior to 30 days after the end of the Agreement Period, or the date of termination, or 10 April of the next fiscal year.

#### **Article 10. Determining the Contract Amount**

1. Upon the receipt of the Performance Report stipulated in paragraph 2 in the previous Article, JAXA shall adjust the expenses within the limit of the original contract amount in accordance with the present Article, Article 11 (Investigation of Actual Expenses) and

Article 12 (Return of Paid Research Funding), determine and notify the RO of the final contract amount.

2. 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 11. 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 12. 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 10, 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 5 and 6 of Article 7 shall be applied.

#### **Article 13. 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 14. 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 via internet.
- (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, the each standard data collected from the Advanced Land Observing Satellite (ALOS) and the Advanced Land Observing Satellite-2 (ALOS-2) shall be limited to fifty scenes every fiscal

year;

- (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;
  - (4) RO shall bear the costs of media and shipment if RO requests to provide the Earth Observation Satellite Data via media.
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 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. Any rights relating to the Earth Observation Satellite Data provided by JAXA to the RO shall confirm to the following;
- a) JAXA retains the intellectual property rights of all the Earth Observation Satellite Data, except for ALOS PALSAR data of which METI is the joint owner;
  - b) If value-added products(modified products with high-level processing which are irreversible to standard data. High-level data processing includes data analysis or combining multiple-satellite data, image processing based on external information, and physical quantity conversion.)are solely developed by RO out of Earth Observation Satellite Data, in the course of executing the Research Projects, RO retains the intellectual property rights of such value-added products;
  - c) Except for cases under paragraph b), all Intellectual Property Rights of the data or product developed by modifying the Earth Observation Satellite Data shall be owned by JAXA;
  - d) In case RO uses the modified Earth Observation Satellite Data for commercial purposes, RO shall notify JAXA and comply with a license condition to be set by JAXA.

#### **Article 15. 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 16. 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 17. 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 18. 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 19. 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 20. 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 21. Ownership of Industrial Property Rights**

1. The RO shall transfer the Industrial Property Rights obtained in compliance with paragraph 1 of Article 19. In this case, the cost for the transfer shall be included in the Research Funding stipulated in paragraph 1 of Article 7.
2. If the RO requests a license to use the Industrial Property Rights assigned to JAXA under the preceding paragraph or applied by JAXA under paragraph 5 of Article 19, 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 19, 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 19.

## **Article 22. 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 23. 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 24. 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 25. 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 26. 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 27. 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 17; provided, however, in compliance with the obligation of Confidentiality Information stated in Article 26 (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 28. 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 29. 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 12 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 32, shall be able to demand the RO incur a penalty.

## **Article 30. 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 12 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 32.

#### **Article 31. 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 12 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 32 shall claim the RO incur a penalty.

#### **Article 32. 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 33. 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 14 (Providing of the Earth Observation Satellite Data and Rights), paragraph 2 to 5 of Article 15 (Providing of Meteorological Data and Rights), Article 16 (Providing of Technical Data), Article 18 (Usage of the Research Results) to 22 (Ownership of the Copyrights of Program/Data), and Article 27 (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 26 (Confidentiality) and Article 27 (Publication of Research Results) possess the terms effect stipulated in the present Article.

### **Article 34. 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 35. Governing Law**

The Agreement shall be governed and interpreted under the laws of Japan.

### **Article 36. Language**

All communications between JAXA and the RO under this Agreement shall be either in Japanese or English.



### **Article 37. Consultation**

In the event that any doubt arises with regard to provisions that are not included 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) * Limited to 50 scenes per year	2006/05/16~2011/04/22	Global
ALOS-2 (Advanced Land Observing Satellite-2) * Limited to 50 scenes per year	2014/08/04~	Global
GCOM-W (The Global Change Observation Mission - Water)	2012/07~	Global
TRMM (Tropical Rainfall Measuring Mission)	1997/12~2014/04	Global (PR: Approximately 36°S-36°N. TMI and VIRS: Approximately 38°S-38°N)
AMSRE (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 (Global Precipitation Measurement)	2014/03~	Global (DPR: Approximately 66°S-66°N. GMI: Approximately 68°S-68°N)

\* GCOM-C and EarthCARE will be added by revision of the Agreement pursuant to Article 33 when provisions of data becomes available



COLLABORATIVE RESEARCH AGREEMENT (FUNDED)  
FOR THE PRECIPITATION MEASURING MISSION

BETWEEN THE  
JAPAN AEROSPACE EXPLORATION AGENCY (JAXA)  
AND  
THE RESEARCH ORGANIZATION  
(FOR THE RESEARCH ANNOUNCEMENT)

JAPAN AEROSPACE EXPLORATION AGENCY



## 8<sup>th</sup> PMM SCIENCE RESEARCH ANNOUNCEMENT COLLABORATIVE RESEARCH AGREEMENT

This agreement ("Agreement") is entered into between the Japan Aerospace Exploration Agency, established under the provision 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:

- (iv) Industrial Property Rights (as defined below);
- (v) Potential Industrial Property Rights (as defined below); and
- (vi) 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**

1. 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.

In case of a conflict between the Confirmation Sheet and this Agreement, the terms and conditions stipulated in the Confirmation Sheet will supersede this Agreement.

2. The Research Organization may renew the Agreement by one fiscal year, 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. Thereafter the procedure shall be the same as above..

#### **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.
3. In case that the Research Organization wishes to conduct the reallocation of budget, which is listed in the Budget Summary within the Commissioned Work Plan, 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 than 500,000 Japanese yen), the Research Organization shall obtain an approval from JAXA in advance.
4. Provided, however, that the Research Organization shall not conduct the reallocation of budget between the general administrative expenses and the direct expenses.
5. In case that JAXA fails to pay the Research Funding within the above period, the Research Organization may request JAXA to pay 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.
6. 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.

#### **Article 7. Accounting**

1. The Research Organization shall conduct accounting of the Research Funding stipulated in Article 6.2. In order to clarify the status of accounting concerning the Research Funding stated in paragraph 1 of the previous Article, the Research Organization shall maintain books to record expenses according to items and types as well as logically storing documents to prove such expenses. In addition, the Research Organization 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 Research Organization to submit a copy of such books and the document to prove the expenses, and the Research Organization shall respond to such a request from JAXA.

## **Article 8. Submission of Financial Statement**

In the event that the research expenses, stated in paragraph 1 of the previous Article 6, exceed one (1) million Japanese yen, the Research Organization shall submit a Performance Report containing the expenses breakdown to JAXA before one of the earliest dates, which are either prior to 30 days after the end of the Agreement Period, or the date of termination, or 10 April of the next fiscal year.

## **Article 9. Determination of Contract Amount**

3. Upon the receipt of the Performance Report stipulated in paragraph 2 in the previous Article, JAXA shall 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), determine and notify the Research Organization of the final contract amount.
4. 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**

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 11. Return of Paid Research Funding**

1. After the payment by the method stipulated in paragraph 1 and 2 of Article 6, 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 Research Organization.
2. In the case of the previous paragraph, the Research Organization shall remit such funds within thirty (30) days from the date when the Research Organization receives an invoice issued by JAXA with regard to such funds.
3. In the event there is no return made by the Research Organization within the set time limit as described in the preceding paragraph, the provisions of paragraph 5 and 6 of Article 6 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 6 shall be retained by JAXA. However, upon mutual agreement between JAXA and the Research Organization the ownership of the equipment may be

transferred to the Research Organization.

2. The Research Organization 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 Agreement ends, the Research Organization must submit to JAXA a list of acquired property.

### **Article 13. 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 via internet 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 amongst the Earth Observation Satellite Data, which the Research Organization may request JAXA, the each standard Data collected from the Advance Land Observing Satellite and the Advance Land Observing Satellite-2 shall be limited to fifty 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;
  - 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; and
  - d) Research Organization shall bear the costs of media and shipment if Research Organization requests to provide the Earth Observation Satellite Data via media.
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 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) JAXA retains the intellectual property rights of all the Earth Observation Satellite Data, except for ALOS PALSAR data of which METI is the joint owner.
- b) If value-added products(modified products with high-level processing which are irreversible to standard data. High-level data processing includes data analysis or combining multiple-satellite data, image processing based on external information, and physical quantity conversion.)are solely developed by Research Organization out of Earth Observation Satellite Data, in the course of executing the Research Projects, Research Organization retains the intellectual property rights of such value-added products.
- c) If Research Organization and JAXA jointly modify the Earth Observation Satellite Data which is provided by JAXA and develop any value-added products, Research Organization and JAXA will discuss the allocation of rights to the value-added products in consideration to degree of contribution or other factors to be considered;
- d) Except for cases under paragraph b) and paragraph c), all Intellectual Property Rights of the data or product developed by modifying the Earth Observation Satellite Data shall be owned by JAXA and;
- e) In case Research Organization uses the modified Earth Observation Satellite Data for commercial purposes, Research Organization shall notify JAXA and comply with a license condition to be set by JAXA.

#### **Article 14. Providing of Meteorological Data by JAXA**

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. 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.

The Research Organization may not disclose the provided Meteorological Data to any third party except for PIs, etc.

The Research Organization shall use the provided Meteorological Data solely for the purpose of conducting the Research Projects.

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 15. 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 16. 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 17. 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 18. 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 19. 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 20. 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 21. 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 22. 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 23. 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 24. 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 25. 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 26. 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 27. 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 28. 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 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 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 29. 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 30. 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 31. 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 11.
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 32. 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 13 (Providing and Rights of Earth Observation Satellite Data by JAXA), Paragraph 2 to 5 of Article 14 (Providing and Rights of Meteorological Data by JAXA), Paragraph 3 of Article 15 (Exchange of Technical Information etc.), and Article 16 (Usage of Research Results) through Article 22 (Transfer of interests to Jointly-Owned Intellectual Property Rights) during the effective period of rights set forth in each Article and Paragraph while Article 23 (Improved Invention), Article 24 (Designation of Know-How), Article 28 (Confidentiality) and Article 29 (Publication of Research Results) shall be effective during the period set forth in each 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 Research Organization has a legitimate reason for not agreeing with the amendment of the previous paragraph, the Research Organization 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. Governing Law**

The Agreement shall be governed and interpreted under the laws of Japan.

### **Article 35. Language**

All communications between JAXA and the Research Organization under this Agreement shall be either in Japanese or English.

### **Article 36. Consultation**

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

# Attachment “Earth Observation Satellite Data”

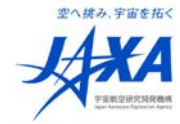
Name of Satellite or Sensor	Observation Period (YYYY/MM/DD)	Observable Area
JERS (Japanese Earth Observation Satellite)	1992/09/01~1998/10/11	Global
ADEOS (Advanced Earth Observation Satellite)	1996/10/15~1997/06/29	Global
ADEOS-II (Advanced Earth Observing Satellite-II)	2003/01~2003/10	Global
ALOS (Advanced Land Observing Satellite) * Limited to 50 scenes per year	2006/05/16~2011/04/22	Global
ALOS-2 (Advanced Land Observing Satellite-2) * Limited to 50 scenes per year	2014/08/04~	Global
GCOM-W (The Global Change Observation Mission - Water)	2012 /07~	Global
TRMM (Tropical Rainfall Measuring Mission)	1997/12~2014/04	Global (PR: Approximately 36°S-36°N. TMI and VIRS: Approximately 38°S-38°N)
AMSRE (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 (Global Precipitation Measurement)	2014/03~	Global (DPR: Approximately 66°S-66°N. GMI: Approximately 68°S-68°N)

\* GCOM-C and EarthCARE 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 PRECIPITATION MEASURING MISSION  
BETWEEN THE  
JAPAN AEROSPACE EXPLORATION AGENCY (JAXA)  
AND  
THE RESEARCH ORGANIZATION  
(FOR THE RESEARCH ANNOUNCEMENT)

JAPAN AEROSPACE EXPLORATION AGENCY



## **8th PMM SCIENCE RESEARCH ANNOUNCEMENT COLLABORATIVE RESEARCH AGREEMENT (NON-FUNDED)**

This agreement ("Agreement") is entered into between the Japan Aerospace Exploration Agency, established under the provision 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 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 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**

1. 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. In case of a conflict between the Confirmation Sheet and this Agreement, the terms and conditions stipulated in the Confirmation Sheet will supersede this Agreement.

#### **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 via internet 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 amongst the Earth Observation Satellite Data, which the Research Organization may request JAXA, the each standard Data collected from the Advanced Land Observing Satellite and the Advance Land Observing Satellite-2 shall be limited to fifty 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;
  - 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; and
  - d) Research Organization shall bear the costs of media and shipment if Research Organization requests to provide the Earth Observation Satellite Data via media.
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 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) JAXA retains the intellectual property rights of all the Earth Observation Satellite Data, except for ALOS PALSAR data of which METI is the joint owner.
  - b) If value-added products(modified products with high-level processing which are irreversible to standard data. High-level data processing includes data analysis or combining multiple-satellite data, image processing based on external information, and physical quantity conversion.)are solely developed by Research Organization out of Earth Observation Satellite Data, in the course of executing the Research Projects, Research Organization retains the intellectual property rights of such value-added products.
  - c) If Research Organization and JAXA jointly modify the Earth Observation Satellite Data which is provided by JAXA and develop any value-added products, Research Organization and JAXA will discuss the allocation of rights to the value-added products in consideration

to degree of contribution or other factors to be considered;

- d) Except for cases under paragraph b) and paragraph c), all Intellectual Property Rights of the data or product developed by modifying the Earth Observation Satellite Data shall be owned by JAXA and;
- e) In case Research Organization uses the modified Earth Observation Satellite Data for commercial purposes, Research Organization shall notify JAXA and comply with a license condition to be set by JAXA.

#### **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. 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 Research Organization has a legitimate reason for not agreeing with the amendment of the previous paragraph, the Research Organization 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 28. Governing Law**

The Agreement shall be governed and interpreted under the laws of Japan.

#### **Article 29. Language**

All communications between JAXA and the Research Organization under this Agreement shall be either in Japanese or English.

#### **Article 30. Consultation**

In the event that any doubt arises with regard to provisions that are not included in the Agreement, it shall be resolved upon mutual agreement between JAXA and the Research Organization 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) * Limited to 50 scenes per year	2006/05/16~2011/04/22	Global
ALOS-2 (Advanced Land Observing Satellite-2) * Limited to 50 scenes per year	2014/08/04~	Global
GCOM-W (The Global Change Observation Mission - Water)	2012/07~	Global
TRMM (Tropical Rainfall Measuring Mission)	1997/12~2014/04	Global (PR: Approximately 36°S-36°N. TMI and VIRS: Approximately 38°S-38°N)
AMSRE (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 (Global Precipitation Measurement)	2014/03~	Global (DPR: Approximately 66°S-66°N. GMI: Approximately 68°S-68°N)

\* GCOM-C and EarthCARE will be added by revision of the Agreement pursuant to Article 27 when provisions of data becomes available