INTRODUCTION OF THE
REMOTE SENSING
CROP MONITORING ACTIVITIES IN
THE PRISMA 4 AFRICA PROJECT .

PRISMA 4 AFRICA

Validation data collection

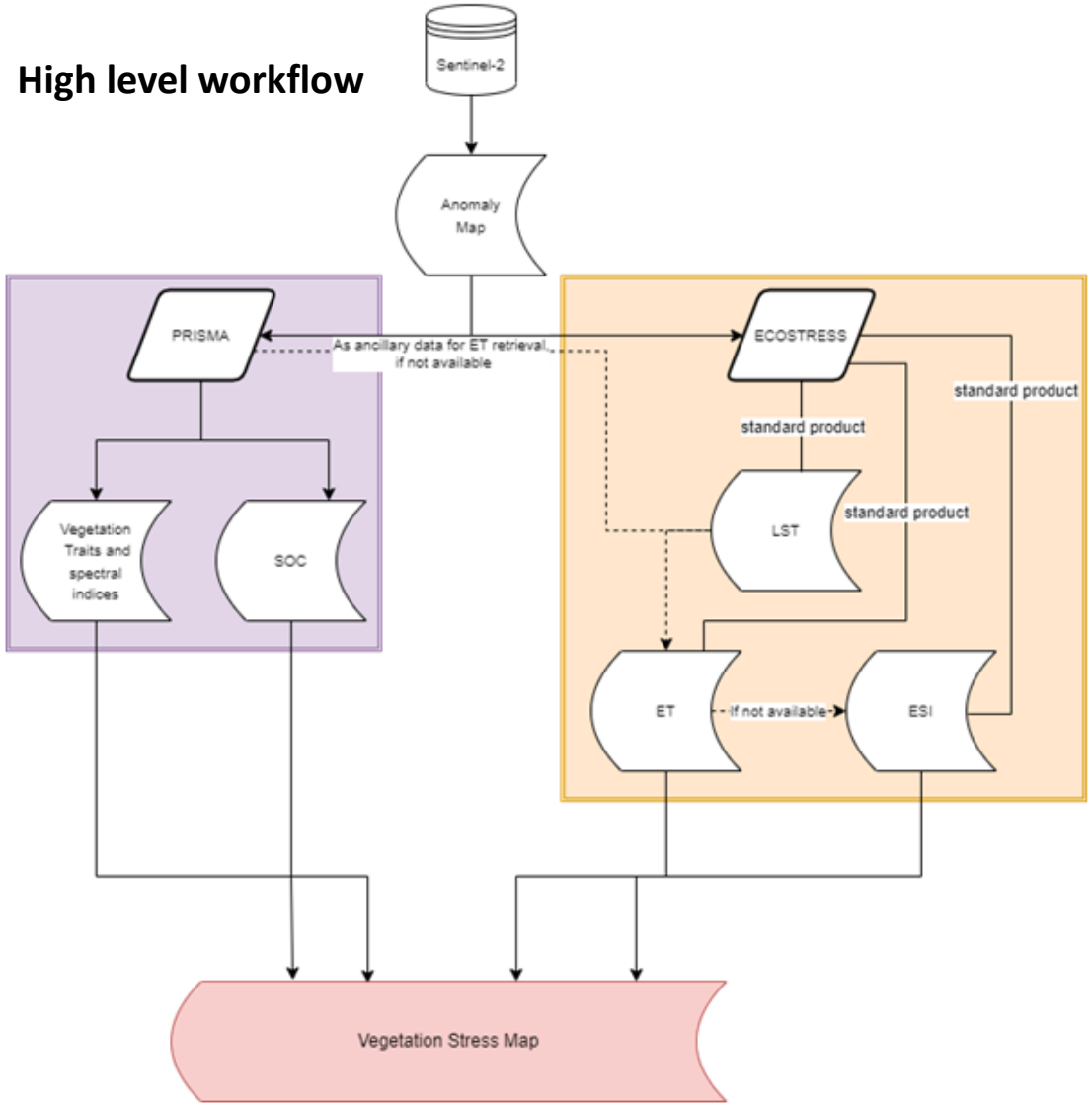
Webinar day#1
18.11.2024

Agenda

- Workflow
- Multispectral vs hyperspectral data
- Multispectral mission:
  - Sentinel-2
- Hyperspectral mission:
  - PRISMA
  - EnMAP
- Thermal mission:
  - ECOSTRESS

PRISMA 4 AFRICA - Workflow

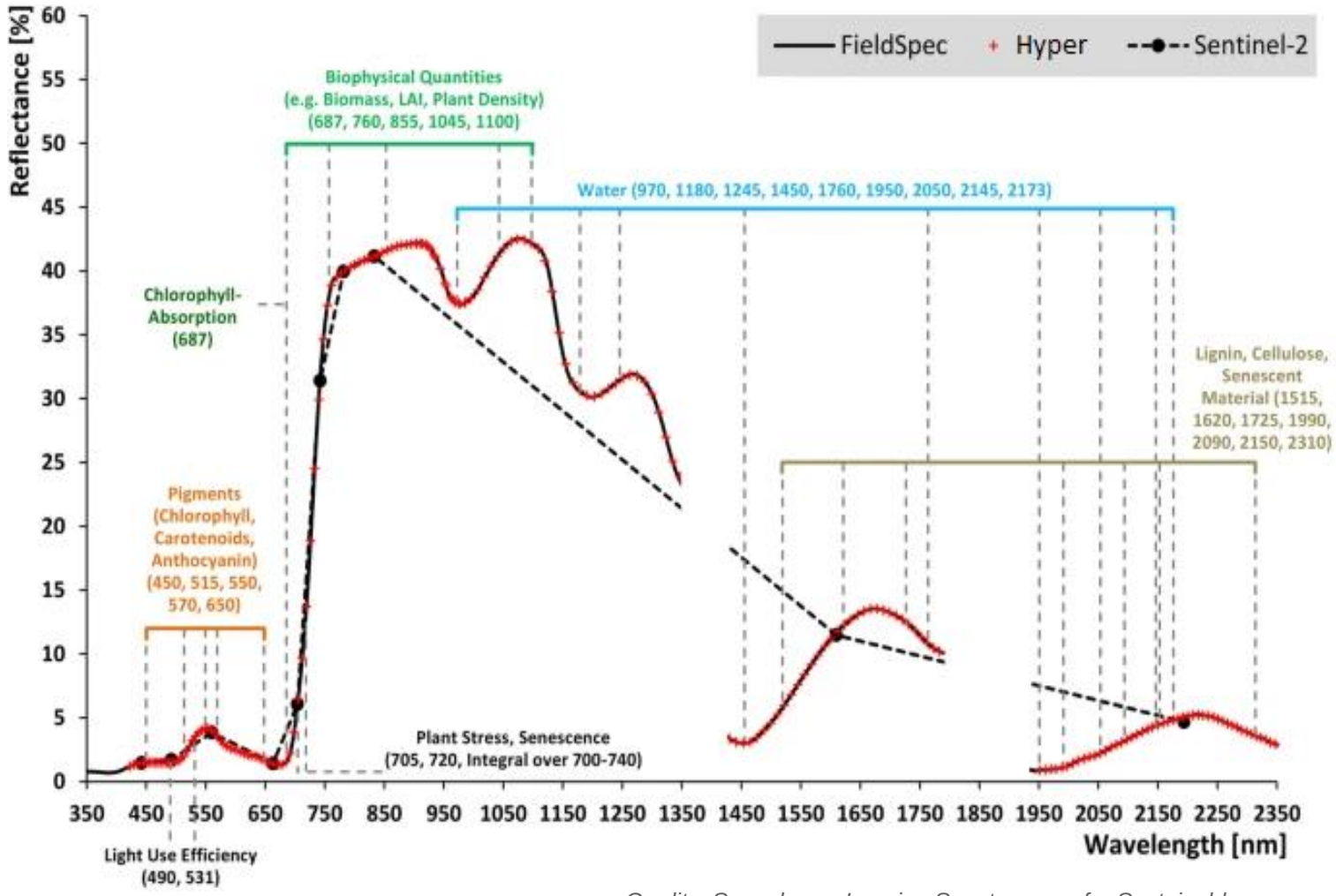
High level workflow



- **Analysis of the Sentinel-2** time series to identify "deviation from normal" of the vegetation behaviour. [Multispectral]
- Application of **hybrid approaches and/or spectral vegetation indices to PRISMA** data, for the retrieval of biophysical and biochemical parameters of vegetation (structural and chemical traits) and agricultural soil characteristics (SOC). [Hyperspectral]
- Analysis of **thermal data** if standard products are available. If not, a preliminary step of generation (ET and ESI) will be performed, starting from **ECOSTRESS** LST. [Thermal]
- Vegetation stress map generation by **merging information** derived from PRISMA and ECOSTRESS.

Multispectral vs Hyperspectral

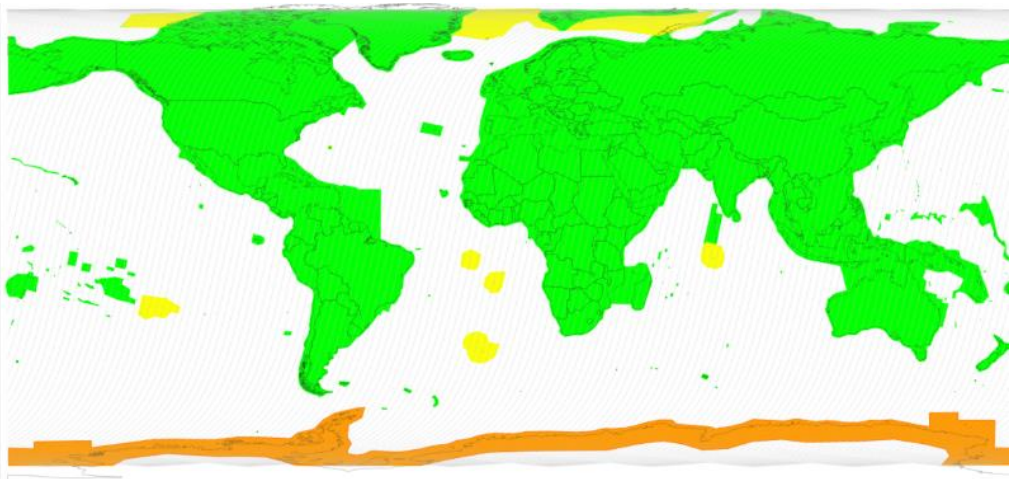
The increased spectral and spatial resolution of the hyperspectral images enable the possibility to analyze in-depth different materials and surfaces present in the observed area



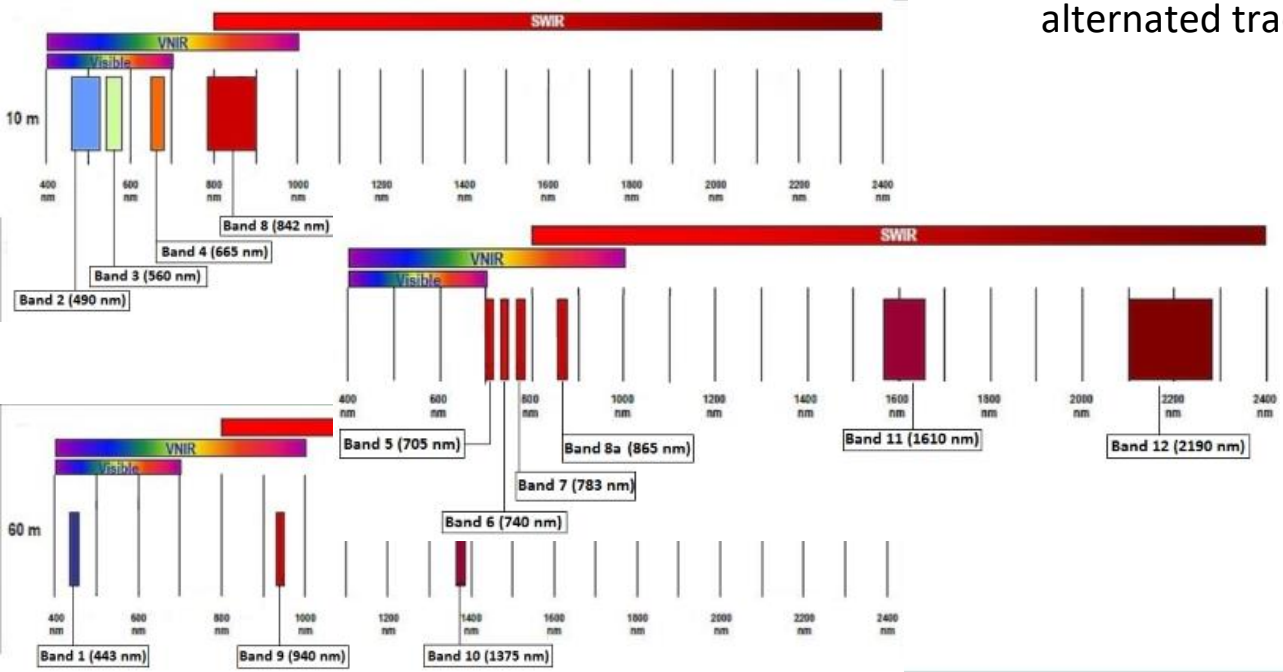
Credits: Spaceborne Imaging Spectroscopy for Sustainable Agriculture: Contributions and Challenges, Hank T. et al. (modified version)

Sentinel-2 mission

- Sentinel-2 mission is based on a constellation of three identical satellites in the same orbit:
  - Sentinel-2A - 23 June 2015
  - Sentinel-2B - 7 March 2017
  - Sentinel-2C - 5 September 2024
- Revist frequency:
  - 5 days
  - 10 days
  - 10 days access from alternated track

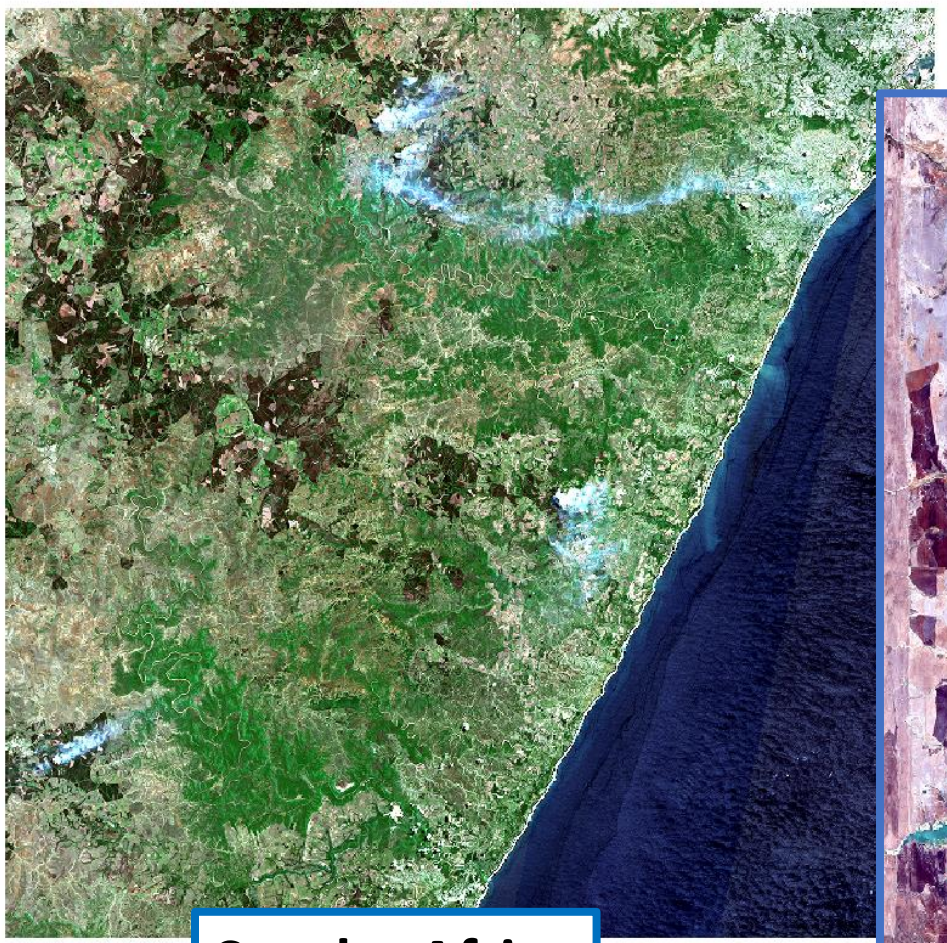


Spectral range:

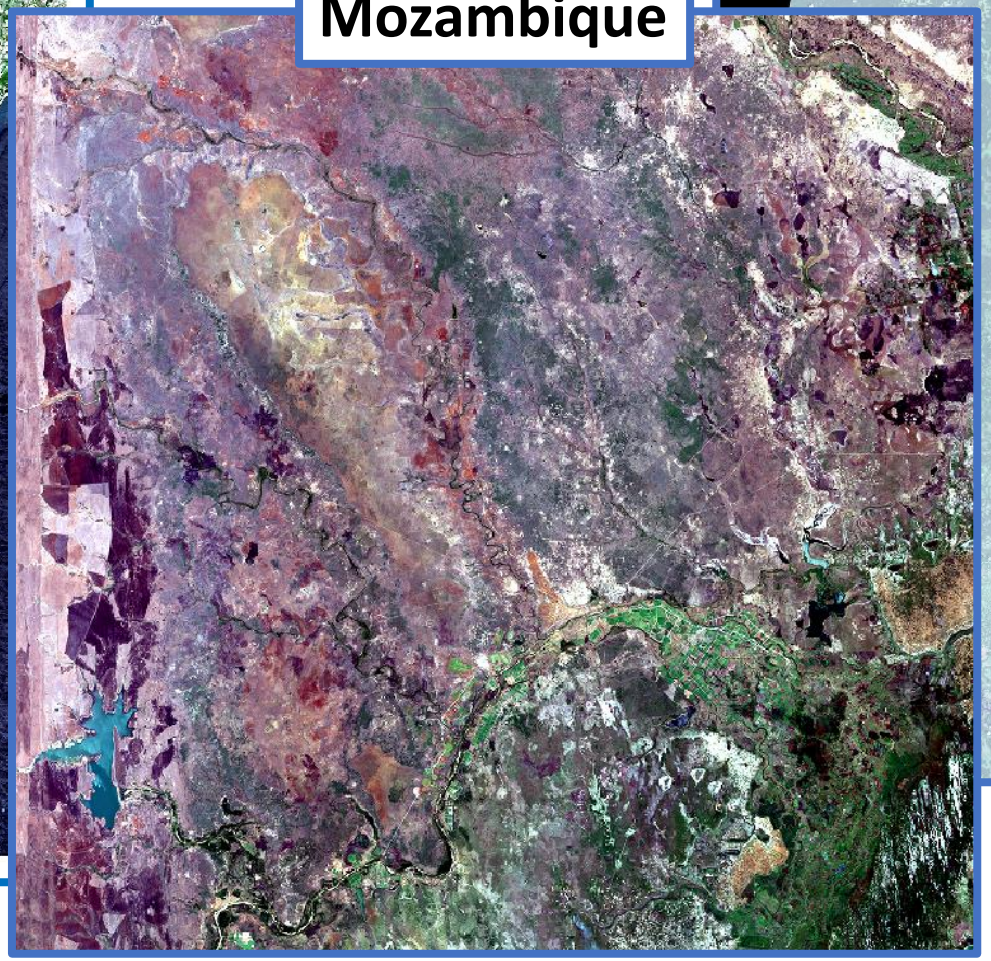


Payload Feature	Value
Orbit Altitude Reference	786 km
Swath	290 km
GSD	four bands: 10 m six bands: 20 m three bands: 60 m

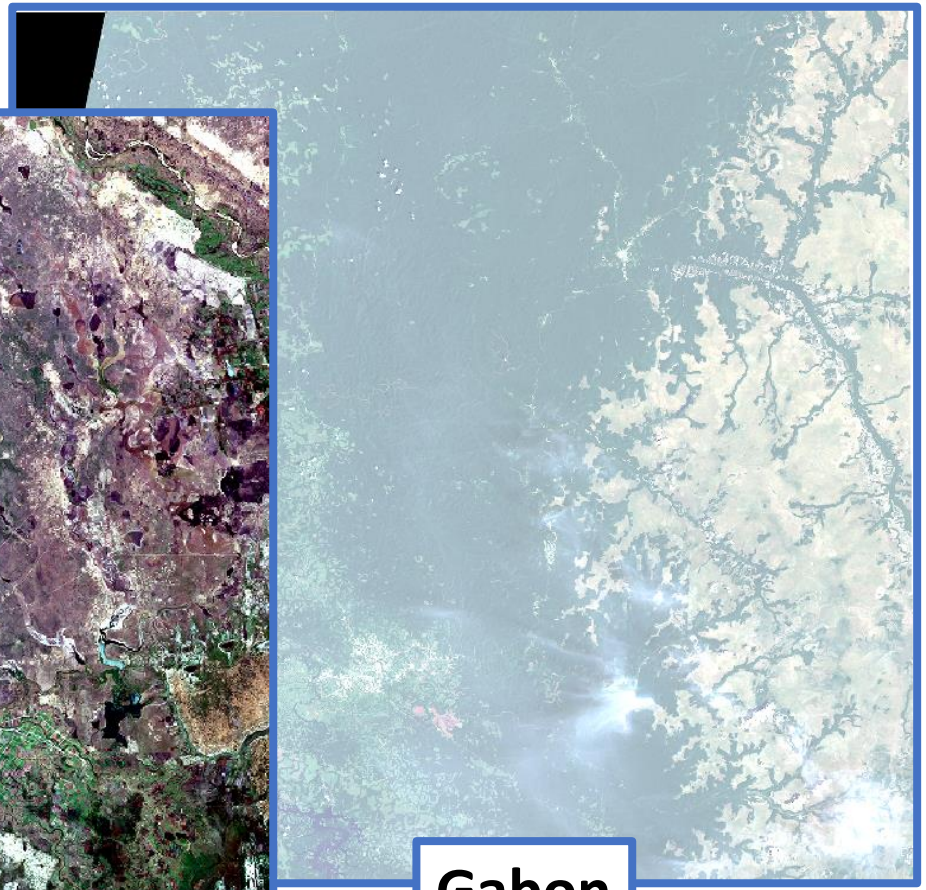
Sentinel-2 mission – Example of images



South - Africa



Mozambique



Gabon

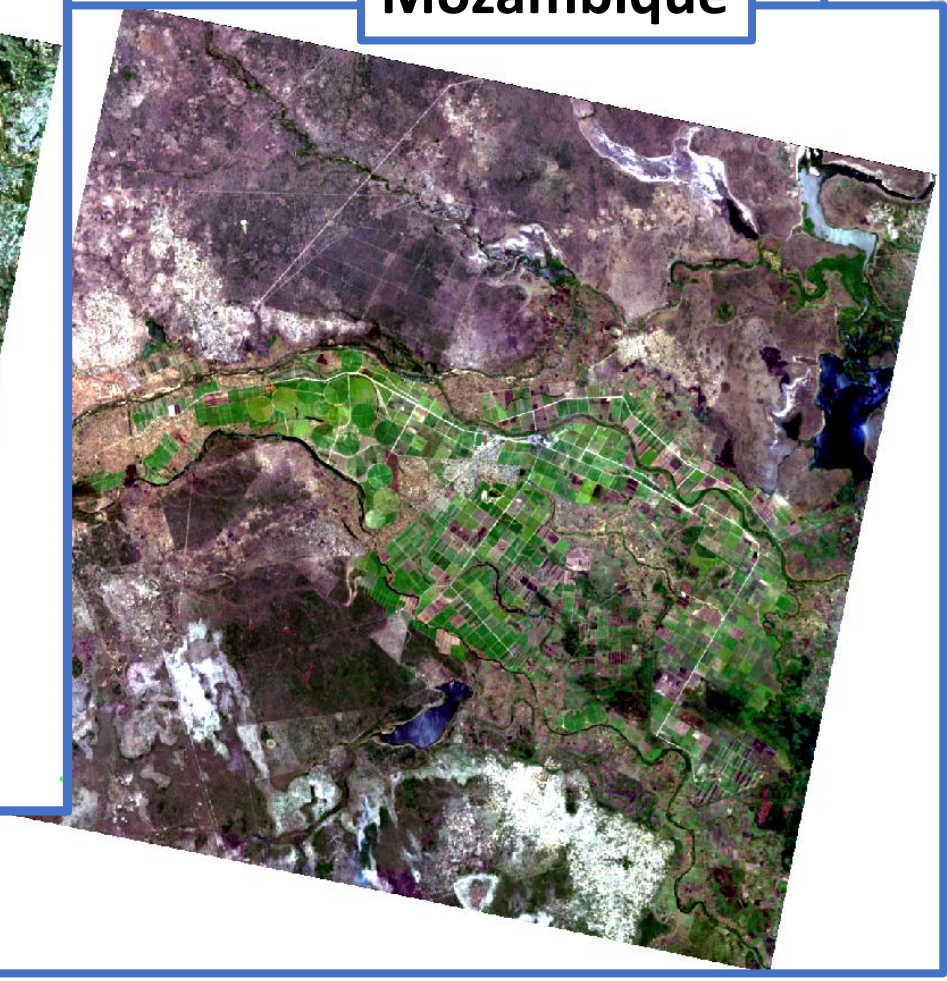
PRISMA mission

- **PRISMA** is in orbit since March the 22nd 2019 and is currently in the operational phase.
- It is a **Technology Demonstrator**.
- The PRISMA Satellite is a **single satellite** placed in suitable LEO SSO orbit characterized by a repeat cycle of approximately **29 days**.
- It is in the small size class, with an operational lifetime of 5 years.
- The PRISMA Payload is composed by an **Imaging Spectrometer** (or Hyperspectral Imager), able to take images in a continuum of spectral bands ranging **from 400 to 2500 nm**, and a medium resolution and a Panchromatic Camera.

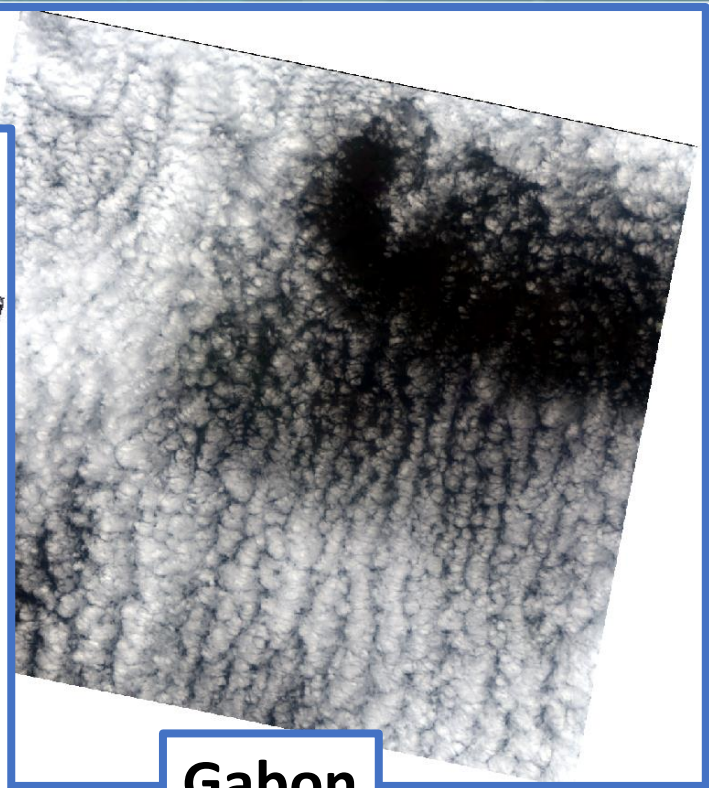
Payload Feature	Value
Orbit Altitude Reference	615 km
Swath / FOV	30 km / 2.77°
GSD	Hyperspectral: 30 m PAN: 5 m
Spectral Range	VNIR: 400 – 1010 nm (66 bands) SWIR: 920 – 2500 nm (173 bands) PAN: 400 – 700 nm

PRISMA mission – Example of images

South - Africa



Mozambique



Gabon

EnMAP mission

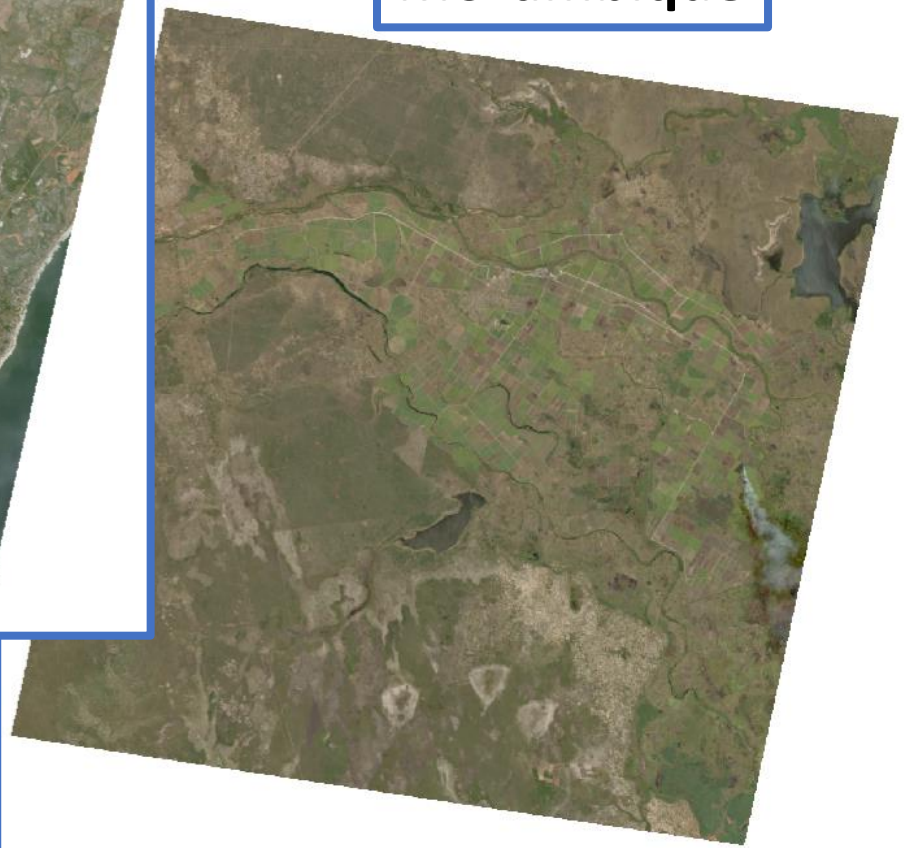
- **EnMAP** is a German hyperspectral satellite mission, it is launched on April 1, 2022
- Revisit time of **27** days and off-nadir (30°) pointing feature for fast target revisit (4 days)

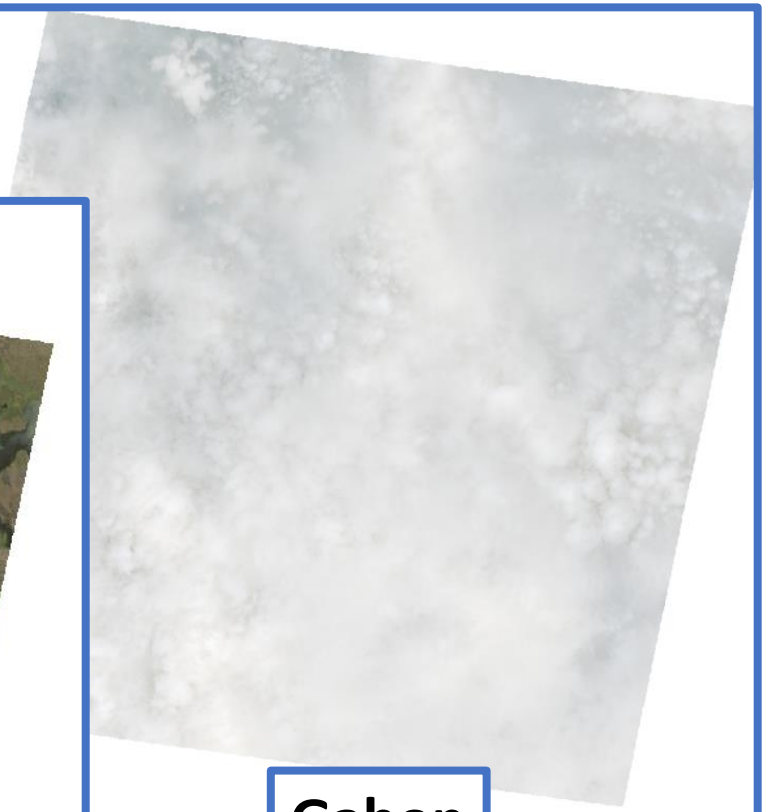
Payload Feature	Value
Orbit Altitude Reference	653 km
Swath / FOV	30 km / 2.63°
GSD	Hyperspectral: 30 m
Spectral Range	VNIR: 420 – 1000 nm SWIR: 900 – 2450 nm 230 bands

EnMAP mission – Example of images

South - Africa

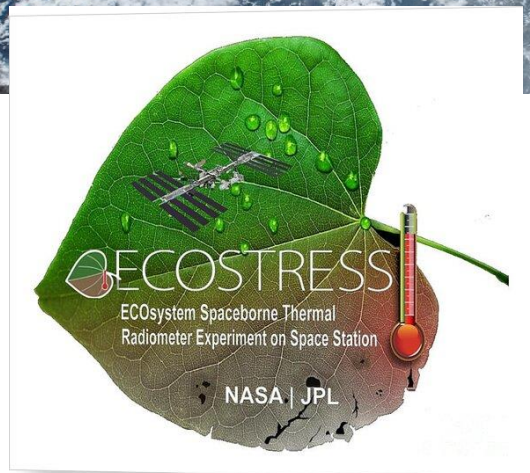
Mozambique





Gabon

ECOSTRESS mission



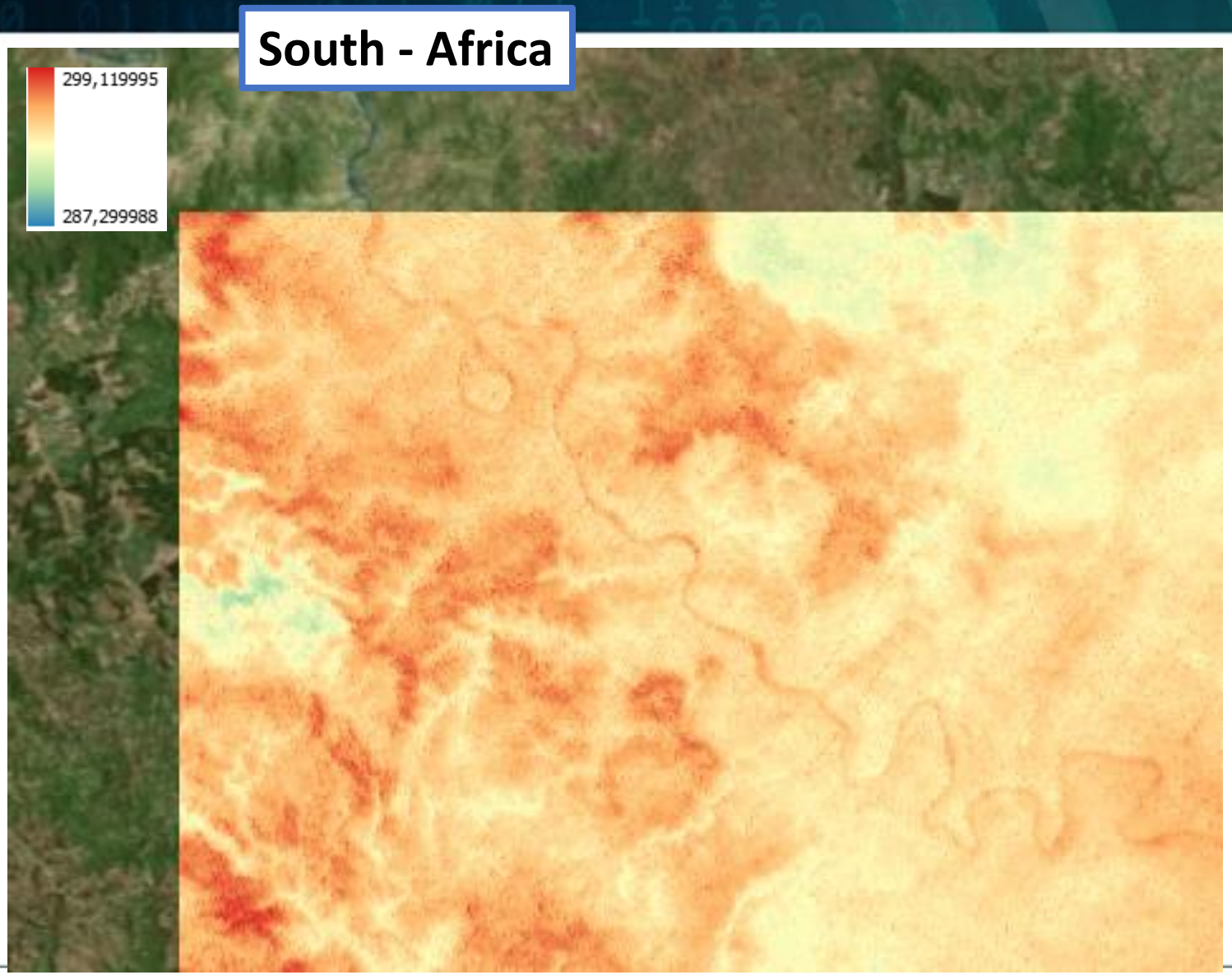
- The ECOSTRESS radiometer has been deployed on International Space Station (**ISS**) on the Japanese Experiment Module - External Facility (JEM-EF) site 10
- It is launched on June 29, 2018, at the beginning the Mission Extension is One year 2019-2020, with proposal to extend mission additional years pending senior review, currently it is operational.
- The radiometry scan is perpendicular to ISS velocity
- Concerning data collection, on average 1 hour of science data per day is scheduled

Description	Value	Unit
Number of spectral bands	6	
Measured band centers	Band 1 - 8.29, *Band 2 - 8.78, Band 3 - 9.20, *Band 4 - 10.49, *Band 5 - 12.09	µm
Pixel size at nadir	69x38	m
Swath width	384	km

ECOSTRESS mission – Example of image

The ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (**ECOSTRESS**), will monitor one of the most basic processes in living plants:
the loss of water through the tiny pores in leaves.

The related process in plants is known as transpiration.
Because water that evaporates from soil around plants also affects the amount of water that plants can use, ECOSTRESS will measure combined evaporation and transpiration, known as evapotranspiration (ET).



Thank you for your attention!