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Copernicus Data and Exploitation Platform – Deutschland

Sentinel-2 Level 2A: Surface Reflectance (AGRO-DE)

Date: 14.03.2019

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1.1 Introduction

CODE-DE provides atmospherically corrected Copernicus Sentinel-2 data (Level 2A). Atmospheric correction of Level 1C data (available on CODE-DE) is performed by means of the PACO processor¹, which is developed in-house at the DLR. PACO is a python implementation and advancement of ATCOR 2/3² and, as such, also has a number of similarities with the ESA Sen2Cor processor.

Level 2A data are made available for all Sentinel-2 granules within Germany, which were acquired from 01/01/2019 onwards and which feature a solar zenith angle smaller than 70°. No radiometric terrain-correction is performed.

L2A data are available in 10m spatial resolution for the original 10m bands and in 20m resolution for all Bands (B2, B3, B4, B5, B6, B7, B8, B11, B12). The latter is also available as a resampled 10m product.

In addition to the L2A product, a cloud-mask is calculated by means of the python implementation³ of the Fmask⁴ cloud, cloud-shadow and snow detector.

This product was developed in the context of the [AGRO-DE](#) Project.

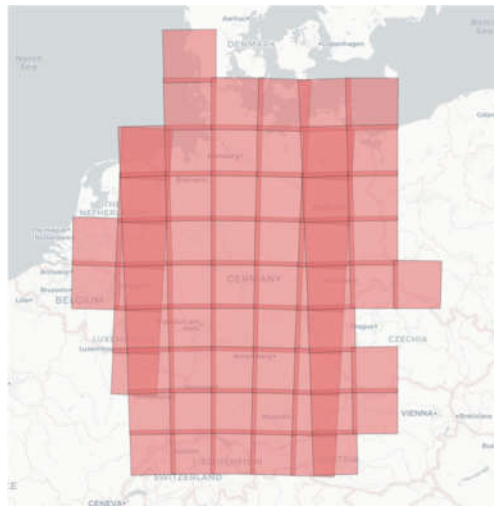


Fig. 1 Sentinel 2 granule coverage of Germany.

¹ de los Reyes, Raquel und Richter, Rudolf und Langheinrich, Maximilian und Pflug, Bringfried und Schwind, Peter (2018) Validation of a new atmospheric correction software using AERONET reference data PACO: Python-based Atmospheric COrrrection. LPVE2018 - Workshop on Land Product Validation and Evolution, Frascati, Italy.

² Richter, R., and D. Schläpfer, (2018) "Atmospheric / Topographic Correction for Satellite Imagery: ATCOR-2/3 User Guide", Wessling, Germany

³ <http://pythonfmask.org>

⁴ Zhu, Z., Wang, S. and Woodcock, C.E. (2015). "Improvement and expansion of the Fmask algorithm: cloud, cloud shadow, and snow detection for Landsats 4-7, 8, and Sentinel 2 images", Remote Sensing of Environment 159, 269-277.

1.2 Product Folder

The product folder contains download links for each granule and acquisition date.

Folder structure is: /agrode/S2_L2A_reflectance/<year>/<month>/<day>/<scene>_paco/

For example:

agrode/S2_L2A_reflectance/2019/02/08/S2B_MSIL1C_20190208T101159_N0207_R022_T32UQA_20190208T122146_paco/

1.3 Product Name

Products are named according to the [ESA standard naming convention](#) for Sentinel-2 Level 1C products with the suffix “_<paco product>.tif” or “_<paco product_spatial resolution of spectral bands>.tif”

For example:

S2B_MSIL1C_20190118T104359_N0207_R008_T32ULU_20190118T123528_atm_10m.tif

1.4 Product Format

Each L2A product consists of 15 GeoTiff files, which are distinguished by their suffix appended to the standard scene identifier, such as

<scene>=“S2A_MSIL1C_20190219T103051_N0207_R108_T31UGQ_20190219T124050”.

Spatial products:

Product Index	Filename	Variable	Spatial resolution	Compression	Interleave	Scale factor	Data type
P1	<scene>_aot.tif	Aerosol optical thickness (AOT)	20m	NONE	BAND	1e4	INT16
P2	<scene>_atm_10m.tif	L2A product. Bands: 2,3,4,8	10m	DEFLATE	PIXEL	1e4	INT16
P3	<scene>_atm_20m.tif	L2A product. Bands: 1 - 13	20m	DEFLATE	PIXEL	1e4	INT16
P4	<scene>_atm_10m_UTM.tif	L2A product. Bands: 1 - 13	10m	DEFLATE	PIXEL	1e4	INT16
P5	<scene>_atm_CM.tif	Fmask cloud mask	20m	LZW	BAND	1	Byte
P6	<scene>_atm_CM_10m.tif	Fmask cloud mask	10m	DEFLATE	BAND	1	Byte
P7	<scene>_ddv.tif	PACO dark dense vegetation (used for AOT estimation)	20m	NONE	BAND	1	Byte
P8	<scene>_hcv.tif	PACO scene classification	20m	NONE	BAND	1	Byte
P9	<scene>_ilu.tif	PACO local illumination map	20m	NONE	BAND	1	Byte
P10	<scene>_visindex.tif	PACO visibility estimate	20m	NONE	BAND	1e4	Int16
P11	<scene>_wv.tif	PACO water vapour estimate	20m	NONE	BAND	1e4	Int16

Metadata:

Filename	Variable
MTD_MSIL1C.xml	Original L1C metadata
cloudFmask_<scene>.txt	cloud cover percentage of entire scene as detected by Fmask
cloudSen2Cor_<scene>.txt	cloud cover percentage of entire scene as detected by PACO

1.5 Product Details

L2A product bands:

P2 Layer	P3 Layer	P4 Layer	Sentinel 2 Band	Interpretation
	1	1	B1	blue1
1	2	2	B2	blue2
2	3	3	B3	green
3	4	4	B4	red
	5	5	B5	red edge1
	6	6	B6	red edge 2
	7	7	B7	red edge 3
4	8	8	B8	NIR 1
	9	9	B8a	NIR 2
	10	10	B9	NIR 3
	11	11	B10	SWIR 1
	12	12	B11	SWIR 2
	13	13	B12	SWIR 3

Resampled products:

P6 is obtained by resampling **P5** to 10m spatial resolution using nearest neighbour resampling.

P4 is obtained by resampling the original 20m and 60m bands of **P3** to 10m spatial resolution using nearest neighbour resampling.

P5 & P6: Fmask products attribute table:

Value	Class label
1	clear
2	cloud
3	shadow
4	snow
5	water

P8: PACO hcw attribute table:

Value	Class label
0	background
1	shadow
2	thin cirrus over water
3	medium cirrus over water
4	thick cirrus over water
5	land
6	saturated (blue/green band)
7	snow / ice
8	thin cirrus over land
9	medium cirrus over land
10	thick cirrus over land
11	thin haze over land
12	medium haze over land
13	thin haze over water
14	medium haze over water
15	cloud over land
16	cloud over water
17	water
18	cirrus cloud



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Issue: Productst
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Class.: 29.06.2018
Page: Public
6

Value	Class label
19	cirrus cloud thick
20	bright
21	topographic shadow

1.6 Terms and Conditions

Products are open access data and can be used under the terms and conditions of the Creative Commons Attribution ShareAlike 4.0 International (CC-BY-SA 4.0) license (<https://creativecommons.org/licenses/by-sa/4.0/>). Please also quote the ESA Copernicus Open Access Hub (<https://scihub.copernicus.eu/>) and the year of reception for the used Sentinel-2 Level 1C data when products are published or distributed.

