



Comisión Nacional de
Actividades Espaciales



Ministerio de Ciencia,
Tecnología e Innovación
Argentina

Status of SABIA-Mar Mission and ocean applications of CONAE

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SABIA-Mar Mission



<https://www.argentina.gob.ar/ciencia/conae/misiones-espaciales/sabia-mar>

SABIA-Mar Mission Summary

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

MAIN PRODUCTS

Global (800 m)

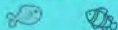


Scenarios

Regional
South America Coast
(200/400 m)



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



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
Pancromatic 400 to 700 nm

Data Collection System
GNSS receiver



Research

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

SCIENCE TEAM

Mission Scenarios



- ▶ Regional Scenario: Coastal zone of South America coming to about 650 km offshore, in addition to Inland Waters in South America. Spatial resolution: 200/400m.
- ▶ Global Scenario: geographical coverage in latitude from $\sim \pm 70^\circ$ latitude with seasonal changing limits: Spatial resolution: 800m.
- ▶ Vicarious Calibration: AERONET-OC stations, South Pacific and Indian ocean, MOBY and/or future available sites. Spatial resolution: 200/400m.

SABIA-Mar Cameras

Main Cameras:

- ▶ **VIS-NIR:** visible 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.
Regional scenario can be extended by agreements.

Secondary Instruments:

- ▶ **HSC:** panchromatic High Sensitivity Camera for night lights detection.
- ▶ **DCS:** Data Collection 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

Camera	Swath	Band	λ_0 [nm]	FWHM [nm]	GSD		L_{typ} [W m ⁻² μm ⁻¹ sr ⁻¹]**	L_{max}	S/N*
					Regional [m]	Global [m]			
VIS/NIR	1495km	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]** 20	1800	10

† Bands 9 and 11 are repeated in both cameras.

* @ L_{Typ} at GSD:1000 m.

Products summary

SABIA-Mar will **operationally produce 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 CONAE 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.

Cal/Val Plan

- ▶ Buoys Program in the Argentinian Sea: on-going project in agreement with Argentinian Institute of Oceanography (IADO).
- ▶ Inter-institutional Monitoring Network for In Situ and Satellite measurements (MISS-Arg).
- ▶ Program for Harmful Algae Blooms monitoring in Península de Valdés (Patagonia Argentina).

Buoy: Variables of interest

1. Chlorophyll-a (Chl-a)
2. Turbidity (T)
3. Downwelling solar irradiance (Es)
4. Downwelling irradiance (Ed) at two depths
5. Upwelling radiance (Lu) at two depths (10 degree FOV)
6. Orientation Angles (two-axis tilt)
7. Geolocation (latitude, longitude and time)
8. Multi-spectral backscattering coefficient (Bb)
9. Beam attenuation coefficient (c)
10. Partial pressure of CO₂ gas dissolved in water (pCO₂)
11. Dissolved O₂
12. pH
13. Wind Speed and compass heading
14. Temperature (below water)
15. Conductivity
16. Pressure
17. Air Temperature
18. Air Relative Humidity
19. Atmospheric pressure
20. Current
21. Wave height and period
22. Nitrate
23. fDOM

SABIA-Mar, SM Complementary, SAOCOM, General

Where are we now?



PMSRR= Preliminary Mission Systems & Requirements Review
PDR= Preliminary Design Review
F&G CDR= Flight and Ground segment Critical Design Review
M&A CDR= Mission and Applications Segment Critical Design Review

MOR=Mission Operations Review
SIR=System Integration Review
PER=Preliminary Environmental Review
ORR=Operational Readiness Review
MRR=Mission Readiness Review
PLAR=Post-Launch Assessment Review

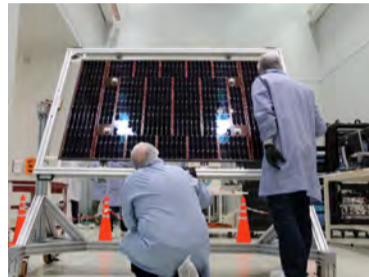
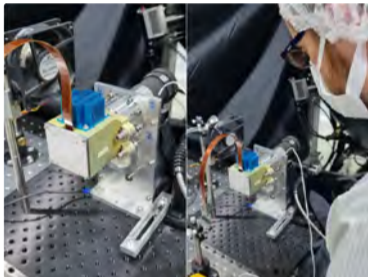
Where are we now?

Mission Critical Design Review (April 2023) was approved.

SABIA-Mar is now in Phase-D.



Where are we now? Pre-Launch tests



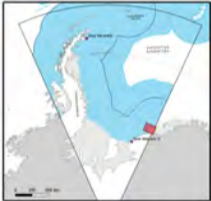
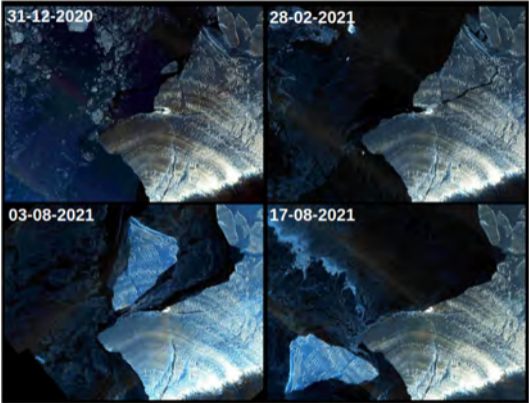
Left: Radiometric tests of NIR-SWIR camera (Sept 23). Centre and right: Solar panel tests at CONAE and INVAP labs (Aug-Sept 23).

SAOCOM Argentine Synthetic Aperture RADAR



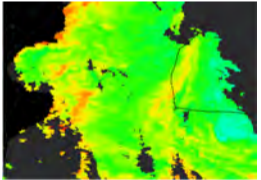
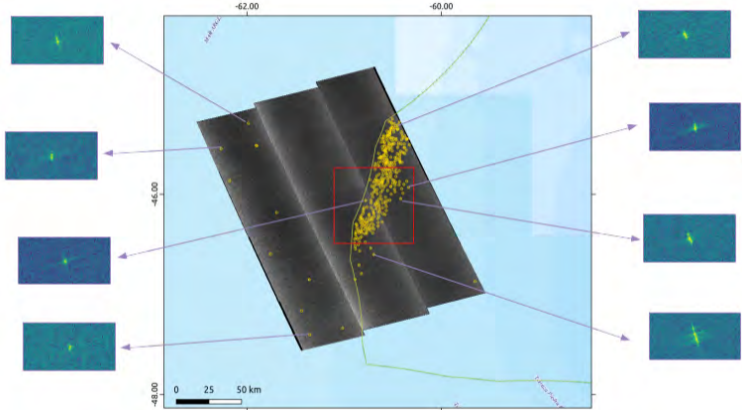
<https://www.argentina.gov.ar/misiones-satelitales/acceso-los-productos>

SAR applications: Iceberg monitoring



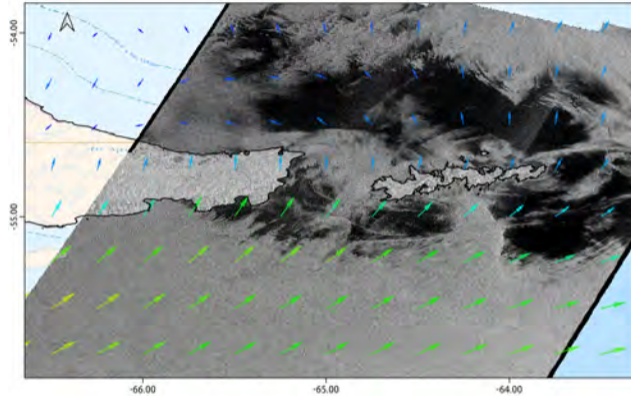
Iceberg monitoring in Antarctica with SAOCOM.

Jiggers boats in Argentinian Sea



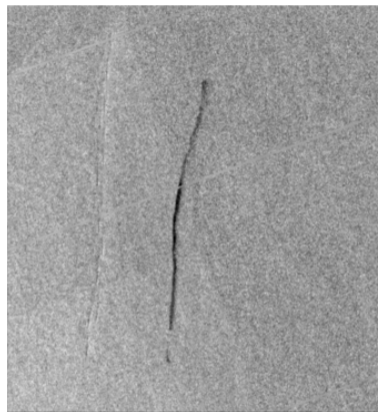
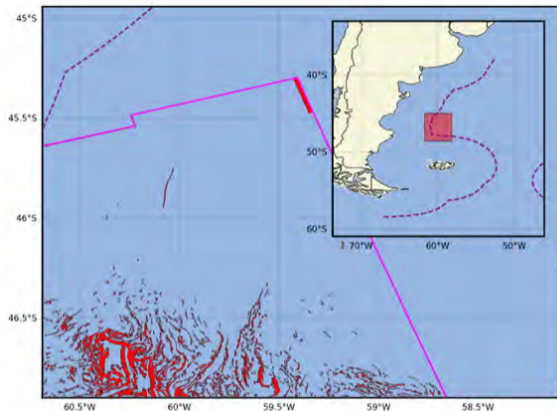
Left: SAOCOM image. Right up: Heat map from SAOCOM. Right down: Chl-a MODIS image.

Wind speed and direction



Wind speed field obtained with ERA-5 model over a SAOCOM data image (VV, σ_0) in South of Argentina (Tierra del Fuego island), showing the good correlation between both. Application under developing.

Dark spots detection



Dark spots in the Argentinian Platform. Right image is related to fishing boats (while bottom structures on left image are probably related to bio-foils).

Back-up

SABIA-Mar Spectral bands and applications

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

SABIA-Mar Products levels summary

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.

¡MUCHAS GRACIAS!

Thank you very much for your attention

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www.argentina.gob.ar/ciencia/conae