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D2.4.4 Product User Guide – Small Fire Database (PUG-SFD)

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Project Partners

Prime Contractor/ Scientific Lead & Project Management	UAH – University of Alcala (Spain)
Earth Observation Team	UAH – University of Alcala (Spain) UPM – Universidad Politécnica de Madrid (Spain) CNR-IREA - National Research Council of Italy – Institute for Electromagnetic Sensing of the Environment (Italy)
System Engineering	BC – Brockmann Consult (Germany)
Climate Modelling Group	MPIM – Max Planck Institute for Meteorology (Germany) CNRS - National Centre for Scientific (France)

Distribution

Affiliation	Name	Address	Copies
ESA	Clément Albergel (ESA)	clement.albergel@esa.int	electronic copy
Project Team	Emilio Chuvieco (UAH) M. Lucrecia Pettinari (UAH) Joshua Lizundia (UAH) Amin Khaïroun (UAH) Gonzalo Otón (UAH) Mihai Tanase (UAH) Consuelo Gonzalo (UPM) Dionisio Rodríguez Esparragón (UPM) Ángel García Pedrero (UPM) Daniela Stroppiana (CNR) Mirco Boschetti (CNR) Thomas Storm (BC) Martin Böttcher (BC) Grit Kirches (BC) Angelika Heil (MPIM) Idir Bouarar (MPIM) Florent Mouillot (CNRS) Philippe Ciais (CNRS)	emilio.chuvieco@uah.es mlucrecia.pettinari@uah.es joshua.lizundia@uah.es amin.khairoun@uah.es gonzalo.oton@uah.es mihai.tanase@uah.es consuelo.gonzalo@upm.es dionisio.rodriguez@ulpgc.es angelmario.garcia@upm.es stroppiana.d@irea.cnr.it boschetti.m@irea.cnr.it thomas.storm@brockmann-consult.de martin.boettcher@brockmann-cons... grit.kirches@brockmann-consult.de angelika.heil@mpimet.mpg.de idir.bouarar@mpimet.mpg.de florent.mouillot@cefe.cnrs.fr philippe.ciais@lsce.ipsl.fr	electronic copy

Summary

This document is the version 2.0 of the Product User Guide for the Small Fire Database of the Fire_cci project version 2.0 (FireCCISFD20). It provides practical information about the use of this product, available for Sub-Saharan Africa for the year 2019, and based on the Sentinel-2 MSI sensor.

	Affiliation/Function	Name	Date
Prepared	UAH EHU	M. Lucrecia Pettinari Ekhi Roteta	21/09/2021
Reviewed	UAH – Project Manager	Lucrecia Pettinari	21/09/2021
Authorized	UAH - Science Leader	Emilio Chuvieco	21/09/2021
Accepted	ESA - Technical Officer	Clément Albergel	22/09/2021

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Document Status Sheet

Issue	Date	Details
1.0	23/03/2017	First Issue of the document.
1.1	01/10/2018	Addressing comments on CCI-FIRE-EOPS-MM-17-0042.
1.2	12/02/2019	New sections added to include the grid product.
2.0	21/09/2021	Update of the document to apply it to FireCCISFD20. Change of the number of the document.

Document Change Record

Issue	Date	Request	Location	Details
1.1	01/10/2018	ESA ESA ESA ESA UL UAH UL UAH UAH, UL	List of figures Section 1 Sections 1.1, 1.2, 2.1, 2.3 Section 1.3 Sections 2, 2.4 Section 2.5 Section 2.6.1 Section 2.6.2 Sections 2.6.3, 3, 4, 5	Deleted. Reduced. Small changes in the text Text reduced Text and figure updated Naming convention updated Figure updated Text and table updated Sections updated
1.2	12/02/2019	UAH	Sections 1.1, 1.3, 2.6.3 Section 2 Section 2.6.1 Section 3 Sections 4, 6 Section 7 Annex 2	Small changes in the text Change in the name of the section Table updated New section and sub-sections describing the grid product have been added Text expanded New references added New annex added
2.0	21/09/2021	UAH	Document number All text Sections 1.2, 2.6.3, 3.5.2, 3.5.5, 4, 5, 6, 7 Section 3.5.5	The number of the document has been updated to 2.4.4 as corresponding to the deliverables numbers of CCI+ Phase 1. Small changes to adapt it to FireCCISFD20, and all Figures updated. Sections updated The previous section was eliminated, as the number of patches attribute is no longer provided.

Table of Contents

1. General overview 5
1.1. Introduction 5
1.2. Input data 5
1.3. BA algorithm 6
2. Pixel BA product 6
2.1. Temporal compositing 6
2.2. Spatial Resolution 6
2.3. Product projection system 7
2.4. Subsets 7
2.5. Product file naming conventions 7
2.6. Pixel attributes 8
2.6.1. Layer 1: Date of the first detection 8
2.6.2. Layer 2: Confidence level 9
2.6.3. Layer 3: Land cover of burned pixels 10
2.7. File metadata 12
3. Grid BA product 12
3.1. Temporal compositing 12
3.2. Spatial Resolution 13
3.3. Product projection system 13
3.4. Product file naming conventions 13
3.5. Grid attributes 14
3.5.1. Attribute 1: Sum of burned area 14
3.5.2. Attribute 2: Standard error 15
3.5.3. Attribute 3: Fraction of burnable area 15
3.5.4. Attribute 4: Fraction of observed area 16
3.5.5. Attributes 5-22: Sum of burned area for each land cover category 17
3.7. File metadata 19
4. Comparison with other burned area products 19
5. Data limitations and constraints 20
6. Data dissemination 20
7. References 20
Annex 1: Metadata of the pixel product (XML file) 21
Annex 2: Metadata of the grid product 22
Annex 3: Acronyms and abbreviations 26

1. General overview

This document contains practical information on how to use the Fire_cci Small Fire Database (SFD) product version 2.0 of the Fire_cci project, which is based on the Multi Spectral Instrument (MSI) on board the ESA Sentinel-2 (S2) satellites A & B. This document applies to the SFD Fire_cci v2.0 (FireCCISFD20) corresponding to 2019.

1.1. Introduction

The SFD products comprise maps of burned area of Sub-Saharan Africa (Figure 1). They were developed and tailored for their use by climate, vegetation and atmospheric modellers, as well as by fire researchers or fire managers interested in spatially detailed burned patterns.

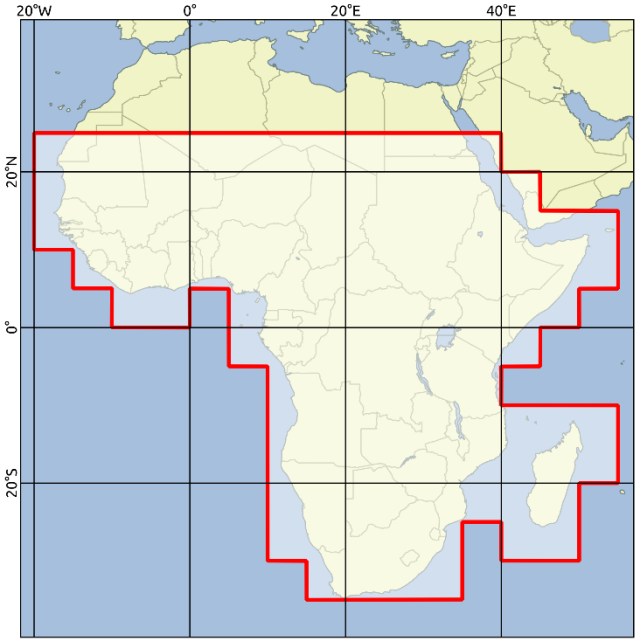

Figure 1: Sub-Saharan Africa, showing the area of processing of the SFD product.

The Fire_cci project produces burned area (BA) products that are available at different spatial resolutions: the PIXEL product (L3S) and the GRID product (L4), which is derived from the pixel one (see Chuvieco et al. 2017).

1.2. Input data

The input images for the FireCCISFD20 product were Multi Spectral Instrument (MSI) Level-2A images, acquired by the Sentinel-2 A&B satellites (https://sentinel.esa.int/web/sentinel/missions/sentinel-2). Images were acquired every 5 days (revisit time considering both satellite). Bands 8A (Near Infrared), 11 (Short SWIR) and 12 (Long SWIR) at their original 20m resolution were used to generate the BA product. The time series covers the period from January to December 2019 to produce the final BA product. The original tiling system (100x100km tiles) was maintained throughout the processing chain of the BA algorithm; original tiles were reprojected and aggregated into 5x5 degrees tiles after detecting burned areas.

The active fire (AF) information was obtained from the Visible Infrared Imaging Radiometer Suite (VIIRS) VNP14IMGML fire location product (https://lpdaac.usgs.gov/

documents/427/VNP14_User_Guide_V1.pdf), which provides global monthly coordinates of detected active fires in ASCII format. Only AF points with type 0 (presumed vegetation fire) were used for the algorithm.

1.3. BA algorithm

The BA algorithm used for producing the FireCCISFD20 BA product is described in the Algorithm Theoretical Basis Document (Roteta, 2021) and the individual-sensor steps are also detailed in Roteta et al. (2019).

2. Pixel BA product

The FireCCISFD20 product is a GeoTIFF file with three layers indicating the date of detection (Figure 2), the confidence level and the land cover in the pixel detected as burned (see Section 2.6 for further detail).

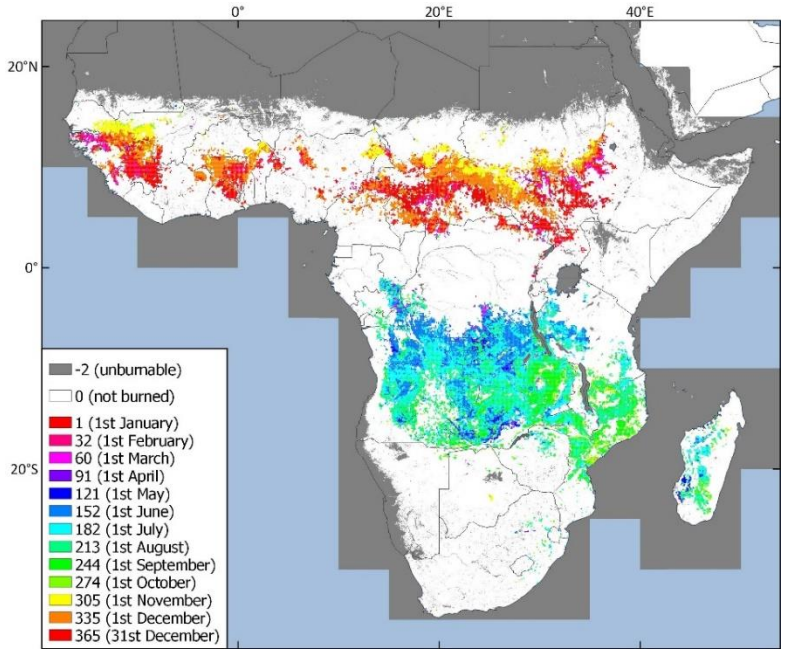

Figure 2: Day of detection or of burn for all the subsets in 2016, derived from the pixel product.

2.1. Temporal compositing

The pixel products are released as monthly composites so they can encompass those pixels that burn more than once during a calendar year. This may occur in the Northern Tropical areas, where the dry season (and hence the burn season) and the fire period commonly occur between December and February.

2.2. Spatial Resolution

The Spatial resolution of this BA product is 0.000179663 degrees (approximately 20 m at the Equator), the original resolution of both SWIR bands in the MSI images.

2.3. Product projection system

The Coordinate Reference System (CRS) used for the global BA products is a geographic coordinate system (GCS) based on the World Geodetic System 84 (WGS84) reference ellipsoid and using a Plate Carrée projection with geographical coordinates of equal pixel size. The coordinates are specified in decimal degrees. Information on product projection, ellipsoid and pixel size is included in the GeoTIFF file header, so every pixel in the file can be geographically referenced without the need of adding specific pixel indicators of geographical position.

2.4. Subsets

The BA product is distributed in 5x5-degree tiles, each one a non-overlapping region. They cover Sub-Saharan Africa from the southernmost point of the continent (latitude 35ºS) to beyond the Tropic of Cancer (latitude 25ºN), between longitudes 20ºW and 55ºE. Figure 3 shows the extent of these tiles.

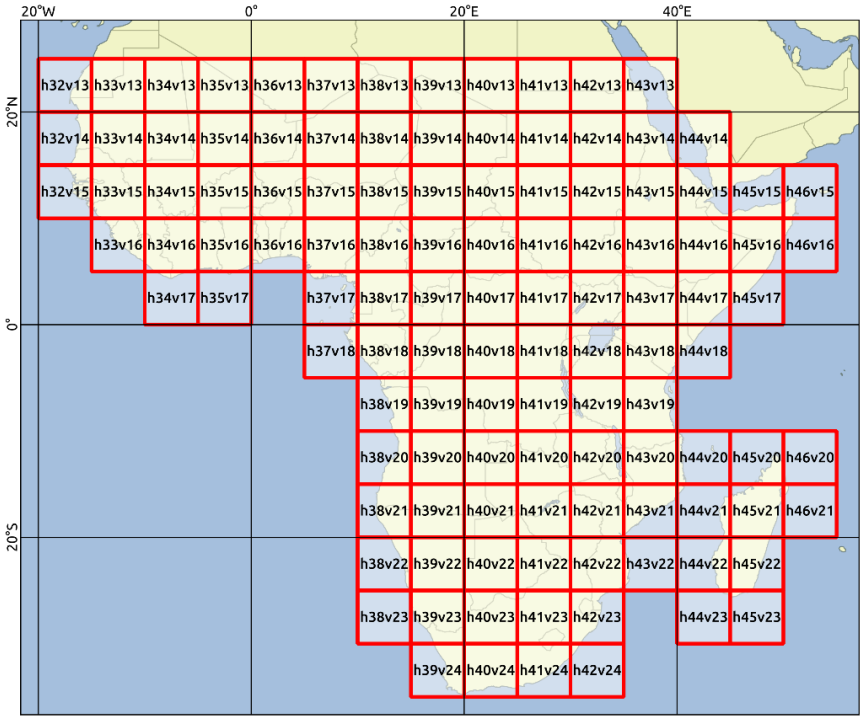

Figure 3: Geographical distribution of subsets of the FireCCISFD20 product.

2.5. Product file naming conventions

The files for each sensor and month are named as follows:

<Indicative_Date>-ESACCI-L3S_FIRE-BA-<Indicative_Sensor> -<Additional_ Segregator>-fv<File_Version>-<Layer>.tif

<Indicative_Date>

The identifying date for this data set:

Format is YYYYMMDD, where YYYY is the four-digit year; MM is the two-digit month from 01 to 12 and DD is the two-digit day of the month from 01 to 31. For monthly products DD=01.

< **Indicative Sensor**>
For version 2.0 of the product, the sensor is MSI.

<Additional_Segregator>

This is AREA_<TILE_NUMBER> being the tile number the subset index described in Section 2.4.

<**File_Version**>

File version number in the form n{1,}[.n{1,}] (That is 1 or more digits followed by optional . and another 1 or more digits). The most recent version is fv2.0.

<Layer>

As each layer is provided as an individual GeoTIFF file, the code of each layer is:

- JD: layer 1, corresponding to the Julian day, or day of the year of detection of the BA.
- CL: layer 2, corresponding to the confidence level
- LC: layer 3, corresponding to the land cover

Example:

20190701-ESACCI-L3S_FIRE-BA-MSI-AREA_ h39v20-fv2.0-JD.tif

2.6. Pixel attributes

The following sub-sections describe each of the layers of the pixel product (Annex 1), including the name of the attributes in the GeoTIFF file, the units of the attributes and the data type, and some information useful for the correct use of the product. They also include examples of the pixel product layers.

2.6.1. Layer 1: Date of the first detection

Layer	Attribute	Units	Data Type	Notes
1 (JD)	Date of the first detection	Day of the year, from 1 to 366	Integer	Possible values: • 0 (zero): when the pixel is not burned. • 1 to 366: day of the first detection when the pixel is burned. • -1: when the pixel is not observed in the month. • -2: used for pixels that are not burnable: water bodies, bare areas, urban areas, permanent snow and ice.

When the pixel is characterized as burned, it is assumed that the complete pixel was burned, as for most BA products. All pixels with confidence level higher than 50% (Layer 2, section 2.6.2) have a day of detection.

The date of detection of the burned pixel (usually also called day of the year or Julian day) may not be coincident with the actual burning date, and it could correspond to several days afterwards, depending on image availability and cloud coverage. For areas with low cloud coverage, the detected date of burn should be very close to the actual date of burn, while for equatorial latitudes or those with high cloud coverage the date might be up to weeks after the fire is over.

An example of this layer corresponding to the month of July for Area h39v20 is shown in Figure 4.

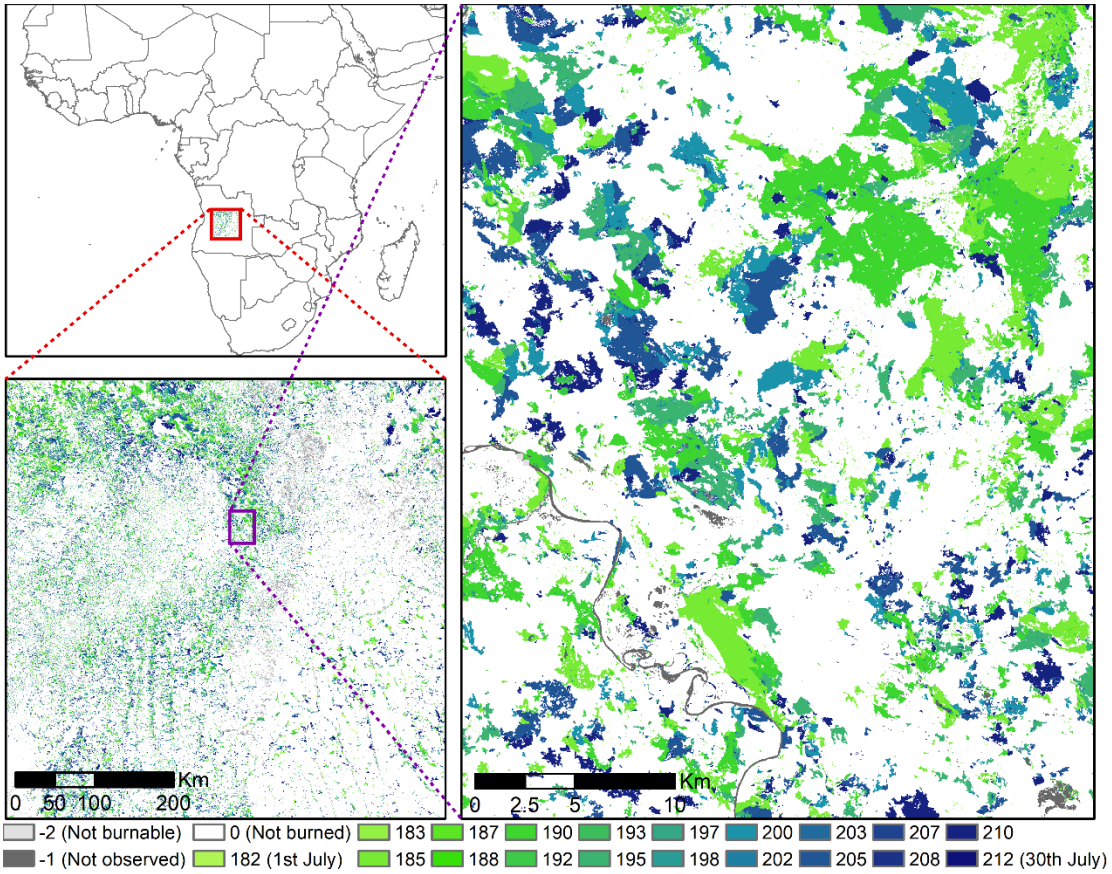

Figure 4: Example of the date of the first detection layer for the Area h39v20 tile during July 2019. The figure shows the extent of the whole Area in the left panels, and a zoomed region in the right panel.

2.6.2. Layer 2: Confidence level

Layer	Attribute	Units	Data Type	Notes
2 (CL)	Confidence level	0 to 100	Integer	Probability of detecting a pixel as burned. Possible values: - 0 (zero): when the pixel is not observed in the month, or it is not burnable. - 1: value assigned when the pixel was observed, but the probability of burn was lower than 50. - 50 to 100: Probability values. The closer to 100, the higher the confidence that the pixel is actually burned.

The confidence level was based on spectral properties of initial burned areas, which were detected near thermal anomalies hotspots from the VNP14IMGML product. The original probability values were rescaled, in order to provide values easier to understand by users. The technical details are explained in Roteta (2021).

An example of this layer corresponding to the month of July for Area h39v20 is shown in Figure 5.

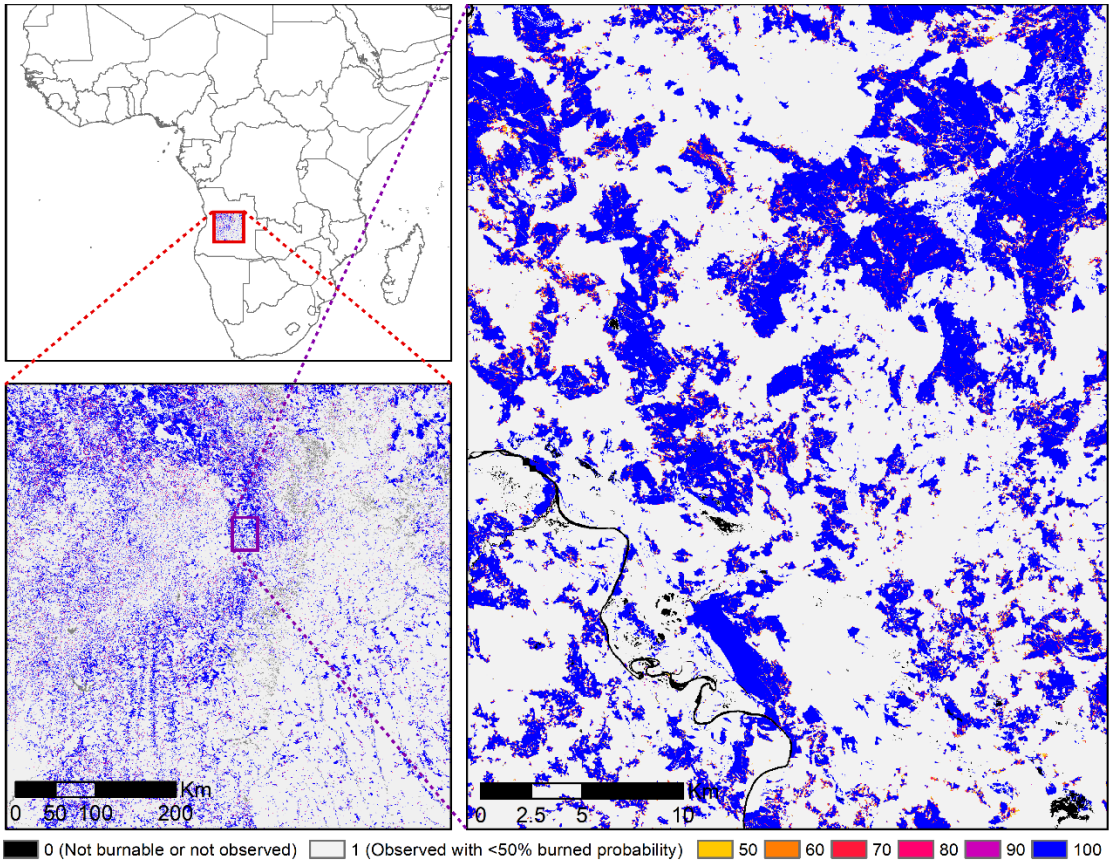

Figure 5: Example of the confidence level layer for the Area h39v20 tile during July 2019. The figure shows the extent of the whole Area in the left panels, and a zoomed region in the right panel.

2.6.3. Layer 3: Land cover of burned pixels

Layer	Attribute	Units	Data Type	Notes
3 (LC)	Land cover of burned pixels	0 to 180	Byte	Land cover of the pixel detected as burned, extracted from the C3S Land Cover map of 2018. Possible values: - 0 (zero): when the pixel is not observed in the month, it is observed and classified as not burned or it is not burnable (i.e. values of layer 1 between -2 and 0) - 1-180: number of the land cover class in the reference map.

The land cover assigned to the pixel detected as burned was extracted from the C3S Land Cover map of 2018 (available at https://cds.climate.copernicus.eu/cdsapp#!/dataset/satellite-land-cover); unburned pixels are assigned the value 0. The land cover categories included in the BA product are listed in Table 1. Further information regarding the land cover map is available in Defourny et al. (2021).

Table 1: Land cover categories in Layer 3.

LC number	Class name
10	Cropland, rainfed
20	Cropland, irrigated or post-flooding
30	Mosaic cropland (>50%) / natural vegetation (tree, shrub, herbaceous cover) (<50%)
40	Mosaic natural vegetation (tree, shrub, herbaceous cover) (>50%) / cropland (<50%)
50	Tree cover, broadleaved, evergreen, closed to open (>15%)
60	Tree cover, broadleaved, deciduous, closed to open (>15%)
70	Tree cover, needleleaved, evergreen, closed to open (>15%)
80	Tree cover, needleleaved, deciduous, closed to open (>15%)
90	Tree cover, mixed leaf type (broadleaved and needleleaved)
100	Mosaic tree and shrub (>50%) / herbaceous cover (<50%)
110	Mosaic herbaceous cover (>50%) / tree and shrub (<50%)
120	Shrubland
130	Grassland
140	Lichens and mosses
150	Sparse vegetation (tree, shrub, herbaceous cover) (<15%)
160	Tree cover, flooded, fresh or brackish water
170	Tree cover, flooded, saline water
180	Shrub or herbaceous cover, flooded, fresh/saline/brackish water

Since the land cover product has a spatial resolution of approx. 300 m, and the BA information is at approx. 20-m resolution, in large burned patches the shapes of the pixels of the different land cover classes can be observed. This is unavoidable due to the difference in resolution. Still, this land cover map was preferred by the users due to its better accuracy compared to other existing product (such as the one used for FireCCISFD11), and to keep consistency between Fire_cci BA products, as described in Heil and Pettinari (2021).

Obviously, errors included in this land cover map also affect the information contained in the BA product, and hence the calculation of emissions using land-cover-based emissions factors would be affected.

An example of this layer corresponding to the month of July for Area h39v20 is shown in Figure 6.

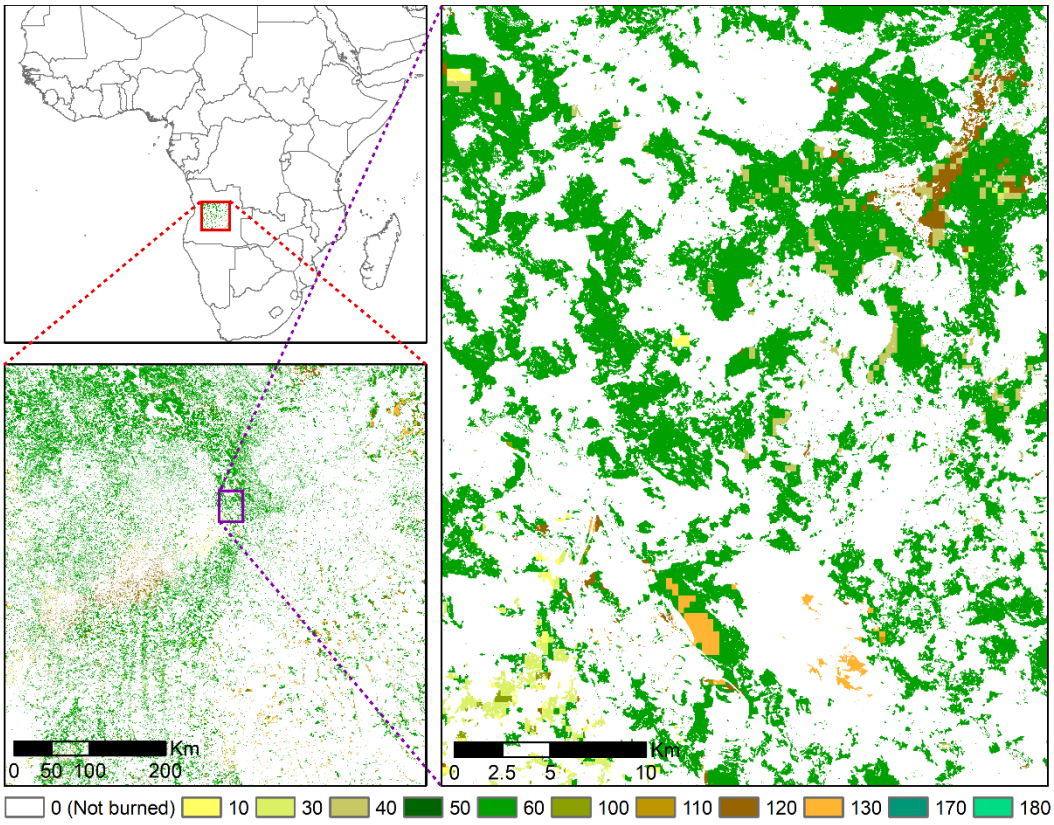

Figure 6: Example of the Land Cover layer for the Area h39v20 tile during July 2019 (class numbers detailed in Table 1). The figure shows the extent of the whole Area in the left panels, and a zoomed region in the right panel.

2.7. File metadata

For each BA file product, an additional xml file with the same name is created. This file holds the metadata information following the ISO 19115 standard. The description of the populated fields is included in Annex 1.

3. Grid BA product

The grid product is the result of summing up burned area pixels within each cell of 0.05 degrees in a regular grid covering the whole Earth in monthly composites. Since FireCCISFD20 only covers sub-Saharan Africa, only the cells in that area have BA information, and the rest of the world has a value of 0.

In addition to this variable, other attributes are stored in the NetCDF file: standard error of the estimations, fraction of burnable area, fraction of observed area, and the burned area for the different land cover classes described in Section 2.6.3. Figure 7 shows the total BA from this product for 2019.

3.1. Temporal compositing

Grid products are released in monthly files, covering from the start to the end of the month. They are named assigning the day 1 of the month in the naming convention (see Section 3.4).

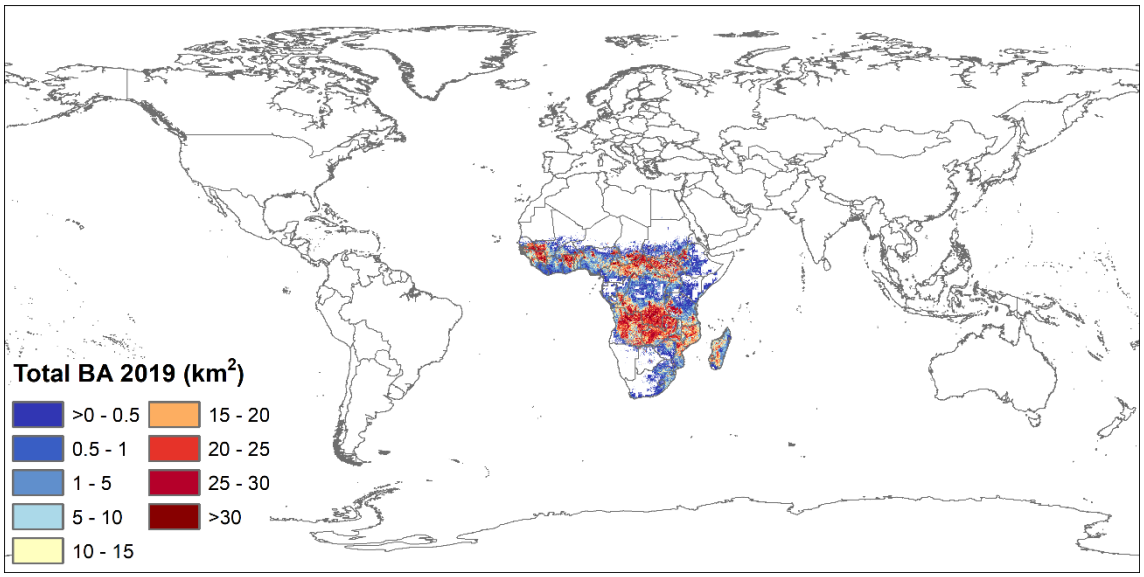

Figure 7: Total burned area for the year 2019.

3.2. Spatial Resolution

The spatial resolution of the grid product is 0.05 x 0.05 degrees (approx. 5 km at the equator). Grid attributes are computed from all pixels included in each cell of that size within the time period previously indicated. As the product only covers sub-Saharan Africa, the other areas of the world have a value of 0 in all layers.

3.3. Product projection system

The grid product is stored in geographical coordinates. Each cell has a latitude and longitude assignment that is tied to the centre of the grid cell. For example, a series of adjacent grid cells have longitude references of 16.025°, 16.075°, 16.025°, etc. Similarly, a series of latitude references are -12.775°, -12.825°, -12.875°, etc.

The product format is NetCDF-CF (see http://www.unidata.ucar.edu/software/netcdf/docs for detailed information about this format).

3.4. Product file naming conventions

The grid files are named as following:

<Indicative_Date>-ESACCI-L4_FIRE-BA-<Indicative_sensor>-fv<xx.x>.nc

<Indicative_Date>

The identifying date for this data set:

Format is YYYYMMDD, where YYYY is the four-digit year; MM is the two-digit month from 01 to 12 and DD is the two-digit day of the month from 01 to 31. For monthly files the day is set to 01.

<Indicative_sensor>

In this version of the product, it is MSI.

fv<File_version>

Version number of the Fire_cci BA algorithm. It is in the form n{1,}[.n{1,}] (That is 1 or more digits followed by optional . and another 1 or more digits.). Current version is fv2.0.

Example:

20190701-ESACCI-L4_FIRE-BA-MSI-fv2.0.nc

3.5. Grid attributes

The following sub-sections describe each of the grid attributes, including the name of the variables (attributes) in the NetCDF file, the unit of the attributes and the data type, and some information useful for the correct use of the product.

They also include an example of the grid product attributes.

3.5.1. Attribute 1: Sum of burned area

	Attribute	Units	Data Type	Notes
1	burned_area	Square metres	Float	Sum of area of all pixels detected as burned within each grid cell and period.

In common with other global BA products, it is assumed that a pixel at the native spatial resolution of the detecting instrument was totally burned. The value in this layer indicates the sum of all the burned area within each 0.05-degree cell. Further description on the methodology to obtain the burned area from the BA detections is included in the Algorithm Theoretical Basis Document (Roteta 2021).

An example of this layer corresponding to July 2019 is shown in Figure 8.

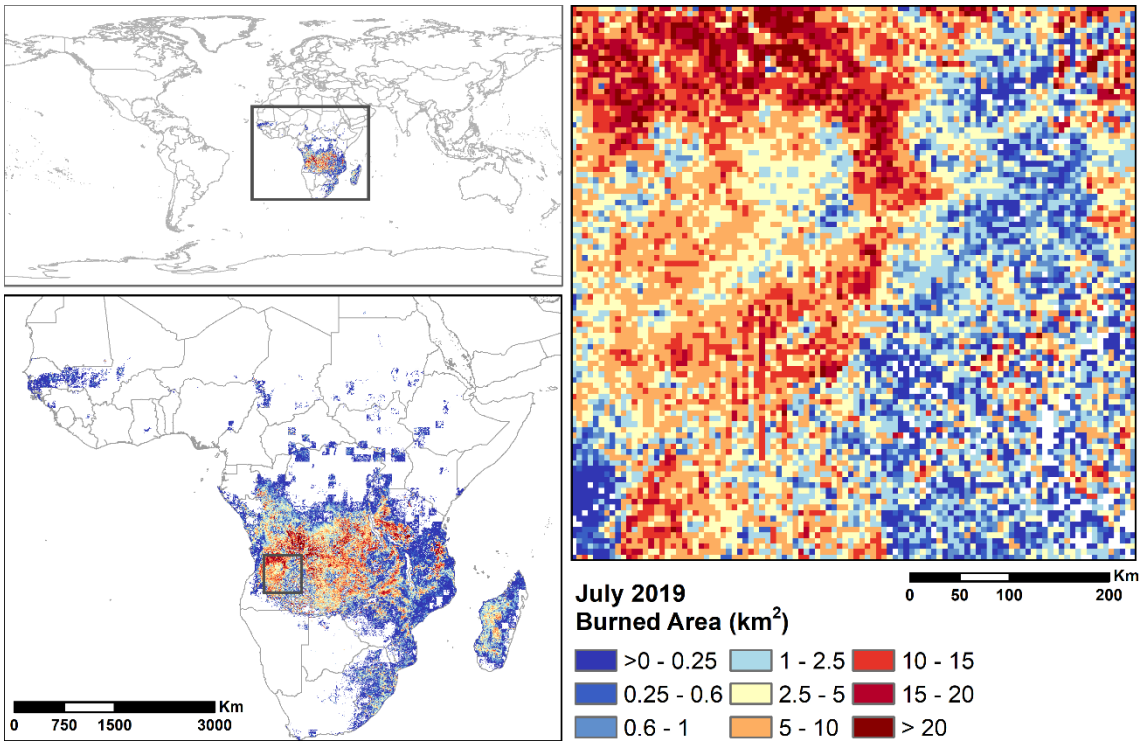

Figure 8: Example of the Burned Area attribute of the 20190701-ESACCI-L4_FIRE-BA-MSI-fv2.0.nc file. The panel on the right corresponds to the area of the h39v20 tile of the pixel product.

3.5.2. Attribute 2: Standard error

	Attribute	Units	Data Type	Notes
2	standard_error	Square metres	Float	This value is the standard error of the estimation of BA in each grid cell, based on the aggregation of the confidence level of the pixel product.

The standard error is modelled from the confidence level (p_b) of the pixel product, using a Poisson Binomial Distribution. The details of the methodology are explained in the End-to-End Uncertainty Budget document (Khaïroun et al., 2021).

An example of this layer corresponding to July 2019 is shown in Figure 9.

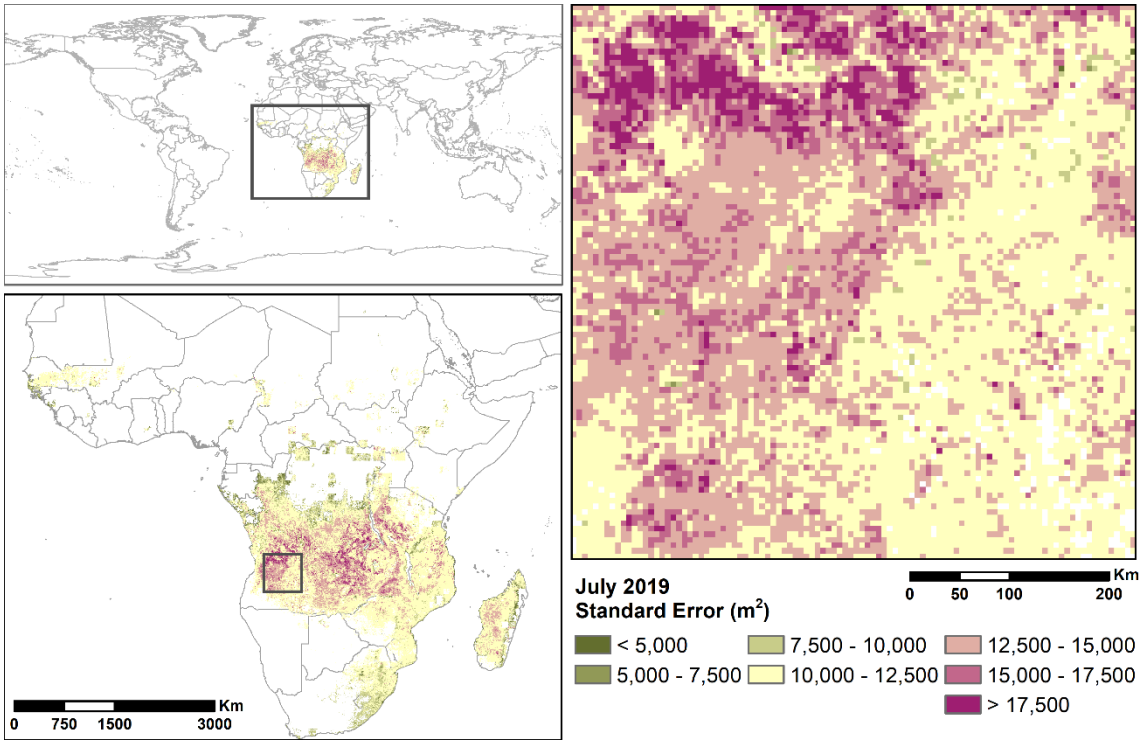

Figure 9: Example of the Standard Error attribute of the 20190701-ESACCI-L4_FIRE-BA-MSI-fv2.0.nc file. The panel on the right corresponds to the area of the h39v20 tile of the pixel product.

3.5.3. Attribute 3: Fraction of burnable area

	Attribute	Units	Data Type	Notes
3	Fraction of burnable area	0 to 100	Float	The fraction of area in the grid that corresponds to land covers that could be affected by fire.

This variable includes all land cover categories that can be burned. Land cover information was extracted from the C3S Land Cover map of 2018 (see Section 2.6.3).

An example of this layer corresponding to July 2019 is shown in Figure 10.

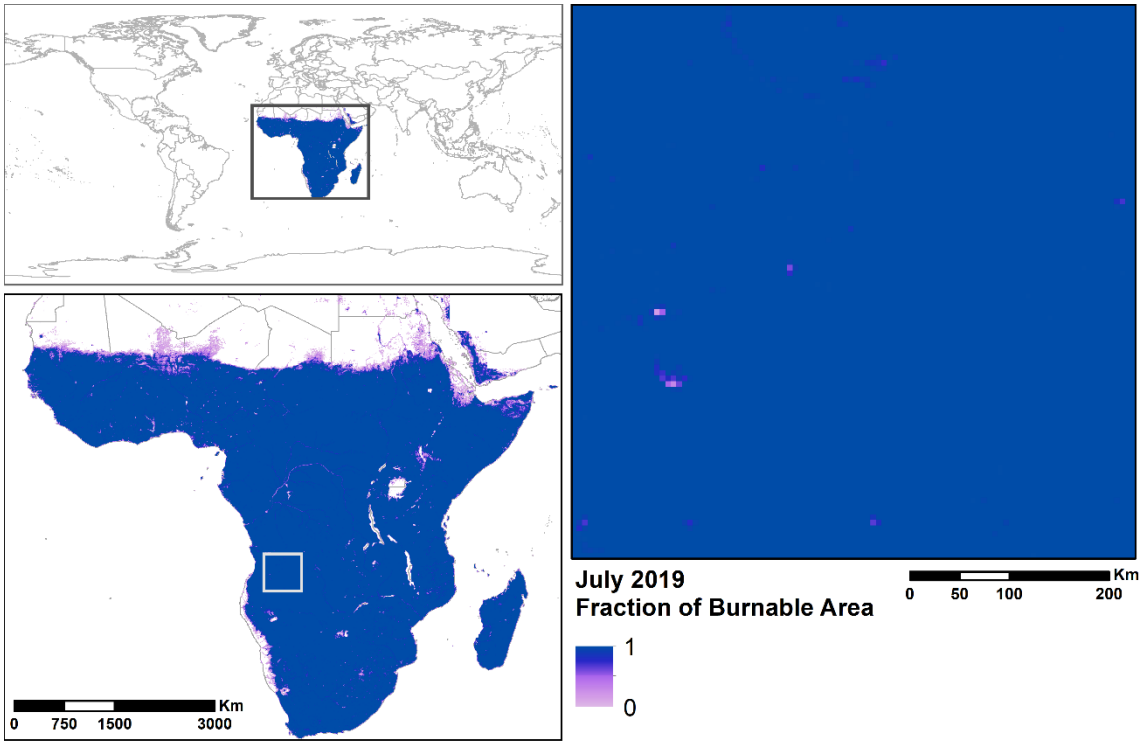

Figure 10: Example of the Fraction of Burnable Area attribute of the 20190701-ESACCI-L4_FIRE-BA-MSI-fv2.0.nc file. The panel on the right corresponds to the area of the h39v20 tile of the pixel product.

3.5.4. Attribute 4: Fraction of observed area

	Attribute	Units	Data Type	Notes
4	Fraction of observed area	0 to 100	Float	The fraction of the total burnable area in the grid that was observed during the month (without cloud cover / haze or low quality pixels)

The fraction of observed area is included as a layer in the grid product with the particular aim of providing information on the incomplete observation of the Earth surface by the input sensor. This may be caused by a sensor failure or by persistent cloud coverage.

Recommendation on product use: this is a very important attribute to consider, as it shows the proportion of each cell that was not observed in a particular month, and therefore it identifies the regions where the product may miss burned pixels. All grid cells with fraction of observed area lower than 80% should be used with care.

An example of this layer corresponding to July 2019 is shown in Figure 11.

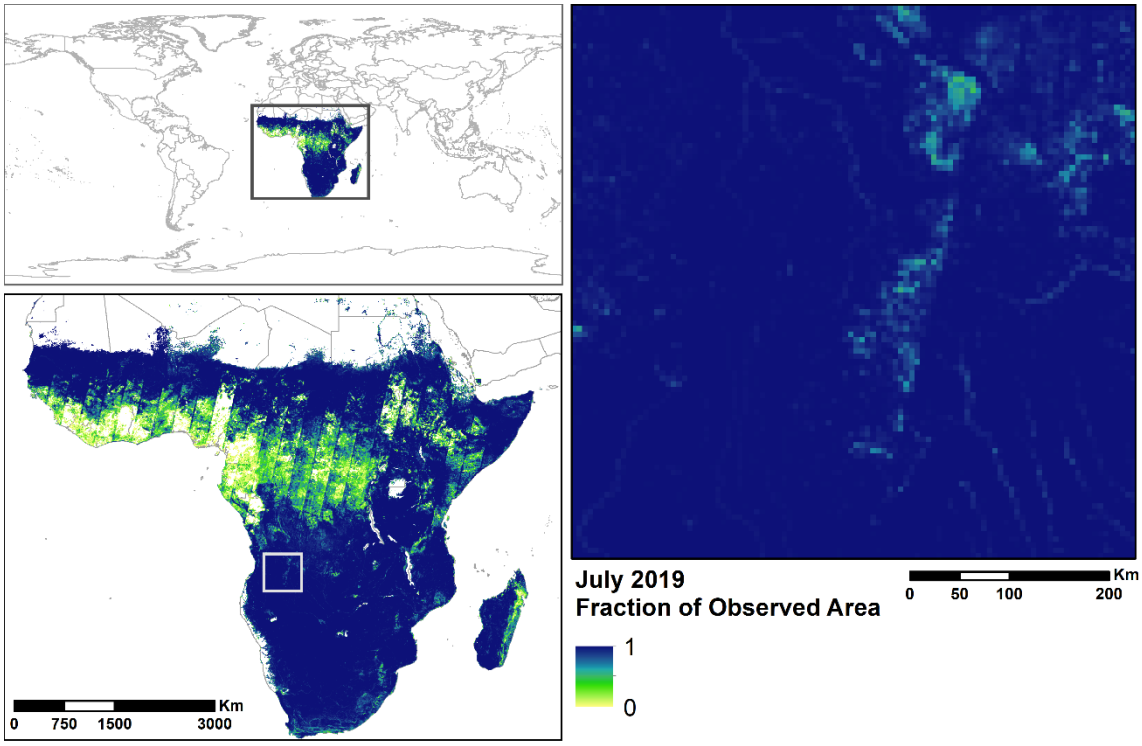

Figure 11: Example of the Fraction of Observed Area attribute of the 20190701-ESACCI-L4_FIRE-BA-MSI-fv2.0.nc file. The panel on the right corresponds to the area of the h39v20 tile of the pixel product.

3.5.5. Attributes 5-22: Sum of burned area for each land cover category

	Attribute	Units	Data Type	Notes
5 to 22	burned_area_in_vegetation_class*	Square metres	Float	Sum of all burned pixels of each land cover as defined by the C3L Land Cover product.

*The vegetation_class categories are those described in Section 2.6.3.

As in the case of the pixel product, it is assumed that each burned pixel that adds to the total burned area in a grid cell corresponds to only one land cover, as in most land cover maps. This is a reasonable estimation for homogenous land cover areas, but it may imply errors for heterogeneous landscapes. The basic land cover map is the C3S Land Cover map of 2018 (see Section 2.6.3). Obviously, the errors of this map affect the estimation provided by the Fire_cci product.

It is assumed that the land cover source has accurately described the land cover type and is spatially consistent. We aim to provide readily available information for users on the type of vegetation that has burned. This information could be used, for example, with the vegetation type dependent fuel load data for calculation of the carbon emissions and other trace gas emissions in fires, or could be used to apply vegetation type relevant combustion completeness and emission factor information in climate modelling research.

Two examples of these types of layers corresponding to July 2019 are shown in the following figures. Figure 12 shows the sum of the burned area of rainfed croplands (class 10, see Table 1 in Section 2.6.3), while Figure 13 shows the sum of BA in broadleaved deciduous forests (class 60) for the same time period.

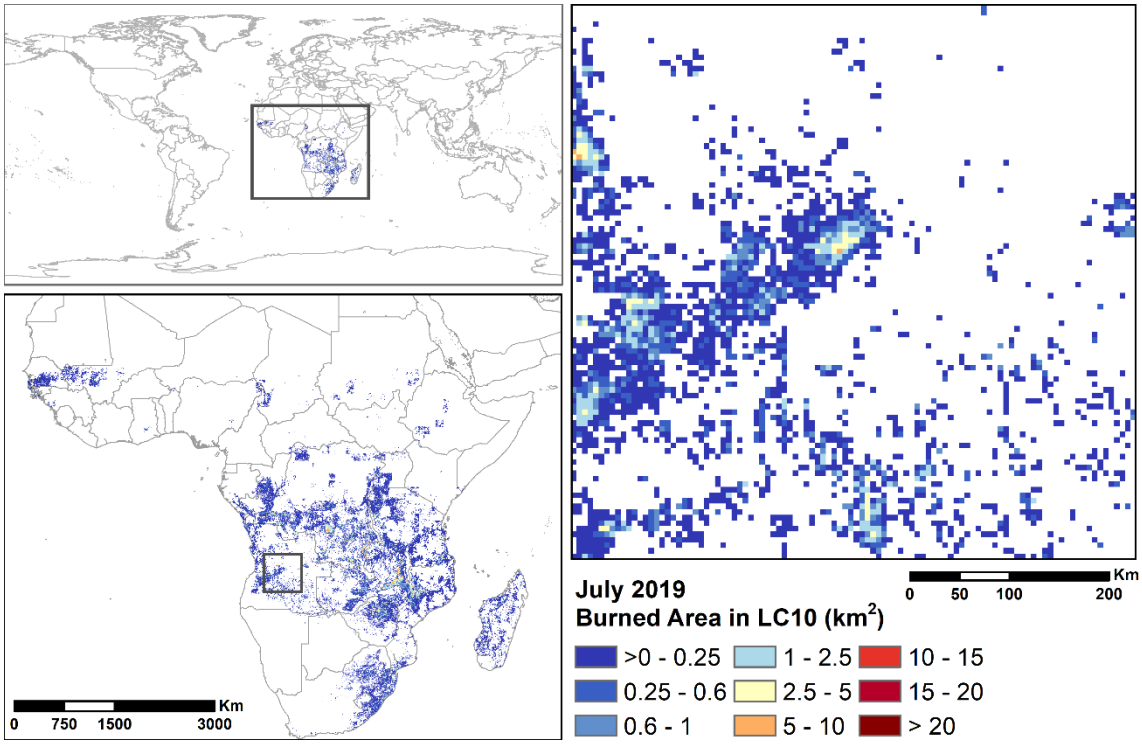

Figure 12: Example of the burned area in rainfed croplands (land cover class 10) attribute of the 20190701-ESACCI-L4_FIRE-BA-MSI-fv2.0.nc file. The panel on the right corresponds to the area of the h39v20 tile of the pixel product.

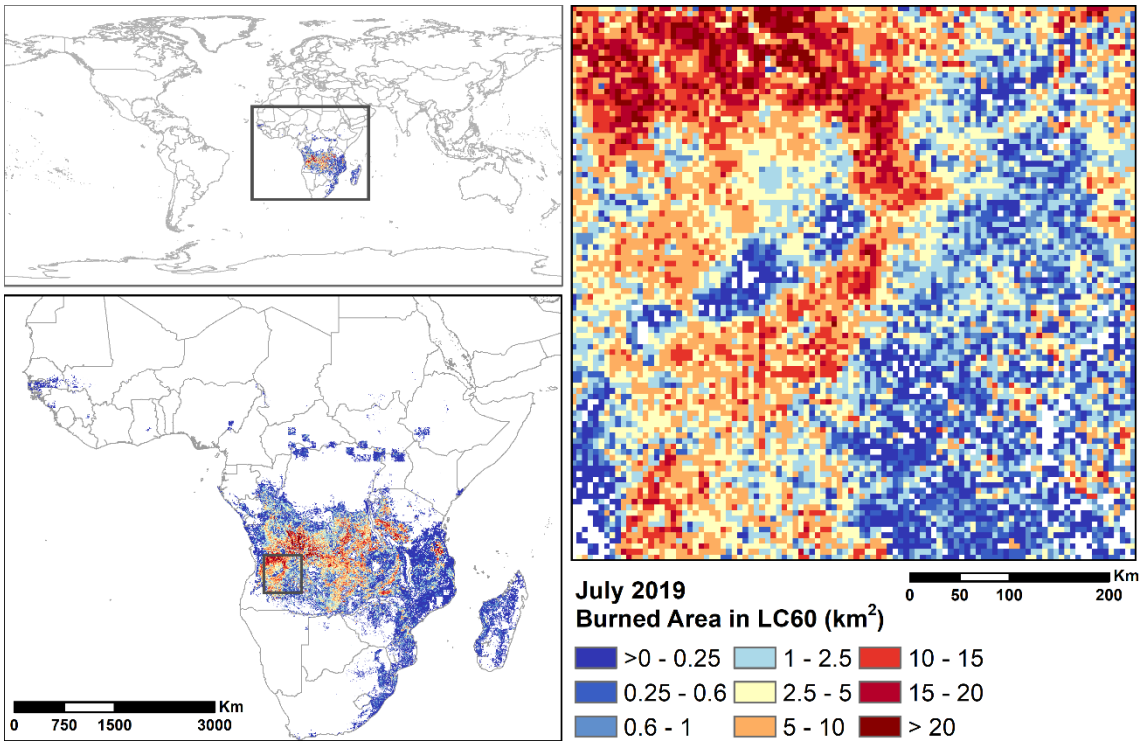

Figure 13: Example of the burned area in Tree cover, broadleaved, deciduous, closed to open (land cover class 60) attribute of the 20190701-ESACCI-L4_FIRE-BA-MSI-fv2.0.nc file. The panel on the right corresponds to the area of the h39v20 tile of the pixel product.

3.7. File metadata

The grid files follow the NetCDF Climate and Forecast (CF) Metadata Convention (http://cfconventions.org/). Annex 2 describes the fields included in the .nc files.

4. Comparison with other burned area products

A preliminary comparison with FireCCI51 (Lizundia-Loiola et al., 2020) product shows that a considerably high number of small burned areas are being detected in FireCCISFD20 compared to the coarser FireCCI51 due to the different spatial resolution (20 m vs 250 m) (Figure 14).

The product is being validated, and the results will be detailed in the Product Validation and Intercomparison Report.

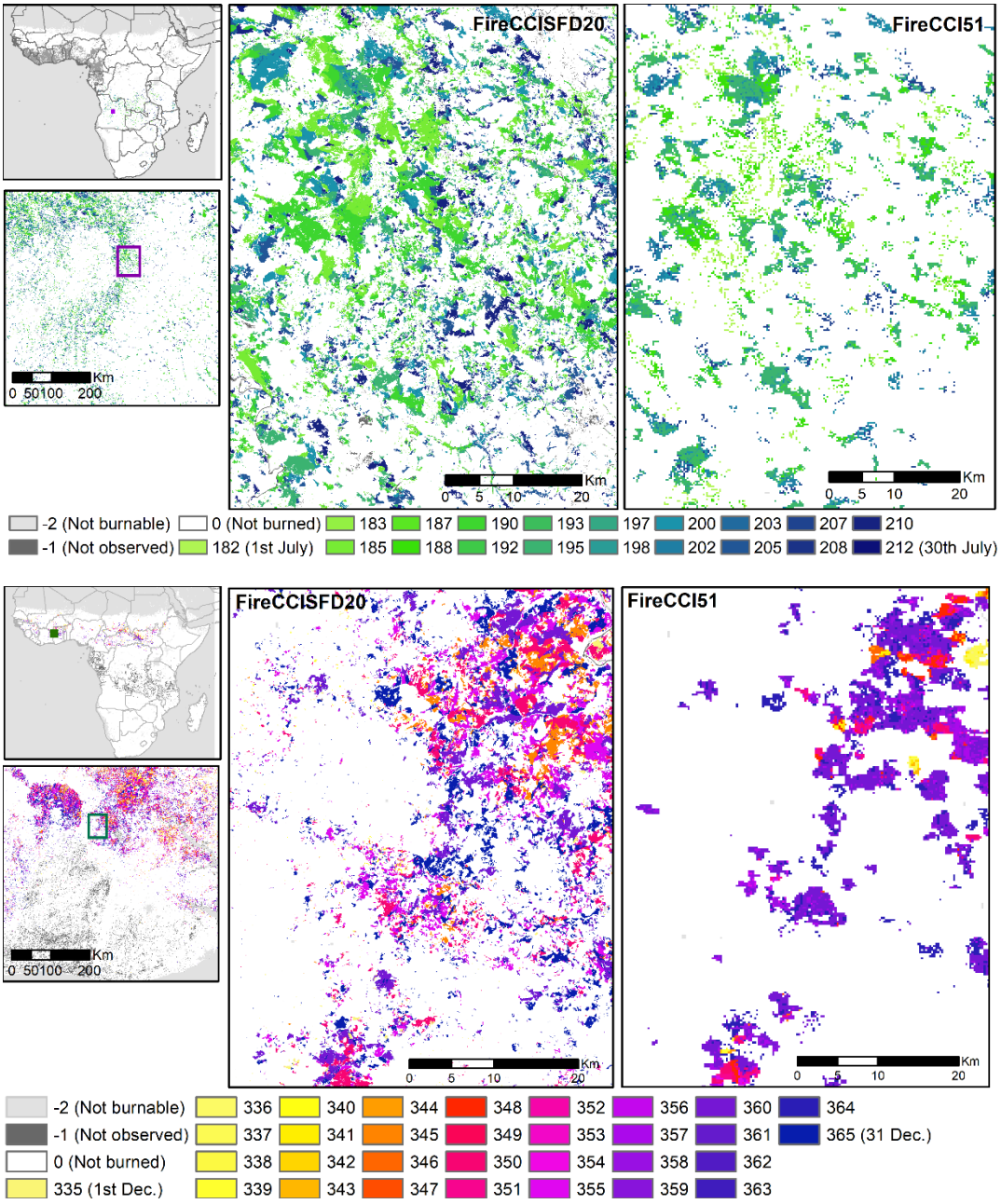

Figure 14: Intercomparison of FireCCISFD20 BA and FireCCI51 products for July (top) and December (bottom) 2019

5. Data limitations and constraints

At the moment of processing the algorithm, there was a lack of Level-2 images corresponding to the year 2018. Since the algorithm requires a pre-fire cloud-free image to compute the difference between different dates, the data of January 2019 might be affected due to the lack of December 2018 images.

Additionally to the not burnable mask derived from the C3S land cover product (corresponding to the land covers that are not vegetated), the land scene classification of the Sentinel-2 Level 2 product, corresponding to the water class, has also been masked. For this reason, in the pixel product the non-burnable areas can have finer or coarser shapes, depending of the origin of the land mask.

6. Data dissemination

The SFD Fire_cci v2.0 BA product is freely available from the Fire_cci website: https://climate.esa.int/en/projects/fire/data/ and the CCI Open Data Portal: https://climate.esa.int/en/odp/#/dashboard.

7. References

Chuvieco E., Pettinari M. L., Heil A., Storm T. (2017) ESA CCI ECV Fire Disturbance: D1.2 Product Specification Document, version 6.3. Available at: https://climate.esa.int/en/projects/fire/key-documents/

Defourny, P., Lamarche, C., Marissiaux, Q., Brockmann, C., Boettcher, M., Kirches, G. (2021). Product User Guide and Specification, ICDR Land Cover 2016-2020. Ref. D5.3.1_PUGS_ICDR_LC_v2.1.x_PRODUCTS_v1.1. Available at: https://datastore.copernicus-climate.eu/documents/satellite-land-cover/D5.3.1_PUGS_ICDR_LC_v2.1.x_PRODUCTS_v1.1.pdf

Heil A.; Pettinari M.L. (2021) ESA CCI ECV Fire Disturbance: D1.1 User requirements document, version 7.2. Available from: https://climate.esa.int/en/projects/fire/key-documents/

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Lizundia-Loiola, J., Otón, G., Ramo, R., Chuvieco, E. (2020) A spatio-temporal active-fire clustering approach for global burned area mapping at 250 m from MODIS data. Remote Sensing of Environment 236, 111493, https://doi.org/10.1016/j.rse.2019.111493

Roteta, E., Bastarrika, A., Padilla, M., Storm, T., Chuvieco, E. (2019) Development of a Sentinel-2 burned area algorithm: Generation of a small fire database for sub-Saharan Africa. Remote Sensing of Environment 222, 1-17, doi: https://doi.org/10.1016/j.rse.2018.12.011

Roteta, E. (2021) ESA CCI ECV Fire Disturbance: D2.1.2 Algorithm Theoretical Basis Document-SFD, version 2.0. Available at: https://climate.esa.int/en/projects/fire/key-documents/

Annex 1: Metadata of the pixel product (XML file)

In each XML file corresponding to the pixel product, the following fields are populated:

- Universal Unique Identifier
- Language
- Contact
- Date stamp
- Metadata Standard Name
- Reference System
- Citation
  - Title
  - Creation date
  - Publication date
  - DOI
  - Abstract (contains general information and information about each layer)
- Point of Contact
  - Resource provider
  - Distributor
  - Principal investigator
  - Processor
- Keywords
- Resource constraints
- Spatial resolution
- Extent:
  - Geographical extent
  - Temporal extent

Annex 2: Metadata of the grid product

Here is an example of the dimensions and variables of the gridded product for the 20190701-ESACCI-L4_FIRE-BA-MSI-fv2.0.nc file:

Global Attributes:
title = 'ESA Fire_cci Small Fire Database (SFD) Burned Area Grid product '
institution = 'University of Alcala'
source = 'MSI L1C, VIIRS FIRMS (VNP14IMGTML), C3S land cover map v2.1.1 of 2018'
history = 'Created on 2021-06-17 22:20:50'
references = 'See https://climate.esa.int/en/projects/fire/'
tracking_id = 'e7e8c87b-cfe3-4af1-8f1a-ae530a44fdb7'
Conventions = 'CF-1.7'
product_version = '2.0'
summary = 'The grid product is the result of summing up burned area pixels within each cell of 0.05 degrees in a regular grid covering the whole Earth in monthly composites. For this product, only sub-Saharan Africa has burned area information. The attributes stored are sum of burned area, standard error, fraction of burnable area, fraction of observed area, and the burned area for 18 individual land cover classes.'
keywords = 'Burned Area, Fire Disturbance, Climate Change, ESA, GCOS'
id = '20190701-ESACCI-L4_FIRE-BA-MSI-fv2.0.nc'
naming_authority = 'int.esa.climate'
keywords_vocabulary = 'NASA Global Change Master Directory (GCMD) Science keywords '
cdm_data_type = 'Grid'
comment = 'These data were produced as part of the ESA CCI programme.'
date_created = '20210617T222050Z '
creator_name = 'University of Alcala'
creator_url = 'https://climate.esa.int/en/projects/fire/'
creator_email = 'emilio.chuvieco@uah.es'
project = 'ESA Fire_cci'
doi = '10.5285/01b00854797d44a59d57c8cce08821eb'
publication_date = '2021-04-30'
geospatial_lat_min = '-90'
geospatial_lat_max = '90'
geospatial_lon_min = '-180'
geospatial_lon_max = '180'
geospatial_vertical_min = '0'
geospatial_vertical_max = '0'
time_coverage_start = '20190701T000000Z'
time_coverage_end = '20190731T235959Z'
time_coverage_duration = ' P1M'
time_coverage_resolution = ' P1M'
standard_name_vocabulary = 'NetCDF Climate and Forecast (CF) Metadata Convention'
licence = 'ESA CCI Data Policy: free and open access'
platform = ' Sentinel-2'
sensor = 'MSI'
spatial_resolution = '0.05 degrees'
geospatial_lon_units = 'degrees_east'

geospatial_lat_units = 'degrees_north'
geospatial_lon_resolution = '0.05'
geospatial_lat_resolution = '0.05'

Dimensions:
vegetation_class = 18
lat = 3600
lon = 7200
nv = 2
strlen = 150
time = 1 (UNLIMITED)

Variables:
lat
Size: 3600x1
Dimensions: lat
Datatype: single
Attributes:
units = 'degree_north'
standard_name = 'latitude'
long_name = 'latitude'
bounds = 'lat_bounds'
lat_ bounds
Size: 2x3600
Dimensions: nv,lat
Datatype: single
lon
Size: 7200x1
Dimensions: lon
Datatype: single
Attributes:
units = 'degree_east'
standard_name = 'longitude'
long_name = 'longitude'
bounds = 'lon_ bounds '
lon_ bounds
Size: 2x7200
Dimensions: nv,lon
Datatype: single
time
Size: 1x1
Dimensions: time
Datatype: double
Attributes:
units = 'days since 1970-01-01 00:00:00'
standard_name = 'time'
long_name = 'time'
bounds = 'time_ bounds '
calendar = 'standard'
time_bounds

Size: 2x1
Dimensions: nv,time
Datatype: single

vegetation_class
Size: 18x1
Dimensions: vegetation_class
Datatype: int32
Attributes:
units = '1'
long_name = 'vegetation class number'

vegetation_class_name
Size: 150x18
Dimensions: strlen,vegetation_class
Datatype: char
Attributes:
units = '1'
long_name = 'vegetation class name'

burned_area
Size: 7200x3600x1
Dimensions: lon,lat,time
Datatype: single
Attributes:
units = 'm2'
standard_name = 'burned_area'
long_name = 'total burned_area'
cell_methods = 'time: sum'

standard_error
Size: 7200x3600x1
Dimensions: lon,lat,time
Datatype: single
Attributes:
units = 'm2'
long_name = 'standard error of the estimation of burned area'

fraction_of_burnable_area
Size: 7200x3600x1
Dimensions: lon,lat,time
Datatype: single
Attributes:
units = '1'
long_name = 'fraction of burnable area'
comment = 'The fraction of burnable area is the fraction of the cell that corresponds to vegetated land covers that could burn. The land cover classes are those from C3S land cover map v2.1.1 of 2018'

fraction_of_observed_area
Size: 7200x3600x1
Dimensions: lon,lat,time
Datatype: single
Attributes:
units = '1'
long_name = 'fraction of observed area'

comment = 'The fraction of the total burnable area in the cell (fraction_of_burnable_area variable of this file) that was observed during the time interval, and was not marked as unsuitable/not observable. The latter refers to the area where it was not possible to obtain observational burned area information for the whole time interval because of lack of input data (non existing data for that location and period).'

burned_area_in_vegetation_class

Size: 7200x3600x6x1

Dimensions: lon,lat,vegetation_class,time

Datatype: single

Attributes:

units = 'm2'

long_name = 'burned area in vegetation class'

cell_methods = 'time: sum'

comment = 'Burned area by land cover classes; land cover classes are from the C3S Land Cover map v2.1.1 of 2018'

Annex 3: Acronyms and abbreviations

AF	Active fire
BA	Burned Area
CCI	Climate Change Initiative
CL	Confidence Level
CRS	Coordinate Reference System
DOI	Digital Object Identifier
ECV	Essential Climate Variables
ESA	European Space Agency
GCS	Geographic Coordinate System
JD	Julian Day (day of detection of the burned area)
LC	Land Cover
MSI	Multi Spectral Instrument
MSI-L2A	MSI Level-2A product
S2	Sentinel 2
SFD	Small Fire Database
SWIR	Short-Wave Infrared
VIIRS	Visible Infrared Imaging Radiometer Suite
WGS84	World Geodetic System 84