

SIMBAD: MARINE ECOSYSTEMS MONITORING

A Scientific Exploitation Platform for Sentinel Imagery

Quasar Science Resources

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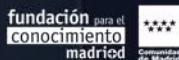
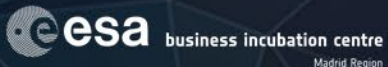
2016

25 employees, a combination of Data Scientists, Software and System Engineers

Aerospace Sector

Earth Observation, Remote Sensing

Quasar Science Resources participates
in the ESA Business Incubation Centre Madrid Region



QUASAR SCIENCE RESOURCES, S. L. IS A TEAM OF HIGHLY QUALIFIED EXPERTS COVERING A WIDE VARIETY OF BACKGROUNDS THAT OFFERS NEW CONCEPTS AND APPROACHES IN,

- SCIENTIFIC AND DATA ANALYSIS CONSULTING SERVICES
- SOFTWARE AND SYSTEM ENGINEERING
- EARTH OBSERVATIONS

WE PROVIDE THESE HIGH QUALITY TAILOR-MADE SERVICES FOR RESEARCH AND DEVELOPMENT PROJECTS TARGETED AT RESEARCH CENTRES, UNIVERSITIES AND PRIVATE COMPANIES LOOKING TO EXPAND THEIR ACTIVITY DOMAIN.

OUR ACTIVITIES COVER MANY DIFFERENT AREAS

SCIENTIFIC SOFTWARE DEVELOPMENT

DESIGN, DEVELOPMENT, DEPLOYMENT, AND MAINTENANCE OF NEW CODE

DATA REDUCTION TECHNIQUES

COMBINED TEAM OF SOFTWARE, ARCHIVE AND SYSTEM ENGINEERS WORK ALONGSIDE OUR SCIENTISTS TO BEST UTILIZE THEIR COMBINED KNOWLEDGE AND EXPERIENCE

HANDLING AND EXPLOITATION OF SCIENTIFIC DATA BASES

DATA MANAGEMENT, EXPLOITATION, AND ARCHIVING FOR LARGE INTERNATIONAL RESEARCH PROJECTS

ARCHIVE ENGINEERING AND DATA MINING

DESIGN, ACCESS, MANIPULATION, DISTRIBUTION, AND MAINTENANCE OF REAL-TIME AND ARCHIVED DATA

COMPUTER SYSTEM ENGINEERING

VIRTUAL MACHINE INFRASTRUCTURE, NETWORK, DATA STORAGE AND BACKUP

OUR TEAM OF EXPERTS INCLUDES

COMPUTER SYSTEM ANALYSTS

SOFTWARE ENGINEERS

DATA ARCHIVE ENGINEERS

DATA SCIENTISTS



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SIMBAD

A SCIENTIFIC EXPLOITATION PLATFORM TO PROTECT EARTH'S ECOSYSTEMS FROM SPACE



SIMBAD (*SENTINEL IMAGERY MULTIBAND ANALYSIS AND DISSEMINATION*) IS A MODULE OF OUR SENTINEL DATA SEP AND PROVIDES CUSTOMIZED SENTINEL IMAGE SERVICES. SIMBAD WAS INCUBATED BY THE ESA BIC COMUNIDAD DE MADRID REGION IN 2018 AND WAS SPECIFICALLY DESIGNED TO MAP THE MEADOWS OF POSIDONIA OCEANICA IN THE MEDITERRANEAN SEA. SINCE THEN, A NUMBER OF DIFFERENT PRODUCTS HAVE BEEN, OR ARE IN THE PROCESS, OF BEING INCORPORATED INTO SIMBAD.



QUASAR
SEP

SCIENTIFIC EXPLOITATION
PLATFORM

THE SCIENTIFIC EXPLOITATION PLATFORM (SEP) FOR SENTINEL DATA IS A QUASAR SCIENCE RESOURCES INITIATIVE FOR THE TRANSFORMATION OF RAW SENTINEL DATA INTO USEFUL FINAL SCIENTIFIC PRODUCTS TO BE USED IN DAY-TO-DAY APPLICATIONS



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POSIDONIA OCEANICA
12,240 SQUARE KILOMETERS
OVER 12,000 KM OF COAST LINE



HIGH MARINE SPECIES RICHNESS
(~17,000 SPECIES)



THE MEDITERRANEAN LARGE MARINE
ECOSYSTEM IS A HETEROGENOUS SYSTEM
WITH HIGH DIVERSITY OF MARINE SPECIES
AND HIGH RATE OF ENDEMISM MAKING IT
ONE OF THE WORLD HOTSPOTS FOR MARINE
BIODIVERSITY

SEAGRASS COMMUNITIES ARE
CONSIDERED ONE OF THE MOST
PRODUCTIVE AND COMPLEX
MARINE ECOSYSTEMS





Launch

Date: 23 June 2015 - Sentinel-2A
07 March 2017 - Sentinel-2B

Site: Kourou, French Guiana

Rocket: Vega rocket

Revisit

5 days at equator

Spatial Resolution

10 metres

SENTINEL-2 MARINE ECOSYSTEMS MONITORING



SENTINEL-2 IS A CONSTELLATION OF TWO IDENTICAL SATELLITES IN THE SAME ORBIT. IT PROVIDES IMAGES OF LAND AND COASTAL AREAS AT HIGH SPATIAL RESOLUTION IN THE OPTICAL DOMAIN UNDER CLOUD FREE CONDITIONS.



Copernicus is the European Union's Earth observation programme coordinated and managed by the European Commission in partnership with the European Space Agency (ESA), the EU Member States and EU agencies



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SENTINEL-2 MARINE ECOSYSTEMS MONITORING

QUASAR HAS DEVELOPED AN
AUTOMATED DATA PROCESSING
PIPELINE FOR SENTINEL-2 IMAGERY
TO EXTRACT PRODUCTS TO BE USED
FOR MARINE ECOSYSTEMS
MONITORING APPLICATIONS



P R O D U C T S

S2 RGB FALSE COLOUR MAPS

AREA OF INTEREST

POSIDONIA OCEANICA MAPS (SHAPEFILES)

10 METRE SPATIAL RESOLUTION

POSIDONIA OCEANICA MAPS (SHAPEFILES)

DIFFERENT TIMESCALES (YEARLY, SEASONAL, ...)



MARINE ECOSYSTEM

SENTINEL-2

MULTISPECTRAL INSTRUMENT (MSI)

WAVE ACQUISITION MODE
13 SPECTRAL BANDS: FOUR OF THEM AT 10 M SPATIAL RESOLUTION
5 DAY REVISIT AT EQUATOR

25



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A P P L I C A T I O N S

TIME-SERIES ANALYSIS OF POSIDONIA OCEANICA CARTOGRAPHY

FOR THE PROVISION OF EVIDENCE TO SUPPORT THE DEVELOPMENT OF BETTER COASTAL LAWS AND REGULATIONS



SPATIAL AND TEMPORAL EVOLUTION STUDIES

TO MONITOR DEGRADATION AS A RESULT OF NATURAL CAUSES OR COASTAL DEVELOPMENT



ASSESSMENT OF ECOSYSTEM STATUS

COMPARE THE BEFORE AND AFTER OF NATURAL EVENTS OR COASTAL HUMAN ACTIVITY, LIKE INFRASTRUCTURE DEVELOPMENT



DETERMINE THE SPATIAL EXTENT COVERED BY MARINE ECOSYSTEM

OVER A RANGE OF DEPTHS (DOWN NOT MORE THAN 30 METERS)



DISTINGUISH DIFFERENT SEAGRASS SPECIES

IN THE MEDITERRANEAN SEA, MAINLY, POSIDONIA OCEANICA AND CYMODOCEA NODOSA



CORRELATION OF MARINE ECOSYSTEMS WITH MARITIME ACTIVITIES

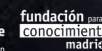
VESSEL TRAFFIC (S1 SAR DATA OR AIS), TOURISM, FISHING, ETC...



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EO DATA ; SENTINEL-2 IMAGERY

CONSULTING SERVICES ABOUT SENTINEL-2 AND APPLICATIONS
SUPPORT THE INTEGRATION OF SENTINEL-2 DATA INTO YOUR SOLUTION

SUPPORT IN ADDING NON-EO DATA INTO YOUR EO SOLUTION

COMBINE SENTINEL INFORMATION WITH AUXILIARY EXTERNAL SOURCES OF DATA, LIKE, WEATHER INFORMATION,

PROVIDE NEAR REAL-TIME MONITORING

SENTINEL-2 REVISIT TIME 5 DAYS AT EQUATOR AND SPATIAL RESOLUTION OF UP TO 10 METRES

TRANSFER ANALYSIS MODELS TO DIVERSE LOCATIONS

THE ANALYSIS DEVELOPED BY QUASAR CAN BE TRANSFERRED TO ANY LOCATION AND DIFFERENT TYPES OF ECOSYSTEMS

DEVELOPMENT OF DEDICATED TAILORED-MADE SOLUTIONS

FOR SATELLITE AND MARINE ECOSYSTEMS APPLICATIONS

PARTICIPATION IN R&D PROJECTS AT NATIONAL AND EUROPEAN LEVELS

QUASAR HAS EXPERIENCE LEADING EUROPEAN AND NATIONAL PROJECTS
QUASAR HAS EXPERIENCE WORKING WITHIN LARGE COLLABORATIONS



MARINE ECOSYSTEM

SENTINEL-2

MULTISPECTRAL INSTRUMENT (MSI)

WAVE ACQUISITION MODE
13 SPECTRAL BANDS: FOUR OF THEM AT 10 M SPATIAL RESOLUTION
5 DAY REVISIT AT EQUATOR

25



C U S T O M E R B E N E F I T

EO DATA-BASED DECISION MAKING

TRANSFORMING EO DATA INTO DECISION-READY PRODUCTS AND ACTIONABLE KNOWLEDGE

SUPPORT FOR TRANSPARENT ENVIRONMENTAL GOVERNANCE

DEVELOP TRANSPARENT DATA SYSTEMS PROVIDING A USEFUL TOOL FOR GOVERNMENTS

RAISING AWARENESS

THROUGH DISCLOSURE AND DISSEMINATION OF INFORMATION

PROTECTION OF THE MARINE ENVIRONMENT AND RESOURCES

IMPORTANCE TO SOCIETY AND THE ECONOMY

INVENTORY AND OBSERVATORY OF MARINE ECOSYSTEMS RESOURCES

NATIONAL AND REGIONAL LEVEL





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S U C C E S S S T O R I E S

MAPPING PO MEADOWS AROUND THE BALEARIC ISLANDS

ESABIC INCUBATION PROGRAM. 2018 – ONGOING. YEARLY MAPS FROM 2017 UNTIL 2021
TIME EVOLUTION STUDIES

MAPPING PO MEADOWS AROUND MALTA

ENVIRONMENT AND RESOURCES AUTHORITY (ERA) OF MALTA. 2022 – ONGOING. YEARLY MAPS 2020 AND 2021

MAPPING OF PO OCEANICA IN THE COAST OF SPAIN

MINIECO PROJECT. AUGUST 2022 – DECEMBER 2022. YEARLY MAP OF COAST OF MAINLAND SPAIN 2021
TIME EVOLUTION STUDY OF AN IDENTIFIED REGRESSION AREA

BOAT PRESSURE OVER MARINE ECOSYSTEMS

STUDY THE PRESSURE OF VESSEL PRESENCE WITH POSIDONIA OCEANICA AROUND THE BALEARIC ISLANDS, SUMMER 2021



MARINE ECOSYSTEM

25

SENTINEL-2

MULTISPECTRAL INSTRUMENT (MSI)

WAVE ACQUISITION MODE
13 SPECTRAL BANDS. FOUR OF THEM AT 10 M SPATIAL RESOLUTION
5 DAY REVISIT AT EQUATOR



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PRODUCE CARTOGRAPHY OF POTENTIAL AREAS OF INTEREST

NATURA 2000 SITES, MARINE PROTECTED AREAS, NATIONAL PARKS, ...

HISTORICAL AND EVOLUTIONARY STUDIES

IDENTIFY PROBLEMATIC REGIONS AND DEVELOP AND IMPLEMENT ALERT SYSTEMS

ADAPT MODEL FOR COMPLEX COASTAL WATER

INCORPORATE EFFECTS OF TURBIDITY, CHLOROPHYL-A, AND CDOM

HIGH RESOLUTION BATHYMETRY AND COMMERCIAL SATELLITE

ASSESS THE POTENTIAL IMPROVEMENT OF MARINE ECOSYSTEMS CARTOGRAPHY BY INTRODUCING HIGH RESOLUTION DATA

MAP OTHER SEAGRASS SPECIES

ZOSTERA SP., CYMODOSEA NODOSA

MEASURE CARBON SEQUESTRATION

BLUE CARBON AND BLUE ECONOMY

11-00—

—11-0

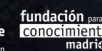
11-00—

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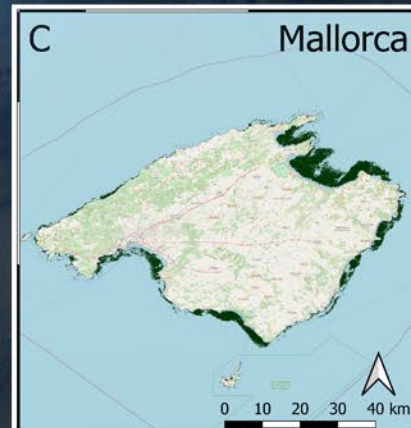
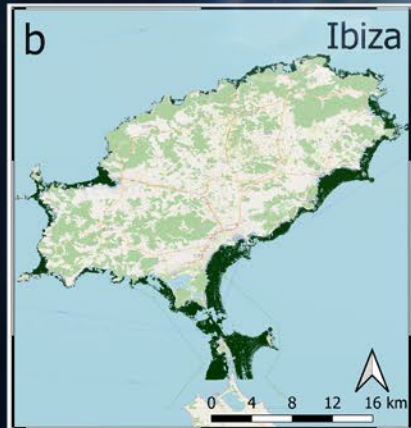
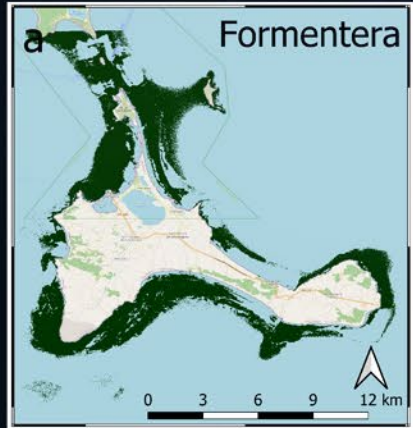




**SENTINEL-2
MARINE ECOSYSTEMS
MONITORING**

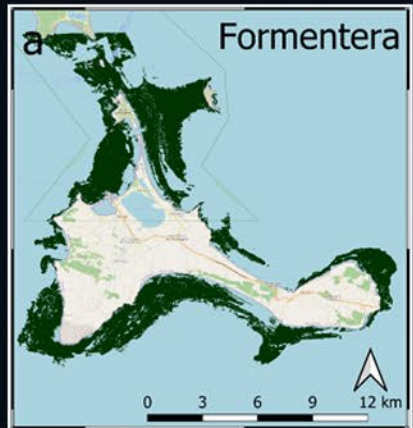
EXAMPLE APPLICATIONS

Case Study: Balearic Islands (2020 cartography)



Balearic Islands (Spain)

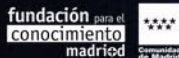
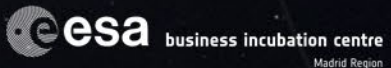
Satellite



In-situ

article in preparation

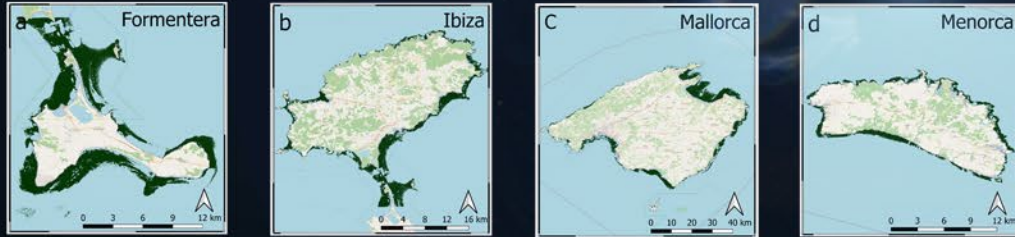
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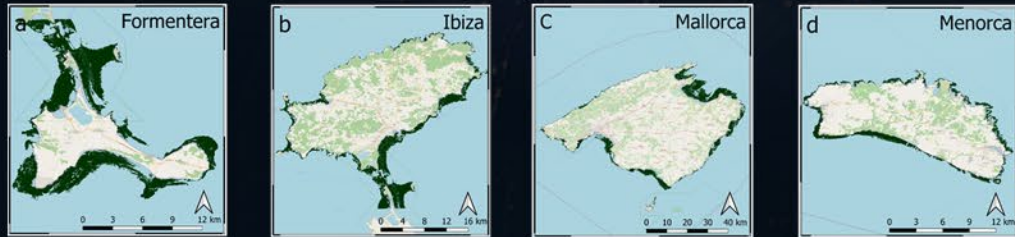
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Case Study: Balearic Islands (2020 cartography)



Satellite



In situ

Satellite – In situ

Match



NN sucessfully predicts PO

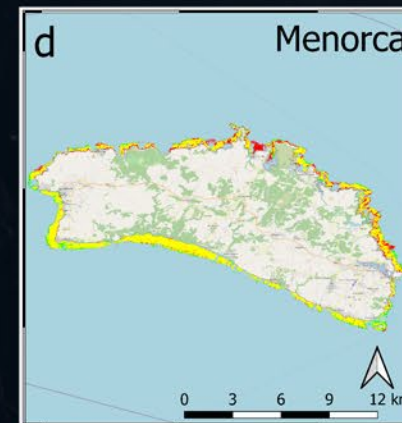
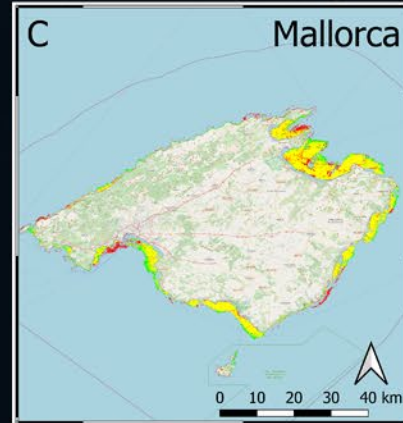
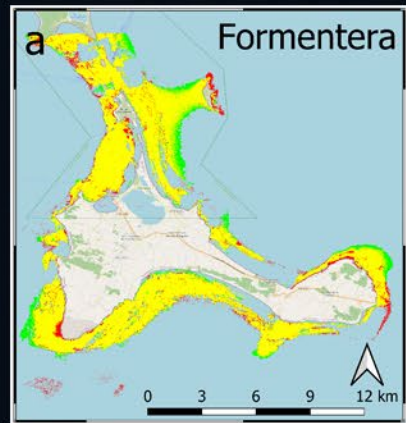
No match



NN failed to predict non-PO



NN failed to predict PO



Positive Precision

84%

Positive Recall

79%

Comparisson

article in preparation

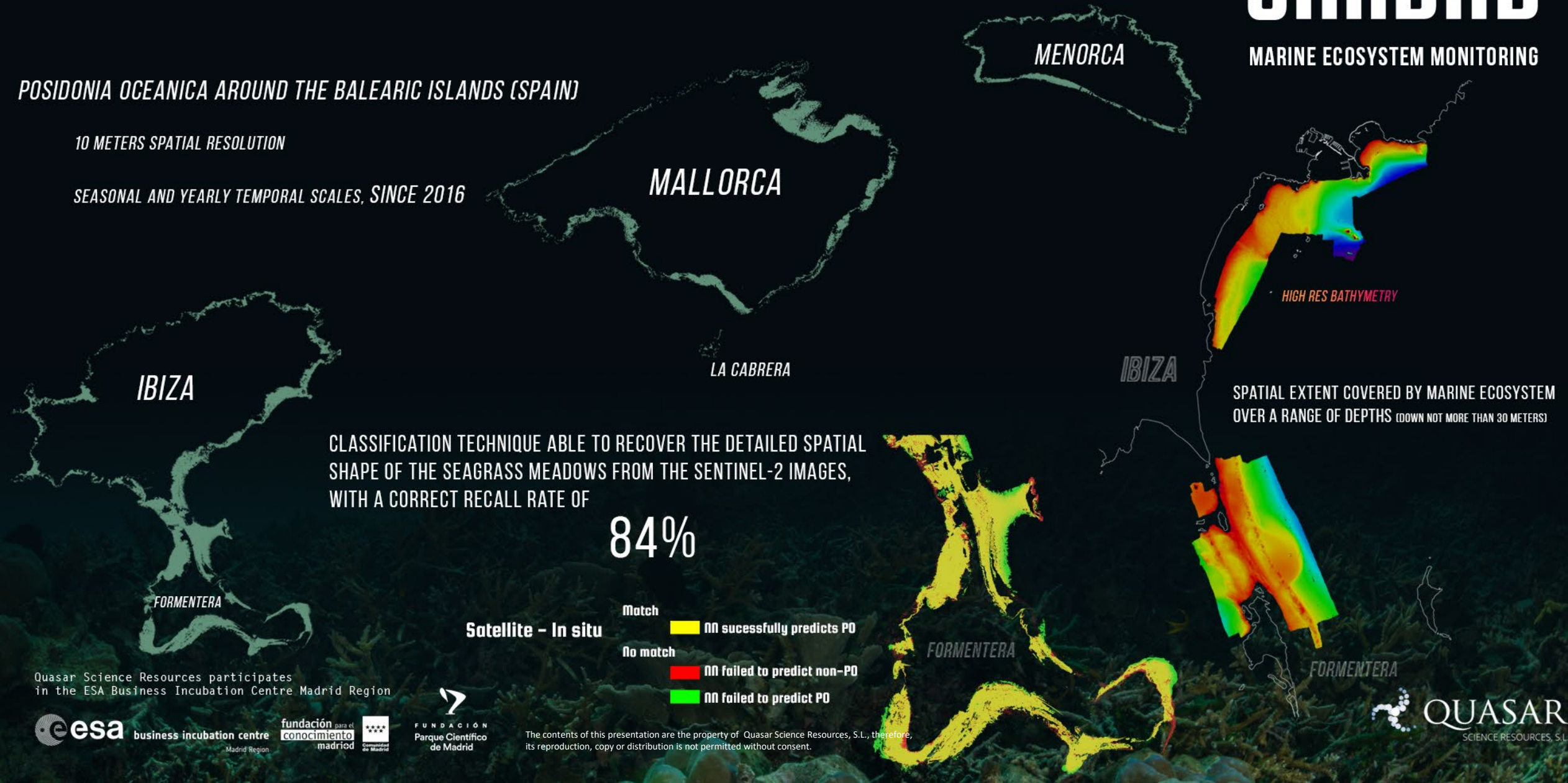
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MARINE ECOSYSTEMS SPATIAL AND TEMPORAL COVERAGE

POSIDONIA OCEANICA AROUND THE BALEARIC ISLANDS (SPAIN)

10 METERS SPATIAL RESOLUTION

SEASONAL AND YEARLY TEMPORAL SCALES, SINCE 2016



CLASSIFICATION TECHNIQUE ABLE TO RECOVER THE DETAILED SPATIAL SHAPE OF THE SEAGRASS MEADOWS FROM THE SENTINEL-2 IMAGES, WITH A CORRECT RECALL RATE OF

84%

Satellite - In situ

- Match
- No match
- NN successfully predicts PO
 - NN failed to predict non-PO
 - NN failed to predict PO

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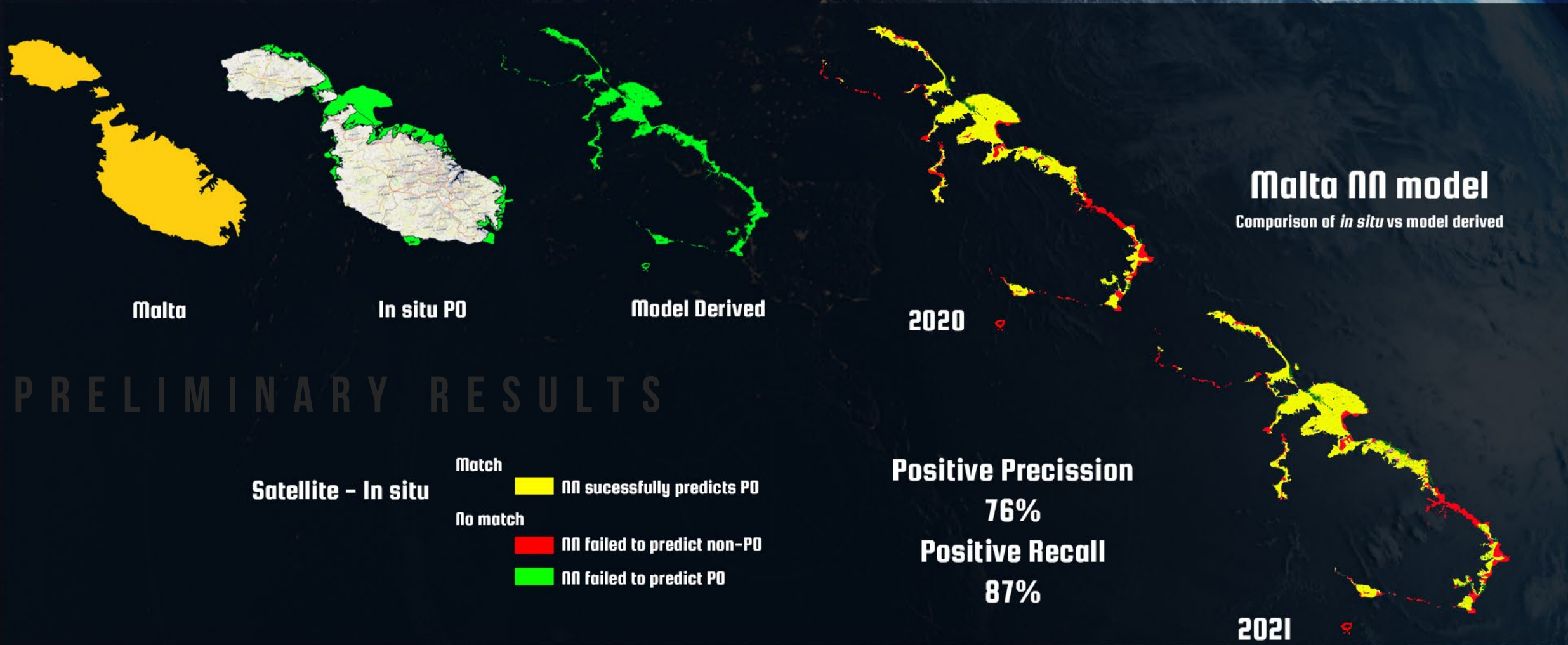


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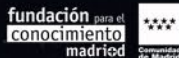
Model Transferability (Validation): Malta



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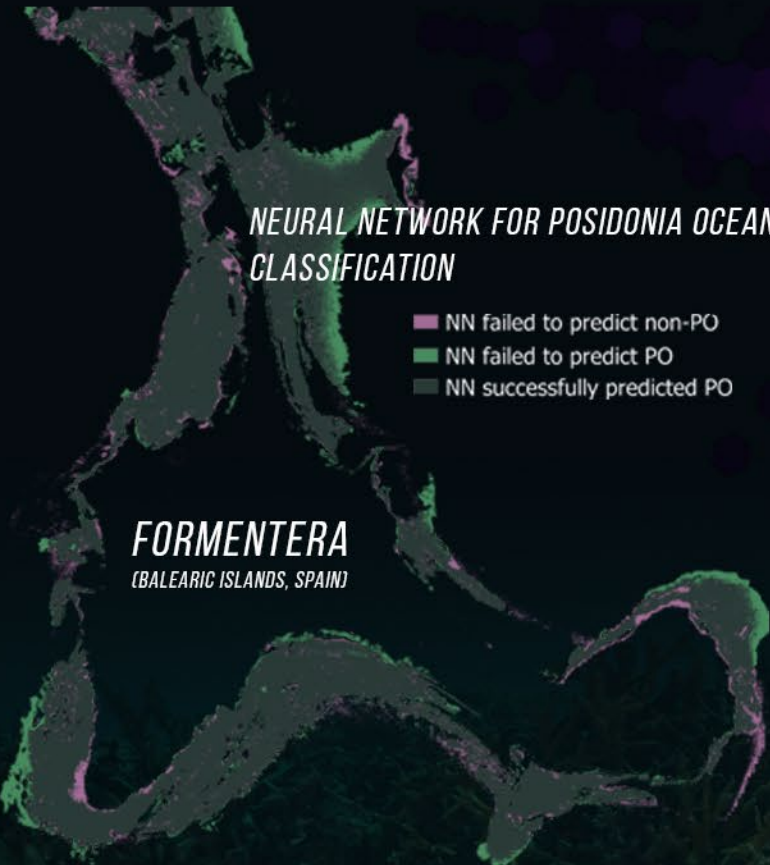
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AIS/SENTINEL-1 SAR DATA TO ASSESS BOAT PRESSURE OVER POSIDONIA MEADOWS



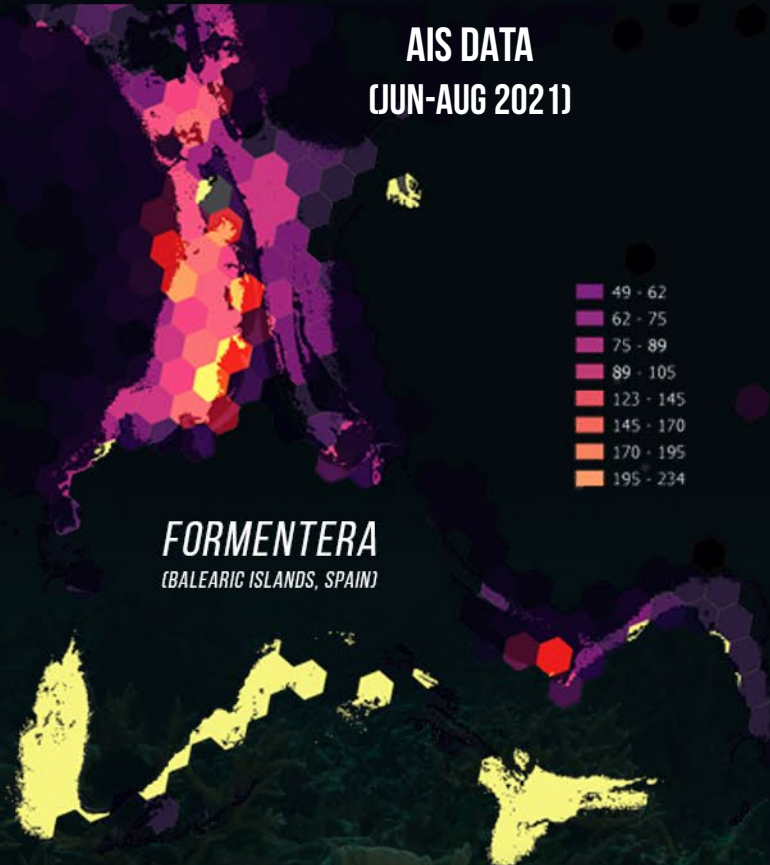
MARINE ECOSYSTEM MONITORING



NEURAL NETWORK FOR POSIDONIA OCEANICA
CLASSIFICATION

- NN failed to predict non-PO
- NN failed to predict PO
- NN successfully predicted PO

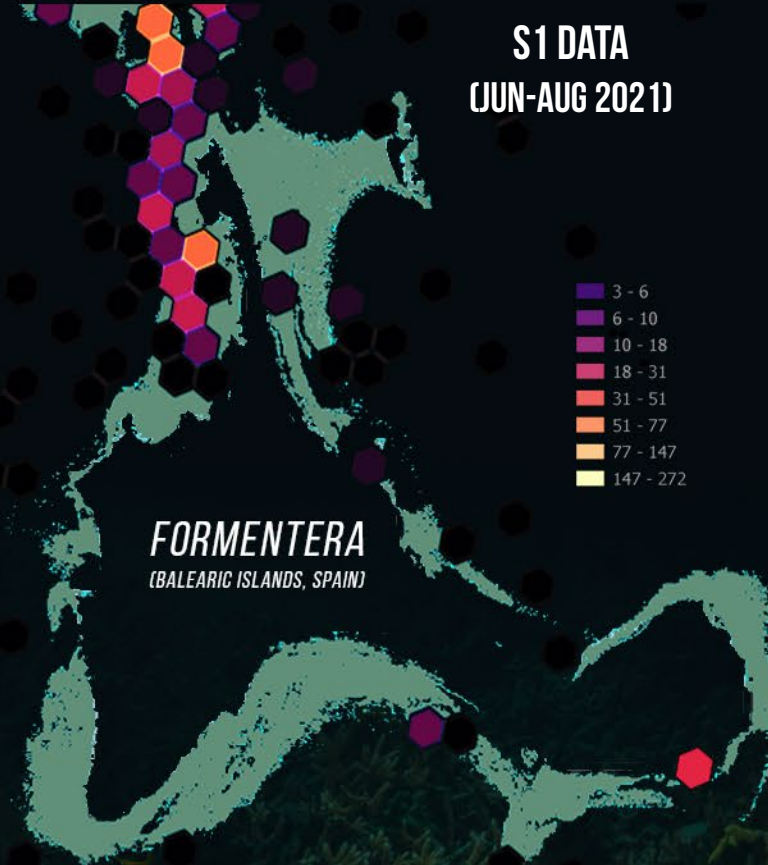
FORMENTERA
(BALEARIC ISLANDS, SPAIN)



AIS DATA
(JUN-AUG 2021)

- 49 - 62
- 62 - 75
- 75 - 89
- 89 - 105
- 123 - 145
- 145 - 170
- 170 - 195
- 195 - 234

FORMENTERA
(BALEARIC ISLANDS, SPAIN)

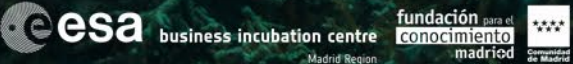


S1 DATA
(JUN-AUG 2021)

- 3 - 6
- 6 - 10
- 10 - 18
- 18 - 31
- 31 - 51
- 51 - 77
- 77 - 147
- 147 - 272

FORMENTERA
(BALEARIC ISLANDS, SPAIN)

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BOAT PRESSURE OVER MARINE ECOSYSTEMS
(AIS AND SENTINEL-1 DATA)





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PRODUCT DELIVERY

BUCKET STORAGE (CLOUD STORAGE: GOOGLE, AMAZON, ...)

ACCESS BY THIRD PARTY APPLICATIONS:
API, GEOSERVER, SFTP

QGIS & ARCGIS PLUGINS

TAILORED-MADE SOLUTION

PRODUCT FORMAT

GEOTIFF AND PNG

(GEOREFERENCE AND GEOCODING INFORMATION)

CLOUD OPTIMIZED GEOTIFF (COG)

(NORMAL GEOTIFF AIMED AT BEING HOSTED
ON A HTTP FILE SERVER)

METADATA SHAPEFILE

(GEOSPATIAL VECTOR DATA FORMAT FOR
GEOGRAPHIC INFORMATION SYSTEM (GIS) SOFTWARE)

TAILORED-MADE SOLUTION

SIMBAD SEP AT A GLANCE

DOCKER + KUBERNETES FOR AUTOMATING DEPLOYMENT, SCALING, AND MANAGEMENT OF CONTAINERIZED APPLICATIONS

SIMBAD PROVIDES,

MODULAR SYSTEM EASY TO MAINTAIN AND/OR MODIFY.
CONFIGURABLE AND SCALABLE IN TERMS OF PERFORMANCE AND FAULT TOLERANCE.
SERVICES ARE DEPLOYED AS NEEDED EITHER LOCALLY OR IN ANY CLOUD ENVIRONMENT.

SECURITY IN CLOUD ENVIRONMENTS

VISUALIZATION

DATA VISUALIZATION, MASK PROCESSING,
ALERTS AND NOTIFICATIONS CONFIGURATION

ADMINISTRATION

REGION CONFIGURATION, DOWNLOAD
AUTOMATIZATION, PROCESSING AUTOMATIZATION,
DATA AND IMAGES STORING

MONITORIZATION

ALERTS AND NOTIFICATIONS MANAGEMENT



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