

**PRECIPITATION MEASURING  
MISSION SCIENCE:  
RESEARCH ANNOUNCEMENT**

**5<sup>th</sup> Tropical Rainfall Measuring Mission  
Research Opportunities**

**JAXA Research Announcement  
Soliciting Research Proposals  
for Period Ending:  
March 31, 2010**

**Issued: February 16, 2007**

**Proposals Due: April 13, 2007**

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

**JAXA RESEARCH ANNOUNCEMENT  
PRECIPITATION MEASURING MISSION SCIENCE:  
RESEARCH OPPORTUNITIES**

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# 1. INTRODUCTION

The Japan Aerospace Exploration Agency (JAXA) hereby announces the solicitation of research proposals to conduct scientific investigations in precipitation measuring mission science in connection with the Tropical Rainfall Measuring Mission (TRMM) satellite launched in November 1997. The mission objective of TRMM is to advance the understanding of global circulation of energy and water from observation of tropical and subtropical rain using TRMM sensors; the Precipitation Radar (PR), the TRMM Microwave Imager (TMI) and the Visible/Infrared Scanner (VIRS). To achieve the mission objective, algorithms to estimate rainfall have been developed and revised. The reprocessed datasets with the Version 6 algorithms have been available. Aside from the algorithms, various researches on climate have been performed, including the trend analysis and precipitation statistics. TRMM demonstrated the world first space-borne precipitation radar technology and yielded many interesting scientific results. Some of the examples are; i) accurate observation of rain distribution in tropical and sub-tropical regions, ii) diurnal, annual, and long-term variations of precipitation, 3-dimensional rain structure, iii) accurate rain observation over ocean and land in equal quality, iv) improvement in weather forecasting with 4-D data assimilation, v) sea surface temperature estimation under clouds, and vi) estimation of soil moisture.

Since the lifetime of the TRMM satellite, estimated from the fuel consumption rate, would be up to 2013, it is expected that further useful data will be accumulated, particularly for studies in climate and precipitation characteristics.

JAXA is therefore soliciting research proposals to promote utilization of the TRMM data for understanding the distribution and variation of tropical/extratropical rainfall and applying them to new scientific areas. Proposals are sought for new or continuing research associated with TRMM, including advanced utilization of PR/TMI and/or other satellite data for Global Precipitation Measurement (GPM). This opportunity, which follows the fourth TRMM RA in 2004, is intended to support subsequent science investigations for the three-year period beginning in early JFY2007. Please note that any standard algorithm-related proposals are not covered in this Research Announcement (RA). JAXA will prioritize budget allocation in areas necessary to accomplish the mission objective of TRMM. Though there are 19 Principal Investigators (PIs), whom JAXA funded under the current RA, JAXA will spend approximately 15 million yen during the fiscal year 2007 for proposed activities of about 10 PIs under the new RA. It should be noted that the budget allocated for the new PIs' activities after fiscal year 2007 may change depending on the budget situation of JAXA. JAXA may select non-funded PIs, if the proposals are not highly relevant to the mission objectives.

Participation in this program is open to all categories of domestic and foreign organizations, including educational institutions (except for students), industry, non-profit institutions, and Japanese Government agencies. In accordance with JAXA policy, all investigations by foreign participants will be conducted without any exchange of funds, that is, investigators whose home institutions are outside Japan will not be funded by JAXA. Proposals may be submitted at any time until April 13, 2007. JAXA reserves the right to consider proposals received after that date if these are in accordance with section 3-7, that is, "the selecting official deems the late proposals to offer significant scientific and/or technical advantage or cost reduction." Proposals submitted to JAXA will be evaluated through a scientific peer review. Selection is expected to be announced in May 2007.

## **2. TECHNICAL DESCRIPTIONS**

The first and second Research Announcements (RAs) focused mainly on “Algorithm Development” and “Calibration and Validation” for the Precipitation Radar (PR). The third RA was on sophisticated algorithm developments and modeling/data analysis. In the fourth RA, we broadened the research areas to explore new scientific and public applications.

Now in the fifth RA, we focus on the following research areas.

### **(1) Research to contribute to understand climate change and global water cycle**

It is very important to understand the global water cycle and its variation, by, for example, mapping of rainfall climatology, validation of global model, or analyzing variability of global rainfall distribution.

### **(2) Synergy of TRMM and other satellite data**

Not only TRMM data but also other satellite data are utilized to study precipitation related research. For example, the study on flood management, which is the cooperative research theme between JAXA and Public Works Research Institute, is to verify the feasibility of flood prediction by multi-satellite rainfall products.

### **(3) Advanced utilization of TRMM/PR data for GPM**

This RA strongly encourages to develop research algorithms, which may help GPM/DPR algorithm development. These include an algorithm for PR/TMI consensus/unified precipitation estimation in order to facilitate the development of high temporal frequency rainfall products by multi-satellite utilization.

### **(4) Climatological research using long-period TRMM data**

More than nine years of TRMM data have now been accumulated. There are many interesting research topic, that can be done with such a long-period of data. These include, for example, studies on error characteristics of rain estimation, trend analysis, analysis of extreme events (rare case but strong impact to our lives), diurnal variation mechanism, effect of the boost, precipitation systems in El Niño/La Niña regimes relationship and PR/TMI rainfall estimation difference between precipitation system.

### **(5) Research for operational purposes**

The Japan Meteorological Agency has utilized the TRMM data for operational weather forecast since 2003 after evaluation of the data quality. Although JAXA selects PIs for research in this RA, JAXA always appreciate the technological transfer from research to operation through verification as quickly and seamlessly as possible. These may include applications for disaster mitigation (typhoon, flood).

The proposer should keep in mind that JAXA is not a general funding body for the scientific community. This RA seeks to accomplish TRMM’s goal and to expand new utilization of TRMM data. The proposal should describe plans for TRMM data usage well.

### **3. INSTRUCTIONS FOR RESPONDING TO JAXA RESEARCH ANNOUNCEMENT**

#### **3.1 Proposal Contents**

Investigators responding to this research announcement must provide the information below to JAXA for evaluation. Further detailed information and the forms are provided in section 4.

- (1) Proposal Cover Sheet
- (2) Abstract
- (3) Project Description
- (4) Management Approach
- (5) Personnel
- (6) Resource Requirements

Proposals should be as brief as possible and concentrate on substantive material. The main body of the Proposals, Project Descriptions, should not exceed 20 pages in length. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal.

#### **3.2 Selection**

Selection decisions will be made following peer and/or scientific review of the proposals. A peer review will be carried out by selected external discipline specialists in the area of the proposal. A selection committee will then be assembled in JAXA and will evaluate the proposals. The final decisions are made by a JAXA selecting official. 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 or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.
- (2) Offerer's capabilities, related experience, facilities, techniques, or unique combinations of these that are integral factors for achieving the proposal objectives.
- (3) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.
- (4) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

#### **3.3 Resources**

JAXA will reserve funds to support selected proposals conducted by Principal Investigators (PIs) whose home institutions are in Japan, subject to availability of funds.

Data sets necessary for enhancing TRMM research and owned by JAXA will basically be provided free of charge. Provision of data sets that JAXA has no authority to disclose will be discussed separately. The following policy shall be observed by participants for using satellite, in-situ and other data sets.

- (1) Data sets shall be used only for research purposes that are proposed and selected under this RA.
- (2) Data sets shall not be disclosed to a third party or parties.

Investigators must provide information on desired resources as part of their proposals in accordance with the forms in section 4.

### **3.4 Research agreement conclusion**

A contract or cooperative agreement will be made between each PI's organization and JAXA. Please note that PIs with funding need to conclude a research agreement every Japanese fiscal year. If a PI needs a Co-Investigator (CI) for research, the PI should specify the name of the CI in the contract. JAXA will not make a contract or cooperative agreement with a CI. The PI and the PI's organization will be responsible for managing and distributing data.

### **3.5 Report to JAXA**

PI has an obligation to report both interim and final report to JAXA.

#### **3.5.1 Interim Report**

Before the end of fiscal year PI is required to submit interim report to JAXA. The interim report covers the research activity and status in the project done during the fiscal year. PI is also required to present the status report at the interim report conference.

#### **3.5.2 Final Report**

PI is required to submit a final report to JAXA in the last fiscal year of the 3-year period.

### **3.6 Utilization of Results**

#### **3.6.1 Usage of results**

JAXA shall retain an irrevocable and royalty-free right to use, without prior consent of PI, any provided research results through these research activities for its own purposes excluding commercial purposes.

#### **3.6.2 Publication of Results**

Results derived from research activities shall generally be published.

A PI who wishes to release his or her research results to a third party organization shall

- (1) Provide JAXA with a copy of the publication before release.
- (2) State in the publication that he or she obtained the results through participating in the Precipitation RA research.
- (3) Not disclose inventions in a publication before patent application without the prior written consent of JAXA.
- (4) Grant JAXA an irrevocable and royalty-free right to use, edit, copy, or distribute the provided publications, unless an academic society responsible for its publication requires the PI to transfer the copyright to it.

### **3.7 Late Proposals**

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

### **3.8 Schedule**

FEBRUARY 16, 2007	Issue this research announcement
APRIL 13, 2007	Due date for research PROPOSAL
MAY, 2007	Announcement of selection

## **4. INSTRUCTIONS FOR PROPOSAL CONTENTS**

### **4.1 Language**

Proposals shall be written in English.

### **4.2 Proposal Cover Sheet**

Please fill out Form 1 according to the following instructions.

- (1) Title. A brief and scientifically valid project title.
- (2) Principal Investigator's Information. PI's legal name, title, department, name of organization, address, phone number, facsimile number and E-mail address.
- (3) Co-Investigator's Information. Name, organization, phone number and E-mail address.
- (4) Budget. 3-year budget broken down by year and 3-year total amount in Japanese yen (from JFY 2007 through JFY 2009).
- (5) Authorization. Signature of a responsible official or authorized representative of the proposing organization, or any other person authorized to legally bind the organization.

### **4.3 Abstract**

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

### **4.4 Project Descriptions**

This part is the main body of the proposal and should not exceed 20 pages in length.

- (1) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected 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 experimental 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.
- (2) When effort is expected to require more than one year for completion, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should, of course, be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.
- (3) Provide the project schedule in Form 2. Include a description of the major activities of the project and their associated schedule.

### **4.5 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.

### **4.6 Personnel**

The Principal Investigator is responsible for supervising of the work and participates in the research. A short biographical sketch of the principal investigator as well as a list of principal publications and any exceptional qualifications should be included. Give similar biographical information for other senior professional personnel who will be directly associated with the project.

## **4.7 Resource Requirements**

Information of required resources will be considered during the selection process. After deciding the total amount of funding for each PI, JAXA will send more detailed forms for resource requirements to selected PIs. Before beginning the second and third years, JAXA will send the same forms for resource requirements again.

### **4.7.1 Instructions for Budget Summary (Form 3)**

Provide a budget summary by cost elements (Personnel Expenses, Computers/Peripheral equipments, Subcontracts, Expendable Materials and Supplies, Travel Expenses, Observation Equipments, 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 of Form 1.

#### **(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 equipments/Software**

Enter the lease and rental cost of computers and/or peripheral equipment. Note that JAXA has the right to change specification of all equipment. Also enter the cost of software here.

#### **(3) Subcontracts**

Provide the cost of subcontracts to outside companies or organizations here.

#### **(4) Expendable Materials and Supplies**

Enter the quantity of each item, following the example.

#### **(5) Travel Expenses**

Describe the proposed domestic and/or international travels including, information on destination and number of days/number of travelers.

#### **(6) Observation Equipments**

Enter costs of observation equipment including installation cost.

#### **(7) Satellite Data**

Investigators requesting satellite data other than JAXA-owned/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.



#### **4.7.2 Instructions for Data requirements (Form 4)**

JAXA owns satellite data including TRMM data, other satellite data listed below, and some ground validation data. JAXA also archives meteorological data provided by the Japan Meteorological Agency (JMA) for TRMM research. JAXA will provide requested data judged necessary for proposed research, subject to availability of data processing.

##### **(1) JAXA-Owned Satellite Data Sets (Form 4-1)**

In addition to TRMM data, JAXA has the authority to provide data sets that are received from:

- Marine Observation Satellite (MOS) (only around Japan)
- LANDSAT (only around Japan)
- SPOT (only around Japan, available until JFY2001)
- European Remote-sensing Satellite (ERS)-1, 2 (only around Japan, for Japanese researchers only, available until JFY2002)
- Japanese Earth Resources Satellite (JERS)-1 (global)
- 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) (TBD 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/index.html>).

To request these satellite data sets, complete Form 4-1.

##### **(2) JAXA-owned TRMM related Ground Validation data (Form 4-2)**

JAXA archives the following X-band Doppler radar data (JAXA data).

- GAME IOP on the Tibetan plateau
- IMCET'99 (May 15 -June 7, 1999) in Okinawa
- X-BAIU in Sendai/Kagoshima in June and July 1999, 2001 and 2002
- Tanegashima from September 1999 to the end of year 2002
- Obama/Fukui in February 2001 (snow data)

##### **(3) JAXA-archived TRMM related JMA data (Form 4-3)**

JAXA archives the following meteorological data that overlaps TRMM observation period and are provided by the Japan Meteorological Agency (JMA) based on an agreement on TRMM data utilization and processing technology between JMA and JAXA.

- Global analysis data
- Decoded data
- Buoy data
- AMeDAS 10-minute rain gauge data
- Raw radar data from the following sites.
  - Mt.Fuji, Kurumayama, Makinohara, Nagoya, Okinawa, Tanegasima, Naze,
  - Ishigaki-jima, Muroto, Fukuoka, Matsue, Hirosima, Osaka, Tokyo, Fukui
- Radar-AMeDAS rainfall analysis data

Proposal Cover Sheet  
JAXA TRMM Research Announcement

<b>Proposal No.</b>	_____ (Leave Blank for JAXA Use)
<b>Title</b>	

**Principal Investigator**

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

**Co - Investigator**

Name	Institution	Telephone	E-mail

**Budget (thousand yen)**

JFY2007	JFY2008	JFY2009	TOTAL

(Leave Blank for JAXA Use)

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

**Research Schedule**

JFY	2007	2008	2009
Month	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3
Milestone			
Activities			

## BUDGET SUMMARY

**1. Personnel Expenses****Outside EORC** (unit: thousand yen)

	2007	2008	2009	TOTAL

**2. Computers / Peripheral Equipments****2.1 EORC Lease Workstation** Workstation**2.2 Peripherals / Software** (unit: thousand yen)

Peripherals / Software	2007	2008	2009	TOTAL

**3. Subcontracts**

(unit: thousand yen)

ITEMS	2007	2008	2009	TOTAL

**4. Expendable Materials and Supplies**

ITEMS (unit)	2007	2008	2009	TOTAL

**5. Travel Expenses** (unit: days / times)

Departure Point – Destination	2007	2008	2009

**6. Observation Equipments** (unit: thousand yen)

ITEMS	2007	2008	2009	Total

**7. Satellite Data** (unit: thousand yen)

Name of Satellite / Sensors	Distributor	Purpose	Cost			
			2007	2008	2009	TOTAL

**8. Other Data** (unit: thousand yen)

Name of Datasets	Distributor	Purpose	Cost			
			2007	2008	2009	TOTAL

**9. Others**

ITEMS	2007	2008	2009	TOTAL

TOTAL				
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## BUDGET SUMMARY

## 1. Personnel Expenses

**Outside EORC** (unit: thousand yen)

	2007	2008	2009	TOTAL
<i>Part-time job for DSD data analysis</i>	320 (40x8)	320 (40x8)	160 (20x8)	800 (100x8)

## 2. Computers / Peripheral Equipments

## 2.1 EORC Lease Workstation

 Workstation

## 2.2 Peripherals / Software (unit: thousand yen)

Peripherals / Software	2007	2008	2009	TOTAL
CD-RW Drive	50			50

## 3. Subcontracts

(unit: thousand yen)

ITEMS	2007	2008	2009	TOTAL
<i>Software development for DSD data analysis</i>	300	1,500	600	2,400

## 4. Expendable Materials and Supplies

ITEMS (unit)	2007	2008	2009	TOTAL
<i>8mm tape (112m)</i>	60	50	50	160
<i>CD-R</i>	100	100	120	320
<i>MO (640MB)</i>	10	15	10	35
<i>A4 Paper (package of 500 sheets)</i>	2	2	1	5

**5. Travel Expenses** (unit: days / times)

Departure Point – Destination	2007	2008	2009
<i>Tokyo - Washington, D.C.</i>	7/2	7/1	
<i>Tokyo - Paris</i>		5/1	8/1
<i>Tokyo - Paris</i>			6/1
<i>Tokyo - Osaka</i>	3/1		

**6. Observation Equipments** (unit: thousand yen)

ITEMS	2007	2008	2009	Total
<i>Micro Rain Radar</i>	1,500			1,500

**7. Satellite Data** (unit: thousand yen)

Name of Satellite / Sensors	Distributor	Purpose	Cost			
			2007	2008	2009	TOTAL

**8. Other Data** (unit: thousand yen)

Name of Datasets	Distributor	Purpose	Cost			
			2007	2008	2009	TOTAL

**9. Others**

ITEMS	2007	2008	2009	TOTAL

TOTAL	2,342	1,987	941	5,270
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## JAXA DATA REQUIREMENTS

### 1. JAXA-Archived Satellite Datasets

(ADEOS, JERS-1, ERS, MOS, SPOT, LANDSAT, Aqua, ADEOS-II, ALOS)

Data Search: Earth Observation Satellite Data Distribution Service (<http://www.eorc.jaxa.jp/en/index.html>).

Name of Satellite / Sensors	Quantity (scene)	Purpose

### 2. JAXA Owned Ground Validation Data

Name of Dataset	Observation Period	Purpose
<input type="checkbox"/> GAME Tibet		
<input type="checkbox"/> IMCET '98, '99		
<input type="checkbox"/> X-BAIU		
<input type="checkbox"/> Tanegashima		
<input type="checkbox"/> Obama/Fukui		

### 3. JAXA-Archived JMA Data at for TRMM Research

Name of Dataset	Observation Period	Purpose
<input type="checkbox"/> Global analysis data		
<input type="checkbox"/> Decorded data		
<input type="checkbox"/> BUOY data		
<input type="checkbox"/> AMeDAS 10minutes rain gauge		
<input type="checkbox"/> Radar data (Site: )		
<input type="checkbox"/> Radar AMeDAS rain analysis data		