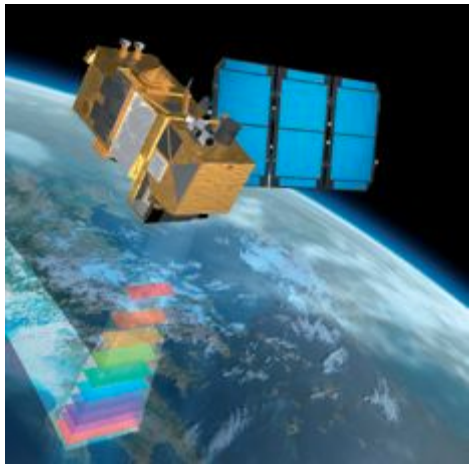
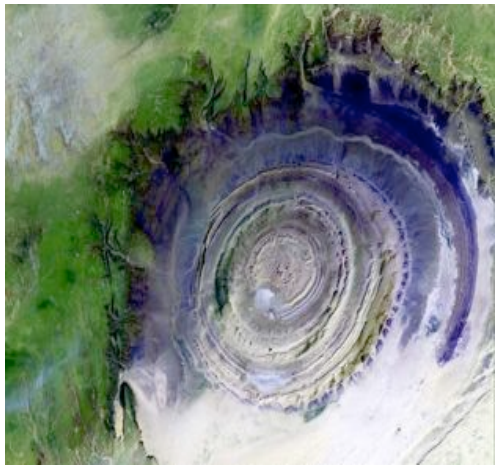
Sentinel-2 Mission Overview





Ferran Gascon

Sentinel-2 Data Quality Manager

20 October 2014

Copernicus Programme and Sentinel-2

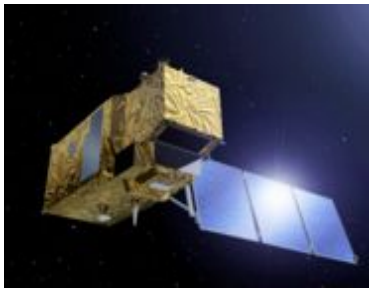
Copernicus is a European space flagship programme led by the European Union

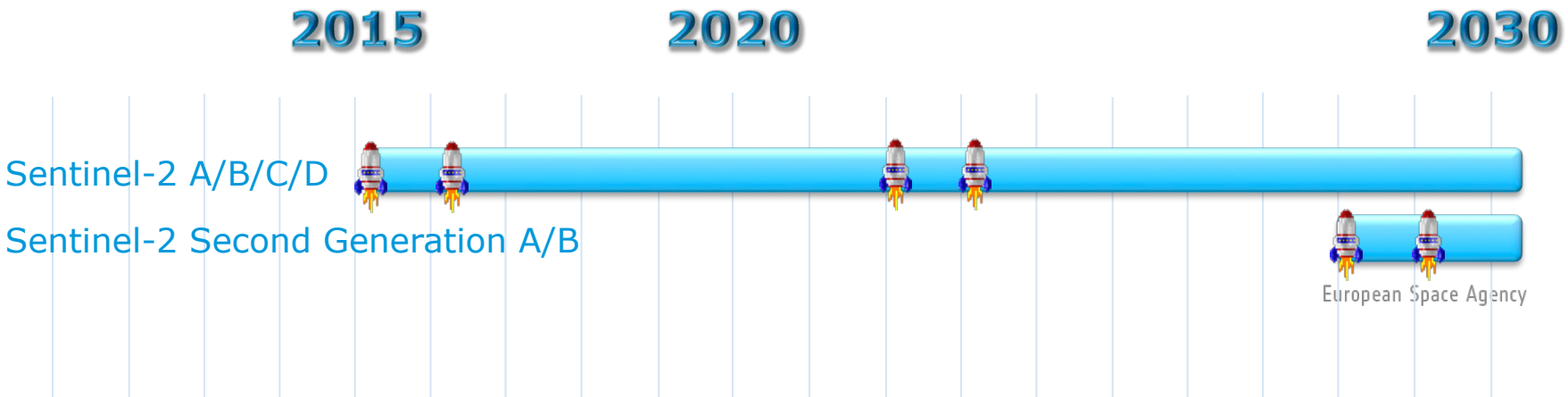
Copernicus provides the necessary data for operational monitoring of the environment and for civil security

Sentinel-2 will provide optical high spatial resolution imagery for Copernicus services

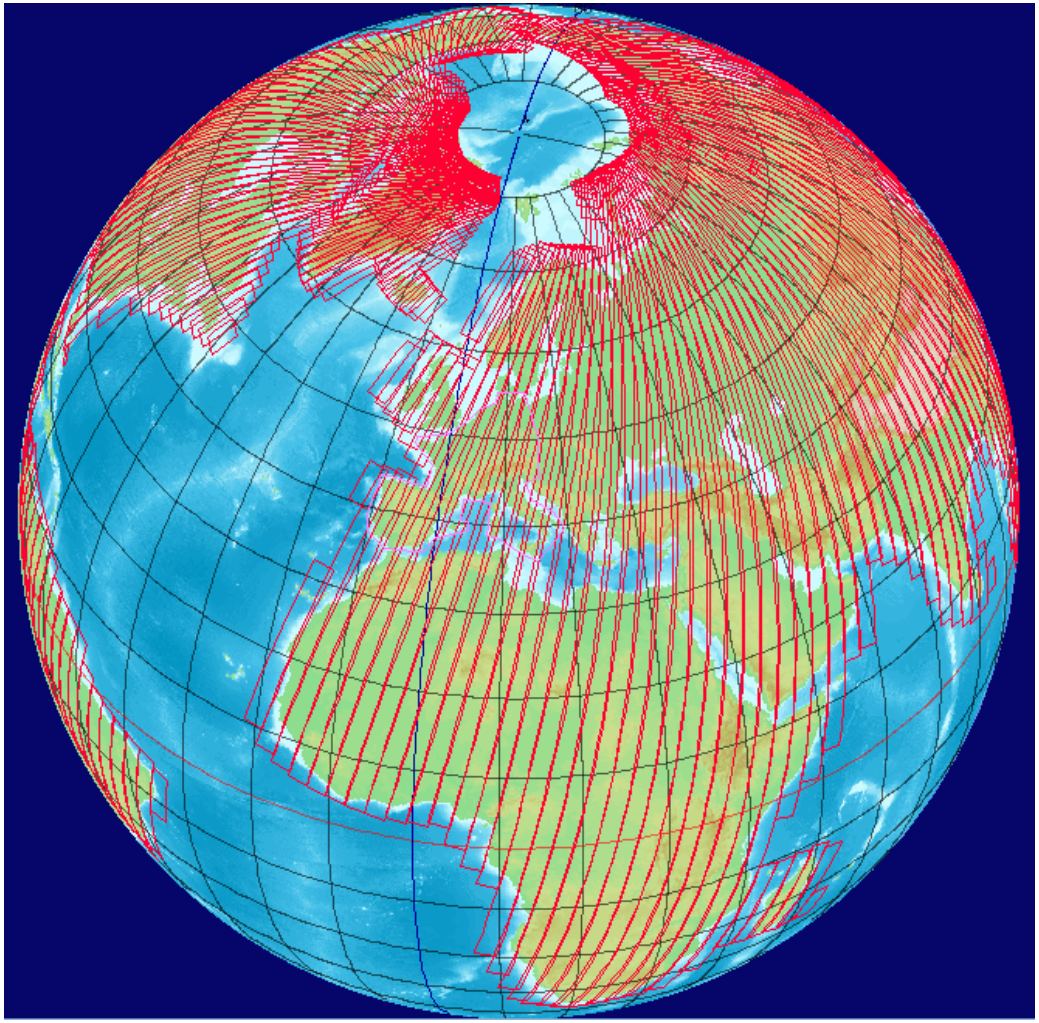
Mission Overview

- Spacecrafts: 2 operating in twin configuration
- Orbit: Sun-synchronous at 786 km (14+3/10 revs per day), with LTDN 10:30 AM
- MultiSpectral Instrument (MSI): operating in pushbroom principle, filter based optical system
- Spectral bands: 13 (VIS–NIR–SWIR spectral domains)
- Spatial resolution: 10m / 20m / 60m
- Swath: 290 km





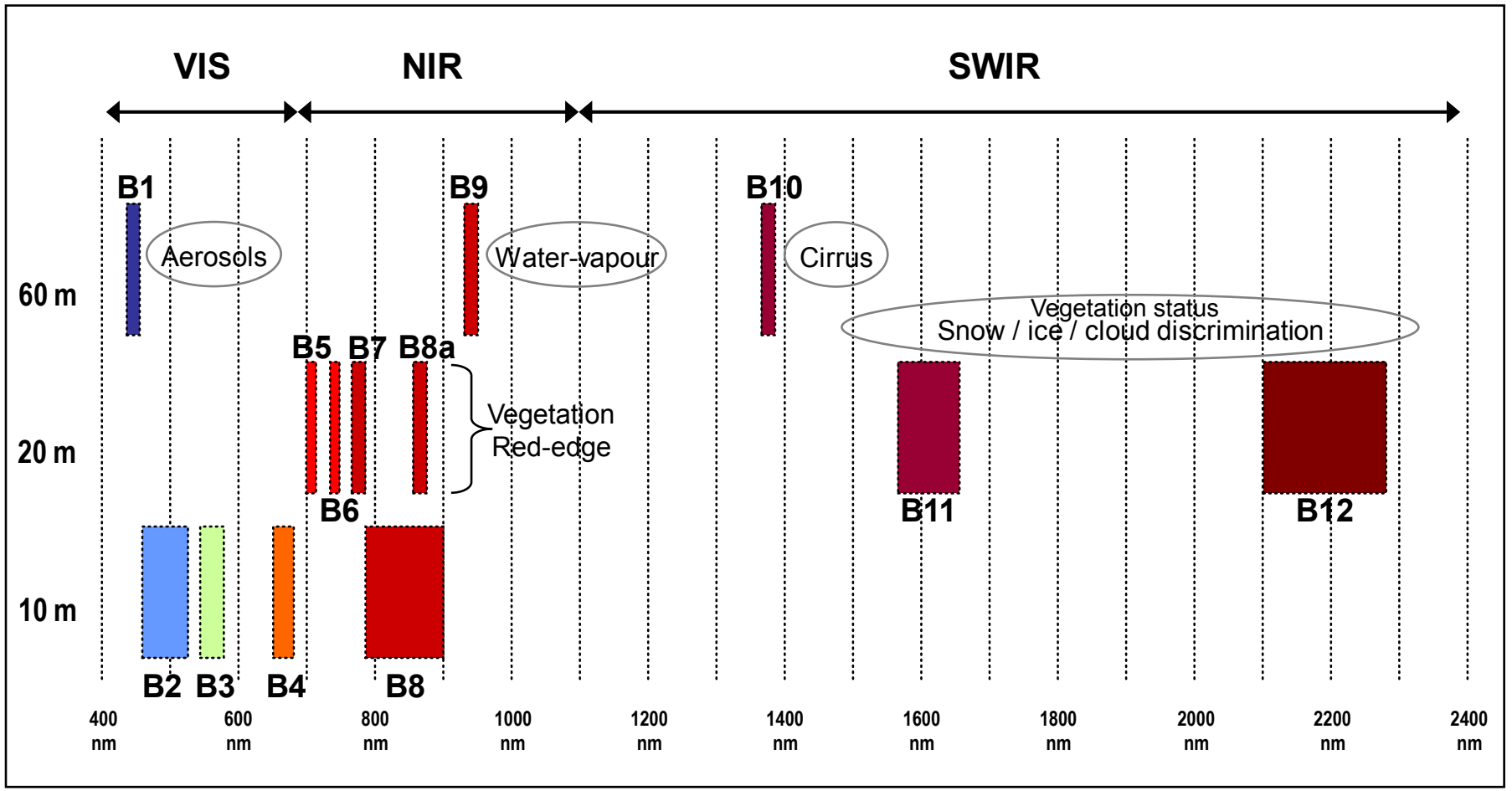
Coverage and Revisit



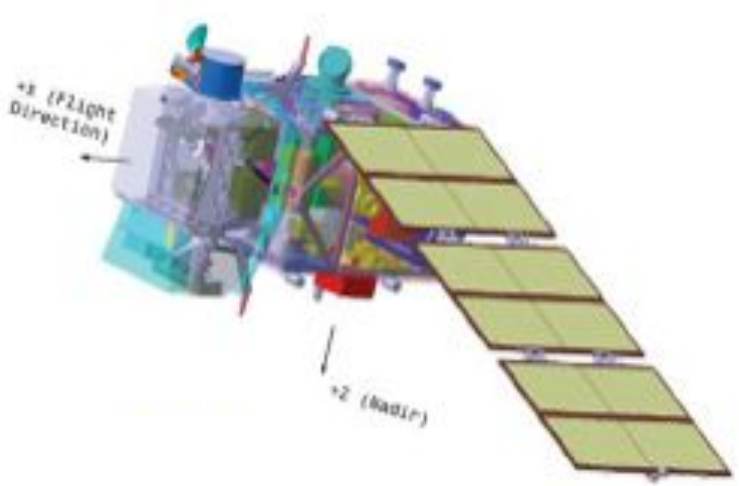
5 days revisit
periodicity
(with 2 satellites)

10 days revisit
periodicity
(with 1 satellite)

Spectral Bands and Spatial Resolution

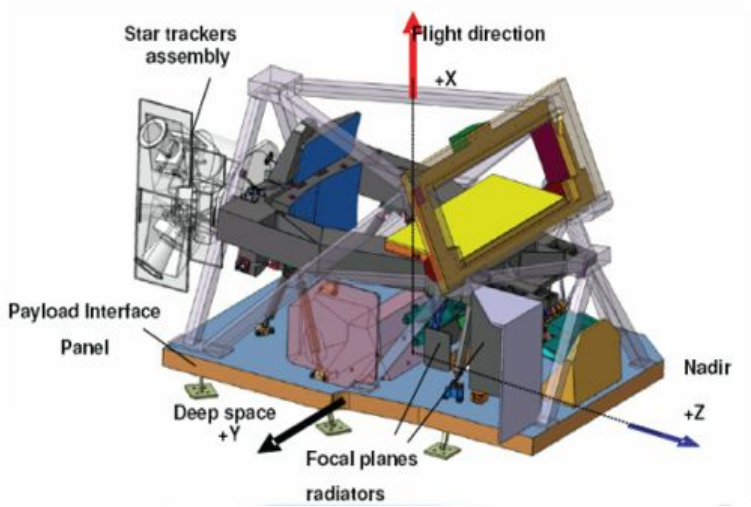


Satellite and Instrument



Satellite

- Satellite mass: 1200 kg
- Satellite power consumption: 1250 W
- Hydrazine propulsion system (120 kg - including provision for safe mode, debris avoidance and EOL orbit decrease for faster re-entry)
- Accurate AOCS based on multi-head Star Tracker and fiber optic gyro
- X band mission data distribution (520 Mbits/sec)
- Mission data onboard storage: 2.4 Tbits



MultiSpectral instrument

- Filter based push broom imager (280 kg, 1 m^3)
- Three mirrors silicon carbide telescope, with dichroic beam splitter
- Focal plane arrays: Si CMOS VNIR detectors, HgCdTe SWIR detectors.
- Onboard wavelet compression (divided by 3)
- Integrated video & compression electronics (state of the art wavelet compression)
- Radiometric resolution 12bits
- Daily generated telemetry: 1.4 TB

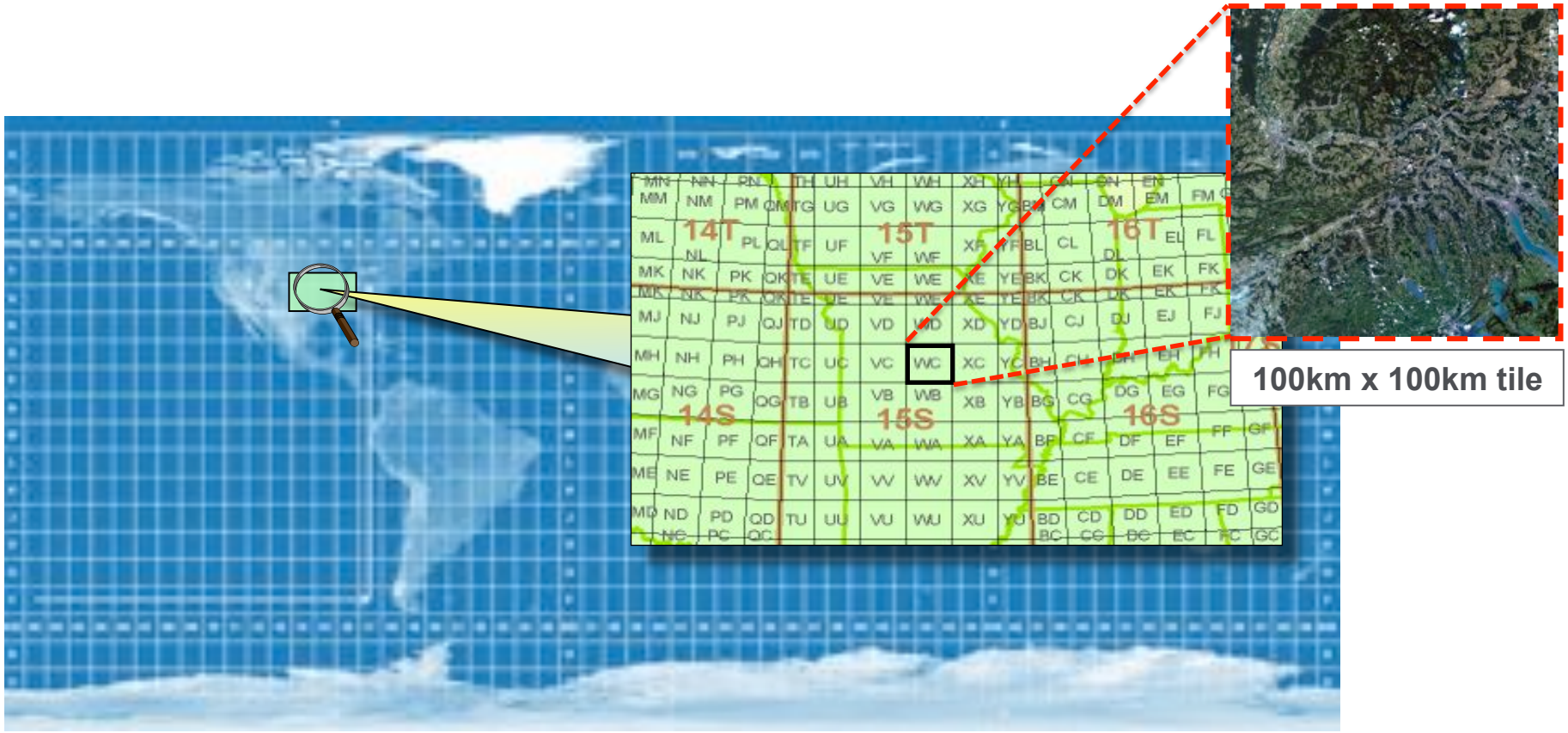
Sentinel-2 Products

- The following products will be made available to users:

Name	High-level Description	Production	Preservation Strategy	Volume
Level-1B	Top-of-atmophere radiances in sensor geometry	Systematic	Long-term	~27 MB (each 25x23km^2)
Level-1C	Top-of-atmosphere reflectances in cartographic geometry	Systematic	Long-term	~500 MB (each 100x100km^2)
Level-2A	Bottom-of-atmosphere reflectances in cartographic geometry (prototype product)	On user side (using Sentinel-2 Toolbox)	N/A	~600 MB (each 100x100km^2)

Level-1C / Tiling

- Cartographic Reference System: UTM (with 6ºx8º grid zones).
- Each grid zone is split into ~100x100km^2 UTM “Tiles”.



Level-1C / Tile Example

RGB composite
of a Level-1C Tile

Level-1C / Algorithm

Level-0

TELEMETRY ANALYSIS

PRELIMINARY QUICK-LOOK AND CLOUD MASK GENERATION

Level-0 Consolidated

DECOMPESSION

SWIR PIXELS REARRANGEMENT

Level-1A

RADIOMETRIC CORRECTIONS

- Inv. on-board equalization,
- Dark signal correction,
- Blind pixels removal,
- Cross-talk correction,
- Relative response correction,
- Defective/no-data correction,
- Deconvolution/Denoising,
- Binning of 60m bands.

GEOMETRIC VIEWING MODEL REFINEMENT

- Refining of the viewing model using a global set of reference images,
- Registration between VNIR and SWIR focal planes (optional).

Level-1B

RESAMPLING

- Geometry interpolation grid computation,
- Resampling (B-splines).

CONVERSION TO REFLECTANCES

PREVIEW IMAGE AND MASKS GENERATION (defective pixels, cloud & land/water)

Level-1C

algorithms developed in cooperation with cnes

Level-1C / Data Quality Targets

Radiometric Data Quality	
Absolute radiometric uncertainty	3 % (goal) , 5 % (threshold)
Inter-band relative radiometric uncertainty	3%
Linearity knowledge accuracy	1%
Modulation Transfer Function (MTF)	0.15 to 0.3 (for 10m bands) <0.45 (for 20 & 60m bands)
Geometric Data Quality	
Absolute geolocation uncertainty	20m 2σ (threshold) 12.5m 2σ (goal) with GCPs
Multi-temporal registration	0.3 pixel 2σ (goal) with GCPs
Multi-spectral registration (for any couple of spectral bands)	0.3 pixel 3σ

Level-2A / Product Example

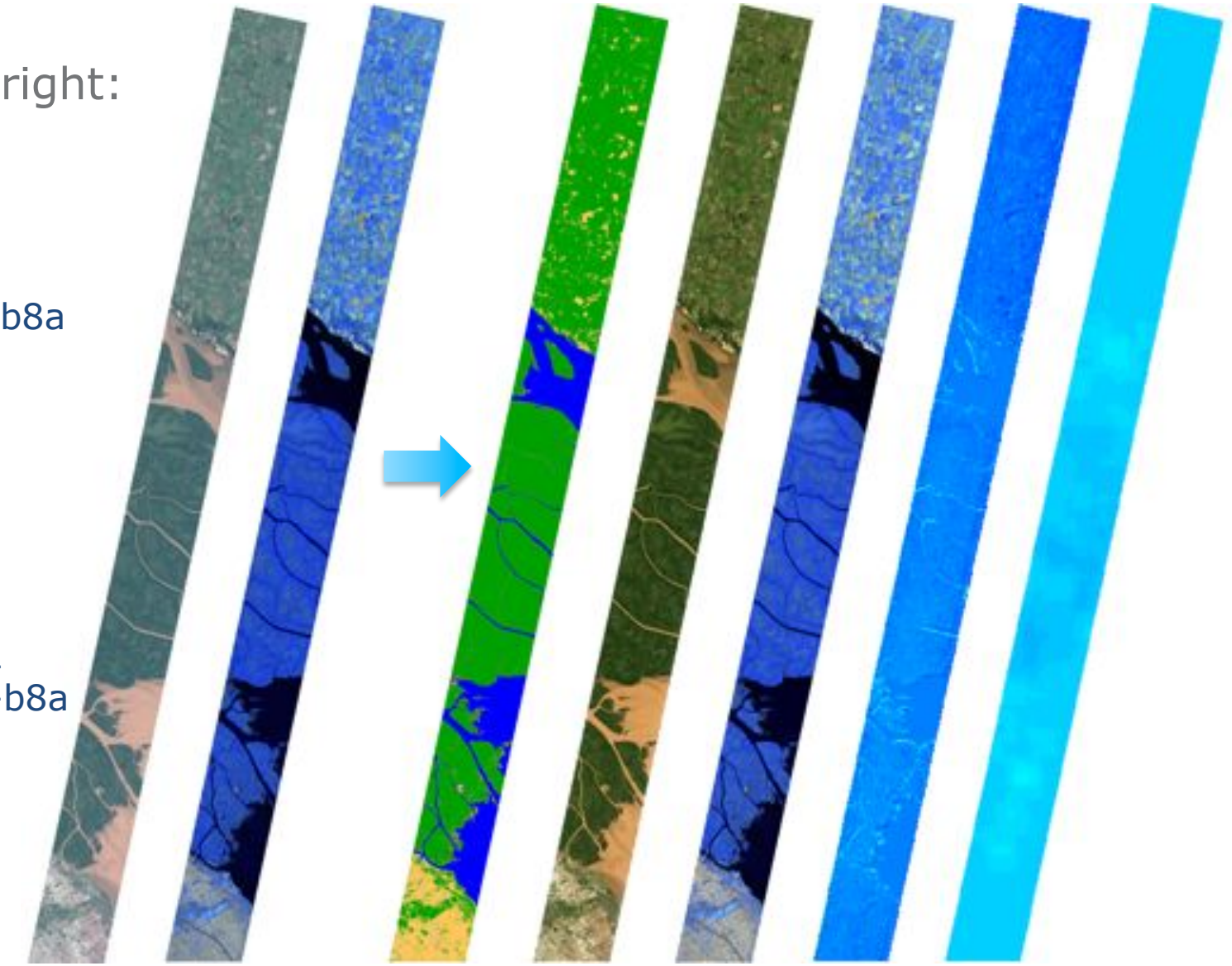
From left to right:

Level-1C

- TOA b4-b3-b2
- TOA b12-b11-b8a

Level-2A

- Scene Classification
- BOA b4-b3-b2
- BOA b12-b11-b8a
- Water Vapour
- AOT



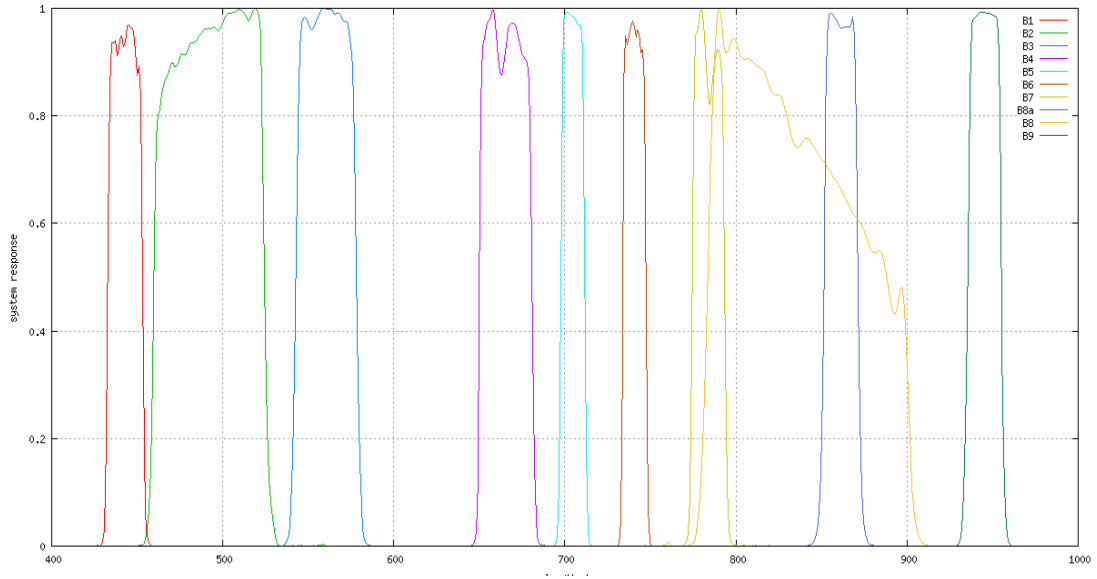
Sentinel-2 Mission

Thank you very much for your attention !

Further information available at: http://sentinel.esa.int

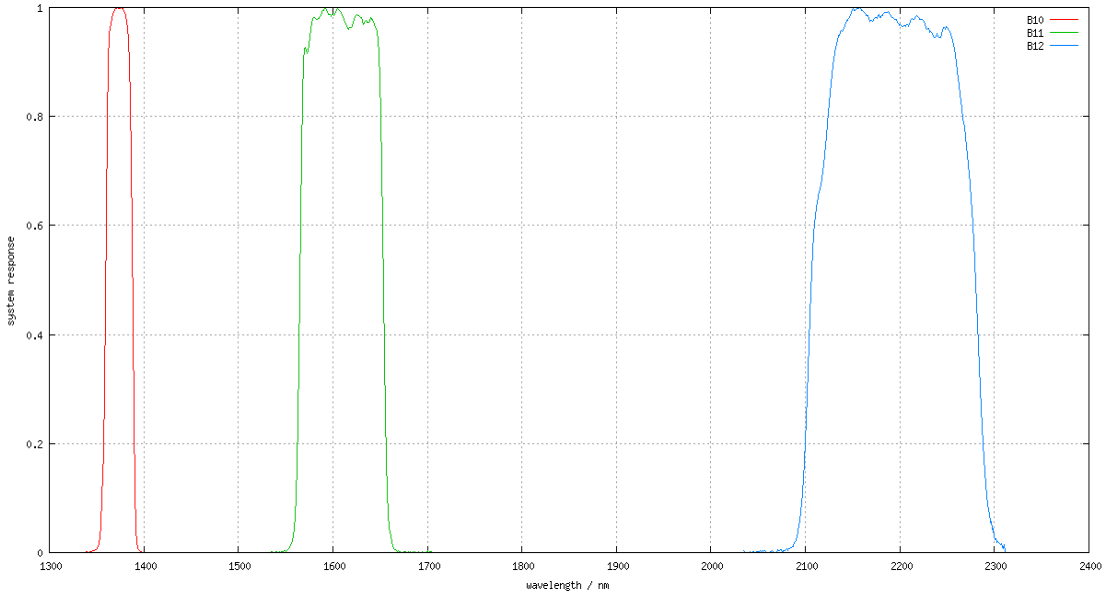
Spectral Responses

Band #	Center λ nm	Spectral Width Δλ nm
B1	**443**	**20**
B2	**490**	**65**
B3	**560**	**35**
B4	**665**	**30**
B5	**705**	**15**
B6	**740**	**15**
B7	**783**	**20**
B8	**842**	**115**
B8a	**865**	**20**
B9	**945**	**20**



VNIR channels spectral response

Band #	Center λ nm	Spectral Width Δλ nm
B10	**1375**	**30**
B11	**1610**	**90**
B12	**2190**	**180**



SWIR channels spectral response