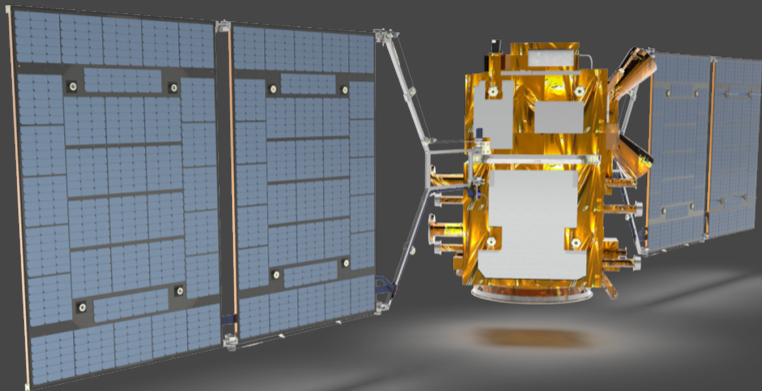


MISSION CRITICAL DESIGN REVIEW



SECTION: 02A

Mision Overview and Science Requirements

Carolina Tauro, CONAE

SABIA-Mar Project

APRIL 24-28, 2023

CENTRO ESPACIAL TEÓFILO TABANERA, CÓRDOBA, ARGENTINA



Ministerio de Ciencia,
Tecnología e Innovación
Argentina

Objectives

Mission main objective and description

Cameras and spectral bands

Products main characteristics

Users and added value products

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- ▶ Introduce the SABIA-Mar Mission, its main objectives and goals, as well as its main characteristics (orbit, revisit, spectral bands, etc).
- ▶ Describe the SABIA-Mar mission products, its users and applications.
- ▶ Review the key driver science requirements.

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- ▶ SB-040000-RQ-00400-C - SABIA-Mar L1 and L2A Requirements Baseline Document (17/03/2022)

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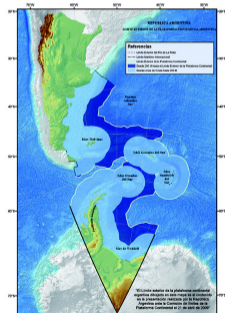
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SABIA-Mar is a satellite mission mainly focused in ocean color studies. It was born as a great contribution to regional coastal studies in the framework of...

- ▶ Argentinian National Space Plan.
- ▶ SAC-D/Aquarius mission continuity.
- ▶ Argentinian Pampa Azul initiative.
- ▶ Sustainable Development Goals contribution.
- ▶ International Ocean Color and climate change communities.



Web Images.



SABIA-Mar mission

Main Objective

Ocean Color information over open oceans and coastal zones of South America, with 2 days of revisit in Argentinean coastal areas, to provide information and value-added products for:

- Primary productivity of the seas
- Carbon cycle
- Ocean and coastal ecosystems, maritime habitats and biodiversity
- Fishery management and Water quality

Global (800 m)



Scenarios



Regional
South America Coast
(1000 km)

MAIN PRODUCTS

- Water Leaving Radiance
- Chl-a concentration
- Kd(490)
- PAR
- Turbidity



THE SATELLITE

- Sun-synchronous Polar orbit
- 702 Km height
- 99.8 min period
- 10:20am local time DN
- 2 days revisit
- 9 days repeat cycle
- 600 kg mass
- 5 years lifetime



Ground Stations

- Córdoba
- Tolhuin



SCIENCE TEAM



Research

- Algorithms development
- Calibration and Validation
- Added value products
- Data distribution for free

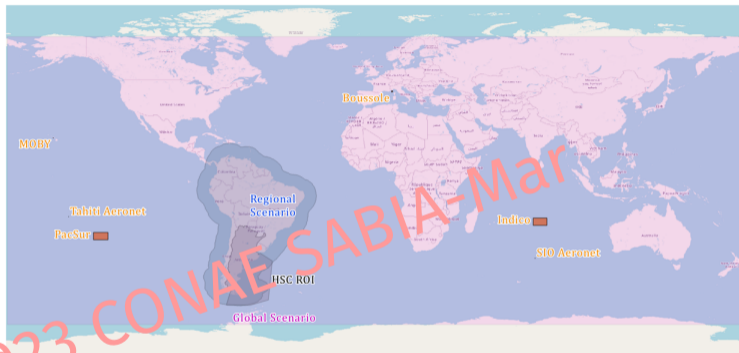
Educational & Public Outreach

- Public Outreach program
- Webinars
- Teaching aids



Instruments

- Visible-Near InfraRed
- NIR-ShortWave InfraRed
- 15 bands from 412 to 1610 nm
- High Sensitivity Camera
- Panromatic 400 to 700 nm
- Data Collection System
- GNSS receiver



- ▶ **Regional**: coastal zone of South America coming to about 650 km offshore, in addition to Inland Waters in South America, with spatial resolution of 200m. For regional studies and monitoring of Vitória-Trindade Ridge and Malvinas Islands regions 1000 km coverage is requested.
- ▶ **Global**: geographical coverage in latitude shall be 140 degrees ($\sim \pm 70^\circ$ latitude) with seasonal changing limits, at a 800m of spatial resolution.

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Main Cameras:

- ▶ **VIS-NIR:** optical and near infrared camera (412-865nm), 200m (regional) and 800m (global) spatial resolution at nadir, swath 1495km.
- ▶ **NIR-SWIR:** near infrared and short wave infrared camera (750-1640nm), 400m spatial resolution at nadir (only regional), swath 1495km.

Secondary Instruments:

- ▶ **HSC:** pancromatic High Sensitivity Camera for night lights detection.
- ▶ **DCS:** Data Colection System, is an UHF receiver on board, ARGOS compatible, to collect data coming from ground platforms.
- ▶ **AGR-T** (Austral GNSS Receiver Technological): technological payload compatible with the on-board computer. The aim of the project is to develop a high reliability Global Navigation Satellite System (GNSS) receiver for low earth orbit (LEO) satellite missions.

SABIA-Mar spectral bands (required)

Camera	Swath	Band	λ_0	FWHM	GSD		L_{typ}	L_{max}	S/N*
			[nm]	[nm]	Regional [m]	Global [m]	[W m ⁻² μm ⁻¹ sr ⁻¹]**		
VIS/NIR	1496km	B0	412	10	200	800	79	602	1000
		B1	443	10	200	800	68	664	1000
		B2	490	10	200	800	52	686	1000
		B3	510	10	200	800	45	663	1000
		B4	555	10	200	800	34	643	1000
		B5	620	10	200	800	21	570	1000
		B6	665	10	200	800	16	536	1000
		B7	680	7.5	200	800	15	517	1500
		B8	710	10	200	800	12	489	1000
		B9 [†]	750	10	200	800	10	447	600
		B11 [†]	865	20	200	800	5.9	333	400
NIR/SWIR	1495km	B9 [†]	750	10	400	-	10	447	600
		B10	765	10	400	-	7.8	430	600
		B11 [†]	865	20	400	-	5.9	333	400
		B12	1044	20	400	-	3.7	236	400
		B13	1240	20	400	-	0.88	158	250
		B14	1610	60	400	-	0.29	82	250
HSC	700km	BHSC	400-700	300	400	-	[nW ² /sr]**		10
							20	1800	

Band	λ [nm]	$\Delta\lambda$ [nm]	Coastal [m]	Global [m]	Applications
B0	412	10	200	800	Coloured Dissolved Organic Matter, Chl separation
B1	443	10	200	800	Chl-a Absorption maximum, band ratio for Chl-a retrieval
B2	490	10	200	800	Chl-a band ratio algorithm and other pigments
B3	510	10	200	800	Chl-a band ratio algorithm Turbidity, HABS, strong O ₃ absorption
B4	555	10	200	800	Bio-optical algorithms (e.g. band ratio Chl), turbidity
B5	620	10	200	800	Cyanobacteria, suspended sediment phycocyanin, Turbidity
B6	665	10	200	800	Chl-b, baseline of fluorescence signal, Turbidity
B7	680	7.5	200	800	Chl- a Fluorescence line peak
B8	710	10	200	800	FLH baseline, HABS, Chl in highly turbid water, turbid water atmospheric correction
B9	750	10	200/400	800	Atmospheric correction open ocean
B10	765	10	400	-	Atmospheric correction open ocean, aerosol altitude, molecular absorption. Cloud altitude and screening
B11	865	20	200/400	800	AC open ocean, water vapor reference over the ocean, Turbidity
B12	1044	20	400	-	Atmospheric correction turbid water, Turbidity
B13	1240	20	400	-	Atmospheric correction turbid water, Turbidity
B14	1610	60	400	-	Atmospheric correction turbid water
HSC	400-700	300	400	-	Boat night light detection

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SABIA-Mar will **operative produce the required products**, which are the main mission products:

- ▶ Ocean Color (VIS-NIR & NIR-SWIR): $[L_w]_N$, Chl-a, FHL, $K_d(490)$, Turbidity, PAR.
- ▶ Night boats detection (HSC)
- ▶ Products will be generated in netCDF4 format with CF and ISO metadata.
- ▶ Levels of processing that will be generated: L0, L1, L2 and L3.
- ▶ L1, L2 and L3 will be available for free in the website.

Other instruments cases:

- ▶ DCS: only L0+ (divided by platform). The data will be distributed to the users that install the ground platforms.
- ▶ AGR-T: it has no science products, it generates data for technological demonstration. Developed by: La Plata University.

L1 Products:

- ▶ L1A: Raw and geolocation data.
- ▶ L1B: TOA radiance/reflectance.
- ▶ Calibrations methods planned: Lunar, solar, vicarious, cold sky, side-slither.
- ▶ Files: Granules of 5 minutes.
- ▶ Native spatial resolution: 800m Global, 200/400m Regional.

L2 Products:

- ▶ Normalized Water Leaving Radiance and Remote Sensing Reflectance, Chlorophyll-a concentration, FHL, Turbidity, Kd(490), PAR, night boat detection.
- ▶ Chl-a and HSC available in Near Real Time for Argentinian sea.
- ▶ Files: Granules of 5 minutes.
- ▶ Native spatial resolution.

L3 Products:

- ▶ All L2 variable will be aggregated.
- ▶ Binned and mapped format.
- ▶ Temporal: Daily, 8-days, monthly, seasonal.
- ▶ Spatial resolution Regional: 460m
- ▶ Spatial resolution Global: 2.32 and 4.6km.
- ▶ Each product in separated file.

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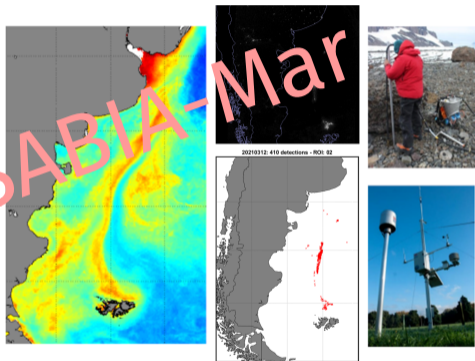
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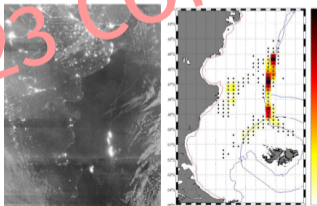
- ▶ Government institutions and Decision makers (INIDEP, SMN, SHN, INA, PNA, AA, IAA, etc).
- ▶ Sistema productivo (blue economy, tourism, etc.).
- ▶ National scientific-technological and education system (Pampa Azul, CONICET, IADO, IAFE, CENPAT, UNS, UNC, CADIC, etc).
- ▶ International Ocean Color and Climate Change communities.
- ▶ HSC users: INIDEP, PNA, AA
- ▶ DCS users: IAA, La Plata University and INTI for meteorological measurements, penguins, seals and petrels tracking.



Chlorophyll-a concentration (MODIS), night light from boats (VIIRS), Data Collection System.

- ▶ Surveillance and navigation support.
- ▶ Fisheries and aquaculture.
- ▶ Health: toxic algae blooms, water quality, coastal sediments.
- ▶ Emergencies.
- ▶ Ocean circulation and dynamic.
- ▶ Climate change and global trending.

Night high sensitivity NPP/VIS, Jigger boats frequency (MIDEP), MODIS image.



Based on MODIS images.

