Operational Sentinel-2 orthoimage series generation in Catalonia: first experiences

Vicenç Palà

CS-PCOT
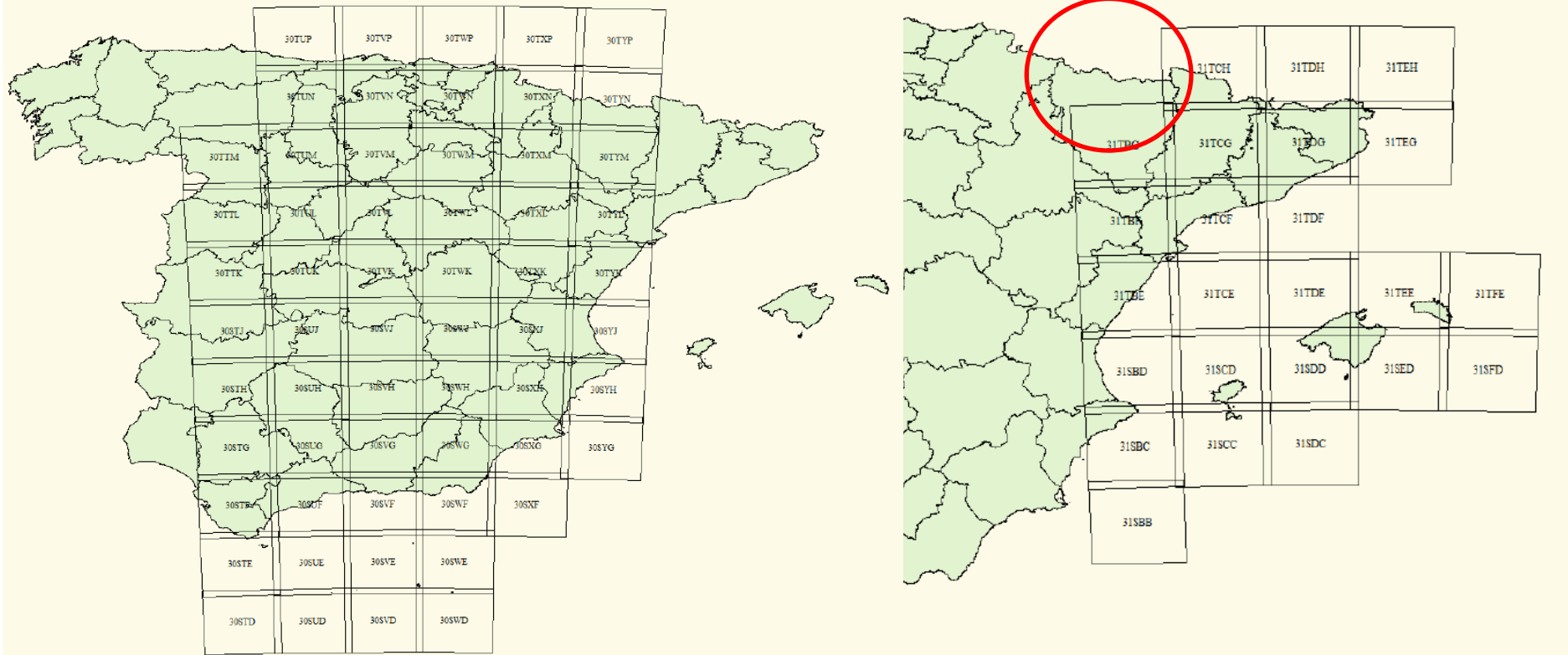
ICGC
Institut
Cartogràfic i Geològic
de Catalunya

Generalitat
de Catalunya

S2 orbits over Catalonia

- Two S2 orbits (51 and 8) with two scenes needed for each
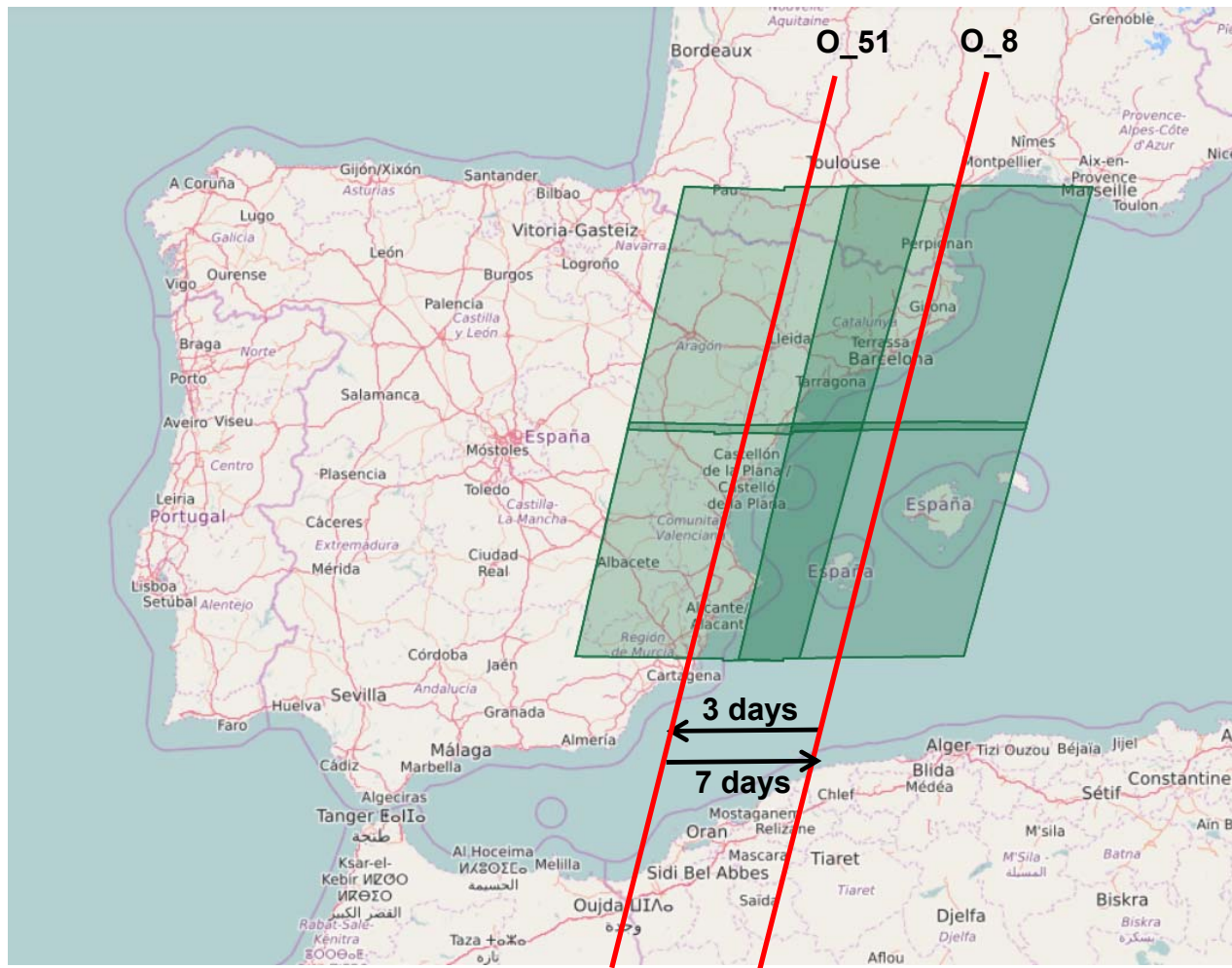
S2 images: "granules"

Missing granule in UTM zone 31

- Each UTM zone presents the granules in their projection. The granules in the border area between UTM zones should be in both UTM zones.

"The tiling grid shall ensure an overlap between tiles at the UTM zone borders"
(Sentinel-2 Products Definition Document. p.30)

S2-CAT orthoimage tech. specifications

- Given the dynamic range of the S2-L1C images (15 bits), and the four high-resolution spectral bands (10 m), we decided to create four products :
    - 8 bits RGB
    - 16 bits RGB
    - 8 bits IRC
    - 16 bits IRC
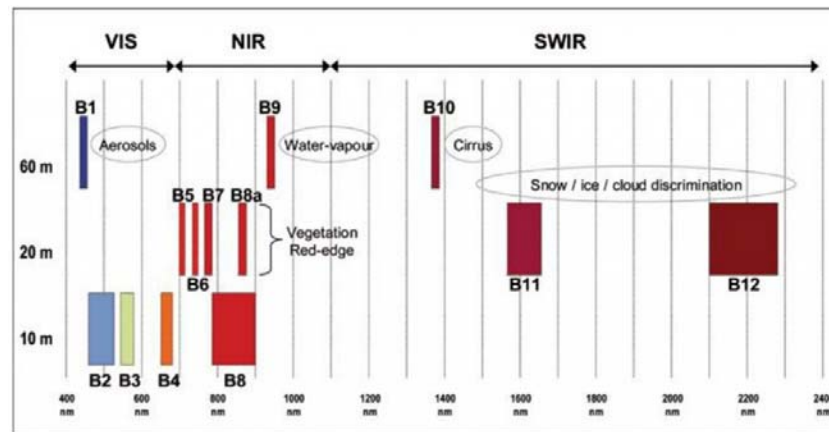
- IRC contains bands B8 (near infrared), B4 (red) and B3 (green)
- RGB contains bands B4 (red), B3 (green) and B2 (blue)
- Reference system: ETRS-89, UTM-31
- GSD: 10 m
- Area limits: West: 240000   East: 540000
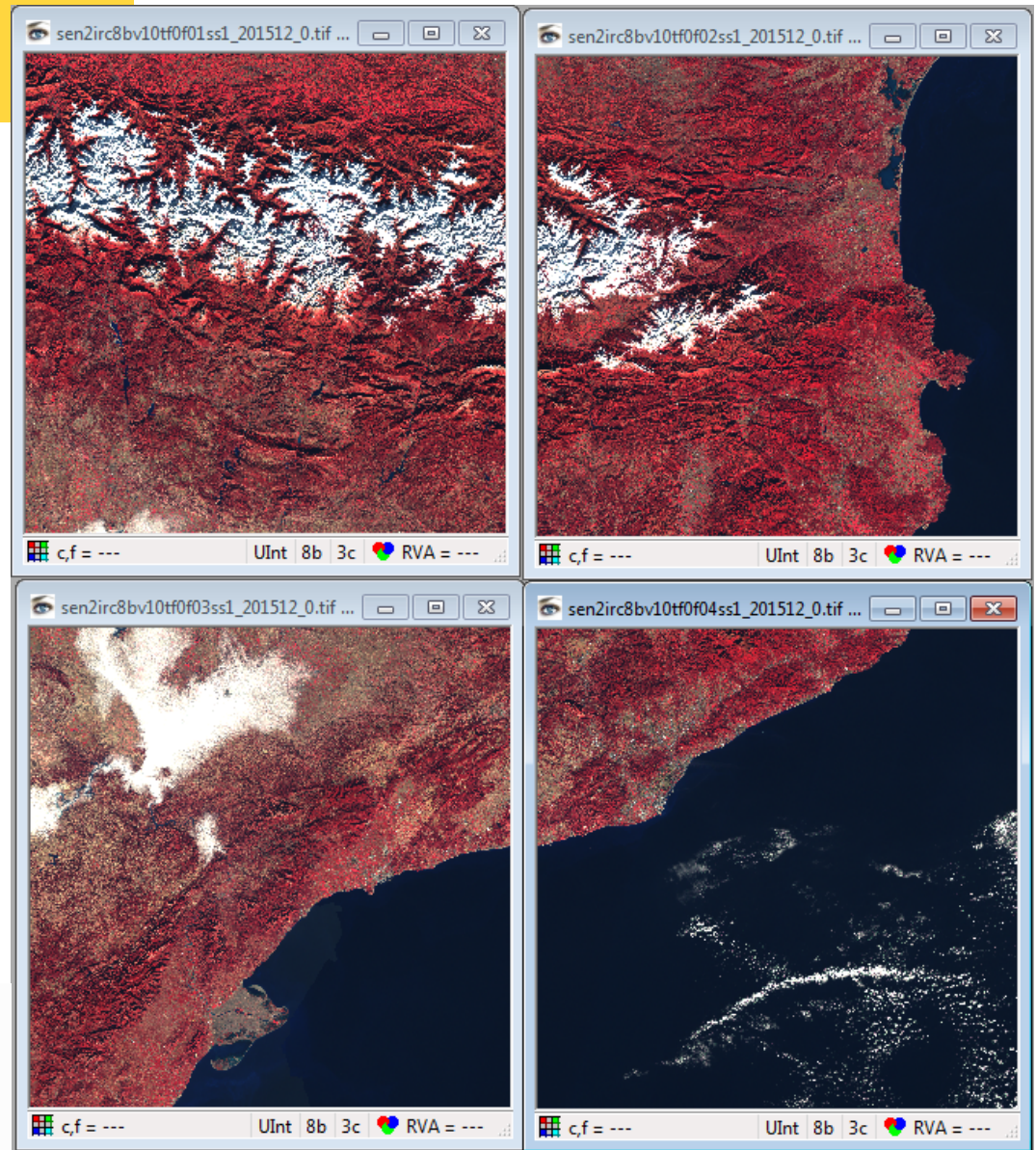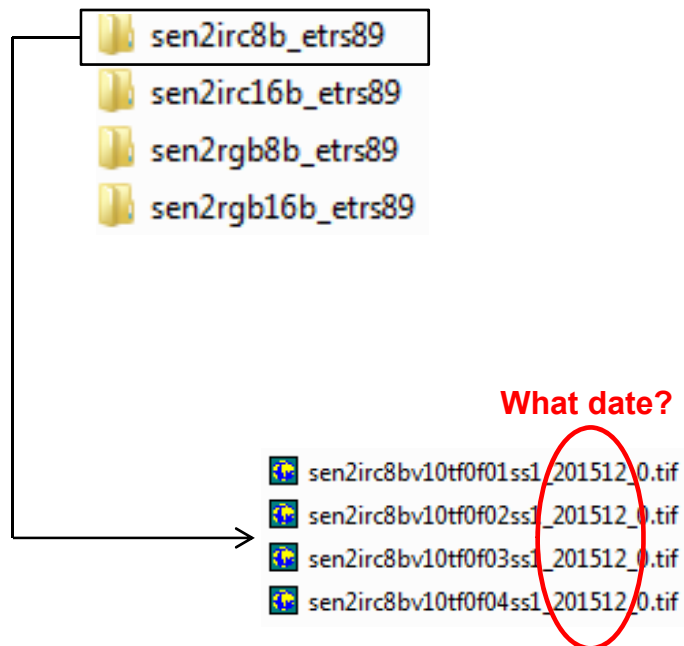   North: 4780000   South: 4480000

S2-CAT orthoimage tech. specifications

- 16 bits products, retaining the original (L1C) radiometry
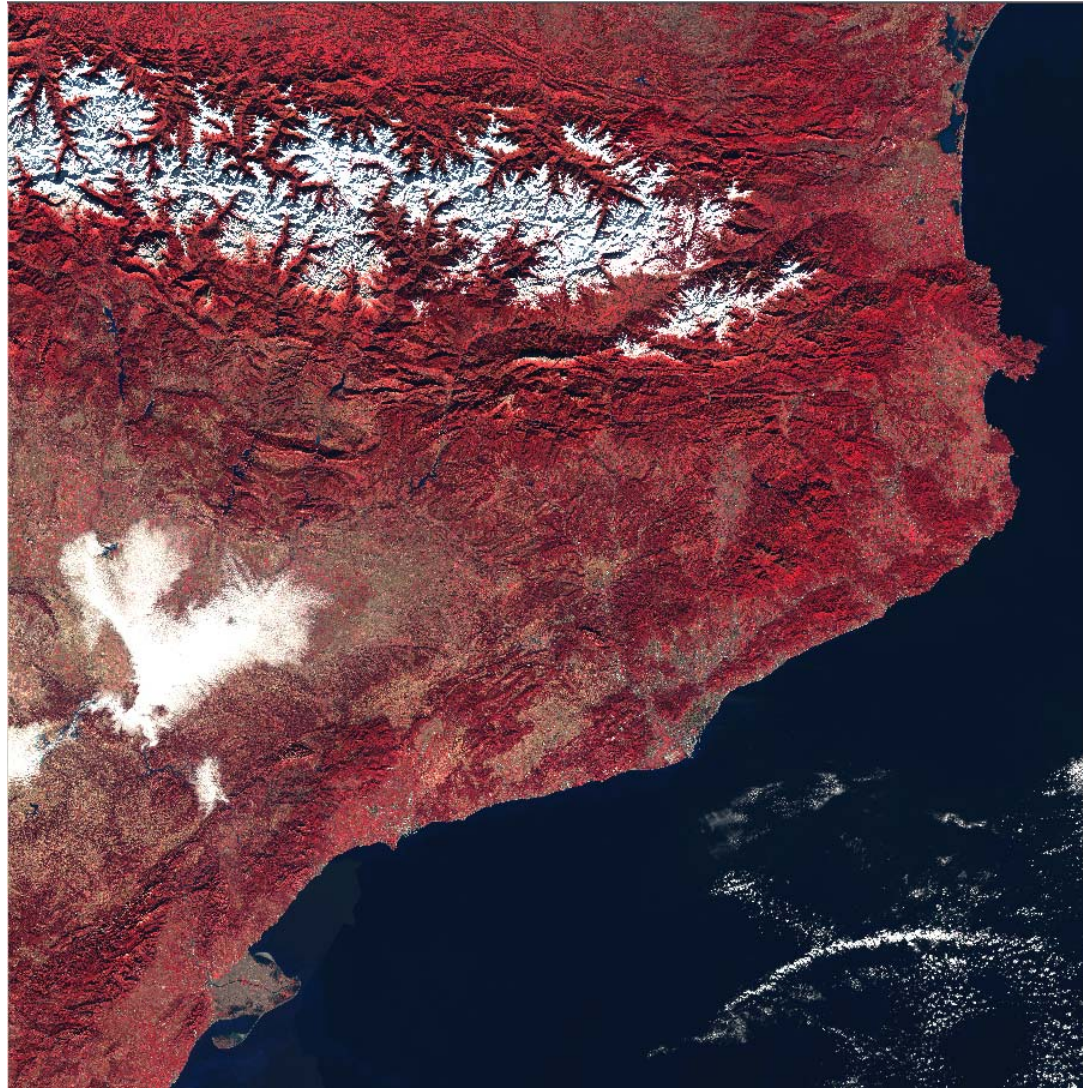- 8 bits products, with unavoidable radiometric saturations

S2-CAT orthoimage tech. specifications

- TIFF files for distribution
- The orthoimage is splited in 4 fragments for distribution
- Metadata files

📁 sen2irc8b_etrs89
📁 sen2irc16b_etrs89
📁 sen2rgb8b_etrs89
📁 sen2rgb16b_etrs89

What date?

🌐 sen2irc8bv10tf0f01ss1_201512_0.tif
🌐 sen2irc8bv10tf0f02ss1_201512_0.tif
🌐 sen2irc8bv10tf0f03ss1_201512_0.tif
🌐 sen2irc8bv10tf0f04ss1_201512_0.tif

First S2-CAT orthoimage

Orthoimatge process

- Four scenes must be downloaded: two for orbit 8 and two for orbit 51
- A unique image file is created for each scene
- An image file for each orbital segment (8 and 51) is generated
- An image mosaic combining both orbital segments is generated, sometimes by means of the generation of automatic irregular seamlines, sometimes just placing one image over the other
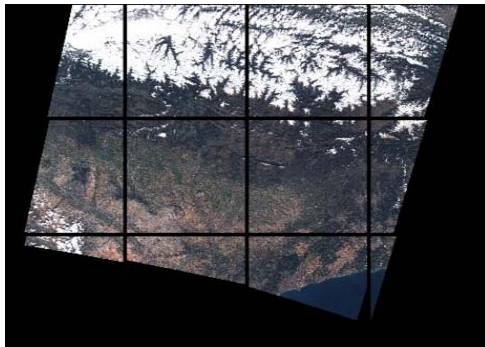
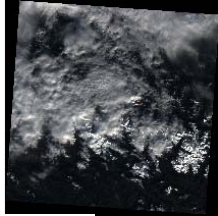Some scenes are loaded in the catalog of the ESA in two fragments.
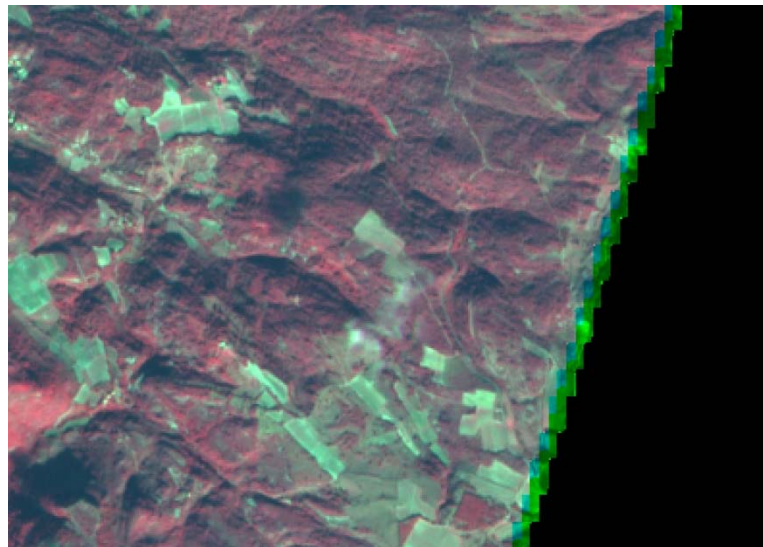
The ends of the S2 images, in the sweep direction of the sensor, show color spots hindering color mosaic process.
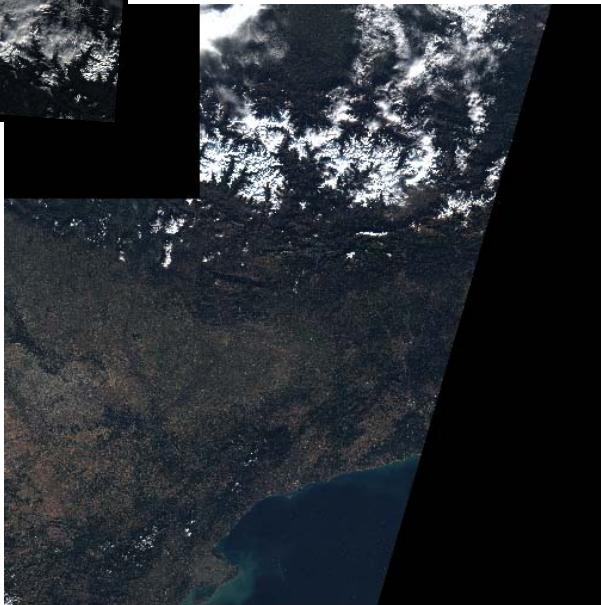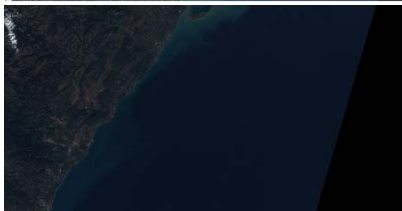
Orthoimatge process

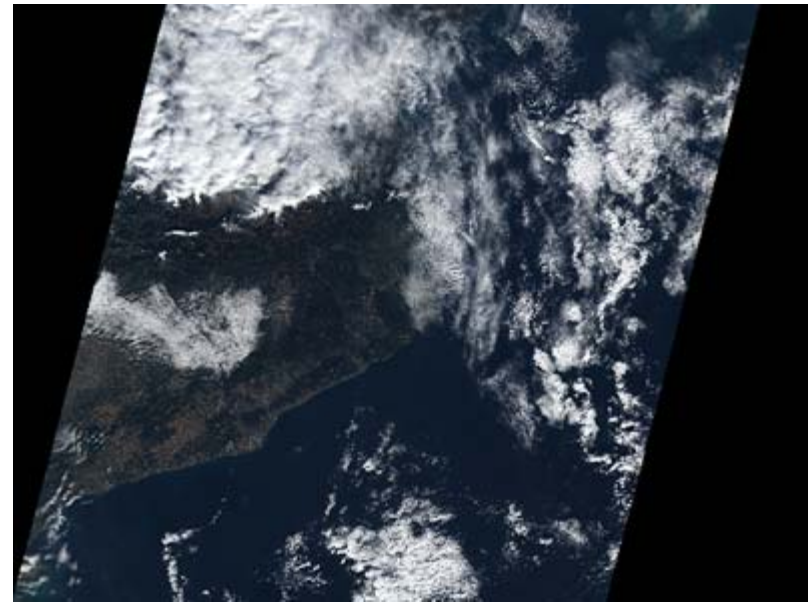**O_51 North UTM-30 granule YN →UTM-31**

O_51 North UTM-31

O_8 North

O_51 South UTM-31

O_8 South
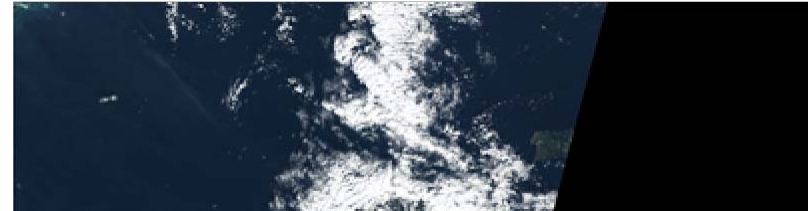
Atmospheric correction.
Level L2A

- Made with E   independently
  and genera

S2-CAT Web Map Services

http://www.icgc.cat

WMS of Sentinel-2 orthoimages

Contains modified **Copernicus Sentinel** data 2015 and 2016.

URL: **http://geoserveis.icgc.cat/icgc_sentinel2/wms/service?**

Technical aspects of the service:

- Supported OGC: WMS 1.3.0, 1.1.1, 1.1.0
- Origin EPSG: 25831
- Supported EPSG: 23031, 32631, 4230, 4258, 4326, 3857
- Supported GetMap formats: GIF, PNG, BMP, JPEG, TIFF
- Supported OGC methods: GetCapabilities, GetMap

Layer	Layer name	Range of scales
Sentinel2 RGB images - TIME parameter enabled	sen2rgb	All scales
Sentinel2 IRC images - TIME parameter enabled	sen2irc	All scales
Sentinel2 RGB image, [monthly]	sen2rgb_[YYYYMM] *	All scales
Sentinel2 IRC image, [monthly]	sen2irc_[YYYYMM] *	All scales

*Note: A month WMS layer is provided whenever the image of the month is processed. Example: sen2rgb_201512

TIME enabled layer request: fill TIME parameter in the WMS request with month desired (&TIME=2016-03)

Example (WMS-Time layer):

http://geoserveis.icc.cat/icgc_sentinel2/wms/service?
REQUEST=GetMap&SERVICE=WMS&VERSION=1.3.0&LAYERS=sen2rgb&STYLES=&FORMAT=image/png&BGCOLOR=0xFFFFFF&TRANSPARENT=TRUE&CRS=EPSG:25831&BBOX=206985.645933014,4480000,573014.354066986,478000
12

Layers with no TIME enabled can be requested as a standard WMS.

Example (WMS layer)

http://geoserveis.icc.cat/icgc_sentinel2/wms/service?
REQUEST=GetMap&SERVICE=WMS&VERSION=1.3.0&LAYERS=sen2rgb_201512&STYLES=&FORMAT=image/png&BGCOLOR=0xFFFFFF&TRANSPARENT=TRUE&CRS=EPSG:25831&BBOX=206985.645933014,4480000,573014.35406698

Compare images S2-CAT

S2-CAT downloading

Technical specifications

- Especificacions tècniques de l'Ortoimatge Sentinel-2 [PDF] [765.4 kB]

Continuous mosaic of images acquired by the Sentinel-2 satellite.

It contains Sentinel Copernicus data of 2015 and 2016 modified by the ICGC.

Key features:

- Pixel size: 10 m
- Covering all Catalonia
- Update frequency: monthly
- RGB and IRC
- Available formats: GeoTIFF 8 bits and GeoTIFF 16 bits
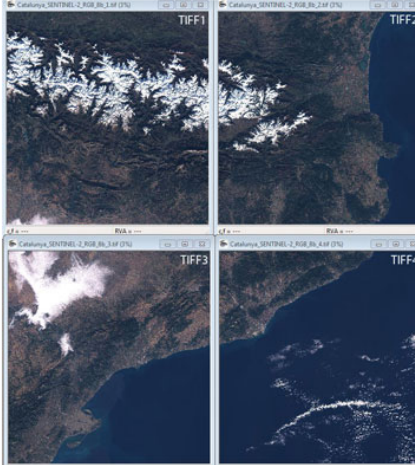
Sentinel-2 images comparator
View the changes of the territory between different available dates.

WMS / WMS-Time
This cartography can be used also on your applications supporting the WMS / WMS-Time protocol.

Download

Date	RGB 8 bits	RGB 16 bits	IRC 8 bits	IRC 16 bits	
December 2015	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	
March 2016	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	
April 2016	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	
May 2016	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	TIFF 1, TIFF 2, TIFF 3, TIFF 4	

Conclusions

- A monthly S2 orthoimage of Catalonia is being generated by ICGC (both, 8 and 16 bits/pixel). Web Mapping Services and downloading capabilities are provided.

- The full automation for the S2 orthoimage generation is still difficult due to acquisition anomalies (image fragmentation, unusual but existing geometric errors, some images are uploaded too late,…).

- Some image granules are not available in the UTM zone of the orthoimage to be generated and must be re-projected.

- The radiometric discontinuities between neighbour granules must be solved to provide atmospherically corrected orthoimages.

Thank you very much!

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