62nd COPUOS Session

PRISMA, the Italian Hyperspectral Mission

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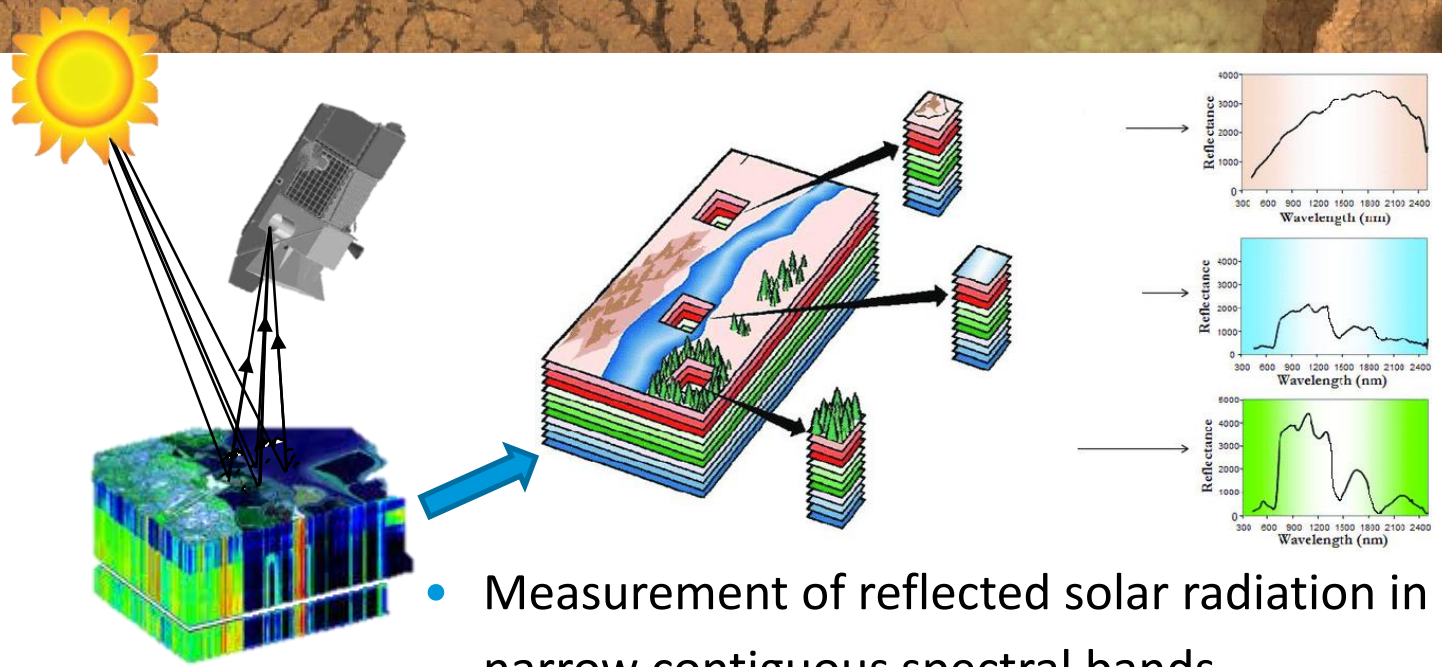
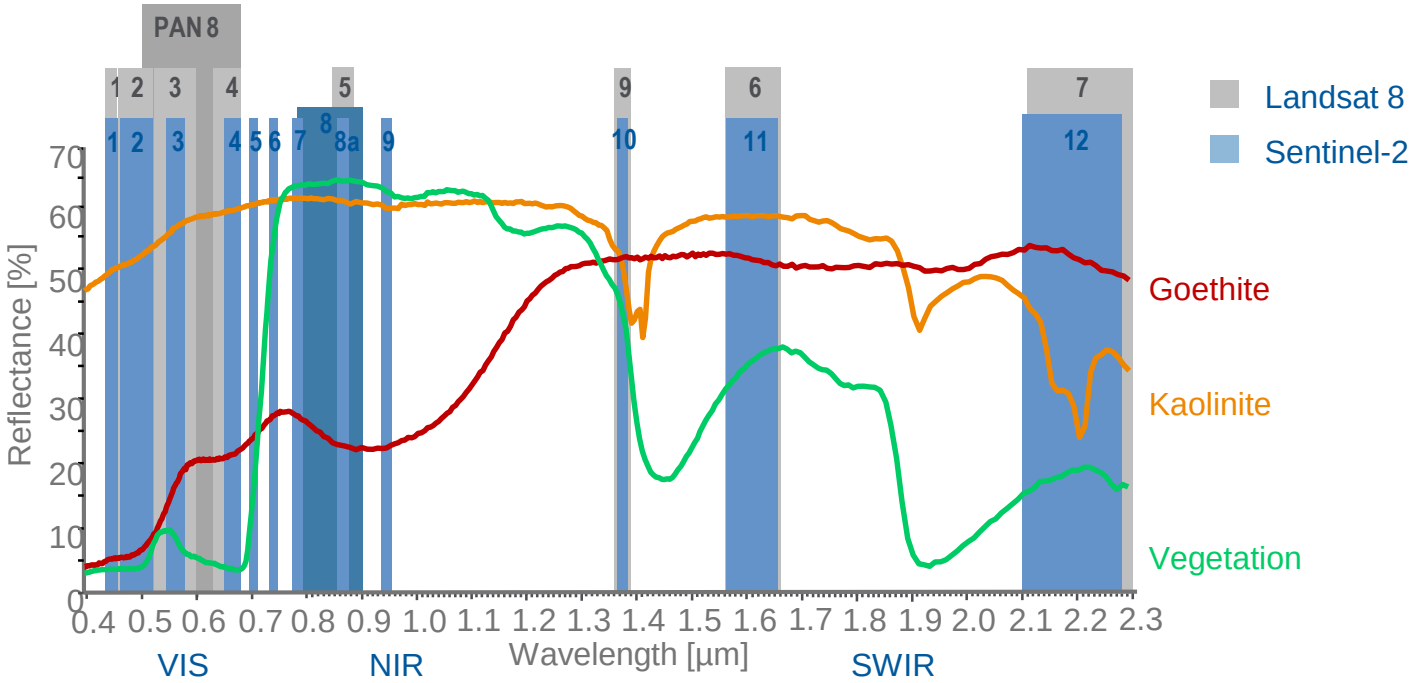
Hyperspectral remote sensing



- Measurement of reflected solar radiation in many narrow contiguous spectral bands
- Quantitative derivation of bio-geophysical parameters of vegetation, soil, water bodies, artificial surfaces

Hyperspectral vs. multispectral systems



Many surface information can be derived more accurately with hyperspectral data: they are essential for applications!

Hyperspectral Earth imaging from visible to shortwave infrared

- Huge experience with airborne hyperspectral sensors… but spatial/temporal coverage is inherently limited.
- Technology of hyperspectral instruments is mature and flight proven:
  - Two hyperspectral missions operated in-orbit: Hyperion on EO-1 (NASA, since 2000, actually de-commissioned) and CHRIS on PROBA-1 (ESA, since 2001 still operational).
- Since 2008, some hyperspectral missions, expected to provide better performances started their development, both in Europe and worldwide, between them **PRISMA….**

what happened?

Launched on March 22th, 2019!

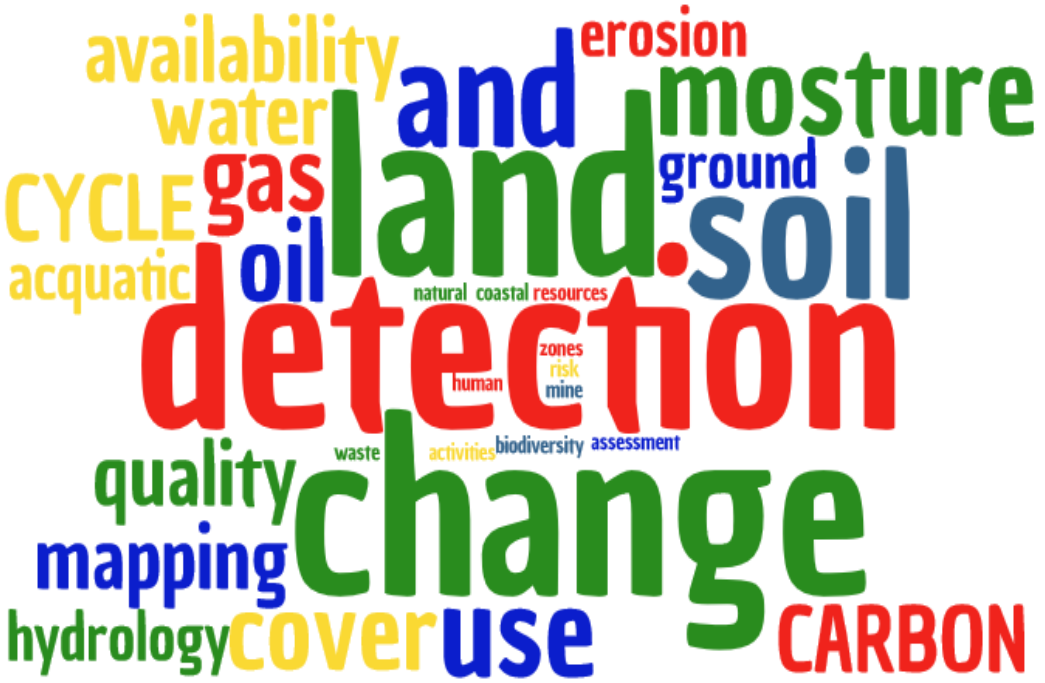
Historic event, with huge symbolic significance for Italy:

- ❑National program - Fully funded and developed by ASI;
- ❑Industrial Organization:
  - Consortium of Italian companies, OHB Italia & LEONARDO
  - TELESPAZIO, THALES ALENIA SPACE Italy and several SME involved:

- ❑Launched by the VEGA, designed and conceived in Italy by AVIO!

PRISMA Mission Objectives

- PRISMA, single satellite mission, detects sunlight reflected from Earth in 240 bands between 400 nm (VNIR) up to 2500 nm (SWIR)
- The combination of bands (PAN/HYP) and radiometric data will enable to recognize chemical and physical characteristics of the elements presents in the observed area, besides the traditional geometric characteristics of the targets of interest.



PRISMA Application Domain

- The PRISMA hyperspectral products will provide useful information for science investigation and applications in the fields of Earth Observation for terrestrial and aquatic ecosystems, or for natural resource monitoring and management support.
- Hyperspectral data can provide useful information to assess water quality conditions of many water aquatic ecosystems.

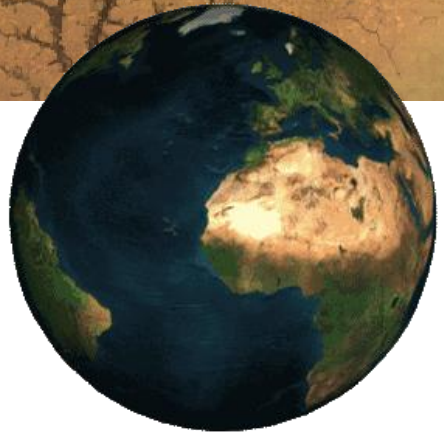
PRISMA data will be essential in supporting the following key applications:

- ***Agricolture and Forests***
- ***Land use***
- ***Inland and Coastal water***
- ***Risk Management***
  (es. volcanic, fires, oil spill, hydrology, etc..)
- ***Atmosphere and Climate***
- ***Geology***
- ***Soil***
- ***Urban Areas***
- ***…***

Mission Highlights

PRIMARY MODE: USER DRIVEN

Data Delivery based on user requests on areas of interest



System enter in operations in

late summer 2019

MISSION	
Orbit	LEO SSO, 620km, 10.30 LTDN
Lifetime	5 years
Coverage	Worldwide
Primary Mission mode	User driven (on-demand)
SYSTEM CAPACITY	
Swath	30 km, GSD: 30 m HYP, 5 m PAN
Data volume	daily > 200.000 km2 on 15/15 orbits/day
Daily products generation	daily processing of 200 hyperspectral scenes (30 km x 30 km) up to level 2d product.
SYSTEM LATENCIES	
Revisit time	< 29 days
Re-look time	< 7 days

SPACE SEGMENT	Single Satellite
Mass (Dry)	827 kg (202.5 kg Payload mass included)
Geometric Dimensions	Height, about 3 m
	Width x depth. about 1.9 m x 1.1 m
GROUND SEGMENT	
MCC/SCC	Mission & Satellite Control Centre: Fucino
IDHS	Image Data Handling Segment: Matera IDHS includes: Centro Nazionale Multimissione (CNM) L0/L1/L2 Processing Hyper-spectral Image Simulator (HSIS)
LAUNCH SEGMENT	
VEGA	Dedicated launch

PRISMA Standard Products

Level 0 (Hyperspectral / PAN)

- formatted data product with appended metadata, including ancillary data and file formatting information (Archived data)

Level 1 (Hyperspectral / PAN) radiometrically corrected and calibrated radiance data in physical units

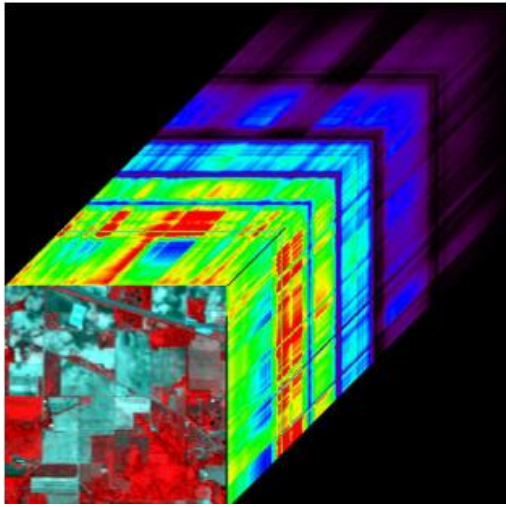
- Top-of-Atmosphere Spectral Radiance
- Cloud mask
- Sun-glint Mask
- Calibration and characterization data
- Classification Mask

Level 2b Geolocated at Ground Spectral Radiance Product (Hyperspectral / PAN)

Level 2c Geolocated At-surface Reflectance Product (Hyperspectral / PAN)

- Aerosol Characterization Product (VNIR)
- Water Vapour Map Product (Hyperspectral)
- Cloud Characterization

Level 2d Geocoded version of the level 2c products (Hyperspectral / PAN)



The dataset is organized in a Cube format, i.e. a 3D dataset.

PRISMA Data Policy

USER CATEGORY

Category A: ASI as system owner and entity carrying out the maintenance of system in operating conditions and the safeguarding of national security;
Category B: Domestic Istitutional User (Universities, Research centres, Local authorities, Agencies, etc..);
Category C: International Istitutional User (Universities, Research centres, Int. authorities, Agencies, etc..);
Category D: General users

PRODUCT USES

Scientific Use: research and study activities;
Institutional Use: innovative, public utility and non-profit applications;
Commercial Use: projects with commercial purposes, currently based exclusively on archive data

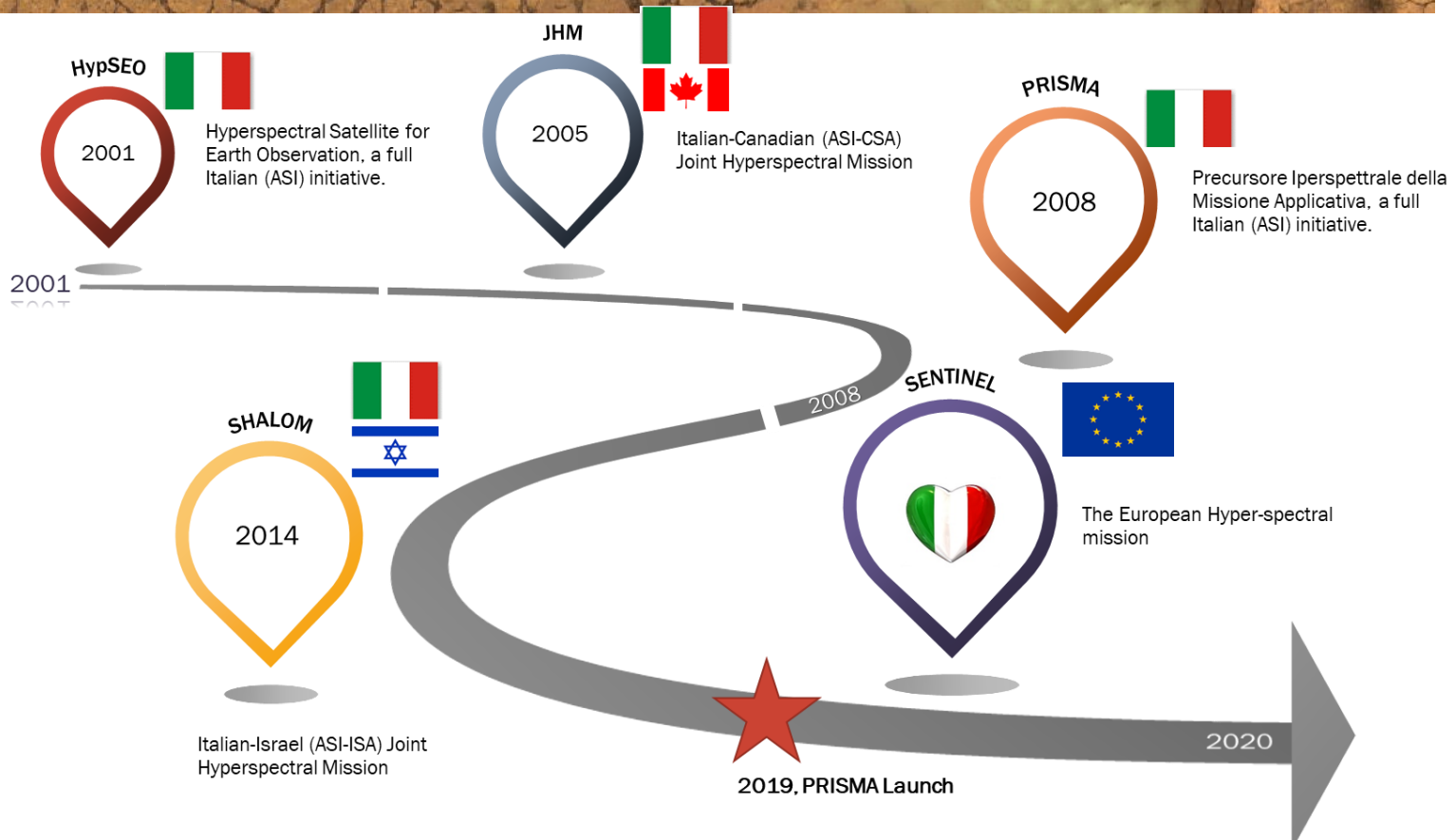
CONDITIONS FOR ACCESS FREE OF CHARGE TO NEW ACQUISITION AND ARCHIVE PRODUCT

- ❑for users of category B who use the products for scientific purposes;
- ❑for users of category B who declare institutional-application use and who request products on Italian territory and Italian territorial waters or exclusive economic zone (EEZ);
- ❑To quotas defined in the context of specific initiatives (e.g. Announcement of Opportunities) promoted by ASI, for scientific and institutional-application use.

The purpose of costless access is to encourage the development of new algorithms and applications, the consolidation of existing applications, to obtain any feedback to optimize performance and exploitation of the mission.

An International Open Call based mechanism, capable to deliver data free of charge to International Institutional and Scientific Users will be launched in the next future

The Italian Hyperspectral roadmap

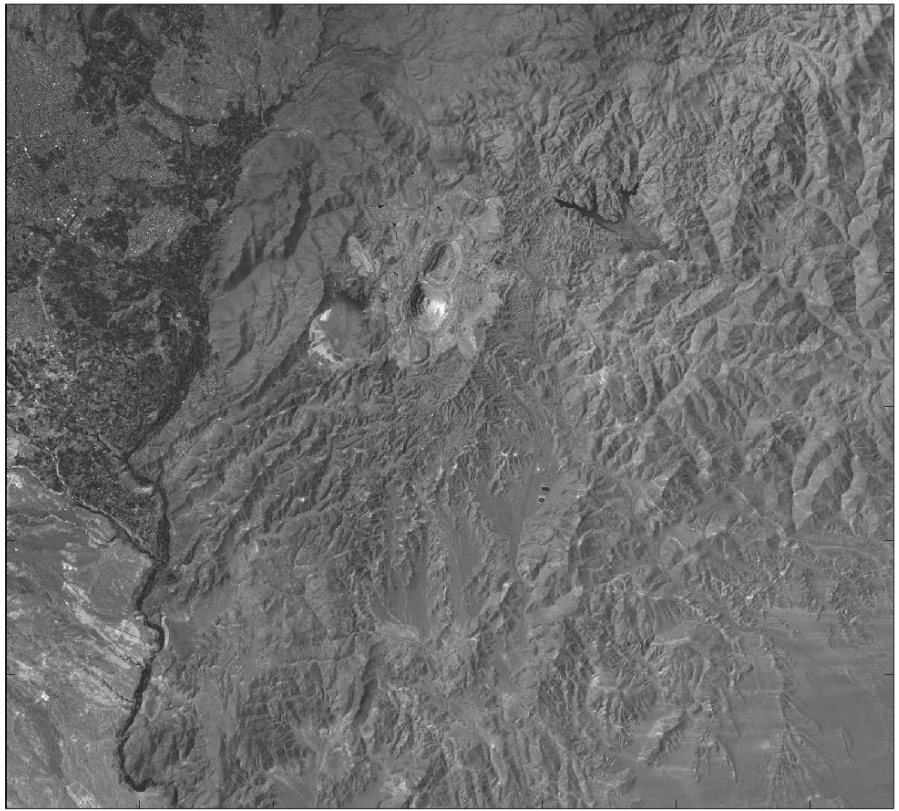


First images acquired during the Commissioning phase

Commissioning Phase

Geographic Area: PERU (Cerro Verde Mine)

Channel: PAN



First images acquired during the Commissioning phase

Commissioning Phase

Geographic Area: PERU (Cerro Verde Mine)

Channel: VNIR

First images acquired during the Commissioning phase

Commissioning Phase

Geographic Area: PERU (Cerro Verde Mine)

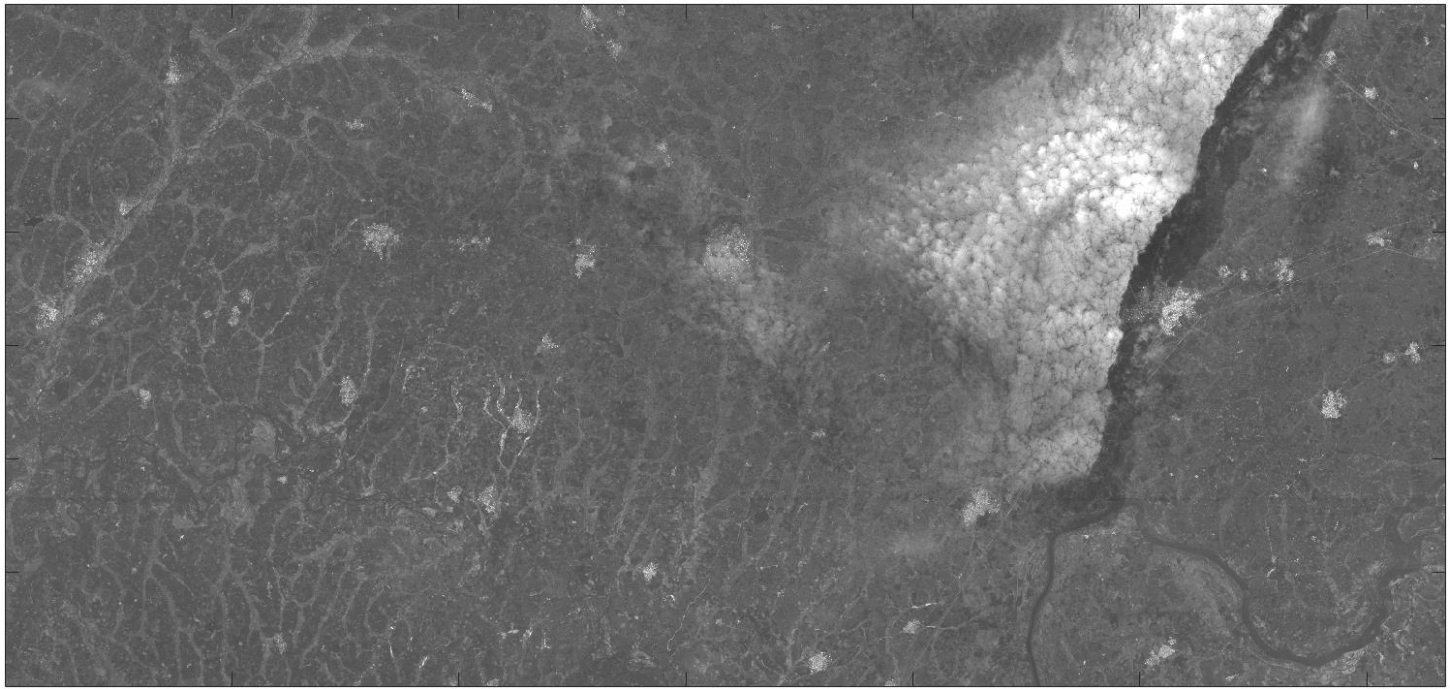
Channel: SWIR

First images acquired during the Commissioning phase

Commissioning Phase

Geographic Area: IVORY COAST (Yabayo)

Channel: PAN



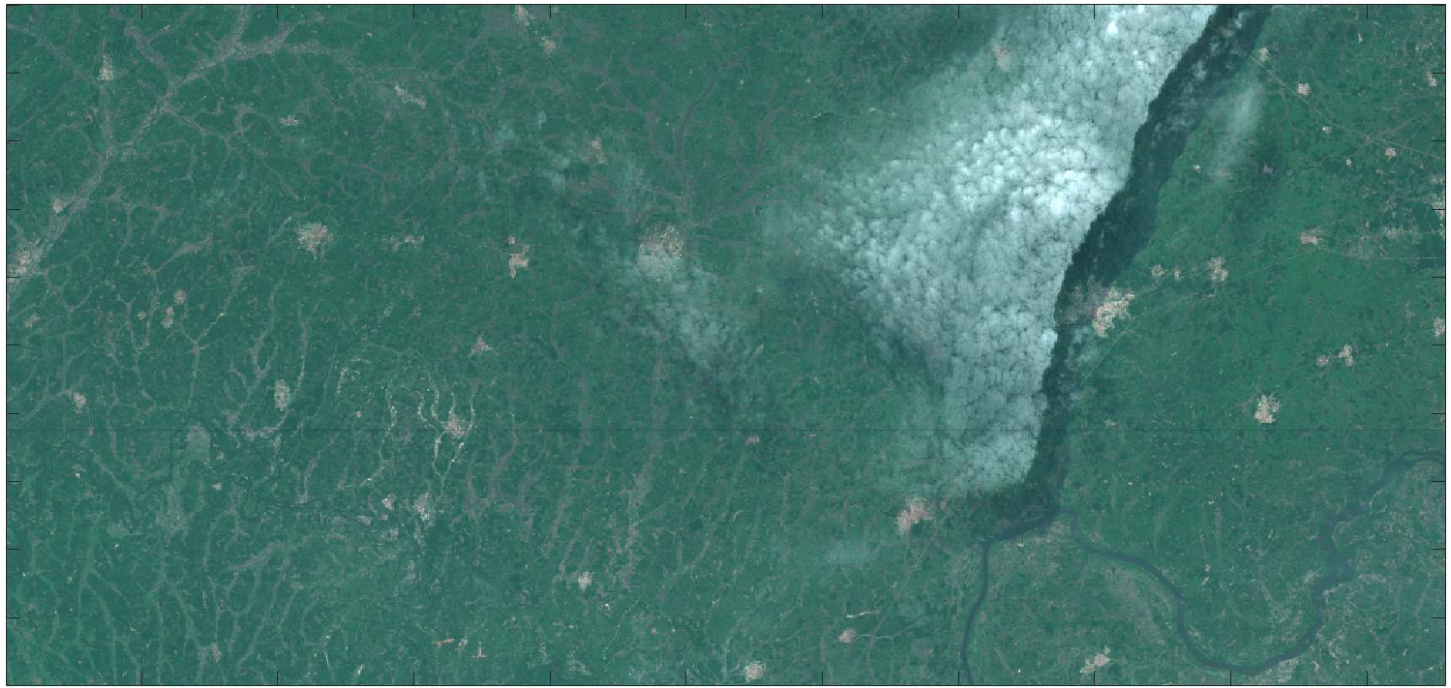
First images acquired during the Commissioning phase

Agenzia Spaziale Italiana

Commissioning Phase

Geographic Area: IVORY COAST (Yabayo)

Channel: VNIR

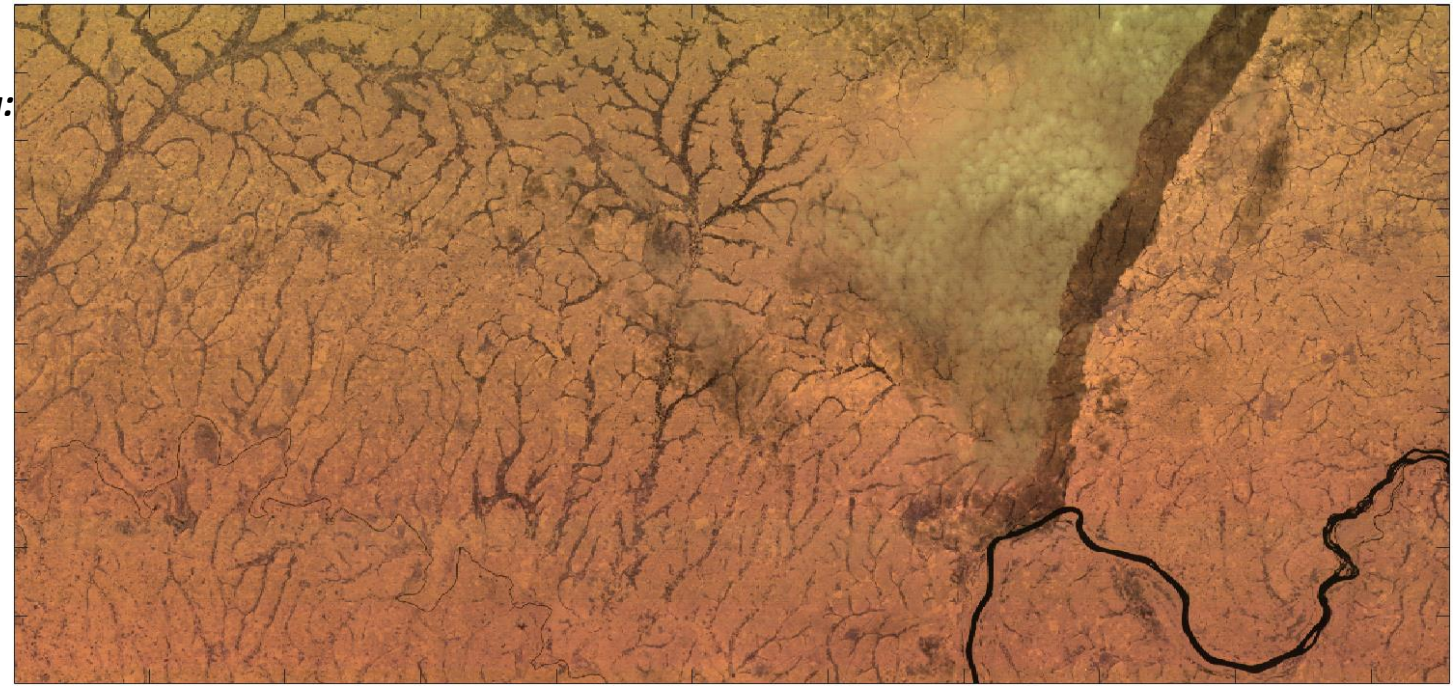


First images acquired during the Commissioning phase

Commissioning Phase

Geographic Area: IVORY COAST (Yabayo)

Channel: SWIR



Thank You!

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For further information visit
www.prisma-i.it