→ THE ESA EARTH OBSERVATION Φ-WEEK

EO Open Science and FutureEO

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HYBRIS: Analysis and Design of a Hyper-Spectral CubeSat Mission for Multiple Remote Sensing Applications and Earth Observation Synergies

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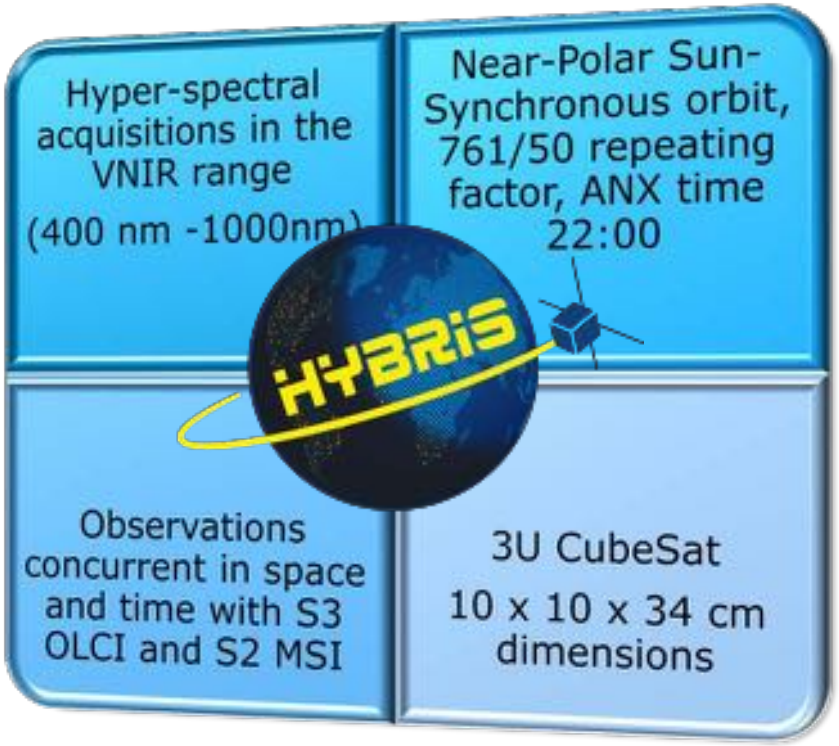
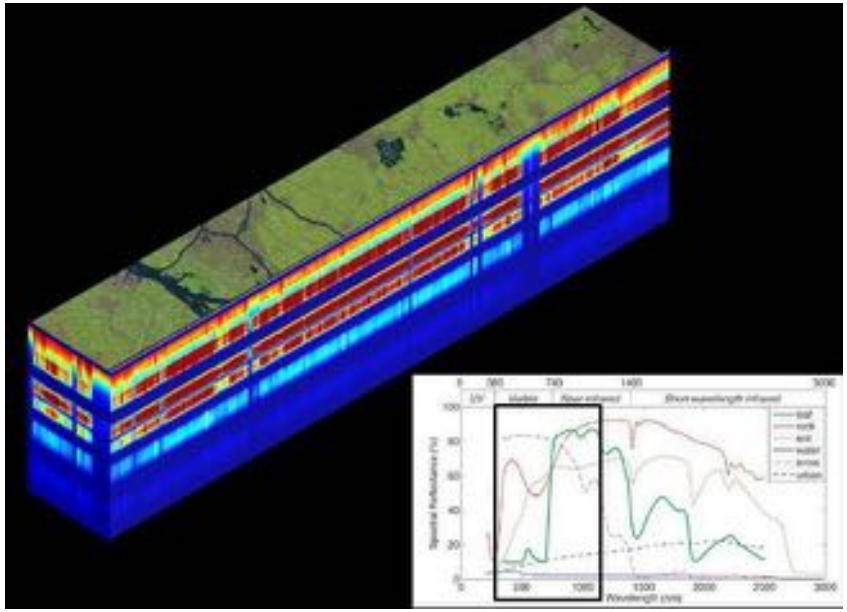
HYBRIS (HYperspectral BRIdge for Sentinels)



HYBRIS Mission Objectives

Hyper spectral (more 120 bands) CubeSat mission



Great variety of possible applications:

- Crops classification;
- Land mapping,
- Coastal applications.

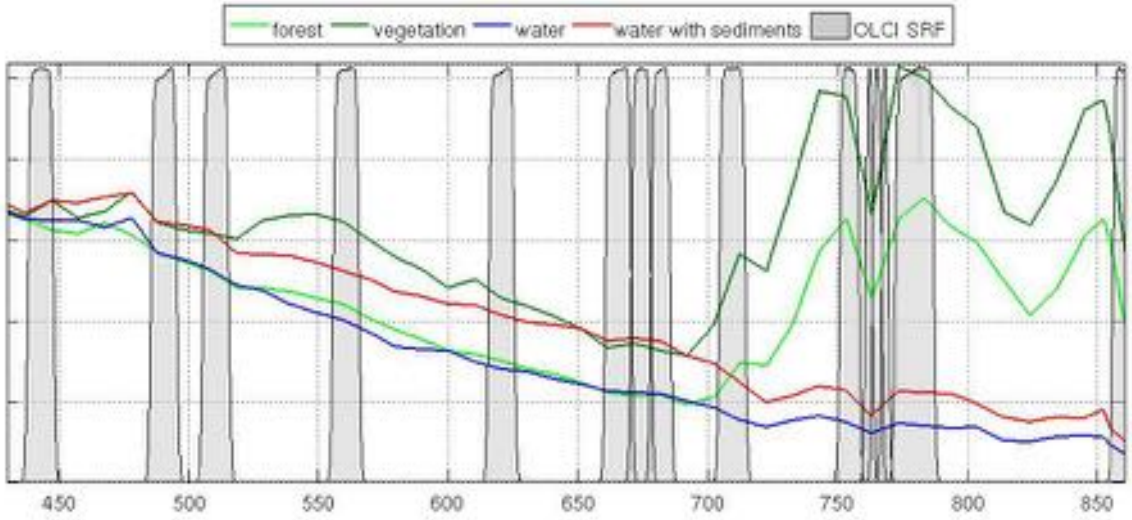
More than 120 bands in VIS and NIR

Spectral range 400-1000 nm
Spectral resolution 5 nm

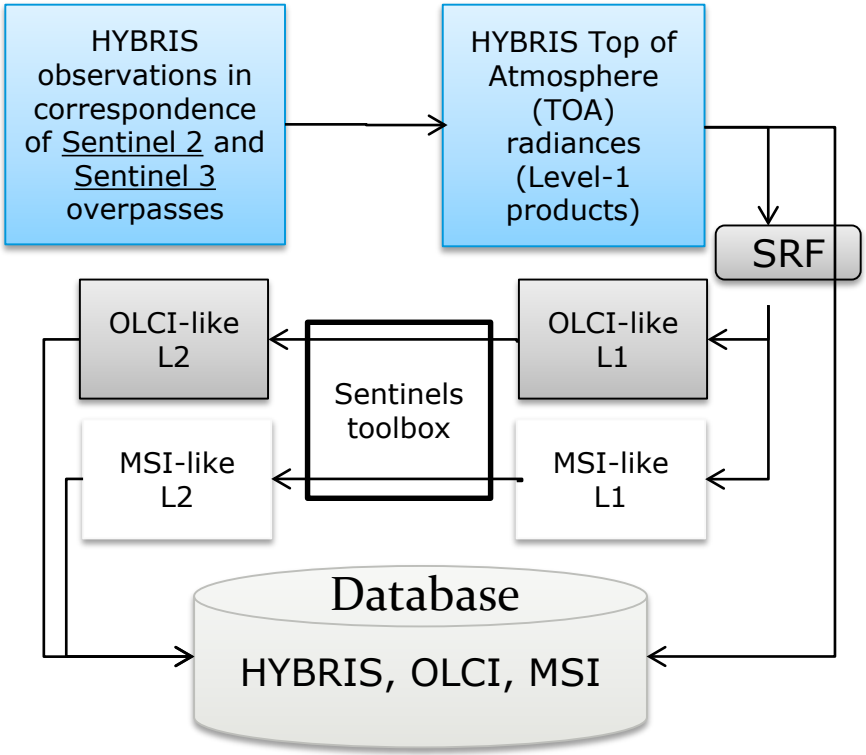
Swath: 40 km
Spatial res.: 20 m

Synergies with Sentinels

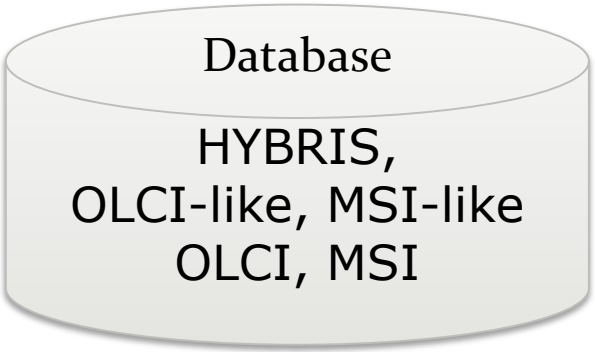
HYBRIS will provide **transfer functions** for implementing combined Sentinel 2 -Sentinel 3 (MSI and OLCI) products



Synergies with Sentinels



Synergies with Sentinels



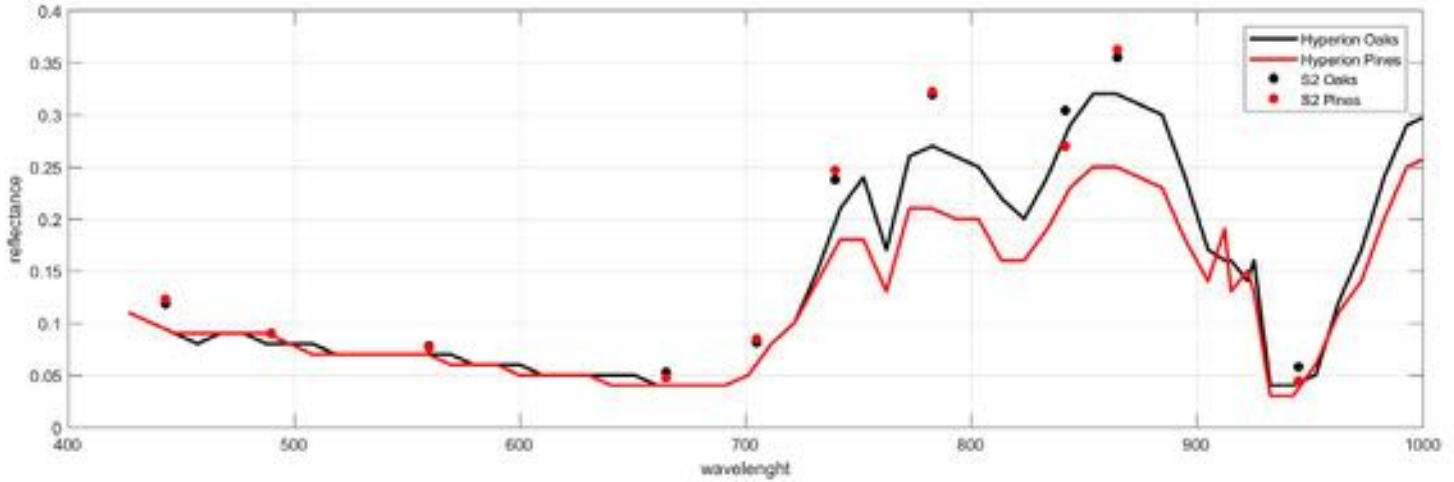
- Systematic comparison of Sentinels and Sentinels-like products
- Inter-calibration with Sentinels-like
- Data fusion studies of OLCI-like and MSI-like
- Data fusion studies of Sentinels and HYBRIS

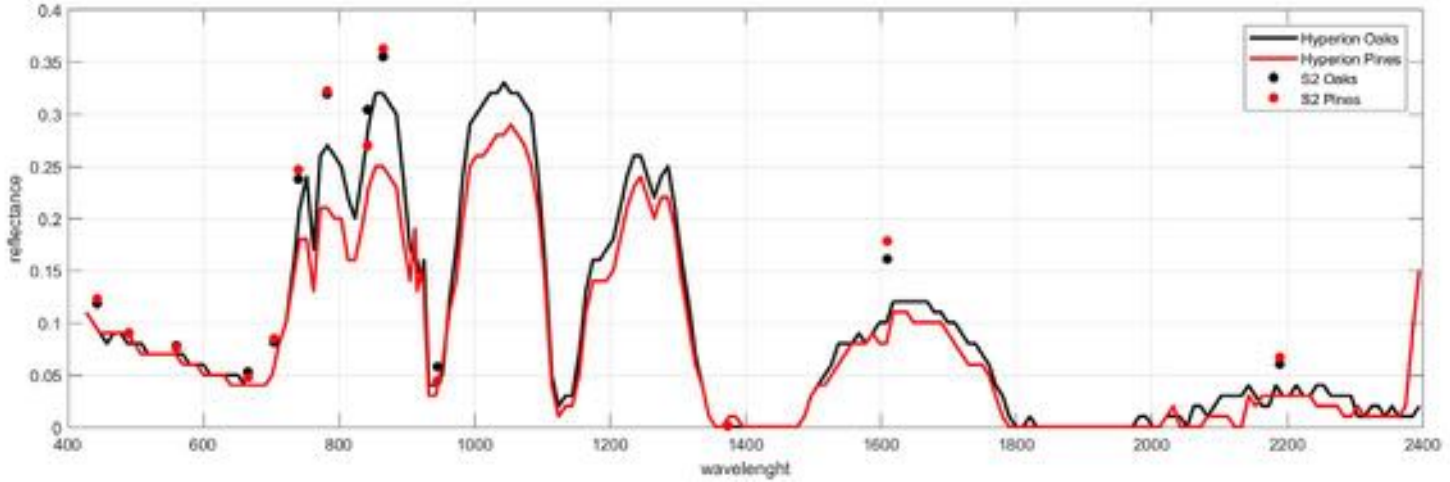
Example with Sentinel-2

Example with Sentinel-2

Hyperion

Sentinel 2





Innovation and benefits

HYBRIS as a low-cost precursor for testing innovative technical solutions for an eventual **future hyperspectral mission**.

The main identified issues will be tackled:

1) on board optimal compression of the hyperspectral measurements,

2) use of advanced and COTS components for data downlink,

3) studies on the correction of the atmospheric effects in the full hyperspectral domain,

4) definition of calibration procedures:

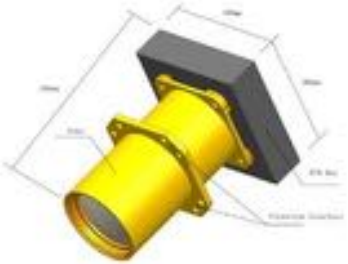
I. selection of vicarious calibration targets

II. inter-calibration with the operational Sentinels optical payloads

Space Segment

Payload Comp.

VNIR Camera



UHF TT&C

Structure

ADCS

X-Band System

Power

OBDH

Risks

Initial risk areas include:

a. COTS camera does not have space heritage or has been validated at LEO temperatures in vacuum.

b. Calibration can be done only with vicarious strategy

c. higher downlink data rates than is typical with CubeSat missions.

d. Onboard SW compression and pre-processing

e. Image acquisition requires high level attitude control and determination.

Risk mitigation strategy:

a.Hardware designed from manufacturer "die hard" and compliant to space environment (more tests).

b.Accurate pre-launch calibration(s) and vicarious calibration on flight.

c.The most advanced S-Band on market has been selected (additional GS could be evaluated).

d.Specific WP (SW design) to these activities (added value!).

e.Dedicated subsystem with:

- Sun sensor and star tracker;
- Reaction Wheels and Magnetorquers.

Consortium

GAUSS SRL

- Nanosatellite Architecture Design and Manufacturing
- Nanosatellite Sub-systems Design, Procurement and Manufacturing
- Ground Stations Design and Procurement
- Nanosatellite Deployment Systems

SERCO SPA

- Spacecraft Management and Operations
- Ground Segment Architecture and PDGS Implementation
- EO Data Processing and Quality, Archiving and Dissemination
- Software Engineering: Processors and Algorithms

CNR-IFAC

- Research in optoelectronics, spectroscopy and ICT
- Sensors, remote sensing, laser technologies, micro optics, microwaves, and image and signal elaboration
- New techniques - Build instruments prototypes – Instrument Calibration and Characterization

Summary

Hyperspectral cubesat mission

Primary goal: testing data fusion between sentinels optical intruments

Secondary goal: realize a low-cost precursor and testing innovative technical solutions

Feasible platform with COTS and addititve manufacturing technologies