

ANNOUNCEMENT OF OPPORTUNITY (AO):

**INNOVATIVE RESEARCH AND
DEVELOPMENT OF APPLICATIONS USING
RADARSAT-1 HURRICANE SAR DATA**

An Initiative Led by the

CANADIAN SPACE AGENCY (CSA)

In Cooperation with the

**CENTER FOR SOUTHEASTERN TROPICAL ADVANCED REMOTE SENSING
(CSTARS),**

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA),

And the

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)



Canadian Space
Agency

Agence spatiale
canadienne



**National Aeronautics
and Space Administration**

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1. INTRODUCTION

The Canadian Space Agency (CSA), in cooperation with the Center for Southeastern Tropical Advanced Remote Sensing (CSTARS), the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA), has agreed to launch an international Announcement of Opportunity (AO) for researching new developments in the application of RADARSAT-1 data and innovative mapping approaches to better understand the dynamics of hurricane* genesis, morphology, movement and the effect of wind on the sea surface.

Spaceborne C-Band SAR data is one of the few forms of information available that can actually image the hidden ocean surface details of an approaching hurricane. The eye of the hurricane and the surface impression that it causes, along with the rain bands are often quite apparent in the SAR imagery. The importance of the water/air interface zone has been long recognized as a determining factor gauging the strength and force of an approaching hurricane as it builds its momentum. However, obtaining actual data of this interface has been elusive. Although excellent imagery of the topside of hurricanes has been available for decades from NOAA, and more recently data through the vertical columns of the cloud mass, the complementary imagery of a hurricane's surface effects are rare.

The Canadian Space Agency Satellite Operations directorate has been collecting RADARSAT-1 data over hurricanes under the "Hurricane Watch" program since 1998. Over this period, 160 hurricane and typhoon images were selected and processed from this unique library focusing on the eye of the storm or edge of the eye from different parts of the world. Appendix A of this AO contains a small scale map with the approximate image centres indicated. CSA will make available to the international research community 160 pre-processed RADARSAT-1 imagery free of charge to encourage innovative new developments. CSTARS will be hosting the database on behalf of the Collaborators for the duration of the project.

This valuable dataset could afford researchers an opportunity to identify new approaches, applications and potential for studying hurricane dynamics. This new research will also help investigators become better prepared for using the more advanced data from missions like RADARSAT-2 and other international missions in the future.

This Announcement of Opportunity is open to the international research community.

** Read also Typhoon, Cyclone and Tropical Storm depending on the wind speed at the time of acquisition and the area covered by the images. To simplify the reading, only the term hurricane will be used.*

2. OBJECTIVES

2.1 Main Objective

The primary objective of this cooperative AO is to stimulate new innovative R & D using RADARSAT-1 data as the primary source for applications that will be useful for researching new developments and innovative mapping approaches to better understand the dynamics of hurricane genesis, morphology and movement.

2.2 Complementary Objectives

Complementary objectives to the AO include:

- The AO will help to foster focused international efforts for the improvement of hurricane monitoring methods;
- The identification of potential new methods and applications, users and markets for the specific monitoring approaches that may be applicable in different parts of the world. This initiative is intended to foster the development of new 'pathfinder' approaches and methods for the advancement of future directions for innovative products and solutions;
- Develop or improve methods and algorithms to extract wind speed and direction of surface wind fields from spaceborne SAR;
- Maximization of the RADARSAT-1 potential that will have further implications for missions like RADARSAT-2 and the ongoing utility of spaceborne SAR data in the hurricane context;
- Promotion of joint Canadian, US and international collaboration for the use of spaceborne technologies with a humanitarian priority;
- Encouragement of the intellectual and professional development of those who may be relatively inexperienced in the field of spaceborne SAR and to expand the body of expertise available to work with future generations of advanced space SAR systems.

3. AO PROJECT SCHEDULE

A preliminary schedule is shown below and may be modified based on further discussion.

<u>Milestone</u>	<u>Date</u>
• Preliminary AO release:	Feb 21/08
• AO release:	April 30/08
• Due date for Letters of Intent (revised):	July 25/08
• Responses to LOIs (revised):	Aug 08/08
• Due date for Full Proposals (revised):	Sept 26/08
• Proposal acceptances (revised):	Oct 31/08
• Mid-Term Reporting (revised):	Mar 27/09
• Final Reports (revised):	Aug 28/09
• Workshop (revised):	Fall /09

4. AO PROJECT ROLES, RELATIONSHIPS AND OBLIGATIONS

The program will be led by the CSA, in cooperation with the Center for Southeastern Tropical Advanced Remote Sensing (CSTARS), the National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration (NASA), which are collectively referred to as the "Collaborators", and in collaboration with the "Principal Investigator" (e.g., private sector, academic institutions, NGOs, government organizations, individuals). The roles and responsibilities of each of these parties are described in the following sections.

4.1 Collaborators

The Collaborators shall provide the following items to support approved projects:

- The provision of 160 pre-processed historical RADARSAT-1 hurricane "eye" (or "eye" edge) images acquired under the CSA Satellite Operations directorate Hurricane Watch program between 2001 and 2007 from different parts of the World. RADARSAT-1 pre-processed data will be made available for this opportunity through a website established at CSTARS (link in appendix A). All RADARSAT-1 data will be available in Level 0 (RAW product in CEOS format), Level 1 (SCW ScanSar Wide Swath product in CEOS format) and GEOTIF formats.. These datasets will be made available free of charge to the approved R&D projects;

- The provision of other complementary datasets, if available, for use in the research;
- Review advanced copies of papers/presentations prepared and submitted by Principal Investigator;
- The Collaborators will provide the above identified SAR data for use by the research community at no charge. No funds will be made available through this AO including support for attendance at the project workshop. It will be the responsibility of the researchers to secure funding for their activities through other sources.
- Coordination Services which will:
 - Provide Principal Investigator with information on the AO project and its guidelines during proposal submission and workshop preparations;
 - Provide coordination services for mid-term and final reporting;
 - Act as a liaison between the Principal Investigator and Collaborators;
 - Provide administrative support to the AO project including the coordination of data processing and delivery services by the Collaborators.

4.2 Principal Investigator

The Principal Investigator shall:

- Accept RADARSAT-1 data terms and conditions of utilization and diffusion with the CSA at the time of accessing the imagery from the CSTARS database website. A summary of the key points in "License Agreement" and the "Non Disclosure Certificate" is contained in Appendix C for your reference;
- Manage the project activities;
- Ensure their project has sufficient funding and resources to complete the planned research within the approved timeframe;
- Submit a brief mid-term report to the Collaborators on key milestones reached;
- Publish the results of the research project and appropriately acknowledge the program;
- Provide to the Collaborators advanced copies of papers/presentations;
- Submit to the Collaborators, in the form of a final report, a summary of the results and methodologies from the research activities;

- Planned attendance at workshop to present results;
- The analysis summaries and related images produced by the researchers and the information in the final reports, as well as the material from the workshop presentations, will be made available to the Collaborators for their promotional purposes without restriction. The Collaborators will acknowledge the Principal Investigator's materials when used.

5. LETTER OF INTENT AND PROPOSAL PREPARATION GUIDELINES

This section provides general guidelines for the preparation of the Letter of Intent and the proposal in response to the Announcement of Opportunity. In order to facilitate an equitable comparative analysis of proposals and to assist in their evaluation, proposals should strictly adhere to these guidelines.

Those wishing to apply to the AO project must complete a two-step process:

1. Submission of a 2 or 3 page Letter of Intent by July 25, 2008;
2. Based on the selection of projects from the Letters of Intent, submission of a proposal not to exceed 10 pages by September 26, 2008.

5.1 Eligibility

This AO is open to all research organizations, academic institutions, individuals and agencies throughout the world. The intent of the AO project is to encourage the R&D in development of applications and methods with an emphasis on hurricane dynamics and wind field extraction from SAR data. It may be used to further ongoing R&D projects or to begin new research initiatives.

5.2 General Guidelines

The following general guidelines provide information for responding to this AO.

- Letters of Intent on the Principal Investigator's letterhead must be submitted by July 25, 2008 **prior** to submission of proposals. The letter should be submitted by email. Guidelines for the Letter of Intent are contained in Appendix B;
- A review board composed by members of the Collaborators organizations, with the help of peer reviewers who represent SAR application specialists and scientists, will use the Letters of Intent as a preliminary review of the proposed project. If the proposed project fulfills the objectives of the AO, the Principal Investigator will be invited to submit a full proposal. The Collaborators do not guarantee that all submitted Letters of Intent will result in invitations to submit full proposals.

- Upon review of the Letters of Intent, the Collaborators will notify the successful Principal Investigator and invite them to prepare and submit proposals. Proposals should not exceed 10 pages in length (not including appendices). Accompanying material, such as resumes, should be included in the appendices to the proposals. Detailed instructions for the submission of proposals will be sent out to the accepted Principal Investigator by August 08, 2008. The proposals should be submitted in softcopy in MS Word, WordPerfect or PDF formats, to the CSA by September 26, 2008;
- The Collaborators may wish to select only a portion of a proposed project, in which case the Principal Investigator will be given the opportunity to accept or decline such a partial approval.
- The Collaborators may ask a Principal Investigator to revise and re-submit a proposal or may suggest possible teaming arrangements with other Principal Investigator, and will give proper notice and consideration in such cases.
- Only the accepted proposals will be provided access to the RADARSAT-1 Hurricane dataset;
- Since this is a joint collaborative initiative between the CSA, CSTARS, NOAA and NASA, the submission of the Letters of Intent and the subsequent proposals are preferred to be in English. However, submissions in French will also be acceptable.

5.3 Letter of Intent

The Letter of Intent will be used by the Collaborators to complete a preliminary review of the type of research being proposed. The AO project will target areas that have a demonstrated high potential for innovation and research interest related to the use of RADARSAT-1 data for hurricane applications. The Letter of Intent should address these requirements.

The Collaborators will review the Letters of Intent and provide feedback to the Principal Investigator. **After a positive acceptance of a Letter of Intent, Principal Investigator will be invited to submit a short (10 page) proposal to the Collaborators.**

The Letter of Intent should be submitted to the CSA by email and should include the information outlined in Appendix B. The information provided in the Letter of Intent will correspond directly to the evaluation criteria listed under Section 6.2 of this AO

The deadline for the submission of a Letter of Intent is July 25, 2008. If you require more time, please send an email requesting an extension. The Letter of Intent is to be submitted to the CSA who is managing the competition process. For more information or to submit your Letter of Intent, please contact :

Mr. Steve Iris
Earth Observation Applications Development Program
Space Technologies
Canadian Space Agency
6767 Route de l'Aéroport
St. Hubert, Quebec
Canada
J3Y 8Y9

Tel.: (450) 926-4439
Email: Steve.Iris@space.gc.ca

5.4 Proposal Structure and Content Requirements

At this stage proposals are not due and will be based on the selection of the submitted LOIs. In the meantime, the following guidelines have been summarized here for reference purposes. Proposals will be submitted in softcopy to the CSA. Proposals are expected to be concise with the main body of the proposal not to exceed 10 pages (excluding appendices) in length; supporting material, such as resumes, should be included in an appendix. Evaluation criteria to be used by the reviewers have been summarized in Section 6.2 below. The following topics in the proposals should be addressed:

A) Project Objectives:

This section should provide a concise statement of the objectives of the project with an explanation regarding how the project satisfies the AO goals.

B) Methodology

This section should provide a description of the approach and methodology to be used to fulfill the project and AO project objectives. It will include a listing and description of tasks to be executed and the overall methodology.

An assessment of the project's technical challenges should be presented. The major assumptions upon which the project is based as well as possible contingency plans or alternatives should be provided.

The technical proposal should also acknowledge the availability or access to equipment and facilities to support the methodology.

C) Project Organization and Management

This section should summarize the project team and organization for the work described in the technical proposal, including identification of the project lead.

The project team members and their associated capabilities should be briefly described with respect to their contribution to the AO project objectives. Resumes should be included in an appendix to the proposal.

D) Project Schedule

The proposal will include a schedule for the achievement of the tasks, keeping in mind the key milestones identified in Section 3 of this AO.

E) Endorsement

A description of Principal Investigator commitment and project team members, Collaborators, consultants, sub-contractors and end user contact information should be included. This should affirm the interest and commitment of that individual / organization to the project.

F) Area of Interest

The Principal Investigator should specify the general geographic area or region of primary interest, such as the Atlantic, Caribbean, Pacific or Indian Oceans. If it is possible to be more precise, please indicate the specific area.

G) Expected Results

Although this is a research program where the results may vary from expectations, it would be useful to anticipate the expected results and to briefly describe them.

H) Outputs and Deliverables

A description of the output products and related deliverables should be included in the proposal based on the research activities to be undertaken in the course of the project.

6. PROJECT SELECTION AND IMPLEMENTATION

6.1 Selection Procedures

A review board composed by members of the Collaborators organizations,, with the help of peer reviewers who represent SAR application specialists and scientists, will review the LoI's and proposals received in response to this AO. The purpose of the review is to evaluate the application and technical merits of the proposed projects in relation to the objectives of the AO project. They will provide comments and advice on the feasibility of the approach, work plans and the technical merit of the ideas.

Final decisions concerning the acceptance of individual proposals will be made by the CSA in concert with the other Collaborators. Accepted proposals will be awarded access to the RADARSAT-1 Hurricane dataset.

6.2 Evaluation Criteria

The proposal should demonstrate:

- An understanding of SAR technologies and how RADARSAT-1 data may provide a technological advantage to the application;
- Understanding and access to SAR analysis tools to be used in the course of the research;
- Potential benefits of the application and the applicability of the output products towards future operational activities;
- A work plan for R&D activities and an indication of the potential utility of the resulting information;
- Willingness to publish project results and to make available the reports and presentation material available to the Collaborators for their promotional purposes;

These criteria will be used to evaluate the information and material as presented in the proposals for the topics described above in section 5.4.

Even though the focus of this AO is mainly on R&D projects, end-user organization involvement would be viewed favorably within the scope of the project.

6.3 Implementation of Successful Proposals

Following notification of selection of the successful proposals, the project Principal Investigators will be given access to the pre-processed RADARSAT-1 hurricane dataset. Prior to accessing the data, the Principal Investigators will have to indicate acceptance of the Agreement for RADARSAT-1 Data Usage (see Appendix C).

7. AO PROJECT ASSUMPTIONS AND LIMITATIONS

7.1 Termination of AO Project

The Collaborators reserve the right to cancel all or part of the AO project at any time without any liability whatsoever.

7.2 Competitive Award

The pre-processed RADARSAT-1 dataset will be provided to projects that are selected on a competitive basis. Acceptance of a Letter of Intent will allow for the submission of a proposal. Submission of a proposal does not guarantee its acceptance.

7.3 Data Suitability

The Collaborators do not warrant the suitability of the RADARSAT-1 or other data for any specific application. The Collaborators do not warrant that (i) the RADARSAT-1 or other data and products will meet Principal Investigator or its collaborator's requirements, (ii) the data and products will operate in combinations selected for use by Principal Investigator or its Collaborators, or (iii) use of the data and products will be uninterrupted or error free. The Collaborators provide all RADARSAT-1 data and other products "as-is", without warranty of any kind.

The Principal Investigator must be aware of SAR imaging capabilities, SAR methods, limitations and applicability for their specific project.

7.4 Data Quantities

Data for this project will include 160 pre-processed RADARSAT-1 hurricane "eye" (or "eye" edge) images acquired under the CSA Satellite Operations directorate Hurricane Watch program between 2001 and 2007 from different parts of the World. All RADARSAT-1 data will be available in Level 0 (RAW product in CEOS format), Level 1 (SCW ScanSar Wide Swath product in CEOS format) and GEOTIF formats. All RADARSAT-1 images have been processed at the Canadian Data Processing Facility by MDA-GSI.

7.5 Data Access

The RADARSAT-1 pre-processed dataset will be made available through a website established at CSTARS (link in appendix A). The website is public open for consultation for metadata and review of the Quicklook images. After acceptance of their proposal, Principal Investigators will be given a unique and confidential login/password to access and download the data.

The Collaborators each reserves the right of use and demonstration for promotional purposes of the results from each of the approved projects for which RADARSAT-1 data

has been made available, including all output material such as reports and presentations, including copyrighted material in the name of the Recipient and/or their respective affiliations.

7.6 Data Award and Services Levels

The AO Collaborators will provide RADARSAT-1 and other selected products to the approved projects free of charge. **No funding will be provided through this AO by the Collaborators.**

7.7 Promotion of Project Results

In accordance with the objectives of the AO, the Collaborators intend to use the results to promote SAR applications. Principal Investigator must agree and undertake to publicize the results of their project in scientific or technical journals and publications with appropriate acknowledgement to this AO project. In addition, they will agree to plan to attend an AO project workshop or symposium to present the results of their projects, and provide the Collaborators with material for promotional purposes.

A final symposium or workshop will be held in the Fall of 2009. Actual dates and locations shall be confirmed at a later date and may be combined with another event. Approved projects shall be presented at the workshop. **No funding under this AO will be made available for participation in the workshop.**

7.8 Intellectual Property

All Principal Investigator are aware that the intellectual property rights to RADARSAT-1 and other copyrighted data, products and derived image products reside with the CSA. All copyrighted datasets shall be marked with copyright identifiers.

The Collaborators encourage the promotion and application of the techniques developed within this AO project. The intellectual property resulting from the project efforts will vest with the Principal Investigator, with rights granted to the Collaborators to use the results for promotional or public use purposes only.

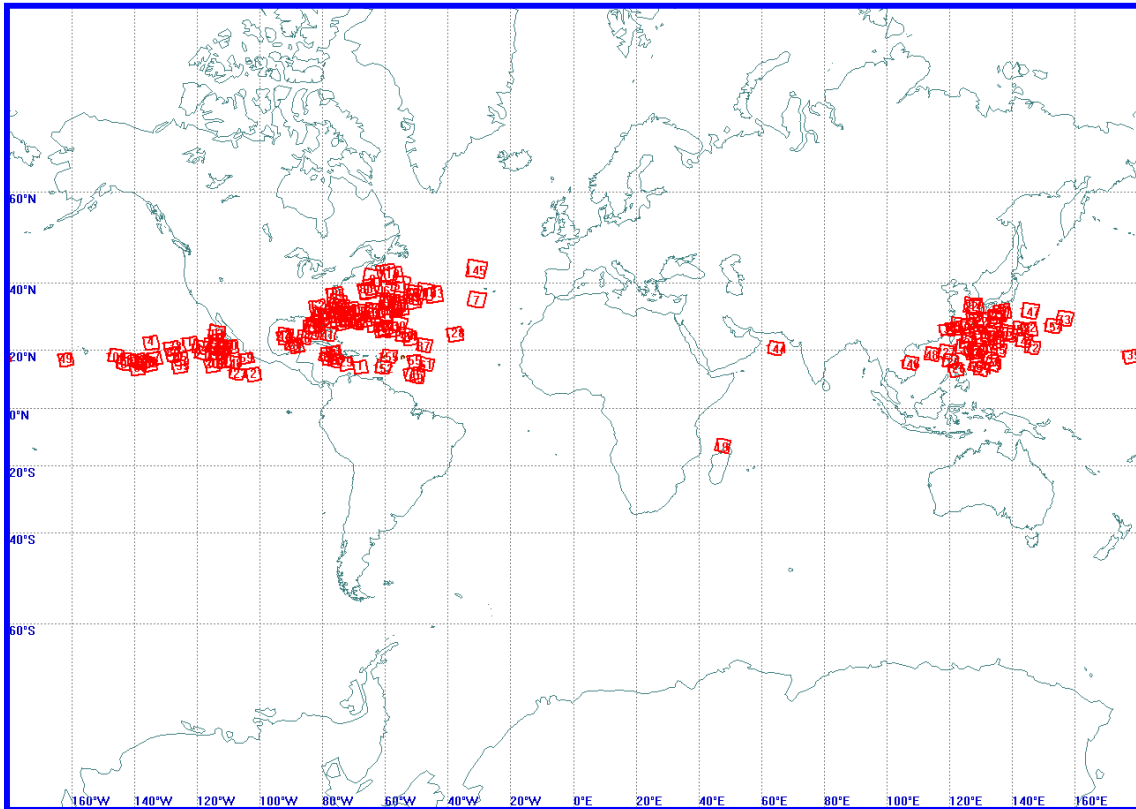
7.9 Reviewer's Non-Disclosure Agreements

All reviewers / evaluators of proposals will sign a non-disclosure agreement to ensure confidentiality of the Principal Investigator ideas. Information of a proprietary nature that is contained in any proposal should be noted by the Principal Investigator, and will be used by the project Collaborators for evaluation purposes only.

APPENDIX A: HURRICANE IMAGE LOCATIONS

The map below indicates the approximate location of the 160 pre-processed image contained in the RADARSAT-1 hurricane database for this AO. The majority of the images occur in the Atlantic and Caribbean areas. However, there are many scenes in the western part of the North Pacific Ocean and the South China Sea, as well as the eastern part of the North Pacific Ocean. A review of the quicklook scenes may be made by visiting the AO website at <https://www.cstars.miami.edu/hw-csa>.

Approximate Locations of the Images Included in the RADARSAT-1 Hurricane AO Database



For further background information regarding the RADARSAT-1 mission and its characteristics, please refer to the CSA website under "Satellites" section:

www.space.gc.ca

Thank you for your interest in this Announcement of Opportunity.

APPENDIX B: LETTER OF INTENT

The following topics should be addressed in the Letter of Intent on the Principal Investigator letterhead. The Letter of Intent should only be 2 or 3 pages in length and include the following information:

1. Title of Project
2. Project Leader/Principal Investigator
3. Affiliation
4. Address
5. Phone number: country code - area code - local number
6. Fax number: country code - area code - local number
7. Email
8. List of Collaborators/Co-Investigators and Affiliations
9. Research and Development activities, including:
 - i. Proposed objective;
 - ii. Demonstrated understanding of SAR technologies and the advantages RADARSAT-1 will provide to the application;
 - iii. A list of any Collaborators, sub-contractors and other team members;
 - iv. Benefits of research towards future operational activities;
 - v. Methodology;
 - vi. Anticipated results
 - vii. Intent to publish

Please forward your Letter of Intent by email by July 25, 2008 to:

Mr. Steve Iris
Earth Observation Applications Development Program
Space Technologies
Canadian Space Agency
6767 Route de l'Aéroport
St. Hubert, Quebec
Canada
J3Y 8Y9

Tel.: (450) 926-4439
Email: Steve.Iris@space.gc.ca

APPENDIX C: AGREEMENT FOR RADARSAT-1 DATA USE AND DERIVED PRODUCTS

The use of the RADARSAT-1 data for this project will require acceptance of a Non-Disclosure Certificate and RADARSAT-1 End-User Licence Agreement by the Principal Investigator that will include some the following representative terms and conditions. The complete certificate and agreement information are available on the AO website (<https://www.cstars.miami.edu/hw-csa>).

By submitting a proposal for this announcement of opportunity, I covenant and agree that the Data received from the RADARSAT-1 system and the derived products generated from these data shall be used only under the following terms and conditions:

1. I covenant and agree to respect the ownership and intellectual property rights of the Canadian Space Agency of all RADARSAT-1 data. I agree and undertake to clearly mark all recognizable RADARSAT-1 data, irrespective of form in which it is reproduced, in such a way that the Canadian Space Agency's copyright is knowledgeable to all, as follows:

" © Canadian Space Agency (year of reception)"; or

" © Agence spatiale canadienne (year of reception)"

2. The data are for my use for bona fide research and demonstration purposes only. No commercial benefit whatsoever is allowed from the data provided under the approved project nor from any products derived from these data sets.

3. The data shall not be reproduced or distributed to any other parties, except that it may be shared amongst the members of my research team (co-investigators) and with other researchers who have duly signed and executed a research agreement. I am fully aware that I shall be responsible for compliance to these agreement terms by members of my research team, with whom I share these data.

4. I shall publish in the open scientific literature and provide the Partner with material for promotional purposes from the results of the research accomplished under this program.

5. I agree and undertake to provide a copy of such results, including derived data sets, algorithms, models, and documentation, to the Partner for archive and potential distribution.

I covenant and undertake that if these conditions are violated, the Partner may take the appropriate action including, but not limited to, the termination of this Agreement and barring from future Research Agreements with the Collaborators.