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SIMBAD: PRECISION AGRICULTURE

A Scientific Exploitation Platform for Sentinel Imagery

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ENHANCE YOUR RESEARCH

Quasar Science Resources

Ignacio de la Calle, Scientist
Madrid, Spain
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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

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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.

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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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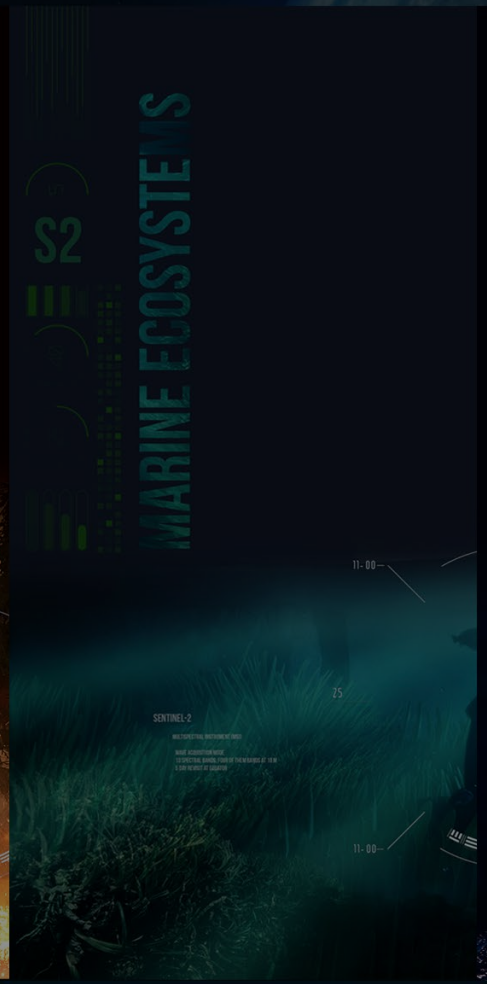
Boat Detection
SIMBAD

Wildfire
SIMBAD

Posidonia
SIMBAD

Water Quality
SIMBAD

Agriculture
SIMBAD



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AGRICULTURE IS CRUCIAL TO ECONOMIC GROWTH: ACCOUNTING FOR 4% OF GLOBAL GROSS DOMESTIC PRODUCT (GDP)

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HEALTHY, SUSTAINABLE AND INCLUSIVE FOOD SYSTEMS ARE CRITICAL TO ACHIEVE THE WORLD'S DEVELOPMENT GOAL. PRECISION AGRICULTURE SUPPORTS DECISION MAKING TO IMPROVE RESOURCES USE EFFICIENCY, PRODUCTIVITY, QUALITY, PROFITABILITY AND SUSTAINABILITY

AGRICULTURAL DEVELOPMENT IS ONE OF THE MOST POWERFUL TOOLS TO FEED A PROJECTED 9.7 BILLION PEOPLE BY 2050

ONE THIRD OF FOOD PRODUCED GLOBALLY IS EITHER LOST OR WASTED.

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Agriculture
SIMBAD

sentinel-1

SENTINEL-1
PRECISION AGRICULTURE

Launch

Date: 03 April 2014 - Sentinel-1A
25 April 2016 - Sentinel-1B

Site: Kourou, French Guiana

Rocket: Soyuz rocket

Revisit

3 days at equator

Synthetic Aperture Radar (SAR)

SENTINEL-1 IS A CONSTELLATION OF TWO IDENTICAL SATELLITES IN THE SAME ORBIT. IT PROVIDES AN ADVANCED RADAR INSTRUMENT TO PROVIDE AN ALLWEATHER, DAY-AND-NIGHT SUPPLY OF IMAGERY OF THE EARTH'S SURFACE.

esa

Copernicus
Europe's eyes on Earth

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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Agriculture
SIMBAD

sentinel-2

SENTINEL-2
PRECISION AGRICULTURE

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 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.

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Copernicus
Europe's eyes on Earth

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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Agriculture
SIMBAD

SENTINEL-1 AND SENTINEL-2 PRECISION AGRICULTURE

QUASAR HAS DEVELOPED AN AUTOMATED DATA PROCESSING PIPELINE FOR SENTINEL-1 SAR AND SENTINEL-2 IMAGERY TO EXTRACT PRODUCTS TO BE USED FOR PRECISION AGRICULTURE APPLICATIONS

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PRODUCTS

VEGETATION PARAMETERS AND INDICES

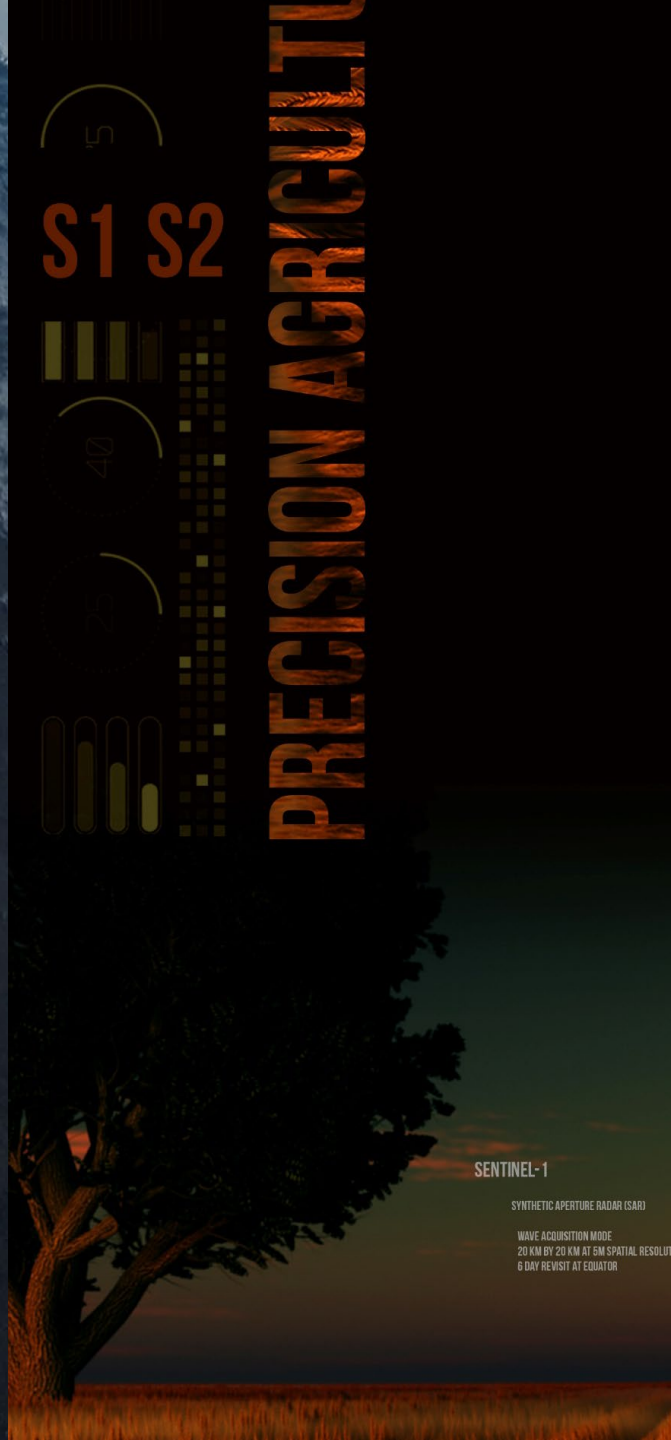
AREA OF INTEREST. NDVI, SAVI, NDWI, DVI, ...

TIME SERIES OF VEGETATION PARAMETERS AND INDICES

DIFFERENT TIMESCALES (YEARLY, SEASONAL, ...)

SOIL MOISTURE MAPS

SENTINLE-1 AND SENTINEL-2. 10 METRE SPATIAL RESOLUTION



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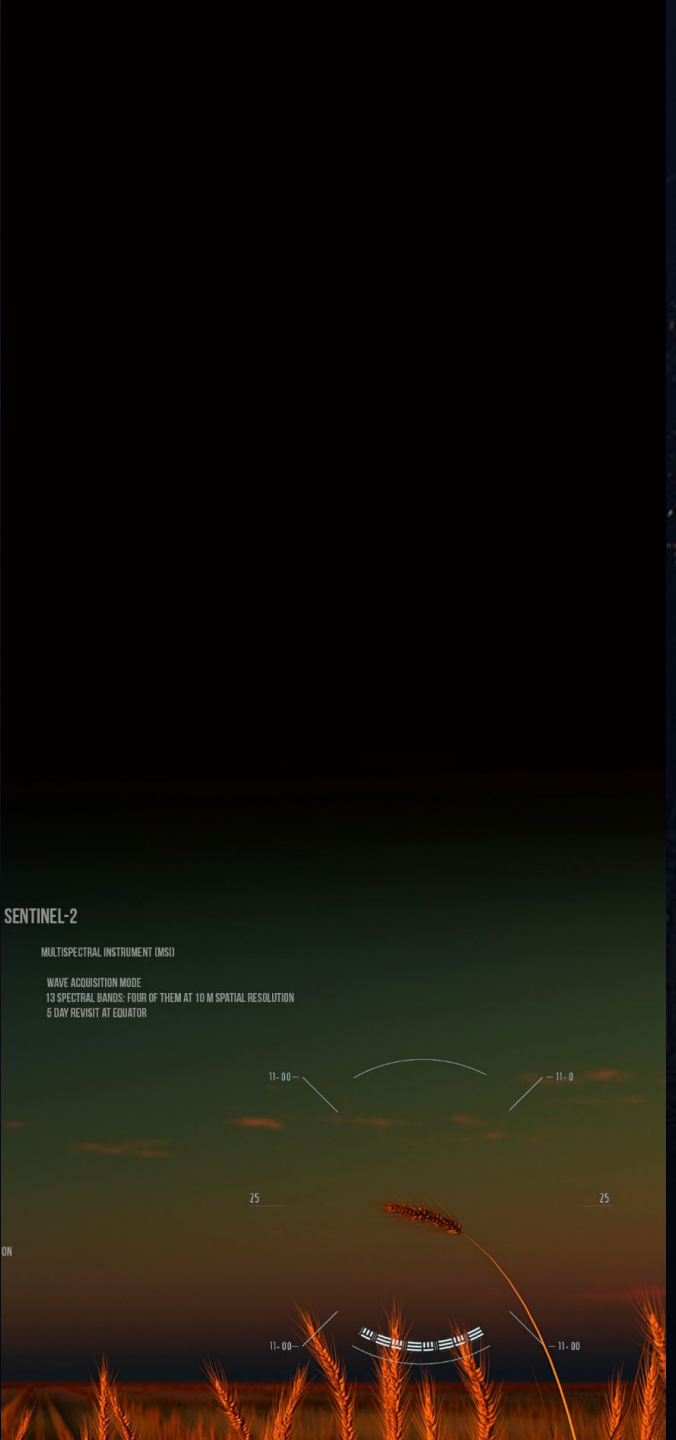

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APPLICATIONS

REMOTE CROP MONITORING

WITH HIGH SPATIAL DETAIL (10 M)

VEGETATION INDICES

WHEN USED CORRECTLY, THESE INDICES PROVIDE INFORMATION ON THE PHYTOSANITARY STATUS OF THE VEGETATION, PHENOLOGY, WATER STRESS, ...

ESTIMATION OF PARAMETERS SUCH AS HEIGHT, VOLUME AND BIOMASS

BISTATIC INTERFEROMETRY TECHNIQUES DATA FROM COMMERCIAL SATELLITES CAN PROVIDE THIS INFORMATION

ANALYSIS OF CROP DYNAMICS AND ROTATION USING TIME SERIES

GENERATION OF ANOMALIES AND PREDICTION MODELS FOR CROP MANAGEMENT

GENERATION OF OPERATIONAL MODELS

CORRELATION OF PHENOLOGICAL CYCLE WITH PRODUCTION

DEVELOPMENT AND APPLICATION OF DIFFERENT TIME SERIES FILTERING

IMAGE IMPROVEMENT, CROP IDENTIFICATION, ...

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SERVICES

EO DATA ; SENTINEL-1 SAR AND SENTINEL-2 IMAGERY
CONSULTING SERVICES ABOUT SENTINEL-1 AND SENTINEL-2 APPLICATIONS
SUPPORT THE INTEGRATION OF SENTINEL-1 AND SENTINEL-2 DATA INTO YOUR SOLUTION

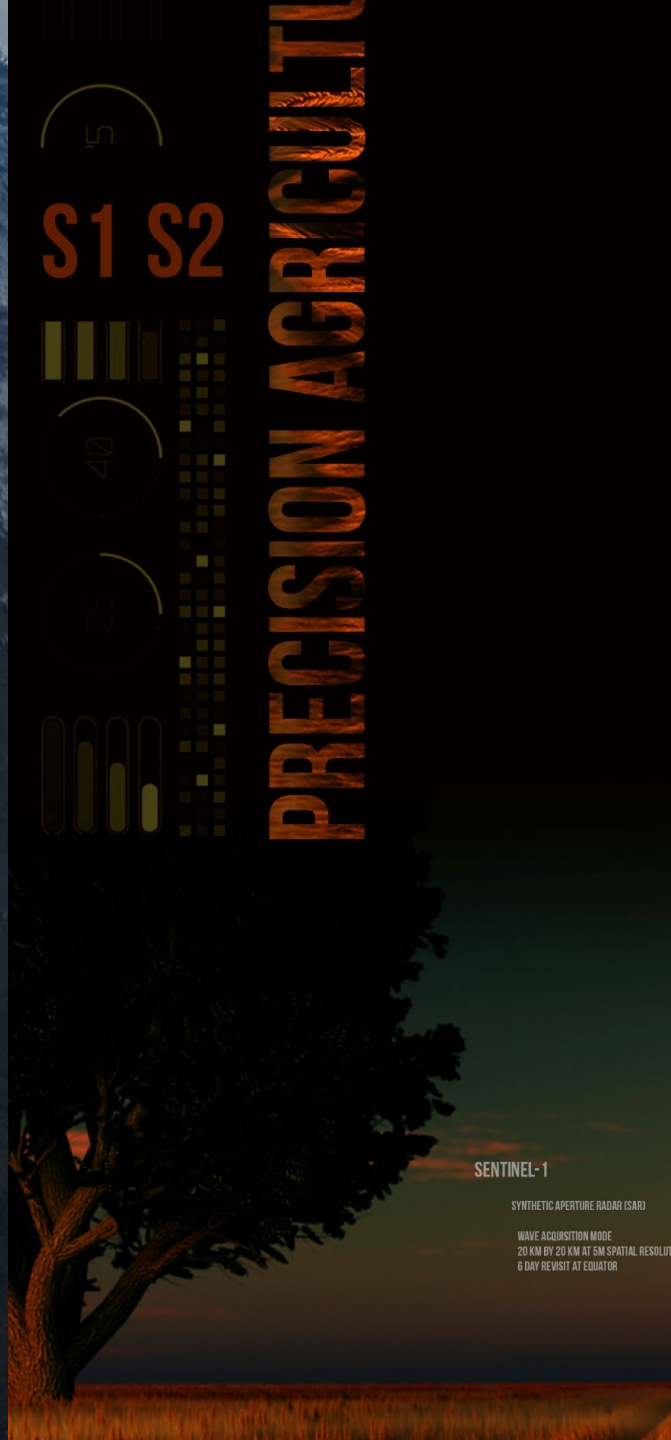
SUPPORT IN ADDING NON-EO DATA INTO YOUR EO SOLUTION
COMBINE SENTINEL INFORMATION WITH AUXILIARY EXTERNAL SOURCES OF DATA, LIKE, WEATHER INFORMATION, ...

PROVIDE NEAR REAL-TIME MONITORING
SENTINEL-2 REVISIT TIME 5 DAYS AT EQUATOR AND SPATIAL RESOLUTION OF UP TO 10 METRES
SENTINEL-1 REVISIT TIME 3 DAYS AT EQUATOR

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 PRECISION AGRICULTURE 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



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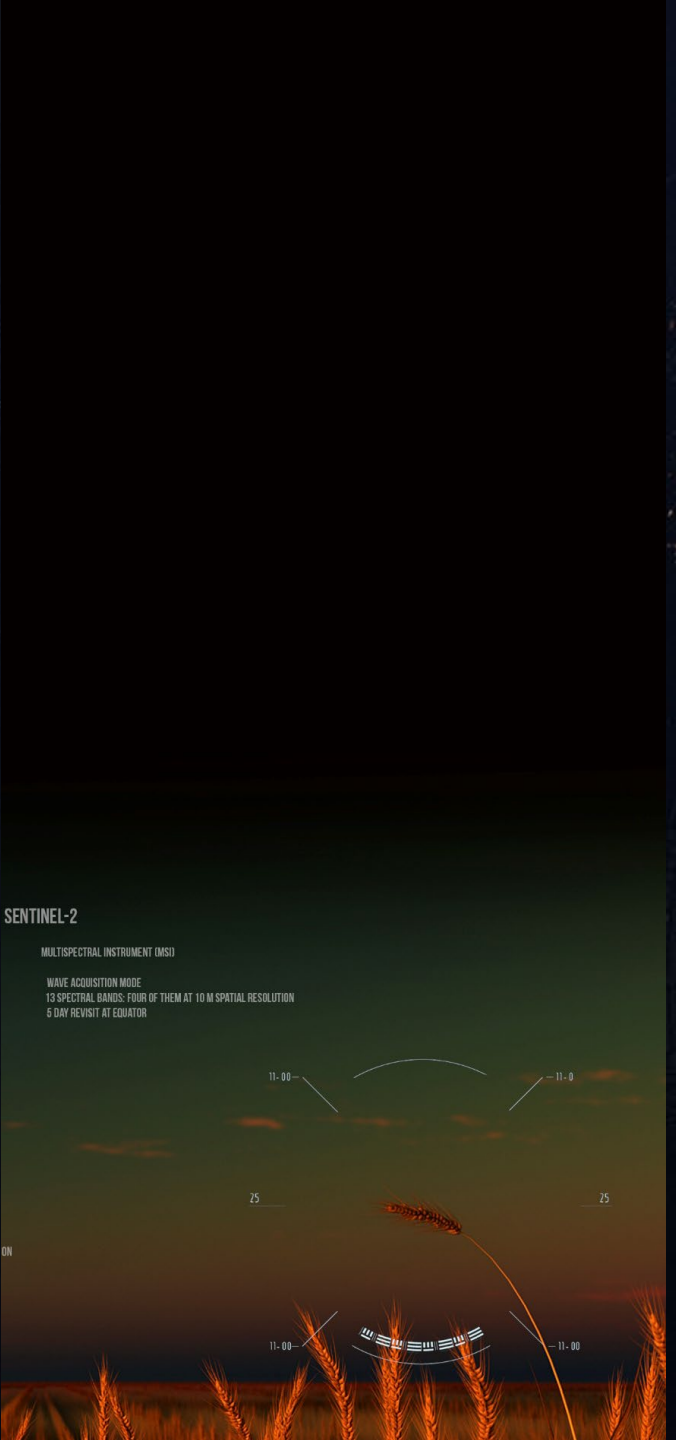

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CUSTOMER BENEFIT

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 AGRICULTURAL ENVIRONMENT

IMPORTANCE TO SOCIETY AND THE ECONOMY

INVENTORY AND OBSERVATORY OF AGRICULTURAL RESOURCES

NATIONAL AND REGIONAL LEVEL

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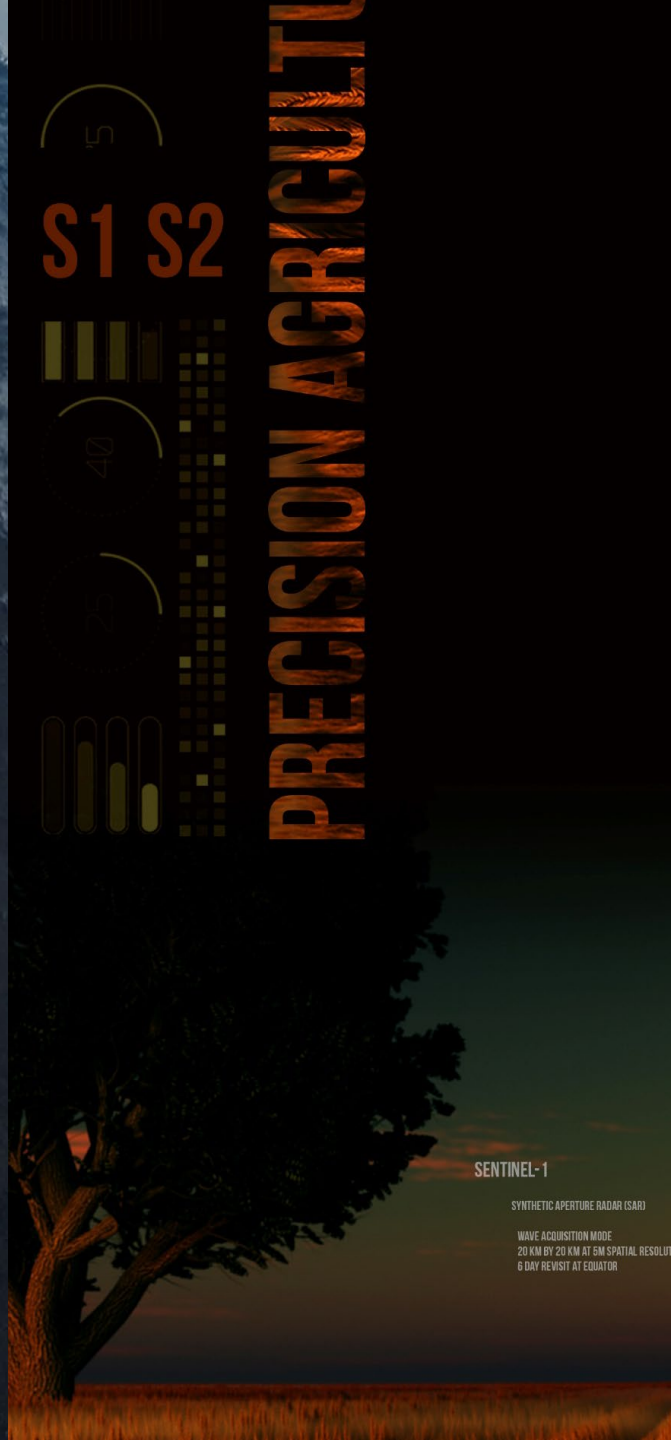
SUCCESS STORIES

EL BURGO DE OSMA (SORIA), APPLE TREE PLANTATION

TESTING OPERATIONAL SYSTEM FOR SOIL MOISTURE MAPPING FOR AGRICULTURE APPLICATIONS, A SOLUTION THAT WORKS OVER BARE SOILS, AS WELL AS SOILS WITH VEGETATION COVER.

EL BURGO DE OSMA (SORIA), APPLE TREE PLANTATION

FOLLOW CHANGES IN THE RADAR SIGNAL WHICH ARE ASSUMED TO BE DUE TO CHANGES IN THE SOIL MOISTURE.



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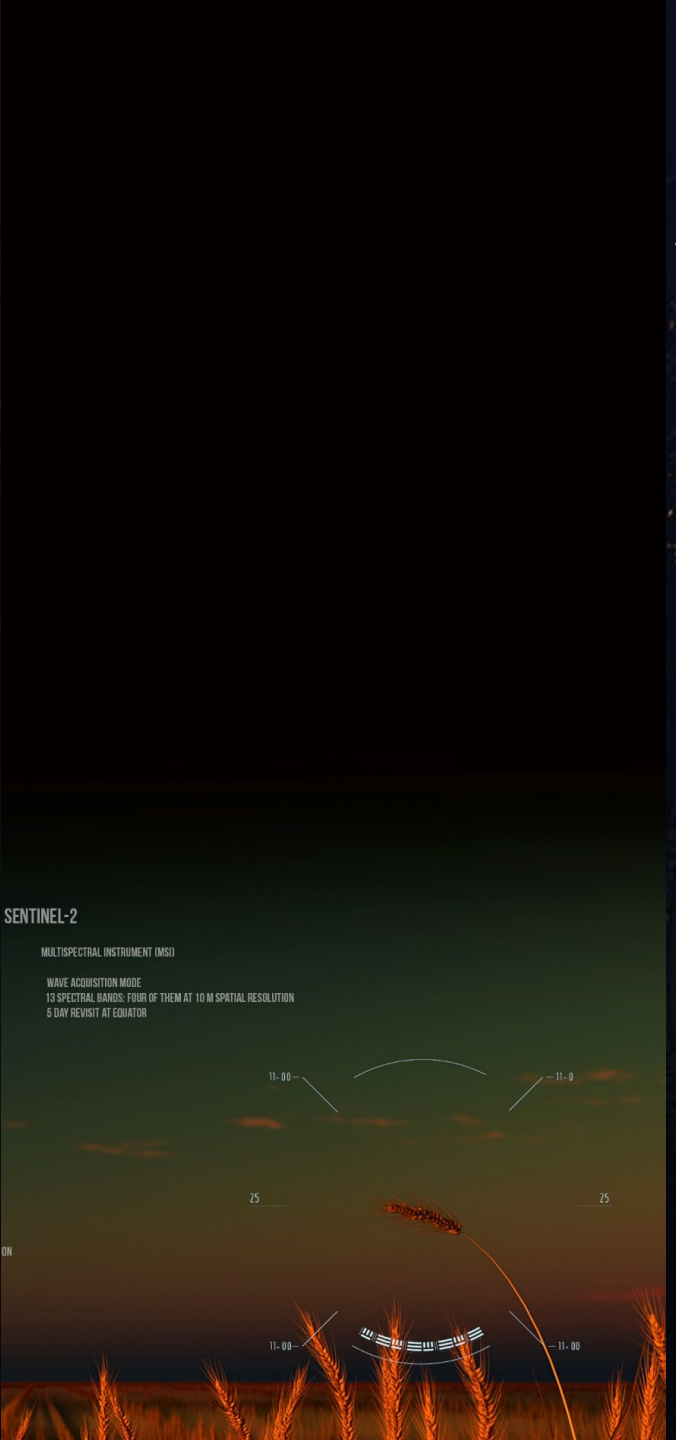

FUTURE DEVELOPMENTS

SOIL PROPERTIES

DEVELOPMENT OF OPERATIONAL MAPS TO DISTINGUISH DIFFERENT TERRAINS, FOR THE MANAGEMENT OF IRRIGATION AND THE IMPLEMENTATION OF AGRICULTURAL STRATEGIES

CROP GROWTH

TOOLS TO DERIVE CROP GROWTH AND BIOMASS AVAILABLE IN CROP FIELDS AND THEIR EVOLUTION WITH TIME

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SENTINEL-1 AND SENTINEL-2 PRECISION AGRICULTURE

EXAMPLE APPLICATIONS

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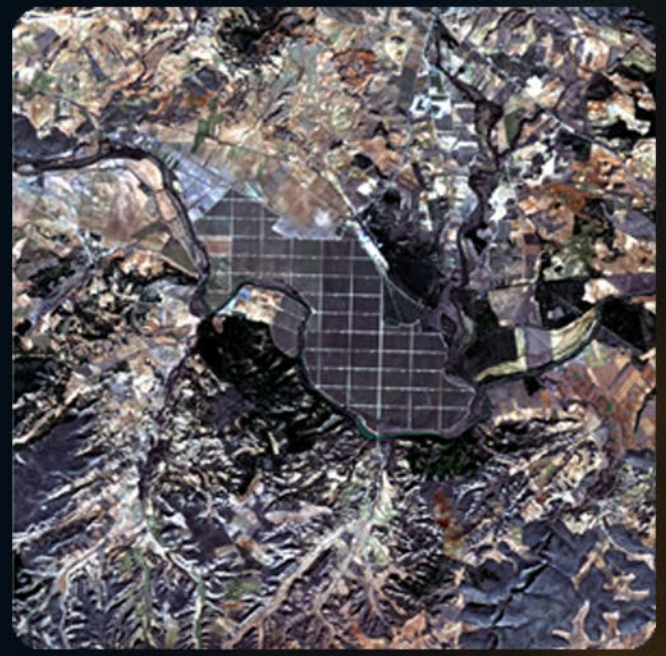
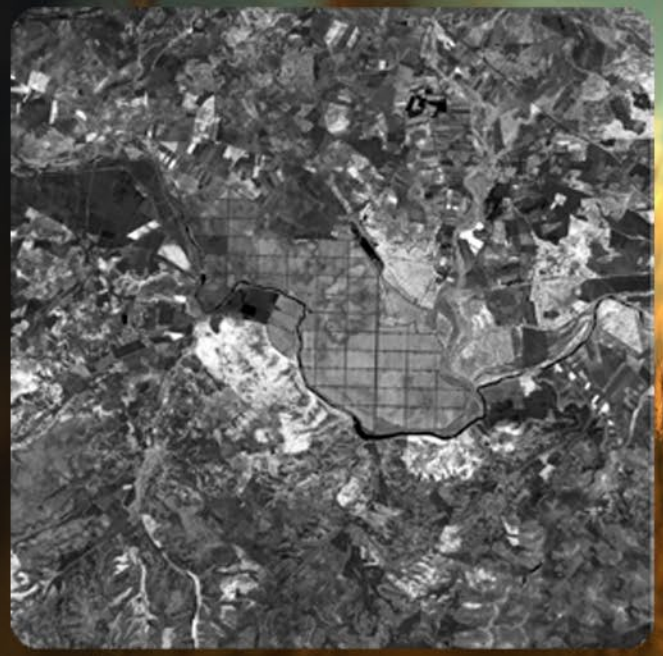
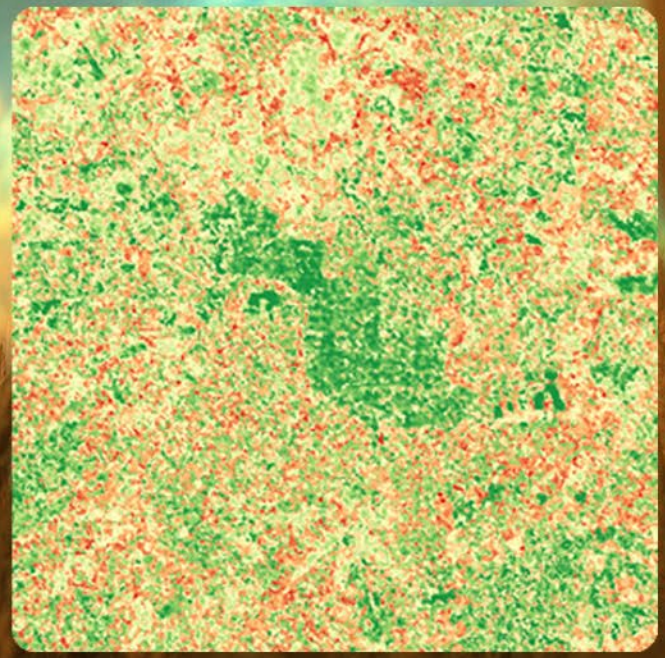
SENTINEL-2 -- RGB IMAGE



SENTINEL-2 -- NDVI



SENTINEL-1 -- SOIL MOISTURE



Agriculture

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SENTINEL-1 SAR SOIL MOISTURE FOR AGRICULTURE APPLICATIONS

SENTINEL-1 AND SENTINEL-2 FOR CROP MONITORING, MANAGEMENT AND ASSESSMENT

- CHARACTERIZATION AND MONITORING OF SOIL MOISTURE (SENTINEL-1 SAR)
- DERIVATION OF SEVERAL VEGETATION INDEXES (NDVI, SAVI, NDWI, DVI, ...)
  FOR PHENOLOGY STUDIES, PHYTOSANITARY AND WATER STRESS STATE OF CROPS
- DEVELOPMENT OF ALGORITHMS TO DETECT VEGETATION CHANGES
- PREDICTION OF THE PRODUCTION AND EVOLUTION OF CROPS USING TEMPORAL SERIES ANALYSIS
- DEVELOPMENT OF PREDICTIVE MODELS FOR CROP MANAGEMENT
- IDENTIFICATION OF CROP CYCLES

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SENTINEL-2 IMAGERY FOR AGRICULTURE APPLICATIONS

SENTINEL-2 TIME SERIES FOR CROP MONITORING, MANAGEMENT AND ASSESSMENT

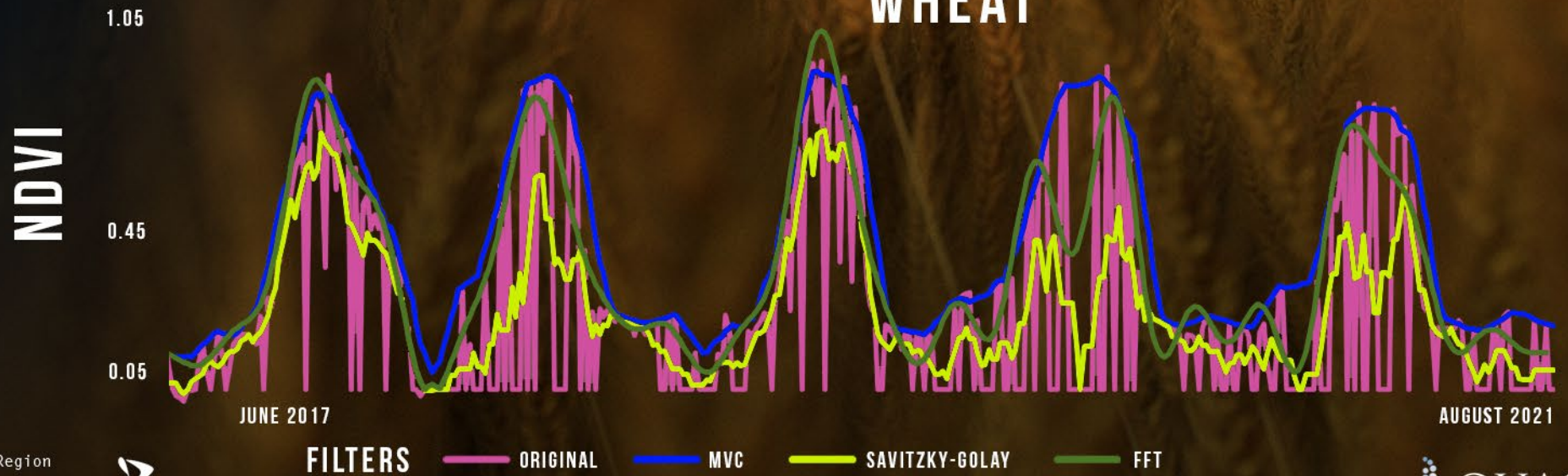
ANALYSIS OF CROP DYNAMICS WITH VEGETATION INDEXES USING TIME SERIES CAN PROVIDE IMPORTANT INFORMATION ABOUT CROP ROTATION.

DIFFERENT FILTERS APPLIED TO THE TIME SERIES CAN BE DEVELOPED AND USED TO, FOR EXAMPLE, OBTAIN CLEANER IMAGES AND IMPROVE THEIR QUALITY, AS WELL AS, TO DEVELOP ANOMALIES AND PREDICTION MODELS.

WHEAT CROP
2019

NDVI

NDVI AFTER FILTERING AND CLOUD INTERPOLATION



NDVI TIME SERIES (2017 - 2021)

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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

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SIMBAD SEP AT A GLANCE

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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

QUASAR SEP
SIMBAD

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