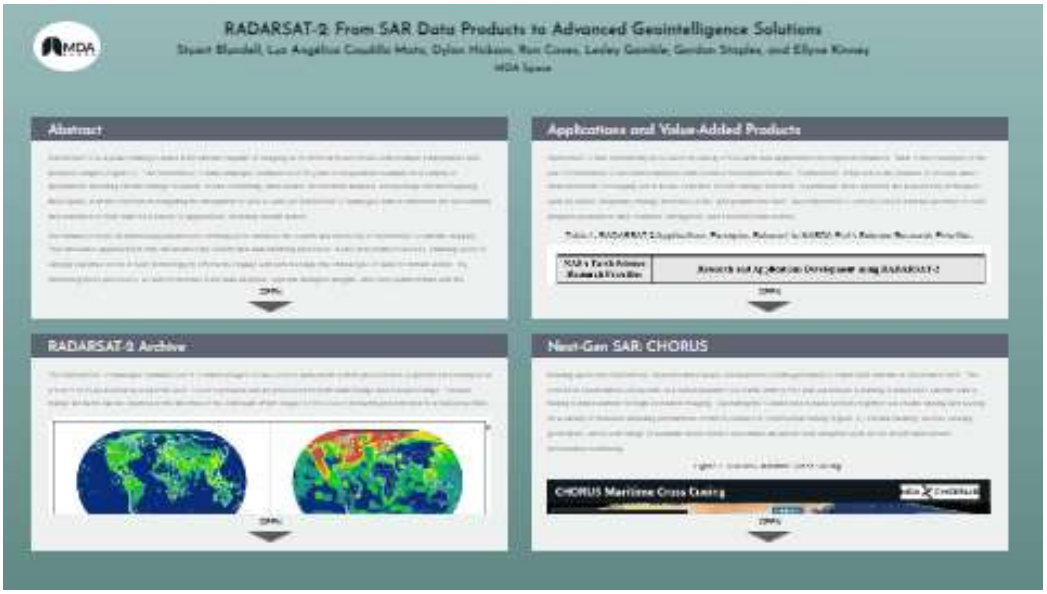
RADARSAT-2: From SAR Data Products to Advanced Geointelligence Solutions



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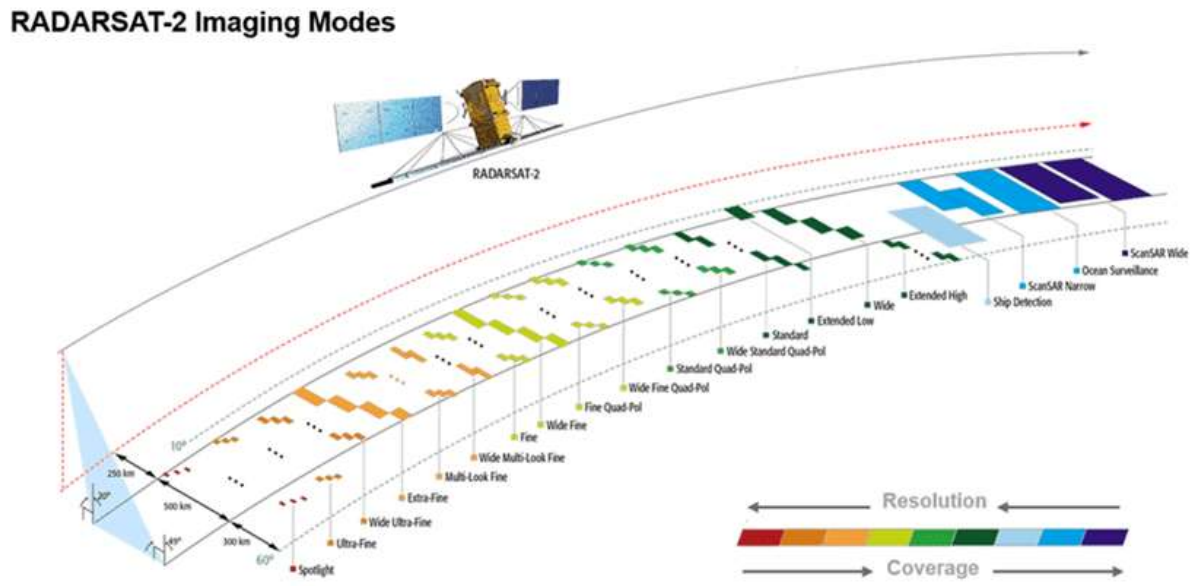
PRESENTED AT:

ABSTRACT

RADARSAT-2 is a polar orbiting C-band SAR satellite capable of imaging in 20 different beam modes with multiple polarizations and incidence angles (Figure 1). The RADARSAT 2 data catalogue contains over 16 years of acquisitions suitable for a variety of applications including climate change research, ocean monitoring, land surface deformation analysis, and geologic hazard mapping. MDA Space is at the forefront investigating the integration of Gen AI with our RADARSAT-2 catalogue data to transform the accessibility and utilization of SAR data for a variety of applications, including climate action.

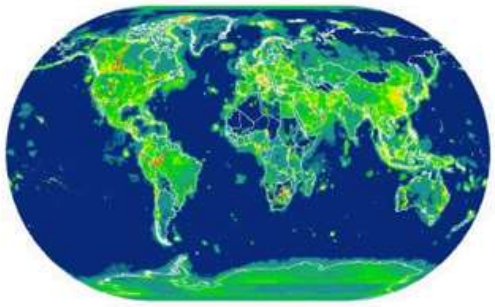
Our initiatives focus on harnessing advanced AI techniques to enhance the search and discovery of RADARSAT-2 satellite imagery. This innovative approach not only streamlines the search and data handling processes, it also democratizes access, enabling users of varying expertise levels in SAR technology to effectively engage with and leverage this critical type of data for climate action. By optimizing these processes, we aim to increase SAR data adoption, expedite analytics insights, and foster partnerships with the scientific community and commercial sectors to address urgent climate change challenges.

Figure 1. RADARSAT-2 Imaging Modes.

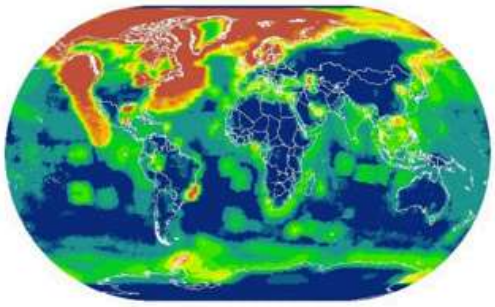


RADARSAT-2 ARCHIVE

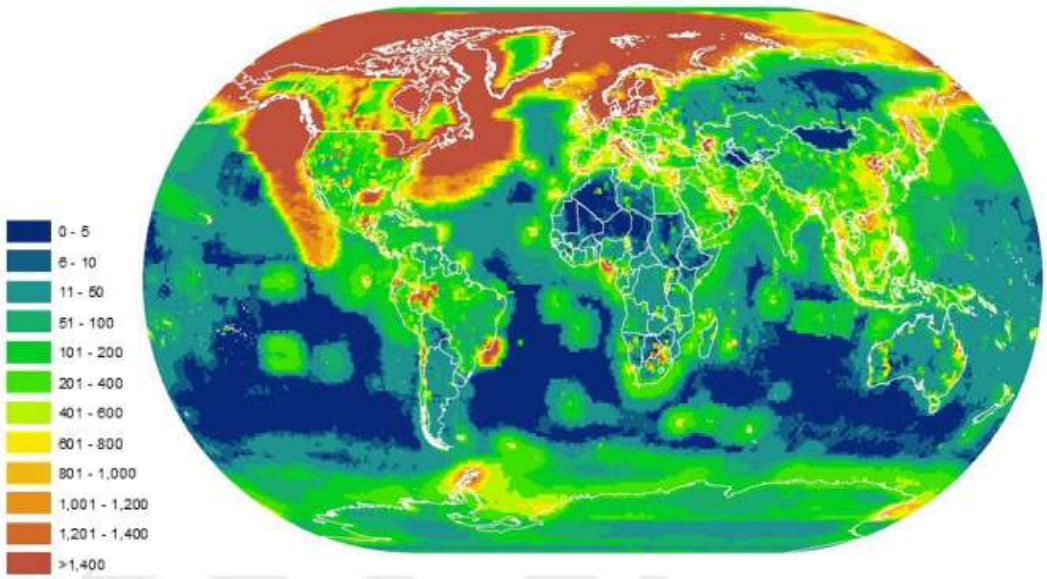
The RADARSAT 2 catalogue contains over 1.1 million images of raw Level 0 data which is then processed to a specific processing level (Level 1 or 2) as desired by a specific user. Level 1 products can be processed to both Slant Range and Ground Range. Ground Range products can be oriented in the direction of the orbit path (Path Image) or for Level 2 products geocorrected to a map projection.



Spotlight and Single Beams are smaller coverages but in higher resolutions (3-15m), ideal for land based applications and change detection analysis.



ScanSAR: lower resolution, but larger swath coverages (300-500 km), primarily for maritime surveillance applications.



The cumulative union of the entire public archive of all acquisitions available for processing, from commissioning in early 2008 to January 2024 inclusive, contains over 1 million acquisitions.

Each record in the catalogue is an acquisition of a particular beam mode and polarization. As such, the catalogue can be searched by spatial queries or attribute filtering including orbit details. For example, queries to find interferometric scene pairs separated by exactly one or more orbit cycles, can be done using the relative orbit attribute to locate two images that can be co-registered for multi-temporal analysis.

APPLICATIONS AND VALUE-ADDED PRODUCTS

RADARSAT-2 has consistently been used for variety of research and applications development initiatives. Table 1 lists examples of the use of RADARSAT-2 relevant to NASDA Earth Science Research Priorities. Furthermore, it has led to the creation of several value-added products, leveraging our in-house expertise in SAR change detection. In particular, these products are powered by techniques such as InSAR, amplitude change detection (ACD), and polarimetric SAR. Our RADARSAT-2 services cover a broad spectrum of SAR analytics products in land, maritime, intelligence, and environmental sectors.

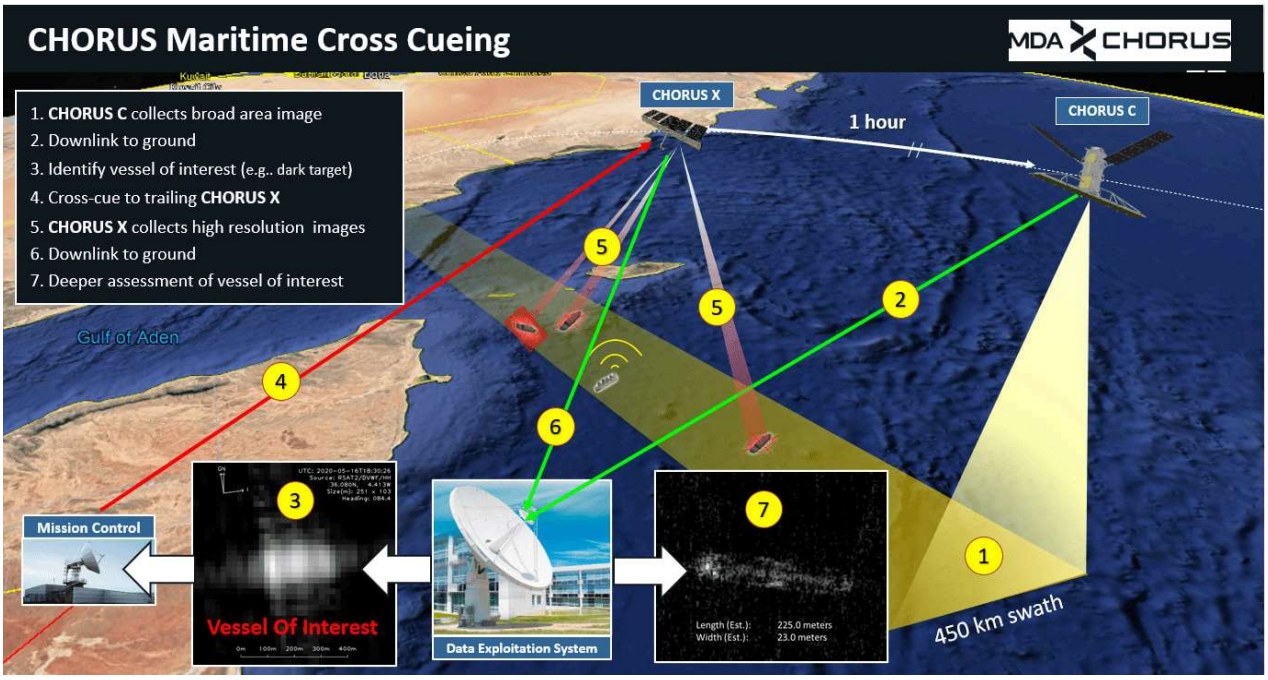
Table 1. RADARSAT-2 Applications Examples Relevant to NASDA Earth Science Research Priorities

NASA Earth Science Research Priorities	Research and Applications Development using RADARSAT-2
Surface Dynamics	• Time series for agricultural crop phenology and soil moisture retrieval • C-band satellite data for the retrieval of aboveground forest biomass (C4BIO) • Monitoring the crustal deformation cycle in the Chile subduction zone • Multi-incidence and Multi-temporal Monitoring of Wetland Environments • Soil Moisture And Crop Biomass Estimates Over Agricultural Fields • Monitoring Of Land Surface Deformation With Time-Series InSAR Techniques
Cryosphere: Sea Ice and Glaciers	• Advances In Mapping Ice-Free Surfaces Within the Northern Antarctic Peninsula • Antarctic Sea-Ice Classification Based on Conditional Random Fields • Sea-Ice Mapping by Integrating Spatial Contexture With Textural Features • Distribution Of Glacial And Periglacial Features Within Ice-Free Areas • Adaptive Probability Thresholding in Automated Ice and Open Water Detection
Seal Level Rise and Ocean Science	• Investigation of full polarimetry information for ocean surface geophysical parameters • Coastal wind retrieval from SAR images with Doppler shift and WRF modeling • Retrieval of Marine Surface Slick Dielectric Properties • Detecting And Tracking Small Scale Eddies In The Black Sea And The Baltic Sea
Geological Hazards and Disasters	• Optimized Rule-Based Flood Mapping Technique Using Multi-temporal Images • RADARSAT-2 and Sentinel-1 SAR To Detect and Monitor Flooding Areas • Landslide Prediction Using Soil Moisture Estimation
Ecosystem Change	• Groundwater Deficit And Land Subsidence Monitored By Grace And RADARSAT-2 • Estimation Of Fuel Moisture Content Based On Quad Polarimetric Decomposition • Snow Cover Mapping Using Polarization Fraction Variation

NEXT-GEN SAR: CHORUS

Building upon prior RADARSAT missions MDA Space will launch its fourth-generation C-Band SAR satellite in December 2025. The CHORUS constellation will operate in a mid-inclination Low Earth Orbit (LEO) and will include a leading C-band SAR satellite with a trailing X-band satellite for high-resolution imaging. Operating the C-band and X-band sensors together will enable tipping and cueing for a variety of missions including interdictions efforts to curtail IUU commercial fishing (Figure 2). Flexible tasking, diverse viewing geometries, and a wide range of available beam modes will enable advanced SAR analytics such as 3D InSAR land surface deformation monitoring.

Figure 2. CHORUS Maritime Cross Cueing.



TRANSCRIPT