

Global Change Observation Mission: 5th Research Announcement

GCOM-W1 Research

Algorithm development, validation, and application research

Multi-Sensor Research

Algorithm development and application research

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Proposal Due: November 15, 2013

**Earth Observation Research Center
Japan Aerospace Exploration Agency**

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1. Introduction

1.1 About the Fifth Research Announcement

In this 5th Global Change Observation Mission (GCOM) research announcement (RA), the Japan Aerospace Exploration Agency (JAXA) is announcing the opportunity to conduct algorithm development, validation, and application research for the first satellite of the GCOM-W (Water) series, GCOM-W1, as well as multi-sensor research mainly using data from GCOM-W1. GCOM-W1 satellite was launched in Japanese fiscal years (JFY) 2012. On the other hand, it is planned that the first satellite of the GCOM-C (Climate) series, GCOM-C1 will be launched in JFY 2016. This RA covers 3-year research period beginning in early JFY 2014.

1.2 Global Change Observation Mission (GCOM)

GCOM seeks to establish and demonstrate a global, long-term satellite observing system to measure essential geophysical parameters for understanding global climate change and the water cycle mechanism, and eventually contribute to improving future climate projections through a collaborative framework with climate model institutions. Demonstrating capabilities of operational applications through the provision of continuous data to operational agencies is another important objective. GCOM will take over the Advanced Earth Observing Satellite-II (ADEOS-II) mission and transition into long-term monitoring of the Earth. To achieve global, comprehensive, long-term, and homogeneous observation, GCOM will consist of three consecutive generations of two satellite types with a 1-year overlap, resulting in a 13-year observation period. The two satellites are GCOM-W and GCOM-C. The GCOM-W1 satellite carries the Advanced Microwave Scanning Radiometer-2 (AMSR2) to contribute to understanding the water and energy cycle. The GCOM-C1 satellite will be equipped with the Second-generation Global Imager (SGLI) to observe the Earth's atmosphere and surface, contributing to the understanding of the carbon cycle and radiation budget.

The AMSR2 instrument on board GCOM-W1 is a multi-frequency, dual-polarized, passive microwave radiometer for observing water-related geophysical parameters. AMSR2 was designed and manufactured based on the experience of the AMSR aboard ADEOS-II and the AMSR for EOS (AMSR-E). Based on the experiences of the Global Imager (GLI) on board ADEOS-II, the SGLI on GCOM-C1 will have special features, including wide spectral coverage from 380 nm to 12 μ m, a high spatial resolution of 250m, a field of view exceeding 1000km, two-direction simultaneous observation, and polarization observation. The GCOM-C1 mission aims to contribute to improving our knowledge and prediction of the global carbon cycle and radiation budget through high-accuracy observation of global vegetation, ocean color, temperature, cloud, aerosol, and polar regions through SGLI observations. Details of the GCOM sensor and satellite specification are presented in APPENDIX C.

1.3 Targets of GCOM and its success criteria

The objectives, targets, and success criteria of GCOM are summarized in Tables 1 and 2.

This RA solicits research proposals that will lead the mission to success by meeting the success criteria and accomplishing these targets with JAXA.

Table 1 GCOM Objectives and GCOM-C1/W1 Targets

GCOM Objectives	GCOM-C1 Targets	GCOM-W1 Targets
Build a long-term observation system that can observe effective physical parameters (e.g., sea surface temperature, soil moisture, and so on.) continuously for 10 to 15 years to solve the mechanism of global climate change and water cycle, and establish its usability.	Produce and distribute satellite-observed radiance, nine land, eight atmosphere, seven ocean, and four cryosphere products as standard products	Produce and distribute satellite-observed brightness temperatures (Tbs), two land, three atmosphere, two ocean, and one cryosphere products as standard products.
Improve the prediction accuracy of long-term climate change by improving the process research on the climate-change mechanism and numerical models, and provide information service in support of national policy decisions through cooperation with user organizations that have climate models.	Process and provide satellite data to the Data Integration and Analysis System established by the University of Tokyo, JAMSTEC, and JAXA.	Process and provide satellite data to the Data Integration and Analysis System established by the University of Tokyo, JAMSTEC, and JAXA.
Establish an Earth-observation satellite system to obtain important physical parameters to assess the global environment and seek integrative use with other observation systems.	Improve the accuracy of climate change prediction by assimilating data and improving model parameters with the cooperation of application research organizations. Through the above activities, confirm the quality of GCOM data and demonstrate its ability to contribute to predicting long-term climate change. Contribute to predicting the global environment response to climate change by observing snow surface temperature, snow grain size, ocean chlorophyll-a concentration, and so on.	Improve short-term prediction accuracy by assimilating data, such as Tbs and water vapor, with the cooperation of application research organizations. Through the above activities, confirm the quality of GCOM data and demonstrate its ability to contribute to predicting long-term climate change. Contribute to predicting the global environment response to climate change by observing sea ice concentration, snow cover, sea surface temperature, and so on.
Contribute directly to operational fields, such as predicting intense weather that may bring disasters by distributing data to operational organizations that provide weather forecasts, fishery information service, sea-route information control, etc.	Improve fishery management by providing data to the Japan Fisheries Information Service Center within the required time frame.	Improve accuracy of weather forecast including typhoons, and fishery management by providing data to the Japan Meteorological Agency and the Japan Fisheries Information Service Center within the required time frame.
Develop new products for effectively clarifying climate change and the water cycle mechanism, which is difficult to do with current analysis technology	Produce five land, three atmosphere, seven ocean, and eight cryosphere research products by cooperating with research and application organizations.	Produce new research products by cooperating with research and application organizations.

Table 2 GCOM Success Criteria

GCOM-W1

Success level		<i>Minimum success</i>	<i>Full success</i>	<i>Extra success</i>
Assessment condition				
<i>data production</i>	Standard product ^{*1} (Set release threshold/ standard/ target accuracies)	Complete calibration and validation phase and start data distribution about 1 year after launch. Achieve release threshold accuracy ^{*2} .	Achieve standard accuracies within 5 years after launch.	Achieve the target accuracy of one or more products within 5 years after launch.
	Research product ^{*1} (Set only target accuracy)	NA	NA	Add new important products for climate change research within 5 years after launch.
<i>data distribution</i>	<i>Real-time availability</i>	From the time of achieving the release threshold accuracy until 4 years after launch ^{*3} , maintain ability to distribute the data within the required time.	From the time of achieving the release threshold accuracy until 5 years after launch, maintain ability to distribute the data within the required time.	NA
	<i>Continuity</i>	From the time of achieving the release threshold accuracy until 4 years after launch ^{*3} , maintain ability to observe and distribute products.	From the time of achieving the release threshold accuracy until 5 years after launch, maintain ability to observe and distribute products.	NA
<p>*1 Standard products are defined as products that are especially important for achieving the mission goal, sufficiently confirm the application reality from ADEOS-II results etc., and are suitable for operational data distribution. Research products are defined as products still in the research phase of development and application, or are unsuitable for operational data distribution.</p> <p>*2 Release threshold accuracy: Minimum accuracy for release as available for climate research</p> <p>*3 Set the period until the GCOM-W2 launch.</p>				

GCOM-C1

Success level		<i>Minimum success</i>	<i>Full success</i>	<i>Extra success</i>
Assessment condition				
<i>data production</i>	Standard product ^{*1} (Set release threshold/ standard/ target accuracies)	Complete calibration and validation phase and start data distribution of more than 20 products ^{*3} achieving the release threshold accuracy ^{*2} about 1 year after launch.	Achieve standard accuracies of all standard products, within 5 years after launch,	Achieve the target accuracy of one or more products within 5 years after launch.
	Research product ^{*1} (Set only target accuracy)	NA	NA	Achieve the target accuracy of one or more products within 5 years after launch or add new important products for climate change research.
<i>data distribution</i>	<i>Real-time availability</i>	When the products achieve the release threshold accuracy, confirm ability to distribute the data within the required time.	Continue required-time data distribution during the operation period from confirmation of the release threshold accuracy to 5 years after launch.	NA
	<i>Continuity</i>	When the products achieve the release threshold accuracy, confirm ability to continuously observe and distribute products.	Continue observation ^{*4} and data distribution from confirmation of release threshold accuracy to 5 years after launch.	NA
<p>*1 Standard products are defined as products that are especially important for achieving the mission goal, sufficiently confirm the application reality from ADEOS-II results etc., and are suitable for operational data distribution. Research products are defined as products still in the research phase of development and application, or are unsuitable for operational data distribution.</p> <p>*2 Release threshold accuracy: Minimum accuracy for release as available for climate research</p> <p>*3 The threshold number of products, 20, corresponds to the number of ADEOS-II GLI standard products in the GCOM-C1 standard products.</p> <p>*4 This means to obtain observation data continuously during the planned Earth-observation operation period</p>				

1.4 Overview of this RA

JAXA plans to select 30 to 40 proposals under this RA. The principal investigator (PI) of each selected proposal will become a member of the GCOM-W1 science team or GCOM-C1 science team depending on the contents of the proposal. The PIs will conduct their research, such as algorithm development and application study, with the cooperation of members of the Earth Observation Research Center (EORC), and must attend and present their status at PI workshops held once a year. The science team leaders will participate in the GCOM Advisory Committee to feed back the science team activities to the GCOM overall objectives and mission requirements.

Selected PIs will be able to receive prioritized distribution of the new version of the GCOM data, as well as to use JAXA owned Earth observation satellite data and in-situ measurement data free of charge. In this RA, JAXA will give budget allocation priority to the areas of GCOM-W1 standard algorithm validation and improvement to meet the standard accuracies, and research algorithm development. Although it will depend on the budget situation, JAXA plans to spend 80 million yen each year in total of this RA period. JAXA may also select non-funded PIs for pure application research and research not highly relevant to GCOM mission success criteria. 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 restricted to domestic PIs, although some exceptions may be made for research necessary to realize GCOM mission success. 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 February 2014.

2. Technical descriptions

2.1 Purposes of this RA

To meet the mission objectives of GCOM, which are to understand global environment variation and to improve its prediction accuracy, this RA seeks to utilize the research results of the 1st and the 3rd RAs for GCOM-W1 and related AMSR-E studies, and to conduct effective research necessary to generate global, long-term, and highly accurate and stable GCOM products, as well as to demonstrate global change research using those products by inviting research themes with new knowledge and science from both domestic and overseas scientists.

2.2 Research areas

JAXA seeks proposals in the following research areas:

- GCOM-W1 standard algorithm improvement and validation
- GCOM-W1 research algorithm development
- Provision of validation data
- Application research mainly using GCOM-W1 data
- Multi-sensor research mainly using GCOM-W1 data

As noted in the previous section, JAXA will give budget priority to the areas of GCOM-W1 standard algorithm improvement and validation to meet the standard and target accuracies, and research algorithm development.

2.2.1 GCOM-W1 research

2.2.1.1 Algorithm development

JAXA seeks proposals of GCOM-W1 standard algorithm improvement to meet the standard and target accuracies, and research algorithm development. As described in Chapter 5, proposals in standard algorithm validation and improvement will be implemented under the “Commissioned Research Agreement (Funded),” and proposals in research algorithm development under the “Collaborative Research Agreement (Funded/Non-funded),” in principle.

(1) Standard algorithm development

In this category, JAXA seeks proposals on improvement of the standard algorithms, which will be used for processing GCOM-W1 standard products after launch. In principle, to utilize the existing results of the first RA directly, proposals from applicants whose algorithms were selected as the standard algorithm after launch through the first RA research activity will continue to be selected. Selected PIs and JAXA will work together in evaluating, implementing, and validating the algorithms, as well as in preparing the algorithm theoretical basis document (ATBD) and validation plans.

The GCOM-W1 standard products and their expected accuracies, which are defined in the mission success criteria, are listed in Table 6 of APPENDIX C. These accuracies were defined in consultation with data users based on the experience and performance of the AMSR and AMSR-E products.

The “data release threshold” accuracy denotes the minimum accuracy for the first data release, the “standard” accuracy is defined as the valuable and standard accuracy, and the “goal” accuracy includes many challenges in improving algorithm performance and/or calibration accuracy and is to be achieved on a research basis. The standard algorithms are required to produce standard products that meet the accuracy requirements in Table 6 of APPENDIX C; particularly, those that meet the standard accuracy during this RA research period to accomplish the full success at least. Therefore, concrete methods and expectancy of validation must be clearly documented. To meet the GCOM objectives, retrieval algorithms will require global applicability, robustness, and long-term stability. Algorithms that can be extended and applied to similar microwave radiometers and historical data records are preferable for integrated retrieval. Computationally efficient, fast-processing algorithms are important for the operational applications of the products.

(2) Research algorithm development

Research algorithms will include a new algorithm to produce standard products with further improved accuracy, and ones to produce research products. The former ones have the potential to be selected as standard algorithms at the time of product revision through the inter-comparison study with other algorithms. Therefore, the research needs to be carried out with the goal accuracy in mind. Other preferable characteristics are the same as those of standard algorithms. Regarding the latter ones, once after the proposed products are selected as research products, those research products will have the potential to be candidates of new standard products. Current candidates of research products are listed below. Research products are not limited to those listed below if new research products of great significance are proposed.

- Ocean

Retrieve all-weather sea surface wind speed under severe weather such as typhoons, by utilizing the AMSR2 lower frequency channels at 7- and 10-GHz frequency bands.

- Land

Produce spatially and temporally homogeneous products by assimilating AMSR2 information into land-hydrology models. Also produce cloud-through land parameters such as land surface temperature, vegetation water content, and vegetation indices by utilizing the characteristics of microwave radiometry.

- Cryosphere

In addition to sea ice extent and concentration, thin sea ice information is valuable from the viewpoint of the heat and energy exchange between ocean and atmosphere as well as ocean circulation. Identify thin ice areas, and further estimate sea ice thickness from

the AMSR2 brightness temperatures. Sea ice motion provides information valuable to understanding the mechanism of sea ice advance and retreat, and to the navigation of vessels. Perform accurate sea ice motion retrieval regardless of seasons and sensor characteristics.

2.2.1.2 Standard algorithm validation and provision of validation data

JAXA seeks proposals contributing to the validation of standard products and to the acquisition of basic datasets, which are necessary to improve algorithms. It is also expected to feed back the validation results to improve AMSR2 calibration. Regarding the field campaign and experiments, obtaining both effective validation results and scientific outputs by collaborating with other research programs is expected. Particularly, in-situ measurements and validation studies of geophysical parameters, for which obtaining the global and operational validation dataset is difficult, are highly desired as indicated below.

- Land

Test sites to obtain validation data such as soil moisture and meteorological measurements are already established and maintained in the Mongolian plateau (semi-arid area), north-east Thailand (humid area), and the Murray-Darling basin in Australia (humid to arid area). JAXA seeks proposals which will actively participate in these validation efforts.

- Atmosphere

JAXA seeks proposals to validate precipitation product by utilizing operational observation data such as ground-based rain radars. For the validation of cloud liquid water, cooperation with other research projects which can provide us validation data, and the research on quantitative validation by comparing with other satellite observations are expected.

- Cryosphere

In addition to ongoing in-situ measurements of snow depth at Yakutsk site in Russia, cooperation with research projects, in which snow pit observations are being conducted under a variety of snow condition, is expected. For sea ice validation, cooperation with research projects operating research vessels in various sea areas, as well as validation using high spatial resolution satellite images, are expected.

To apply for improving the algorithms, obtained in-situ data and knowledge need to be provided to JAXA. Furthermore, JAXA intends to open these in-situ data to the public, after consulting with the PIs about their disclosure level and release timing. Proposals including both algorithm development and validation can be submitted to the category of algorithm development.

As described in Chapter 5, the research themes in this category will be implemented under the “Collaborative Research Agreement (Funded/Non-funded),” in principle.

2.2.1.3 Application research

JAXA seeks research themes aiming to understand global environment changes and improve prediction accuracy using AMSR2 and existing datasets, such as the Special Sensor Microwave/Imager (SSM/I), Special Sensor Microwave Imager / Sounder (SSMIS) and the AMSR-E, as well as research themes that contribute to satisfying societal needs, such as monitoring severe weather and water-related hazards, ocean environment monitoring, and agricultural applications. Research themes based on new concepts or needs, and new research and products resulting from the fusion of numerical models are preferable.

As described in Chapter 5, the research themes in this category will be implemented under the “Collaborative Research Agreement (Non-funded),” in principle.

2.2.2 Multi-sensor research

JAXA seeks multi-sensor research proposals, particularly those mainly using data from GCOM-W1. They include multi-sensor algorithm development to create new products and application research utilizing variety of sensor information. Examples of expected multi-sensor combinations are listed below, but are not limited to them:

- GCOM-W1 and GCOM-C1

Multi-sensor research is highly expected for GCOM-W1 and GCOM-C1, since the contribution of GCOM to climate and water cycle change research is done through comprehensive utilization of both datasets. In research directly combining both datasets, some models or objective analysis methods may be used to consider the differences of satellite orbits and observing local times.

- GCOM-W1 and A-Train constellation

To continue obtaining the AMSR-E type data and to produce further scientific results from AMSR2 through multi-sensor research using other satellites and sensors, GCOM-W1 participates in the A-Train constellation, which is being led mainly by the National Aeronautics and Space Administration (NASA) and the Centre National d’Etudes Spatiales (CNES). Therefore, multi-sensor proposals to fully utilize the AMSR2 data are expected. Participating A-Train platforms, which fly contiguously in formation, enable the synchronized observation of various observing instruments. Various combinations and science are expected, such as research on clouds and precipitation systems and their interaction with aerosols using cloud radar/lidar, visible and infrared radiometers, infrared and microwave sounders. This also includes research on merged sea surface temperatures and atmosphere-ocean interaction using visible and infrared radiometer and infrared sounders, as well as the improvement of land and cryospheric products using high-resolution visible and infrared observations. Observation data of the A-Train satellites are available from respective development and operating agencies.

- GCOM-W1 and JAXA Earth environmental observing satellites

Some of JAXA’s Earth environmental observing satellites including the Tropical

Rainfall Measuring Mission (TRMM), the Greenhouse gases Observing SATellite (GOSAT), the Global Precipitation Measurement (GPM), and the Earth Clouds, Aerosols and Radiation Explorer (EarthCARE), have the potential to overlap in the observation period with GCOM-W1. JAXA seeks multi-sensor proposals to fully utilize the GCOM-W1 observations and effectively combine them with those JAXA missions. GCOM-W1 will also undertake a role as a constellation satellite of GPM mission.

In principle, the research themes in this category will be implemented under the “Collaborative Research Agreement (Funded/Non-funded)” for multi-sensor algorithm development, and the “Collaborative Research Agreement (Non-funded)” for multi-sensor application research, as described in Chapter 5.

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

3. Instructions for responding to this RA

3.1 Qualifications

If the proposal is for peaceful purposes and has non-commercial objectives, researchers from all categories, except students, of domestic and foreign organizations, including educational institutions, government offices, public companies, private enterprises, and 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. In principle, the associated terms and conditions of research agreements attached in APPENDIX D will be used. However, JAXA may coordinate with a PI to use a standard contract document depending on the contents of the proposal and its research phase. All applicants should read Chapter 5 carefully, which describes detailed information on contract matters and the associated terms and conditions of the research agreement in APPENDIX D.

3.3 Research period

The total research period of this RA will be 3 years from JFY 2014. However, performance will be evaluated based on an interim report at the end of each JFY 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 mainly available for GCOM-W1 standard algorithm development and validation, and research algorithm development within JAXA's budget limitation. Proposals submitted to other areas may be funded if they provide a substantial contribution to the GCOM mission.
- B) JAXA funding is basically restricted to domestic PIs, although some exceptions may be made for research that is necessary to the success of the GCOM mission.
- C) JAXA funding is restricted to the direct cost of research ("Direct Cost") and does not cover any overhead costs, indirect costs, general costs, or whatsoever ("Overhead Cost") of the organization to which an applicant belongs. However, if this is impossible or requires special procedures, an applicant may fill in the provided remarks column of the Resource Requirement (APPENDIX B) as such.
- D) If funding is not available for an applicant, the applicant may be selected as a non-funded PI upon consultation with JAXA.

(2) Earth observation satellite data by JAXA

For PIs and CIs, AMSR2 products will be provided free of charge via "GCOM-W1 Data Providing Service" (<https://gcom-w1.jaxa.jp/auth.html>). Additionally, other Earth observation satellite data necessary for conducting research and owned by JAXA will be provided free of charge within the limitations of the distribution capability of JAXA. Available data are listed in APPENDIX B. Those who receive Earth observation satellite data shall comply with the 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 their funding status.

- (1) Funded PIs shall submit to JAXA a yearly report on the results at the end of each JFY and a final report at the end of the entire research period. Furthermore, funded PIs are required to participate in the workshop organized by JAXA once a year and present a status report. PIs must cover necessary travel expenses to participate in the workshop within the funds provided by this RA.
- (2) Non-funded PIs shall also submit a yearly report and a final report. However, such reports can be substituted with papers published during the term. Participation in the workshop is highly recommended. 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) Qualifications, capabilities, and experience of the proposed PI and CI
- (4) Overall standing among similar proposals and/or evaluation against the state-of-the-art

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. To withdraw a proposal, the applicant should notify JAXA immediately.

3.9 Cancellation and postponement

JAXA reserves the right to cancel or postpone this RA for reasons of JAXA's own. In addition, JAXA assumes no liability for canceling this RA or for postponing this RA schedule.

3.10 Important dates

August 23, 2013	5th Research Announcement Issued
<u>November 15, 2013</u>	<u>Proposal Due Date</u>
February 2014	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 (Portable Document Format) and sent via E-mail** to the GCOM RA Office. The maximum file size acceptable by E-mail is **10 MB**.

GCOM RA Office E-mail address: GCOM_RA@jaxa.jp

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

GCOM 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:

GCOM RA Office
Earth Observation Research Center

Tel: +81-50-3362-6529
Fax: +81-29-868-2961
E-mail address: GCOM_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 from other institutions or have the potential to infringe on third-party rights
 - 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 the cover sheet, work plan, and resource requirements can be found in APPENDIX A and APPENDIX B. Only the following formatting is mandatory in other parts of the proposal:
 - A) The page or paper size should be A4 or letter size.
 - B) The page number must appear at bottom center of each page, and the name of the applicant must appear in the upper right corner.
 - C) Proposals should be word-processed documents in either English or Japanese, with a font size no smaller than 12 points.
- (3) Proposals should be brief and to the point, concentrating on substantive material. The main body of the proposal should not exceed 20 pages. 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 a relevant category to which the proposal belongs.
 - C) Information of applicants
 - Identifying information of the PI
State the name, job title, organization, address, E-mail address, and telephone and facsimile numbers of the PI.
 - Identifying information of the 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.

D) Budget

Provide a budget broken down by year and the total amount in Japanese yen.

E) Endorsement

Provide a signature of a responsible official or authorized representative of the proposing 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 should not exceed 20 pages. 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 the 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 regarding required resources will be considered during the selection process. After deciding the total amount of funding for each PI, JAXA will send

detailed forms for resource requirements to selected PIs for the final adjustment of funding. Before the beginning of each subsequent year, 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 Organization”), not to the PI or CI.
- (2) A research agreement will be made using associated terms and conditions, such as those in APPENDIX D. The Organization should submit the application form with the necessary documents according to the guidelines by the submission due date. Submission of the application form will be regarded as definite intention of making an agreement with JAXA in accordance with the terms and conditions as stipulated in APPENDIX D, and the agreement will be effective upon issuance of the confirmation sheet by JAXA.
- (3) If JAXA determines that extension of a research project is qualified by the interim report at the end of the JFY, the research agreement will be extended for 1 year, and up to March 31, 2014. Funded organizations should submit the continuing agreement application form to JAXA at the beginning of every JFY.
- (4) Organizations shall comply with the terms and conditions defined in the research agreement.
- (5) JAXA may coordinate to make an agreement with the Organization using JAXA’s standard contract document if JAXA thinks it appropriate in consideration of the research content and phase.

5.2 Research agreement summary

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

(1) Commissioned Research Agreement (Funded)

- In principle, the Commissioned Research Agreement will be applied to research in the “GCOM-W1 algorithm development (standard algorithm)” category. The Organization shall conduct the research according to the Statement of Work provided by JAXA.
- JAXA will provide the necessary funds and Earth observation satellite data to the Organization to conduct the research as described in the Statement of Work.
- JAXA will own the research results required to be delivered by the Statement of Work (Deliverable Research Results).
- JAXA will retain royalty-free rights to use research results other than the Deliverable Research Results only for its own research and development purposes.
- In the event JAXA provides prior written consent, the Organization may use the

Deliverable Research Results for its own research and development purposes.

- If the Agreement is terminated, the Organization will refund to JAXA any unexpended research funds that have already been paid by JAXA.
- JAXA will adjust the amount of the research funds based on a fiscal financial statement at the end of a year-on-year contract.

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

- In principle, the Collaborative Research Agreement will be applied to research in a category “other than” GCOM-W1 algorithm development (standard algorithm).
- JAXA will provide the necessary funds (for funded cases) and Earth observation satellite data to the Organization to conduct the research.
- In principle, the research results will be jointly owned by the parties.
- JAXA will retain the right to use all results including results belonging to the Organization (if any), and the Organization will retain the right to use jointly-owned research results only for its own research and development purposes, without prior consent by the other party.

The difference between a funded agreement and non-funded agreement:

-Collaborative Research Agreement (Funded)

JAXA provides part of the research funds and the Earth observation satellite data. JAXA adjusts the amount of the research funds based on a fiscal financial statement at the end of a year-on-year contract. The 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 Organization shall refund to JAXA any unexpended funds that have already been paid by JAXA.

-Collaborative Research Agreement (Non-funded)

JAXA provides the Earth observation satellite data. The 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.

(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 and obtain JAXA’s consent,
- State in the publication that the results are obtained 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 GCOM Research Announcement**

Proposal No.	_____ (Leave Blank for JAXA Use)
Title	
Research category (check one)	
GCOM-W1: <input type="checkbox"/> Algorithm (Standard) <input type="checkbox"/> Algorithm (Research) <input type="checkbox"/> Validation <input type="checkbox"/> Application	
Multi-Sensor: <input type="checkbox"/> Algorithm <input type="checkbox"/> Application	

Principal Investigator

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

Co - Investigator

Name	Institution	Telephone	E-mail

Budget (yen in thousands) (Direct Cost only)

JFY2014	JFY2015	JFY2016	TOTAL

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(Leave Blank for JAXA Use)

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

Research Schedule

JFY	2014				2015				2016			
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)

	2014	2015	2016	Total

2. Purchases

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

ITEM	2014	2015	2016	Total

2.2 Software (unit: yen in thousands)

ITEM	2014	2015	2016	Total

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

ITEM	2014	2015	2016	Total

3. Subcontracts (unit: yen in thousands)

ITEM	2014	2015	2016	Total

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

Departure Point – Destination	2014	2015	2016

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

ITEM	2014	2015	2016	Total

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

Name of Satellite / Sensors	Distributor	Purpose	Cost			
			2014	2015	2016	Total

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

Name of Data Sets	Distributor	Purpose	Cost			
			2014	2015	2016	Total

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

ITEM	2014	2015	2016	Total

TOTAL (unit: yen in thousands) (Except “4.Travel Expenses”)				
--	--	--	--	--

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

Please check either of the following boxes:

Unnecessary

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

Indispensable (Reason(s):)

BUDGET SUMMARY (EXAMPLE)

1. Personnel Expenses (unit: yen in thousands)

	2014	2015	2016	Total
<i>Part-time job for DSD data analysis</i>	<i>320</i> <i>(40x8)</i>	<i>320</i> <i>(40x8)</i>	<i>160</i> <i>(20x8)</i>	<i>800</i> <i>(100*8)</i>

2. Purchases

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

ITEM	2014	2015	2016	Total

2.2 Software (unit: yen in thousands)

ITEM	2014	2015	2016	Total

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

ITEM	2014	2015	2016	Total
<i>8mm tape (112m)</i>	<i>60</i>	<i>50</i>	<i>50</i>	<i>160</i>
<i>CD-R</i>	<i>100</i>	<i>100</i>	<i>120</i>	<i>320</i>
<i>MO (640MB)</i>	<i>10</i>	<i>15</i>	<i>10</i>	<i>35</i>
<i>A4 Paper (package of 500 sheets)</i>	<i>2</i>	<i>2</i>	<i>1</i>	<i>5</i>
<i>CD-RW Drive</i>	<i>50</i>			<i>50</i>

3. Subcontracts (unit: yen in thousands)

ITEM	2014	2015	2016	Total
<i>Software development for DSD data analysis</i>	<i>300</i>	<i>1,500</i>	<i>600</i>	<i>2,400</i>

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

Departure Point – Destination	2014	2015	2016
<i>Tokyo - Washington, D.C.</i>	<i>7/2</i>	<i>7/1</i>	
<i>Tokyo - Paris</i>		<i>5/1</i>	<i>8/1</i>
<i>Tokyo - Paris</i>			<i>6/1</i>
<i>Tokyo - Osaka</i>	<i>3/1</i>		

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

ITEM	2014	2015	2016	Total
<i>Micro Rain Radar</i>	<i>1,500</i>			<i>1,500</i>

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

Name of Satellite / Sensors	Distributor	Purpose	Cost			
			2014	2015	2016	Total

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

Name of Data Sets	Distributor	Purpose	Cost			
			2014	2015	2016	Total

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

ITEM	2014	2015	2016	Total

TOTAL (unit: yen in thousands) (Except "4.Travel Expenses")	<i>2,342</i>	<i>1,987</i>	<i>941</i>	<i>5,270</i>
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JAXA DATA REQUIREMENTS

1. JAXA-Archived Satellite Datasets

(e.g.: ADEOS, JERS-1, ERS, MOS, LANDSAT, TRMM, Aqua, ADEOS-II, ALOS)

Name of Satellite / Sensor	Quantity (scenes)	Purpose

B.1 Instructions for budget summary

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

- (1) Personnel expenses
Enter expenses for part-time workers here as the total cost calculated by multiplying the unit cost per day by the number of days. For part-time workers, use your own cost estimates.
- (2) Computers/peripheral equipment/software
Enter the lease and rental cost of computers and/or peripheral equipment. Note that JAXA has the right to change specifications of all equipment. Also enter the cost of software here.
- (3) Expendable materials and supplies
Enter the quantity of each item, following the example.
- (4) Subcontracts
Provide the cost of subcontracts to outside companies or organizations here.
- (5) Travel expenses
Describe the 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 are listed below. JAXA will provide requested data judged necessary for the proposed research, subject to availability of data processing.

- Marine Observation Satellite (MOS) (only around Japan)
- LANDSAT (only around Japan)
- European Remote-sensing Satellite (ERS)-1, 2 (only around Japan; for Japanese researchers only; available until JFY2002)
- Japanese Earth Resources Satellite (JERS)-1 (global)
- Tropical Rainfall Measuring Mission (TRMM)
- Advanced Earth Observing Satellite (ADEOS)
- Advanced Microwave Scanning Radiometer for EOS (AMSR-E) aboard EOS-Aqua satellite
- Advanced Earth Observing Satellite-II (ADEOS-II)
- Advanced Land Observing Satellite (ALOS) (10 scenes from JAXA archives)

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

APPENDIX C
OVERVIEW OF THE GLOBAL CHANGE OBSERVATION
MISSION (GCOM)

1. Introduction

Comprehensive observation, understanding, assessment, and prediction of global climate change are common and important issues for all mankind. This is also identified as one of the important socio-economic benefits by the 10-year implementation plan for Earth Observation that was adopted by the Third Earth Observation Summit to achieve the Global Earth Observation System of Systems (GEOSS). International efforts to comprehensively monitor the Earth by integrating various satellites, in-situ measurements, and models are gaining importance. As a contribution to this activity, the Japan Aerospace Exploration Agency (JAXA) plans to develop the Global Change Observation Mission (GCOM). GCOM will take over the mission of the Advanced Earth Observing Satellite-II (ADEOS-II) and develop into long-term monitoring of the Earth.

As mentioned in the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC), warming of the climate system is unequivocal as is now evident from observations of increases in global average air and ocean temperatures and widespread melting of snow and ice. However, climate change signals are generally small and modulated by natural variability, and are not necessarily uniform over the Earth. Therefore, the observing system of the climate variability should be stable, and should cover a long term over the entire Earth.

To satisfy these needs, GCOM consists of two medium-size, polar-orbiting satellite series and three generations with one-year overlaps between consecutive generations for inter-calibration. The two satellite series are GCOM-W (Water) and GCOM-C (Climate). Two instruments were selected to cover a wide range of geophysical parameters: the Advanced Microwave Scanning Radiometer-2 (AMSR2) on GCOM-W1 and the Second-generation Global Imager (SGLI) on GCOM-C. The AMSR2 instrument will perform observations related to the global water and energy cycle, while the SGLI will conduct surface and atmospheric measurements related to the carbon cycle and radiation budget. This chapter presents an overview of the mission objectives, observing systems, and data products of GCOM.

2. Mission Objectives

The major objectives of GCOM can be summarized as follows.

- Establish and demonstrate a global, long-term Earth-observing system for understanding climate variability and the water-energy cycle.
- Enhance the capability of climate prediction and provide information to policy makers through process studies and model improvements in concert with climate model research institutions.
- Construct a comprehensive data system integrating GCOM products, other satellite data, and in-situ measurements.
- Contribute to operational users including weather forecasting, fishery, and maritime agencies by providing near-real-time data.
- Investigate and develop advanced products valuable for understanding of climate change and water cycle studies.

Detailed explanations of the objectives are as follows.

(1) Understanding global environment changes

- A) Establish and demonstrate a global, long-term Earth-observing system that is able to observe valuable geophysical parameters for understanding global climate variability and water cycle mechanisms.

- B) Contribute to improving climate prediction models by providing accurate values of model parameters.
 - C) Clarify sinks and sources of greenhouse gases.
 - D) Contribute to validating and improving climate prediction models by forming a collaborative framework with climate model institutions and providing long-term geophysical datasets to them.
 - E) Detect trends of global environment changes (e.g., global warming, vegetation changes, desertification, variation of atmospheric constituents, wide area air pollution, and depletion of ozone layers) from long-term variability of geophysical parameters by extracting short-term (three- to six-year) natural variability.
 - F) Advance process studies of Earth environmental changes using observation data.
 - G) Estimate radiative forcing, energy and carbon fluxes, and albedo by combining satellite geophysical parameters, ground in-situ measurements, and models.
 - H) Advance the understanding of the Earth's system through the activities above.
 - I) Contribute to an international environmental strategy utilizing the results above.
- (2) Direct contribution to improving people's lives
- A) Improvement of weather forecast accuracy (particularly typhoon track prediction, localized severe rain, etc.).
 - B) Improvement of forecast accuracy for unusual weather and climate.
 - C) Improvement of water-route and maritime information.
 - D) Provision of fishery information.
 - E) Efficient coastal monitoring.
 - F) Improved yield prediction of agricultural products.
 - G) Monitoring and forecasting air pollution including yellow dust.
 - H) Observation of volcanic smoke and prediction of the extent of the impact.
 - I) Detection of forest fires.

3. Observing Systems

3.1. Overall concept

As mentioned in the previous section, the entire GCOM will consist of two satellite series spanning three generations. However, a budget will be approved for each satellite. Currently, only the GCOM-W1 and GCOM-C1 satellites have been approved for actual development as the first satellite in the GCOM series. Both GCOM-W1 and GCOM-C1 satellites are medium-size platforms that are smaller than the ADEOS-II satellite. This is to reduce the risk associated with large platforms having valuable and multiple observing instruments. Also, since the ADEOS-II problem was related to the solar paddle, a dual solar-paddle design was adopted for both satellites. To assure data continuity and consistent calibration, follow-on satellites will be launched so as to overlap the preceding satellite by one year. The concept is summarized in Fig. 1. GCOM-W1 satellite has been launched in May 2012, and GCOM-C1 satellite is scheduled to be launched in Japanese Fiscal Year of 2016.

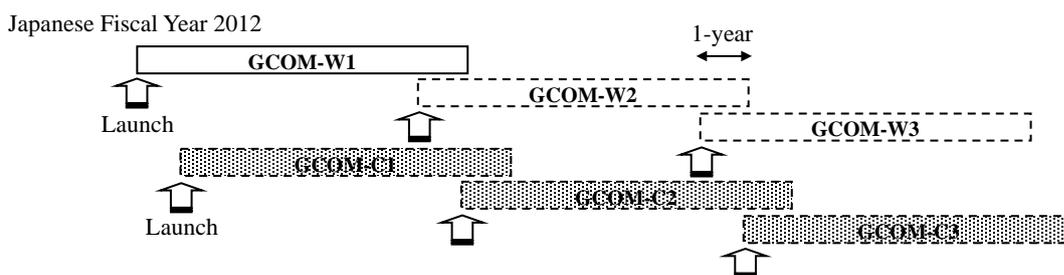


Fig. 1. GCOM concept

3.2. GCOM-W1 and AMSR2 instrument

Figure 2 presents an overview of the GCOM-W1 satellite; its major characteristics are listed in Table 1. GCOM-W1 carries AMSR2 as the sole onboard mission instrument. The satellite is on orbit at an altitude of about 700km and has an ascending node local time of 1330, to maintain consistency with Aqua/AMSR-E observations.

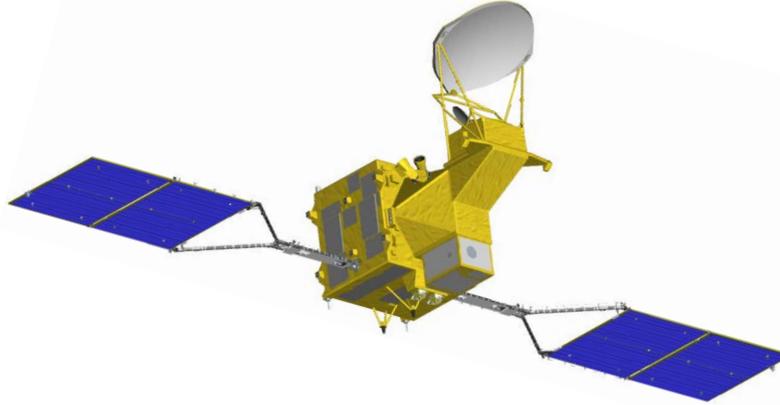


Fig. 2. Overview of GCOM-W1 satellite

TABLE 1
MAJOR CHARACTERISTICS OF GCOM-W1 SATELLITE

Instrument	Advanced Microwave Scanning Radiometer-2 (AMSR2)
Orbit	Sun-synchronous orbit Altitude: 700km (over the equator)
Size	5.1m (X) * 17.5m (Y) * 3.4m (Z) (on-orbit)
Mass	1991kg
Power	More than 3880W (EOL)
Launch	18 May 2012 (JST) by H-IIA Rocket
Design Life	5 years

Figure 3 presents an overview of the AMSR2 instrument in two different conditions. Also, basic characteristics including center frequency, bandwidth, polarization, instantaneous field of view (FOV), and sampling interval are indicated in Table 2. The basic concept is almost identical to that of AMSR-E: a conical scanning system with a large offset parabolic antenna, feed horn cluster to realize multi-frequency observation, external calibration with two temperature standards, and total-power radiometer systems. The 2.0m diameter antenna, which is larger than that of AMSR-E, provides better spatial resolution at the same orbit altitude of around 700km. The antenna will be developed based on the experience gained from the 2.0m diameter antenna for ADEOS-II AMSR except the deployment mechanism. For the C-band receiver, we adopted additional 7.3GHz channels for possible mitigation of radio-frequency interference. An incidence angle of 55 degrees (over the equator) was selected to maintain consistency with AMSR-E. The swath width of 1450km and the selected satellite orbit will provide almost complete coverage of the entire Earth's surface within two days independently for ascending and descending observations.

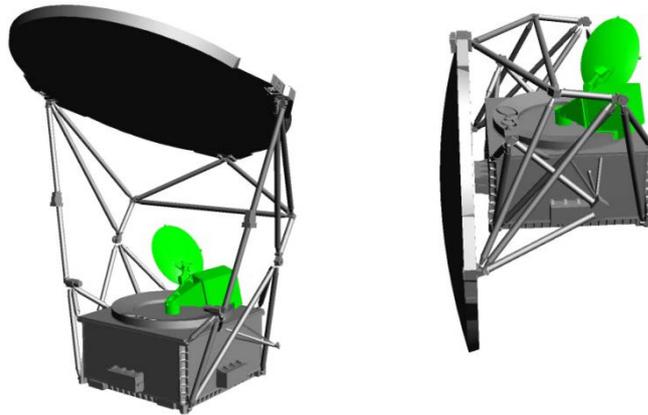


Fig. 3. Sensor unit of AMSR2 instrument in deployed (left) and stowed (right) conditions.

TABLE 2
MAJOR CHARACTERISTICS OF AMSR2 INSTRUMENT

Parameter	Performance and characteristics					
Center Frequency (GHz)	6.925/7.3	10.65	18.7	23.8	36.5	89.0
Bandwidth (MHz)	350	100	200	400	1000	3000
Polarization	Vertical and Horizontal polarization					
NE Δ T (K) ¹	< 0.34/0.43	< 0.70	< 0.70	< 0.60	< 0.70	< 1.20/1.40 ²
Dynamic range (K)	2.7 to 340					
Nominal incidence angle (deg.)	55.0					55.0/54.5 ²
Beam width (deg.)	1.8	1.2	0.65	0.75	0.35	0.15
IFOV (km) Cross-track x along-track	35x62	24x42	14x22	15x26	7x12	3x5
Approximate sampling interval (km)	10					5
Swath width (km)	1450 (1600, effectively)					
Digital quantization (bits)	12					
Scan rate (rpm)	40					

3.3. GCOM-C1 and SGLI instrument

Figure 4 gives an overview of the GCOM-C1 satellite; its major characteristics are listed in Table 3. GCOM-C1 will carry SGLI as the sole mission onboard instrument. The satellite will orbit at an altitude of about 800km; the descending node local time will be 1030, to maintain a wide observation swath and reduce cloud interference over land.



Fig. 4. Overview of GCOM-C1 satellite

TABLE 3
MAJOR CHARACTERISTICS OF GCOM-C1 SATELLITE

Instrument	Second-generation Global Imager (SGLI)
Orbit	Sun-synchronous orbit Altitude: 798km (over the equator)
Size	4.6m (X) * 16.3m (Y) * 2.8m (Z) (on orbit)
Mass	2093kg
Power	More than 4000W (EOL)
Launch	JFY2016 by H-IIA Rocket
Design Life	5 years

The SGLI instrument has two major new features: 250m spatial resolution for most of the visible channels and polarization/multidirectional observation capabilities. The 250m resolution will provide enhanced observation capability over land and coastal areas where the influences of human activity are most obvious. The polarization and multidirectional observations will enable us to retrieve aerosol information over land. Precise observation of global aerosol distribution is a key for improving climate prediction models.

SGLI consists of two major components: the Infrared Scanner (IRS) and the Visible and Near-infrared Radiometer (VNR). An overview of the SGLI instrument is shown in Fig. 5 for the entire radiometer layout, IRS, and VNR components. Also, requirements for sensor performance are listed in Tables 4 and 5. VNR can be further divided into two components: VNR-Non Polarized (VNR-NP) and VNR-Polarized (VNR-P). VNR-NP and VNR-P are the 11-channel multi-band radiometer and the polarimeter with three polarization angles (0, 60, and 120 degrees). VNR-P has a tilting function to meet the scatter angle requirement from aerosol observation. The IRS is an infrared radiometer covering wavelengths from 1 μ m to 12 μ m. It consists of short infrared (SWI; 1.05 to 2.21 μ m) and thermal infrared (TIR 10.8 and 12.0 μ m) sensors. It employs a scanning mirror system with a 45-degree tilted flat mirror rotating continuously to realize an 80-degree observation swath and calibration measurement in every scan.

Through intensive discussions and optimizing studies, the number of SGLI channels was decreased from the 36 channels of GLI aboard ADEOS-II to 19 channels, while the number of SGLI standard products will increase compared to those of GLI.

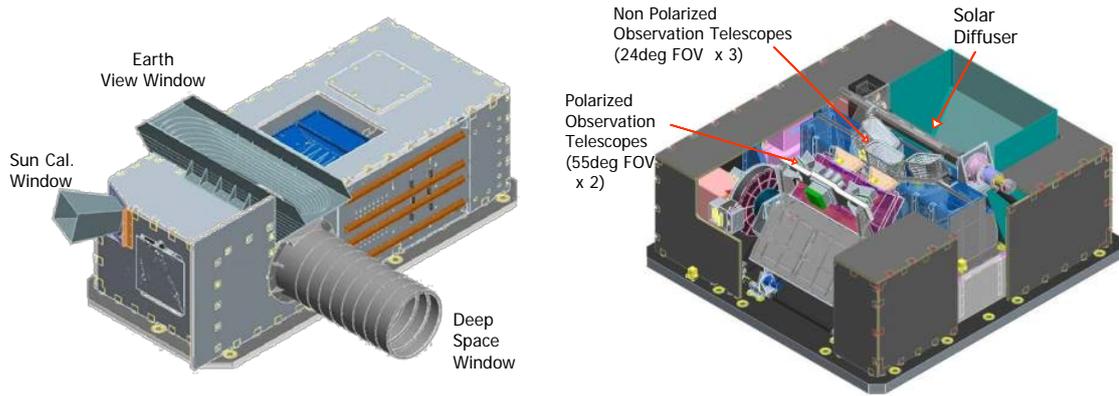


Fig. 5. Overview of IRS instrument (left), and VNR radiometers (right).

TABLE 4
SGLI MAJOR PERFORMANCE REQUIREMENTS

Item	Requirement
Spectral Bands	VNR-NP : 11CH 380-868.5nm VNR-P : 2CH 673.5, 868.5nm / 0, 60, 120deg Polarization IRS SWI : 4CH 1.05-2.21 μ m IRS TIR : 2CH 10.8, 12.0 μ m
Scan Angle	VNR-NP : 70deg (Push broom scanning) VNR-P : 55deg (Push broom scanning) IRS SWI/TIR : 80deg (45deg rotation mirror scanning)
Swath width	1150km for VNR-NP/P 1400km for IRS SWI/TIR
Instantaneous field of view (IFOV) at nadir	VNR-NP : 1000m(VN9CH), 250m VNR-P : 1000m IRS SWI : 250m(SW3CH), 1000m(SW1,2,4CH) IRS TIR : 500m
Observing direction	\pm 45 degrees in along track direction for VNR-P Nadir for VNR-NP, IRS SWI, and IRS TIR
Quantization	12bit
Absolute Calibration Accuracy	VNR : \leq 3% IRS : \leq 5% TIR : \leq 0.5K
Lifetime	5 Years

TABLE 5
SGLI OBSERVATION REQUIREMENT DETAILS

	CH	λ	$\Delta\lambda$	IFOV	SNR	L (for SNR)
		nm: VNR, IRS SWI μm : IRS TIR		M	SNR: VNR, IRS SWI NE Δ T(K): IRS TIR	$\text{W}/\text{m}^2/\text{sr}/\mu\text{m}$
VNR-NP	VN1	380	10	250	250	60
	VN2	412	10	250	400	75
	VN3	443	10	250	300	64
	VN4	490	10	250	400	53
	VN5	530	20	250	250	41
	VN6	565	20	250	400	33
	VN7	673.5	20	250	400	23
	VN8	673.5	20	250	250	25
	VN9	763	12	1000	1200	40
	VN10	868.5	20	250	400	8
	VN11	868.5	20	250	200	30
VNR-P	P1	673.5	20	1000	250	25
	P2	868.5	20	1000	250	30
IRS SWI	SW1	1050	20	1000	500	57
	SW2	1380	20	1000	150	8
	SW3	1630	200	250	57	3
	SW4	2210	50	1000	211	1.9
IRS TIR	T1	10.8	0.74	500	0.2	300 (K)
	T2	12.0	0.74	500	0.2	300 (K)

4. Products

Geophysical products made available by GCOM-W1 and GCOM-C1 are listed in Tables 6 and 7. There are two categories of data products: standard product and research product. A “standard” product is defined as a product with proven accuracy that is to be operationally processed and distributed. In contrast, a “research” product is a prototype for a standard product and is processed on a research basis. Both tables indicate standard products with shading.

TABLE 6
GEOPHYSICAL PRODUCTS OF GCOM-W1

Product	Areas	Grid (km)	Accuracy ¹			Range	
			Release threshold	Standard	Goal		
Integrated water vapor	Global, over ocean	15	±3.5 kg/m ²	±3.5 kg/m ²	±2.0 kg/m ²	0-70 kg/m ²	Vertically integrated (columnar) water vapor amount. Except sea ice and precipitating areas.
Integrated cloud liquid water	Global, over ocean	15	±0.10 kg/m ²	±0.05 kg/m ²	±0.02 kg/m ²	0-1.0 kg/m ²	Vertically integrated (columnar) cloud liquid water. Except sea ice and precipitating areas.
Precipitation	Global, except cold latitudes	15	Ocean ±50 % Land ±120 %	Ocean ±50% Land ±120 %	Ocean ±20% Land ±80 %	0-20 mm/h	Surface precipitation rate. Accuracy is defined as relative error (ratio of root-mean-square error to average precipitation rate) in 50km grid average.
Sea surface temperature	Global, over ocean	50	±0.8 °C	±0.5 °C	±0.2 °C	-2-35 °C	Except sea ice and precipitating areas. Goal accuracy is defined as monthly mean bias error in 10 degrees latitudes.
Sea surface wind speed	Global, over ocean	15	±1.5 m/s	±1.0 m/s	±1.0 m/s	0-30 m/s	Except sea ice and precipitating areas.
Sea ice concentration	Polar region, over ocean	15	±10 %	±10 %	±5 %	0-100 %	Accuracy is expressed in absolute value of sea ice concentration (%).
Snow depth	Land	30	±20 cm	±20 cm	±10 cm	0-100 cm	Except ice sheets and dense forest areas. Accuracy is expressed in snow depth and defined as mean absolute error of instantaneous observations.
Soil moisture	Land	50	±10 %	±10 %	±5 %	0-40 %	Volumetric water content over global land areas including arid and cold regions, except areas covered by vegetation with 2kg/m ² water equivalent. Accuracy is defined as mean absolute error of instantaneous observations.

¹ Accuracy is defined as root-mean-square error of instantaneous values unless otherwise stated. Assumed validation methodologies are not explained here.

TABLE 7
GEOPHYSICAL PRODUCTS OF GCOM-C1 (1/3)

Area	Group	Product	Category	GLI heritage*1	Day/night	Production unit	Grid size	Release threshold*2	Standard accuracy*2	Target accuracy*2
common	Radiance	TOA radiance (including system geometric correction)	Standard	A(non-Pol) B(Pol)	TIR and land 2.2μm: both, Other VNR, SWI: daytime (+special operation)	Scene	VNR,SWI Land/coast: 250m, offshore: 1km, polarimetry:1km TIR Land/coast: 500m, offshore: 1km	Radiometric 5% (absolute)*3 Geometric<1 pixel	VNR,SWI: 5% (absolute), 1% (relative)*3 TIR: 0.5K (@300K) Geometric<0.5 pixel	VNR,SWI: 3% (absolute), 0.5% (relative)*3 TIR: 0.5K (@300K) Geometric<0.3 pixel
Land	Surface reflectance	Precise geometric correction	Standard	A	Both	Scene, Global (mosaic 1, 16 days, month)	250m	<1pixel	<0.5pixel	<0.25pixel
		Atmospheric corrected reflectance (incl. cloud detection)	Standard	B	Daytime	Scene, Global (1, 16 days, month)	250m	0.3 (<=443nm), 0.2 (>443nm) (scene)*7	0.1 (<=443nm), 0.05 (>443nm) (scene)*7	0.05 (<=443nm), 0.025 (>443nm) (scene)*7
	Vegetation and carbon cycle	Vegetation index	Standard	A	Daytime	Scene, Global (1, 16 days, month)	250m	Grass: 25%, forest: 20% (scene)	Grass: 20%, forest: 15% (scene)	Grass: 10%, forest: 10% (scene)
		fAPAR	Standard	B				Grass: 50%, forest: 50%	Grass: 30%, forest:20%	Grass: 20%, forest: 10%
		Leaf area index	Standard	B				Grass: 50%, forest: 50%	Grass: 30%, forest:30%	Grass: 20%, forest: 20%
		Above-ground biomass	Standard	B	Daytime	Scene, Global (1, 16 days, month)	1km 1km 250m, 1km	Grass: 50%, forest: 100%	Grass: 30%, forest: 50%	Grass: 10%, forest: 20%
		Vegetation roughness index	Standard	B				Grass and forest: 40% (scene)	Grass and forest: 20% (scene)	Grass and forest: 10% (scene)
		Shadow index	Standard	B				Grass and forest: 30% (scene)	Grass and forest: 20% (scene)	Grass and forest: 10% (scene)
	Temperature	Surface temperature	Standard	B	Both	Scene, Global (1, 16 days, month)	500m	<3.0K (scene)	<2.5K (scene)	<1.5K (scene)
	Application	Land net primary production	Research	C	Daytime	Global (month, year)	1km	N/A	N/A	30% (yearly)
		Water stress trend	Research	C	N/A	Scene, Global (1, 16 days, month)	500m	N/A	N/A	10%*13 (error judgment rate)
		Fire detection index	Research	B	Both*12	Scene	500m	N/A	N/A	20%*14 (error judgment rate)
		Land cover type	Research	B	Daytime	Global (month, season)	250m	N/A	N/A	30% (error judgment rate)
		Land surface albedo	Research	B	N/A	Scene, Global (1, 16 days, month)	1km	N/A	N/A	10%
	Atmosphere	Cloud	Cloud flag/Classification	Standard	A	Both	Scene, Global (1 day, month)	1km	10% (with whole-sky camera)	Incl. below cloud amount
Classified cloud fraction			Standard	A	Daytime	Global (1 day, month)	1km (scene), 0.1deg (global)	20% (on solar irradiance)*9	15% (on solar irradiance)*9	10% (on solar irradiance)*9
Cloud top temp/height			Standard	A	Both	Scene, Global (1 day, month)		1K*4	3K/2km (top temp/height)*5	1.5K/1km (temp/height)*5
Water cloud OT/effective radius			Standard	B	Daytime	Scene, Global (1 day, month)		10%/30% (Cloud OT/radius)*6	100% as CLW*7	50%*7 / 20%*8
Ice cloud optical thickness			Standard	B	Daytime	Scene, Global (1 day, month)		30%*6	70%*8	20%*8
Water cloud geometrical thickness			Research	C	Daytime	Scene, Global (1 day, month)		N/A	N/A	300m
Aerosol		Aerosol over the ocean	Standard	A	Daytime	Scene, Global (1 day, month)		0.1 (Monthly τ _{a_670,865})*10	0.1(scene τ _{a_670,865})*10	0.05 (scene τ _{a_670,865})
		Land aerosol by near UV	Standard	B	Daytime	Scene, Global (1 day, month)	0.15 (Monthly τ _{a_380})*10	0.15 (scene τ _{a_380})*10	0.1 (scene τ _{a_380})	
		Aerosol by Polarization	Standard	B	Daytime	Scene, Global (1 day, month)	0.15 (Monthly τ _{a_670,865})*10	0.15 (scene τ _{a_670,865})*10	0.1 (scene τ _{a_670,865})	
Radiation budget		Long-wave radiation flux	Research	C	Daytime	Scene, Global (1 day, month)	N/A	N/A	Downward 10W/m2, upward 15W/m2 (monthly)	
	Short-wave radiation flux	Research	B	Daytime	Scene, Global (1 day, month)	N/A	N/A	Downward 13W/m2, upward 10W/m2		

TABLE 7
GEOPHYSICAL PRODUCTS OF GCOM-C1 (2/3)

Area	Group	Product	Category	GLI heritage*1	Day/night	Production unit	Grid size	Release threshold*2	Standard accuracy*2	Target accuracy*2
Ocean	Ocean color	Normalized water-leaving radiance (incl. cloud detection)	Standard	B	Daytime	Scene, Global (1, 8 days, month)	Coast: 250m Offshore: 1km Global: 4-9km	60% (443~565nm)	50% (<600nm) 0.5W/m ² /str/um (>600nm)	30% (<600nm) 0.25W/m ² /str/um (>600nm)
		Atmospheric correction parameter	Standard	A				80% (AOT@865nm)	50% (AOT@865nm)	30% (AOT@865nm)
		Photosynthetically available radiation	Standard	A	Daytime	Scene, Global (1, 8 days, month)		20% (10km/month)	15% (10km/month)	10% (10km/month)
		Euphotic zone depth	Research	B	Daytime	Scene, Global (1, 8 days, month)		N/A	N/A	30%
	In-water	Chlorophyll-a concentration	Standard	A	Daytime	Scene, Global (1, 8 days, month)	Coast: 250m Offshore: 1km Global: 4-9km	-60 to +150% (offshore)	-60 to +150%	-35 to +50% (offshore), -50 to +100% (coast)
		Suspended solid concentration	Standard	A				-60 to +150% (offshore)	-60 to +150%	-50 to +100%
		Colored dissolved organic matter	Standard	A				-60 to +150% (offshore)	-60 to +150%	-50 to +100%
		Inherent optical properties	Research	C	Daytime	Scene, Global (1, 8 days, month)		N/A	N/A	a (440): RMSE<0.25, bbp (550): RMSE<0.25
	Temperature	Sea-surface temperature	Standard	A	Both	Scene, Global (1, 8 days, month)	Coast: 500m Others: Same as above	0.8K (daytime)	0.8K (day & night time)	0.6K (day and night time)
	Application	Ocean net primary productivity	Research	C	Daytime	Scene, Global (1, 8 days, month)	Coast: 500m Others: Same as above	N/A	N/A	70% (monthly)
		Phytoplankton functional type	Research	C	Daytime	Scene, Global (1, 8 days, month)	Coast: 250m Others: Same as above	N/A	N/A	error judgment rate of large/small phytoplankton dominance<20%; or error judgment rate of the dominant phytoplankton functional group <40%
		Red tide	Research	B	Daytime	Scene, Global (1, 8 days, month)		N/A	N/A	error judgment rate <20%
		multi sensor merged ocean color	Research	B	Daytime	Area, Global (1, 8 days, month)	Coast: 250m Offshore: 1km	N/A	N/A	-35 to +50% (offshore), -50 to +100% (coast)
		multi sensor merged SST	Research	A	Both			N/A	N/A	0.8K (day & night time)
Cryosphere	Area/distribution	Snow and Ice covered area (incl. cloud detection)	Standard	A	Daytime	Scene, Global (1, 16 days, month)	250m (scene), 1km (global)	10% (vicarious val with other sat. data)	7%	5%
		Okhotsk sea-ice distribution	Standard	A	Daytime	Area (1day)		250m	10%	5%
		Snow and ice classification	Research	B	Daytime	Global (16 days, month)	1km	N/A	N/A	10%
	Surface properties	Snow covered area in forests and mountains	Research	B	Daytime	Area (1, 8 days)	250m	N/A	N/A	30%
		Snow and ice surface Temperature	Standard	A	Daytime	Scene, Global (1, 16 days, month)	500m (scene), 1km (global)	5K (vicarious val with other sat. data and climatology)	2K	1K
		Snow grain size of shallow layer	Standard	B	Daytime	Scene, Global (1, 16 days, month)		250m (scene), 1km (global)	100% (vicarious val. with climatology between temp-size)	50%
		Snow grain size of subsurface layer	Research	B	Daytime	Scene, Global (1, 16 days, month)	1km	N/A	N/A	50%
		Snow grain size of top layer	Research	C	Daytime	Scene, Global (1, 16 days, month)	250m (scene), 1km (global)	N/A	N/A	50%
Snow and ice albedo	Research	B	Daytime	Global (1, 16 days, month)	1km	N/A	N/A	7%		

TABLE 7
GEOPHYSICAL PRODUCTS OF GCOM-C1 (3/3)

Area	Group	Product	Category	GLI heritage*1	Day/night	Production unit	Grid size	Release threshold*2	Standard accuracy*2	Target accuracy*2
Cryosphere	Surface properties	Snow impurity	Research	B	Daytime	Scene, Global (1, 16 days, month)	250m (scene), 1km (global)	N/A	N/A	50%
		Ice sheet surface roughness	Research	C	Daytime	Area (Season)	1km	N/A	N/A	0.05 *15
	Boundary	Ice sheet boundary monitoring	Research	B	Daytime	Area (Season)	250m	N/A	N/A	<500m

Common notes:

*1. Heritage levels from ADEOS-II/GLI study are shown by A-C; A: high heritage, B: Remaining issues, C: new or many issues remaining to be resolved

*2. The "release threshold" is minimum levels for the first data release at one year from launch. The "standard" and "research" accuracies correspond to full and extra success criteria of the mission. Accuracies are basically shown by RMSE.

Radiance data notes:

*3. Absolute error is defined as offset + noise; relative error is defined as relative errors among channels, FOV, and so on. Release threshold of radiance is defined as estimated errors from vicarious, onboard solar diffuser, and onboard blackbody calibration because of lack of long-term moon samples

Atmosphere notes:

*4. Vicarious val. on sea-surface temperature and comparison with objective analysis data

*5. Inter comparison with airplane remote sensing on water clouds of middle optical thickness

*6. Release threshold is defined by vicarious val. with other satellite data (e.g., global monthly statistics in the mid-low latitudes)

*7. Comparison with cloud liquid water by in-situ microwave radiometer

*8. Comparison with optical thickness by sky-radiometer (the difference can be large due to time-space inconsistency and large error of the ground measurements)

*9. Comparison with in-situ observation on monthly 0.1-degree

*10. Estimated by experience of aerosol products by GLI and POLDER

Land data notes:

*11. Defined with land reflectance~0.2, solar zenith<30deg, and flat surface. Release threshold is defined with AOT@500nm<0.25

*12. Night time 250m product can be produced by special observation requests of 1.6µm channel

*13. Evaluate in semiarid regions (steppe climate, etc.)

*14. Fires >1000K occupying >1/1000 on 1km pixel at night (using 2.2µm of 1 km and thermal infrared channels)

Cryosphere notes:

*15. Defined as height/width of the surface structures

APPENDIX D

Terms and Conditions of Research Contract

FOR COMMISSIONED RESEARCH D-2 ~ D-14

FOR COLLABORATIVE RESEARCH D-15 ~ D-27

FOR COLLABORATIVE RESEARCH (NON-FUNDED) D-28~D-39

5th GCOM 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, the Global Change Observation Mission ("GCOM") aims to construct, use, and verify systems that enable continuous global-scale observations of effective geophysical parameters for clarifying global climate change and water circulation mechanisms;

WHEREAS, JAXA issued the Research Announcement ("RA") to engage in research activities directly related to retrieval algorithms for geophysical products, product validation, and data application of GCOM, 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) "Industrial Property Rights" means all domestic and foreign patents, utility models and industrial designs.
 - (3) "Commissioned Research Plan" means the plan described in Attachment 1 of the Application Form for the GCOM Research Announcement Commissioned Research Agreement (hereinafter "Application Form").
 - (4) "Research Period" means the research period as described in the Commissioned Research Plan. In accordance with the provisions of this Agreement, in the event that the Agreement ended prior to the completion date of the research originally set, the date the Agreement ends shall be read as the research period.

- (5) “Annual Evaluation” means JAXA’s annual review, which is carried out by JAXA before the end of the Japanese fiscal year during which the Agreement was concluded. At the end of each fiscal year, the review is conducted through the RO’s presentation at workshops and meetings as well as based on the Progress Report.
- (6) “Earth Observation Satellite Data” means data sets obtained from satellites, which are retained by JAXA at the time of execution of this Agreement. The available data sets including names of satellites or sensors, observation period that can be offered, and observation areas listed in the Attachment of this Agreement.
- (7) “Meteorological Data” means the data provided by the Japanese Meteorological Agency.
2. In this Agreement, “Invention etc.” contains multiple meanings: When it is a subject of patent rights it refers to an invention; when it is a subject of a utility model it refers to an idea; when it is a subject of the rights for industrial design, literary work of program and database, it refers to a creation; when it is a subject of algorithm and technological know-how it refers to proposition.
3. In this Agreement, “utilization” of Industrial Property Rights and Research Results refer to the acts specified in paragraph 3 of Article 2 of the Patent Act, paragraph 2 of Article 3 of the Utility Model Act, paragraph 3 of Article 2 of the Design Act, and Article 21 and 27 of the Copyright Act (including the use of the secondary publication created by JAXA), as well as the use of algorithm and technical know-how.
4. In this Agreement, “PI” (Principal Investigator) refers to the person who submitted the research proposal to this Research Announcement and who is also the RO employee selected to be responsible for the implementation of the accepted Research Project. “CI” means “Co-Investigator” who supports the research activities represented by the PI. Name of the PI and CI (hereinafter “Commissioned Researchers”) and their affiliated organization will be shown in the “Commissioned Research Plan”.

Article 2. Purpose and Scope of Research Projects

The RO shall implement the following tasks.

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

Article 3. Effective Term and Renewal

The Agreement shall be concluded upon the acceptance through the issuance of the Confirmation Sheet by JAXA for the application submitted by the RO using the application form, and the Agreement shall become effective as per the date prescribed on the Confirmation Sheet issued by JAXA and shall continue to be in effect until the

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

Article 4. Annual Evaluation

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

Article 5. Commissioned Researchers

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

Article 6. Prohibition of Re-commission

1. The RO shall not commission the whole Research Projects to a third party (hereinafter “Subcontract”). The RO may, however, subcontract part of it upon prior written application to JAXA and approval from JAXA. Should there be a case where subcontractors further re-commission the Research Projects to a third party, the company name, address and scope of business of such third party are required to be submitted to the RO in writing.
2. If the RO subcontracts the Research Projects in accordance with the preceding paragraph, any act of all the third parties involved in the subcontract, which includes a contractor and commissioned party of the RO, re-commissioned party, subcontractor and supplier at any tier, in connection with the subcontractor shall be deemed to be an act of the RO and the RO shall be responsible therefor.
3. In the event that the RO subcontract part of the Agreement, the RO shall enter an agreement with the subcontractor regarding the items necessary for the RO to comply with the contents of the Agreement as well as the items specified by JAXA.

Article 7. Research Funding

1. JAXA shall make advance payment of the “Research Funding” stated in the Confirmation Sheet or Continuous Confirmation Sheet, which is issued in accordance with Article 3, to the RO as a necessary research expense to carry out the Agreement.
2. JAXA shall, within thirty (30) days from the date when they receive an invoice duly

issued by the RO, make payment for the Research Funding described in the previous paragraph. If JAXA fails to pay the RO within the above period, JAXA shall pay to the RO default interest of six (6) percent per annum (calculation on a daily basis) on the unpaid amount.

3. If the interest on late payment calculated following the preceding paragraph is less than 10,000 Japanese yen, JAXA shall be exempt from payment of such interest. Where there is a fraction of that amount and if it is less than 1,000 yen, such a fraction shall be omitted.
4. The RO shall report to JAXA if there is a need to reallocate the budget, which is listed in the Budget Summary within the Commissioned Work Plan, between Expense Item Categories of Budget Summary. However, if the RO wishes to conduct the reallocation between Expense Item Categories with an increase in the personnel cost, or with items including the one with an amount that has more than 30% increase or decrease (500,000 Japanese yen in case the amount of 30% is less than 500,000 Japanese yen), the RO shall obtain an approval from JAXA in advance.
5. In order to clarify the status of accounting concerning the Research Funding stated in paragraph 1 above, the RO shall maintain books to record expenses according to items and types as well as logically storing documents to prove such expenses. In addition, the RO shall keep all the accounting documents for five (5) years after the end of the research period and starting the next fiscal year. JAXA may request the RO to submit a copy of such books and the document to prove the expenses, and the RO shall respond to such a request from JAXA.

Article 8. Submission of Completion Notice and Performance Report

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

Article 9. Determining the Contract Amount

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

Article 10. Investigation of Actual Expenses

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

Article 11. Return of Paid Research Funding

1. After the payment by the method stipulated in paragraph 1 and 2 of Article 7, if the

amount already paid exceeds the final contract amount determined through the process stipulated in paragraph 1 of Article 9, JAXA shall reclaim the excess amount from the RO.

2. In the case of the previous paragraph, the RO shall remit such funds within thirty (30) days from the date when the RO receives an invoice issued by JAXA with regard to such funds.
3. In the event there is no return made by the RO within the set time limit as described in the preceding paragraph, the provisions of paragraph 2 and 3 of Article 7 shall be applied.

Article 12. Ownership of the Rights to the Acquired Equipment

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

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

1. JAXA will provide the RO with the Earth Observation Satellite Data necessary for the implementation of the Agreement free of charge.
 - (1) JAXA may not provide all of the Earth Observation Satellite Data, which the RO may request due to limitations on the capacity of the JAXA equipment or resources; Amongst the Earth Observation Satellite Data, which the RO may request JAXA, there is a limit of ten scenes in total within one fiscal year regarding the data collected from the Advanced Land Observing Satellite (ALOS);
 - (2) JAXA does not guarantee a specific quality or the timely provisions of the Earth Observation Satellite Data and will not be liable for any deterioration of quality and delay in providing the Data;
 - (3) JAXA will not be liable for any situation whereby the Earth Observation Satellite Data cannot be supplied to the RO due to faults relating to the satellites, limitations on their operations, or for any other reason.
2. With respect to the handling of the Earth Observation Satellite Data provided by JAXA, the RO shall follow the conditions below:
 - (1) RO may not duplicate the Earth Observation Satellite Data for any purpose other than creating a backup. However, this excludes the duplication to provide for the collaborating research organizations stated in Article 5 and the re-commissioned party (hereinafter "PI etc.") stated in Article 6 that are necessary for the implementation of the Agreement;
 - (2) The RO may not disclose the Earth Observation Satellite Data, which is restorable to its primary data, to any third party, except the PI etc.
 - (3) The RO shall use the provided the Earth Observation Satellite Data solely for the purpose stipulated in the Agreement;
 - (4) The RO shall return or otherwise appropriately keep the Earth Observation Satellite Data in accordance with the instruction of JAXA upon the termination of this Agreement.
3. The right concerning the Earth Observation Satellite Data provided by JAXA shall not be transferred to the RO through the supply. In addition, for the handling of the Data, the RO will follow the instruction of JAXA.
4. Regardless of the preceding paragraphs, if value-added products, which refers to highly processed products (data analysis or a combination of satellite data acquired

by different missions, image processing based on external information other than the original data, conversion to physical quantities, and so forth.) that are irreversible to the primary Earth Observation Satellite Data, are developed by Research Organization in the course of executing the Agreement, Research Organization retains the intellectual property rights of such value-added products, if RO's copyright in such value-added products are acknowledged.

Article 14. Providing of Meteorological Data and Rights

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

Article 15. Providing of Technical Data

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

Article 16. Ownership of the Research Results

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

Article 17. Usage of the Research Results

1. Of the Research Results acquired through the implementation of the Agreement,

JAXA may use the Research Results other than the one specified in paragraph 1 of the previous Article free of charge only for the purpose of its research development including the case for allowing a third party, which includes partners of joint research projects, to use the Research Results for its own purpose, as well as for its own peaceful and non-commercial purposes.

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

Article 18. Industrial Property Rights

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

Article 19. Foreign Application for Industrial Property Rights

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

Article 20. Ownership of Industrial Property Rights

1. The RO shall transfer the Industrial Property Rights obtained in compliance paragraph 1 of Article 18. 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, JAXA will grant the RO such a license unless it is reasonable for it to be deemed to be inappropriate. The conditions for the approval shall be determined by mutual agreement between the Parties as necessary.
3. With regard to the Industrial Property Rights stipulated in paragraph 1 of Article 18, if the RO, before obtaining the Rights, wishes to use it for any

purpose other than that of the Agreement, or wishes to grant its use to a third party, shall consult JAXA as necessary.

4. In accordance with the provisions in paragraph 1, JAXA, based on the criteria determined by JAXA, shall bear the total or a portion of the costs, which the RO should pay the commissioned researcher who created the technology, which is subject to the Industrial Property Rights transferred from the RO and the Right to receive the transferred Industrial Property Rights from the RO stipulated in paragraph 5 of Article 18.

Article 21. Ownership of Program/Data Copyrights

1. Upon the completion of the Agreement, the RO shall notify JAXA without delay in the event that the RO creates a program and/or database (hereinafter “Program/Data”) that may potentially constitute the Program/Data copyrights. In this case, the Program/Data that the Statement of Work specifies its delivery shall be excluded from the notification stipulated in this Article.
2. The RO shall transfer the copyrights of the Program/Data, including the rights stipulated in Article 27 and 28 of the Copyrights Act, acquired through the implementation of this Agreement to JAXA. The cost for this transfer shall be included in the Research Funding stipulated in paragraph 1 of Article 7. Regarding the Program/Data of which the RO already had its rights prior to the conclusion of the Agreement as well as among the know-how, routine, subroutine and modules that are commonly used by similar program the RO specified, copyrights of such products are retained by the RO but not transferred to JAXA.
3. In the event that the RO transfer copyrights to JAXA, if the product subject to the copyright is created by the RO, the RO waives any related moral rights. If it is created by a third party but not by the RO, the RO shall take measures to prevent the third party from using any related moral rights.
4. If the RO requests a license to use the Program/Data copyrights assigned to JAXA, JAXA will grant the RO such a license unless it is reasonable for it to be deemed to be inappropriate. The conditions for the approval shall be determined by mutual agreement between the Parties as necessary.
5. In the event that programs are modified/adapted not by JAXA or the RO but by a third party, JAXA shall bear the responsibility related to the use of such programs and the RO shall not be responsible for any liability caused by such programs.
6. With regard to the know-how, routine, subroutine and modules utilized commonly by similar programs, the copyrights of which are retained by the RO in accordance with paragraph 2 of this Article, the RO shall approve JAXA of a royalty-free right to use such products in the form of the program acquired through the implementation of the Agreement without consent from the RO. Such used by JAXA shall include the right of JAXA to grant a third party the right to use the know-how, routine, subroutine and modules without paying any royalties to the RO.

Article 22. Use of Facilities

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

Article 23. Bringing in Instruments

If necessary for the implementation of the Agreement, the RO may bring instruments and other items into JAXA’s facilities with the prior consent of JAXA. In such a case the

RO shall be in compliance with all the regulations stipulated by JAXA.

Article 24. Delivery of Rental Items, Storage and Return

1. If required to implement the Agreement, JAXA shall lend the RO any instruments and other items owned by JAXA.
2. At the time of delivery of the instruments and items for lending (hereinafter “Rental Items”) in accordance with the preceding paragraph, JAXA shall submit a delivery note to the RO and the RO shall submit a receipt to JAXA.
3. In the event that the RO received the delivery of the Rental Items, the RO shall confirm the presence of any abnormality regarding the list of articles and numbers. If a lack of quantity or abnormality including inappropriate quality and standard for use, with the Rental Items is found, the RO shall notify JAXA of the matter immediately and seek further instruction.
4. The RO shall manage and use the Rental Items delivered with the care of a good manager and shall use items solely for the purpose of the Agreement.
5. The RO shall maintain books of receipts and shipment as well as management regarding the Rental Items delivered, record and organize the receipts, and always make the situation of the Rental Items clear.
6. In the event that the Rental Items are lost or damaged, the RO shall report this to the lender without delay.
7. In the event that all or part of the Rental Items become unnecessary due to the completion of the whole or part of the Agreement as well as of any amendment or termination of the Agreement, the RO shall notify JAXA and undertake a procedure to return the Rental Items in compliance with JAXA’s instruction without delay.

Article 25. Confidentiality

1. In this Agreement, “Confidentiality Information” means those that are applicable to any of the following items.
 - (1) Amongst the outcome as a result of the Agreement, any documents with an indication of confidential notice, tangible objects such as samples, or regardless of its form in tangible or intangible, any items that have been confirmed in writing as Confidential Information by JAXA and the RO.
 - (2) Any information that a party discloses or presents as confidential in the forms of document, drawing, photograph, test piece, sample, magnetic tape, and floppy disk.
2. JAXA and the RO must manage Confidential Information properly and may not leak or disclose to anyone other than those involved in the Agreement. However, any information that is applicable to any of the following items may be an exception:
 - (1) Information that is already known to the public when disclosed by the disclosing party;
 - (2) Information that becomes known to the public after the disclosure by the disclosing party without intentional misconduct of the receiving party;
 - (3) Information that the receiving party already had before the disclosure by the disclosing party and that is able to verify this fact;
 - (4) Information with proof that the receiving party acquires legally from a duly authorized third party not subject to confidentiality obligations;
 - (5) Information and materials that the receiving party independently acquire without utilizing information obtained from the disclosing party and that are able to verify this fact;
 - (6) Information with written consent from the disclosing party for the disclosure and the publication; or
 - (7) Information that is required to be disclosed by applicable laws, judgment or order of a competent court. In this case, the receiving party shall promptly notify the

disclosing party of the necessity of disclosure.

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

Article 26. Publication of Research Results

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

Article 27. Security

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

Article 28. Impossibility of Performance

1. In the event it becomes impossible for the RO to carry out all or any part of the Agreement due to reasons attributable to the RO, JAXA may terminate all or any part of the Agreement.
2. In the case of the termination of the Agreement following the previous paragraph, JAXA shall apply the provisions in paragraph 1 of Article 11 *mutatis mutandis* and demand the restitution of the disused amount.
3. In the case of the termination of the Agreement in accordance with Article 1, JAXA, based on paragraph 3 of Article 31, shall be able to demand the RO incur a penalty.

Article 29. Incompleteness of Performance

1. If the performance of the RO for the Agreement is confirmed not to be following the purpose of the Agreement due to the liability of the RO, JAXA may claim the RO subsequent completion by setting an appropriate period.
2. In the event that there is no prospect of the completion of the performance by the RO in accordance with the Agreement despite the claim made for the subsequent

completion stipulated in paragraph 1, JAXA may terminate all or part of this Agreement.

3. In case the termination of the Agreement is performed in accordance with the preceding paragraph, JAXA shall apply the provisions in paragraph 1 of Article 11 and claim a return of the amount of Research Funding that becomes unnecessary.
4. In case the termination of the Agreement is performed in accordance with paragraph 2 above, JAXA may claim the RO incur a penalty in accordance with paragraph 3 of Article 31.

Article 30. Extension of the Delivery Deadline

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

Article 31. Termination of the Agreement

1. In the event of any of the following conditions, JAXA and the RO may terminate the Agreement.
 - (1) Upon the consent of both JAXA and the RO.
 - (2) When the other party commits a dishonest or inequitable act and the breaching party fails to offer any satisfactory remedial measures within seven (7) days after receiving demands for corrective action.
 - (3) When the other party violates any of the terms and conditions of this Agreement provided that the breaching party fails to offer any satisfactory remedial measures within seven (7) days after receiving demands for corrective action.
 - (4) When the events stipulated in paragraph 5 (transfer of the PI) of Article 4 occurs and there is no one who engages in this joint research project at the RO.
 - (5) When unavoidable circumstances occur such as natural disasters
2. Upon the termination of the Agreement, the RO shall submit to JAXA all work in progress and completed work based on the research carried out prior to the termination.
3. In the event that the Agreement is terminated in accordance with number 2 or 3 of paragraph 1, JAXA and the RO may claim the other party a penalty equivalent to 10% of the Research Funding stipulated in paragraph 1 of Article 7, which corresponds to the contents of the termination above. However, if the amount of the penalty is less than 10,000 Japanese yen, the payment of such penalty is not required. Where there is a fraction of that amount and if it is less than 1,000 yen, such a fraction shall be omitted.
4. Neither JAXA nor the RO shall claim any compensation in case the termination of the Agreement is exercised in accordance with number 5 of paragraph 1 of the present Article.

Article 32. Effective Term of the Agreement

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

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

Article 33. Amendment of the Agreement

1. JAXA can amend the contents of this Agreement. In such a case, JAXA announces the amended contents by posting it to the website operated by JAXA, and thereafter the Agreement is handled based on the amended contents.
2. In the case the RO has a legitimate reason for not agreeing with the amendment of the previous paragraph, the RO may terminate the Agreement by notifying JAXA in writing within thirty (30) days from the date the amended contents were posted on the website.

Article 34. Governing Law

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

Article 35. Language

All communications between JAXA and the RO 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 RO as necessary.

Attachment “Earth Observation Satellite Data”

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

* GCOM-C1, ALOS-2, GPM and EarthCARE will be added by revision of the Agreement pursuant to Article 33 when provisions of data becomes available

**5th GCOM 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, the Global Change Observation Mission ("GCOM") aims to construct, use, and verify systems that enable continuous global-scale observations of effective geophysical parameters for clarifying global climate change and water circulation mechanisms;

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 GCOM, 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 GCOM ("Application").
- (4) "Research Period" means a period described in the Collaborative Research Plan. Based on the regulations of this Agreement, in case this Agreement is terminated before the completion date of the Research Period, such date of termination of the Agreement shall be the final date of the Research Period.
- (5) "Annual Evaluation" means evaluation by JAXA for the results achieved within the year in which this Agreement was concluded. JAXA evaluates the results by reports presented at the research presentation meeting by the Research Organization and Research Results Report (as defined below).
- (6) "Earth Observation Satellite Data" means data sets obtained from satellites which are retained by JAXA at the time of execution of this Agreement. The available data sets (including names of satellites, sensors, observation period that can be offered, and observation areas) are listed in Attachment A of this Agreement.
- (7) "Meteorological Data" means data sets provided by the Japan Meteorological Agency pursuant to the agreement between JAXA and the Japan Meteorological Agency.
2. In this Agreement, "Invention, etc." means an invention in terms of a subject of patent rights, a utility model in terms of a subject of utility model rights, a creation in terms of a subject of copyrights such as design rights and programs, and ideas in terms of a subject of algorithm and know-how.
3. In this Agreement, "utilization" of the intellectual property rights and Research Results means act defined in Article 2, Paragraph 3 of the Patent Act, act defined in Article 2, Paragraph 3 of the Utility Model Act, act defined in Article 2, Paragraph 3 of the Design Act, enforcement of right defined in Articles 21 and 27 of Copyright Act (including utilization of secondary work created by JAXA or the Research Organization), and use of algorithm and know-how.
4. In this Agreement, "Principal Investigator" ("PI") means the Research Organization employee who submitted the proposal in response to the RA and was selected to be responsible for the Research Projects. "Co-Investigator" ("CI") means a person who supports the PI in performing the Research Projects with approval by JAXA. Names, affiliation, and other information concerning PI and CI (collectively "Collaborative Researchers") shall be described on the Collaborative Research Plan.

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

1. JAXA shall make reasonable efforts to perform the following tasks related to the Research Projects:
 - a) Deliver the Earth Observation Satellite Data and Meteorological Data required for performing the Collaborative Research to the Research Organization free of charge;
 - b) Hold research presentation meetings for checking progress of the research and other necessary meetings;
 - c) Evaluate the Research Result Report submitted at the end of fiscal year for the Annual Evaluation.
2. For the purpose of ensuring the Research Organization's performance of the above

obligations, the Research Organization shall perform certain actions including, but not limited to:

- a) The Research Organization shall conduct and complete the Research Projects in accordance with the Collaborative Research Plan.
- b) Participate in necessary workshops and meetings for the Research Projects such as the research presentation meeting hosted by JAXA at the end of the fiscal year;
- c) Participate in the research presentation meeting hosted by JAXA every year to report on the the Research Results and progress of research to JAXA; and
- d) Deliver the reports as a report of all the Research Results obtained during the fiscal year by the end of such fiscal year to JAXA. Furthermore, at the completion of the research period, the Research Organization shall report all the Research Results obtained throughout the entire period of the Collaborative Research in the Final Report and submit it to JAXA. In this case, the Research Organization does not need to separately submit an annual report for the final year of the term.

Article 3. Finalization and Renewal of the Contract

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

Article 4. Researchers

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

Article 5. Subcontract

1. The Research Organization shall not re-commission the whole Research Projects to a third party ("Subcontract"). Provided, however, that the Research Organization may re-commission part of it upon a written prior application to JAXA and a prior

written approval of JAXA. Should there be a case where subcontractors re-commission part of the Research Projects to a third party, the company name, address and scope of business of such third party are required to be submitted to the Research Organization in writing.

2. If the Research Organization re-commissions the Research Projects to a third party at any tier (contractor or subcontractor, including any company of any stage of the Projects in connection with the subcontract) of the Research Organization, act of such subcontractor, or, any act of such third party in connection with the subcontract shall be deemed to be an act of the Research Organization and the Research Organization shall be fully responsible therefor.
3. If the Research Organization re-commissions part of the Research Projects to a third party, the Research Organization shall conclude an agreement with the subcontractor on issues necessary for the Research Organization to comply with the Agreement and on issues designated by JAXA.

Article 6. Research Funding

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

Article 7. Submission of Financial Statement

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

Article 8. Determination of Contract Amount

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

Article 9. Checking of Funding Spent

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

Article 10. Refund

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

Article 11. Ownership of the Rights to the Acquired Equipments

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

Article 12. Providing of Earth Observation Satellite Data by JAXA

1. JAXA will provide the Research Organization with the Earth Observation Satellite Data for the Research Projects free of charge in accordance with Article 2, Paragraph 1, Item 2 subject to the following conditions:
 - a) The Research Organization agrees and accepts that JAXA may not provide all the Earth Observation Satellite Data which the Research Organization may request due to restrictions in the allowance range of JAXA's equipment and in resources.
Note that the Advance Land Observing Satellite data, which is one portion of the Earth Observation Satellite Data required by the Research Organization and is to be provided to the Research Organization, shall be limited to ten scenes every fiscal year;

- b) JAXA does not guarantee a specific quality or the timely provisions of the Earth Observation Satellite Data and does not take responsibility for quality and delay of provisions of such data; and
 - c) JAXA reserves the right to curtail or suspend Earth Observation Satellite Data supply to the Research Organization due to faults or difficulties relating to the satellites, limitations on their operations, or any other reasons and JAXA shall be exempt from any responsibility for such curtailing and for suspension
2. With respect to the Earth Observation Satellite Data provided by JAXA, the Research Organization shall:
 - a) Not duplicate the Earth Observation Satellite Data except for the purpose of backup. However, this excludes duplication for distributing to authorized Collaborative Researchers stipulated in Article 4 and subcontractors stipulated in Article 5 (“PIs, etc.” collectively) which are necessary for the Collaborative Research Project.
 - b) Not provide or disclose the Earth Observation Satellite Data which can be converted back to the primary Earth Observation Satellite Data except to PI;
 - c) Only use the Earth Observation Satellite Data for the singular purpose of advancing the efforts of the Research Projects; and
 - d) Return or otherwise appropriately manage the Earth Observation Satellite Data upon completion of this Agreement, according to the directives of JAXA.
 3. Any rights regarding the Earth Observation Satellite Data provided by JAXA shall conform to the following:
 - a) Any rights relating to the Earth Observation Satellite Data provided by JAXA to the Research Organization shall not be transferred to the Research Organization by such provisions. In terms of the intellectual property rights of the data, the Research Organization shall follow instructions of JAXA.
 - b) Regardless of the preceding paragraphs, if value-added products, which refers to highly processed products (data analysis or a combination of satellite data acquired by different missions, image processing based on external information other than the original data, conversion to physical quantities, and so forth.) that are irreversible to the primary Earth Observation Satellite Data, are developed by Research Organization in the course of executing the Agreement, Research Organization retains the intellectual property rights of such value-added products, if RO’s copyright in such value-added products are acknowledged..

Article 13. Providing of Meteorological Data by JAXA

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

Article 14. Disclosure of Technical Data

1. To the extent feasible, each party shall disclose and allow use of all necessary technical information, programs, etc. ("Technical Data"), which does not include the Earth Observation Satellite Data and the Meteorological Data, necessary for performing the Collaborative Research free of charge. The Parties will undertake to handle expeditiously any request for the Technical Data presented by the other party.
2. The Technical Data shall be used by the receiving party only for the purpose of fulfilling the receiving party's responsibilities under this Agreement and shall not be disclosed to any third party except for PIs, etc.
3. According to directives of the furnishing party, the receiving party shall return or otherwise dispose of Technical Data provided under the Agreement upon completion of the activities under the Agreement.

Article 15. Usage of Research Results

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

Article 16. Ownership of Research Results

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

Article 17. Application etc. of Intellectual Property Rights

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

resulting Intellectual Property Rights as solely-owned ones, provided that it shall obtain prior confirmation of the other party. In this case, expenses for application and rights preservation shall be borne by the party solely holding the Intellectual Property Rights.

4. In the event that the Parties jointly generate an invention etc., and submit an application for Intellectual Property Rights to such invention, the Parties shall enter into a separate joint ownership agreement ("Joint Ownership Agreement") and jointly perform submission of the application and other procedures according to the Joint Ownership Agreement. In this case, expenses for application and rights preservation shall be borne by the both JAXA and the Research Organization depending on the degree of ownership.

Article 18. Application of Intellectual Property Rights Overseas

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

Article 19. Utilization of Jointly-Owned Intellectual Property Rights

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

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

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

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

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

notice thereof and transfer its interests to the other party, only if the other party wishes to acquire it.

Article 22. Improved Invention

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

Article 23. Designation of Know-How

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

Article 24. Utilization of Facilities, etc.

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

Article 25. Installation of Equipment

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

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

1. The Parties may lend machinery or other material to the other party if it is required for implementation of the Research Projects.
2. Upon delivery of the machinery or other material ("Lent Equipment") lent in accordance with the previous Paragraph, owner of the Lent Equipment ("Lessor") shall submit the other party a Note of Delivery and the other party shall submit the Lessor a receipt.
3. The Parties shall confirm items, amount, etc. of the Lent Equipment upon delivery

of the Lent Equipment and if there is a shortage in the amount or any defect (including ones whose quality and/or specification does not meet the requirement), JAXA or the Research Organization shall notify such fact to the Lessor and receive an instruction from the Lessor.

4. JAXA and the Research Organization shall manage and use the Lent Equipment with the care of a good manager and should not use the Lent Equipment for the purposes other than the Research Projects.
5. JAXA and the Research Organization shall keep the record of usage and management of the Lent Equipment to record delivery, usage, and returning of the Lent Equipment for the purpose of clarifying the condition of the Lent Equipment.
6. In the case of loss or damage to the Lent Equipment, JAXA and the Research Organization shall immediately notify the fact to the Lessor without delay.
7. The party shall notify the Lessor if any of the Lent Equipment becomes unnecessary due to the reasons such as completion, change, or termination of whole or part of the Research Projects and shall take returning procedures according to the instruction from the Lessor.

Article 27. Confidentiality

1. In this Agreement, "Confidential Information" means any information that corresponds to any of the following:
 - (1) Any information that includes documents classified "Confidential", any material object such as a sample, or any information, either material or immaterial, which JAXA and the Research Organization agreed to handle as the Confidential Information by a written agreement, obtained in the course of these Research Projects; and
 - (2) Any information disclosed or distributed to the other party as Confidential Information in the form of a document, a drawing, a photograph, a specimen, a sample, a magnetic tape, a floppy disk, or the like for the purpose of the Research Projects.
2. The Parties shall appropriately keep the Confidential Information secret, and shall not disclose or divulge any Confidential Information to any party other than those who engage in the Research Projects; provided, however, that any information which corresponds to any of the following is not included in the Confidential Information.
 - a) Information that is already known to the public when disclosed by the disclosing party;
 - b) Information that becomes known to the public after the disclosure by the disclosing party without intentional misconduct or negligence of the receiving party;
 - c) Information that the receiving party already had before the disclosure by the disclosing party;
 - d) Information that the receiving party acquires from a 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 28. Publication of Research Results

1. The Parties may disclose or publish the Research Results obtained in the course of the Research Projects (Publication of Research Results”) provided that such publishing party follows the obligations stipulated in Article 27.
2. In the case of the previous Paragraph, before publishing, JAXA or the Research Organization (“the publishing party”) shall provide the other party with a written document regarding the description of the subjected Research Results to be published and request a written consent of the other party. The other party will not unreasonably withhold consent from the publishing party's request for such publication.
3. The other party, upon receiving the notice, will request correction of the content of the publication in a written form if it is judged that such content includes a portion which may lead to the loss of the future interest of the other party and the publishing party shall consult with the other party about such portion. The publishing party may not publish the portion which the other party notified as having possibility of resulting in the loss of the future interest of the other party without consent of the other party.
4. The Research Organization shall state in the publication that such Research Results have been obtained pursuant to this Agreement and identify the owner of the rights to the Earth Observation Satellite Data and Meteorological Data used in such publication.
5. The period during which the notification pursuant to Paragraph 2 is required shall be one (1) year from the day following the day of termination of the Agreement. However this period may be extended or shortened by mutual agreement between JAXA and the Research Organization.
6. JAXA and the Research Organization shall provide the other party with a copy of the publication immediately after the disclosure or publishing of such publication. Each party is entitled to an irrevocable and royalty-free right to use the provided publications, unless the copyright of such publication is owned or held by an academic society.

Article 29. Security

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

Article 30. Termination of the Contract

1. The Parties may terminate the Agreement in any case that corresponds to any one of the following. In such a case, the Parties agree to waive any claim against the other.
 - (1) Upon the consent of both JAXA and the Research Organization;
 - (2) When the other party commits a dishonest and/or inequitable act; provided, that breaching party fails to offer any effective and satisfactory remedial measures within seven (7) days after receiving demands for corrective action from the harmed party;
 - (3) When the other party breaches the Agreement; provided, that breaching party fails to offer any effective and satisfactory remedial measures within seven (7) days after receiving demands for corrective action from the harmed party;
 - (4) When the Research Organization loses a person who engages in the Research Projects due to the reasons described in Paragraph 5 of Article 4 such as transfer of

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

Article 31. Effective Term

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

Article 32. 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 33. Governing Law

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

Article 34. Language

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

Article 35. 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)	2006/05/16~2011/04/22	Global
GCOM-W1 (The Global Change Observation Mission 1st-Water)	2012 Fiscal Year~	Global
TRMM (Tropical Rainfall Measuring Mission)	1997/12~	Global (PR: Approximately 36°S-36°N. TMI and VIRS: Approximately 38°S-38°N)
AMSR-E (Advanced Microwave Scanning Radiometer for EOS-Aqua satellite)	2002/06/19~2011/10/04	Global
GOSAT (Greenhouse Gases Observing Satellite)	2009/04/23~	Global

* GCOM-C1, ALOS-2, GPM and EarthCARE will be added by revision of the Agreement pursuant to Article 33 when provisions of data becomes available

**5th GCOM 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, the Global Change Observation Mission ("GCOM") aims to construct, use, and verify systems that enable continuous global-scale observations of effective geophysical parameters for clarifying global climate change and water circulation mechanisms;

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 GCOM, 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 GCOM ("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

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

Article 4. Researchers

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

Article 5. Research Funding

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

Article 6. Ownership of the Rights to the Acquired Equipment

Equipment acquired by each party in the course of the Research Projects shall be owned by the party who purchased such equipment.

Article 7. Providing of Earth Observation Satellite Data by JAXA

1. JAXA will provide the Research Organization with the Earth Observation Satellite Data for the Research Projects free of charge in accordance with Article 2, Paragraph 1, a) subject to the following conditions:
 - a) The Research Organization agrees and accepts that JAXA may not provide all the Earth Observation Satellite Data which the Research Organization may request due to rights restrictions of JAXA's equipment and resource limitations.
Note that the Advanced Land Observing Satellite data, which is one portion of the Earth Observation Satellite Data required by the Research Organization and to be provided to the Research Organization, shall be limited to ten scenes every fiscal year;
 - b) JAXA does not guarantee a specific quality or the timely provision of the Earth Observation Satellite Data and does not take responsibility for the quality or any delay of provision of such data; and
 - c) JAXA reserves the right to curtail or suspend Earth Observation Satellite Data supply to the Research Organization due to faults or difficulties relating to the satellites, limitations on their operations, or any other reasons, and JAXA shall be exempt from any responsibility for such curtailing or suspension.
2. With respect to the Earth Observation Satellite Data provided by JAXA, the Research Organization shall:
 - a) Not duplicate the Earth Observation Satellite Data except for the purpose of backup. However, this excludes duplication for distributing to authorized researchers engaged in the Research Project as stipulated in Article 4 and subcontractors stipulated in Article 4 ("Collaborative Researchers" collectively) which are necessary for the Collaborative Research Project.
 - b) Not provide or disclose the Earth Observation Satellite Data which can be converted back to the primary Earth Observation Satellite Data except to the PI;
 - c) Only use the Earth Observation Satellite Data for the singular purpose of advancing the efforts of the Research Projects; and
 - d) Return or otherwise appropriately manage the Earth Observation Satellite Data upon completion of this Agreement, according to the directives of JAXA.
3. Any rights regarding the Earth Observation Satellite Data provided by JAXA shall conform to the following:
 - a) Any rights relating to the Earth Observation Satellite Data provided by JAXA to the Research Organization shall not be transferred to the Research Organization by such provisions. In terms of the intellectual property rights of the data, the Research Organization shall follow instructions of JAXA.
 - b) Regardless of the preceding paragraphs, if value-added products, which refers to highly processed products (data analysis or a combination of satellite data acquired by different missions, image processing based on external information other than the original data, conversion to physical quantities, and so forth.) that are irreversible to the primary Earth Observation Satellite Data, are developed by Research Organization in the course of executing the Agreement, Research Organization retains the intellectual property rights of such value-added products, if RO's copyright in such value-added products are acknowledged.

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)	2006/05/16~2011/04/22	Global
GCOM-W1 (The Global Change Observation Mission 1st-Water)	2012 Fiscal Year~	Global
TRMM (Tropical Rainfall Measuring Mission)	1997/12~	Global (PR: Approximately 36°S-36°N. TMI and VIRS: Approximately 38°S-38°N)
AMSR-E (Advanced Microwave Scanning Radiometer for EOS-Aqua satellite)	2002/06/19~2011/10/04	Global
GOSAT (Greenhouse Gases Observing Satellite)	2009/04/23~	Global

* GCOM-C1, ALOS-2, GPM and EarthCARE will be added by revision of the Agreement pursuant to Article 33 when provisions of data becomes available