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

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S2 orbits over Catalonia

- Two S2 orbits (51 and 8) with two scenes needed for each
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 split in 4 fragments for distribution
- Metadata files

What date?
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_51 South UTM-31

O_8 North

O_8 South
Atmospheric correction. Level L2A

- Made with ESA software (sen2cor), each granule is processed independently and generates radiometric discontinuities.
S2-CAT Web Map Services

WMS of Sentinel-2 orthoimages

Contains modified Copernicus Sentinel data 2015 and 2016.

URL: http://geoservies.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

<table>
<thead>
<tr>
<th>Layer</th>
<th>Layer name</th>
<th>Range of scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentinel2 RGB images - TIME parameter enabled</td>
<td>sen2rgb</td>
<td>All scales</td>
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<tr>
<td>Sentinel2 IRC images - TIME parameter enabled</td>
<td>sen2irc</td>
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<tr>
<td>Sentinel2 RGB image, [monthly]</td>
<td>sen2rgb_YYYYMM *</td>
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<tr>
<td>Sentinel2 IRC image, [monthly]</td>
<td>sen2irc_YYYYMM *</td>
<td>All scales</td>
</tr>
</tbody>
</table>

*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 (e.g. TIME=2016-03)

Example (WMS-TIME layer):
http://geoservies.icgc.cat/icgc_sentinel2/wms/service?
REQUEST=GetMap&SERVICE=WMS&VERSION=1.3.0&LAYERS=sen2rgb&TIME=201512&STYLES=&FORMAT=image/png&BGCOLOR=0x000000&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://geoservies.icgc.cat/icgc_sentinel2/wms/service?
REQUEST=GetMap&SERVICE=WMS&VERSION=1.3.0&LAYERS=sen2rgb_201512&STYLES=&FORMAT=image/png&BGCOLOR=0x000000&TRANSPARENT=True&CRS=EPSG:25831&BBOX=206985.645933014,4480000,573014.354066986,478000 12
Compare images S2-CAT

Operational S2 orthoimage series in Catalonia

INSPIRE Conference 2016
S2-CAT downloading

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

Download

<table>
<thead>
<tr>
<th>Date</th>
<th>RGB 8 bits</th>
<th>RGB 16 bits</th>
<th>IRC 8 bits</th>
<th>IRC 16 bits</th>
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<tr>
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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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