Product User Manual

Fire Detection and Monitoring (FD&M)

PRODUCTS: LSA-501

The EUMETSAT Network of Satellite Application Facilities

LSA SAF Land Surface Analysis

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	Name	Date	Signature
Prepared by :	Carlos C. DaCamara, Teresa J. Calado, Sofia L. Ermida, Teresa L. Rosa and Sílvia A. Nunes		
Approved by :	Land SAF Project Manager (IPMA)		

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Version II/2011	23/05/2011	Changes following the ORR meeting of April 2010: (1) The validation report was updated with the aim of demonstrating that the accuracy requirements are fulfilled; (2) Results related to the comparison with the FRP pixel (LSA-31) are not included.
Version III/2013	12/10/2013	Version presented to the ORR.
Version IV/2014	11/11/2015	Version addressing action issued from ORR
Version 2.0	27/01/2016	- Editorial changes (updated product identifier; Introduction and LSA SAF product list) - Geolocation/Rectification (navigation of "full disk" area) - Algorithm description simplified - Examples of outputs replaced by more recent cases (August 2015)
Version 2.1	01/08/2016	-Section 2.4 is included -Reference to two modes was removed (section 2.1.3)

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1. Introduction

The EUMETSAT Satellite Application Facility (SAF) on Land Surface Analysis (Trigo et al., 2009) is part of the SAF Network, a set of specialised development and processing centres, serving as EUMETSAT (European organization for the Exploitation of Meteorological Satellites) distributed Application Ground Segment. The SAF network complements the product-oriented activities at the EUMETSAT Central Facility in Darmstadt. The main purpose of the LSA SAF is to take full advantage of remotely sensed data, particularly those available from EUMETSAT sensors, to measure land surface variables, which will find primarily applications in meteorology (http://landsaf.ipma.pt/):

The spin-stabilised Meteosat Second Generation (MSG) has an imaging-repeat cycle of 15 minutes. The Spinning Enhanced Visible and Infrared Imager (SEVIRI) radiometer embarked on the MSG platform encompasses unique spectral characteristics and accuracy, with a 3 km resolution (sampling distance) at nadir (1km for the high-resolution visible channel), and 12 spectral channels (Schmetz et al., 2002).

The EUMETSAT Polar System (EPS) is Europe’s first polar orbiting operational meteorological satellite and the European contribution to a joint polar system with the U.S. EUMETSAT will have the operational responsibility for the “morning orbit” with Meteorological-Operational (Metop) satellites, the first of which was successfully launched on October 19, 2006. Despite the wide range of sensors on-board Metop (http://www.eumetsat.int/), most LSA SAF parameters make use of the Advanced Very High Resolution Radiometer (AVHRR) and, to a lesser extent, of the Advanced Scatterometer (ASCAT).

Several studies have stressed the role of land surface processes on weather forecasting and climate modelling (e.g., Dickinson et al., 1983; Mitchell et al., 2004; Ferranti and Viterbo, 2006).

The LSA SAF initially, has been especially designed to serve the needs of the meteorological community, particularly Numerical Weather Prediction (NWP). However, there is no doubt that the LSA SAF addresses a much broader community, namely in what respects to agricultural and forestry applications, land use, and the broader topics of climate and environment monitoring.

The involvement of the user community in the design of LSA SAF products, already established during the IOP and CDOP, shall be a priority throughout its whole lifecycle. The targeted users include operational or research groups within

(i) NWP community;

(ii) agriculture and forest applications,

(iii) food management,

(iv) environment monitoring and risk assessment

(v) hydrological applications

(vi) climate modelling and monitoring

(vii) other remote sensing applications

Table 1 – The LSA SAF Set of Products and respective sensors and platforms. The table covers both existing and future EUMETSAT satellites, and therefore refers to operational products and development activities.

Product Family	Product Group	Sensors/Platforms
Radiation	Land Surface Temperature (LST)	SEVIRI/MSG, AVHRR/Metop, FCI/MTG, VII/EPS-SG
	Land Surface Emissivity (EM)	SEVIRI/MSG, FCI/MTG (internal product for other sensors)
	Land Surface Albedo (AL)	SEVIRI/MSG, AVHRR/Metop, FCI/MTG, VII/EPS-SG, 3MI/EPS-SG
	Down-welling Short-wave Fluxes (DSSF)	SEVIRI/MSG, FCI/MTG
	Down-welling Long-wave Fluxes (DSLF)	SEVIRI/MSG, FCI/MTG
Vegetation	Normalized Difference Vegetation Index (NDVI)	AVHRR/Metop, VII/EPS-SG
	Fraction of Vegetation Cover (FVC)	SEVIRI/MSG, AVHRR/Metop, FCI/MTG, VII/EPS-SG, 3MI/EPS-SG
	Leaf Area Index (LAI)	SEVIRI/MSG, AVHRR/Metop, FCI/MTG, VII/EPS-SG, 3MI/EPS-SG
	Fraction of Absorbed Photosynthetically Active Radiation (FAPAR)	SEVIRI/MSG, AVHRR/Metop, FCI/MTG, VII/EPS-SG, 3MI/EPS-SG
	Gross Primary Production (GPP)	SEVIRI/MSG, FCI/MTG
	Canopy Water Content (CWC)	AVHRR/Metop, VII/EPS-SG
Energy Fluxes	Evapotranspiration (ET)	SEVIRI/MSG, FCI/MTG
	Reference Evapotranspiration (ET0)	SEVIRI/MSG, FCI/MTG
	Surface Energy Fluxes: Latent and Sensible (LE&H)	SEVIRI/MSG, FCI/MTG
Wild Fires	Fire Detection and Monitoring (FD&M)	SEVIRI/MSG
	Fire Radiative Power (FRP)	SEVIRI/MSG, FCI/MTG, VII/EPS-SG
	Fire Radiative Energy and Emissions (FRE)	SEVIRI/MSG, FCI/MTG, VII/EPS-SG
	Fire Risk Map (FRM)	SEVIRI/MSG, FCI/MTG
	Burnt Area (BA)	AVHRR/Metop, VII/EPS-SG

The LSA SAF products (Table 1) are based on level 1.5 SEVIRI/Meteosat and/or level 1b MetOp data. Forecasts provided by the European Centre for Medium-range Weather Forecasts (ECMWF) are also used as ancillary data for atmospheric correction.

The SEVIRI/Meteosat derived products are generated and distributed for the full disk; distribution is also available for the 4 different geographical areas within Meteosat disk shown in Figure 1.

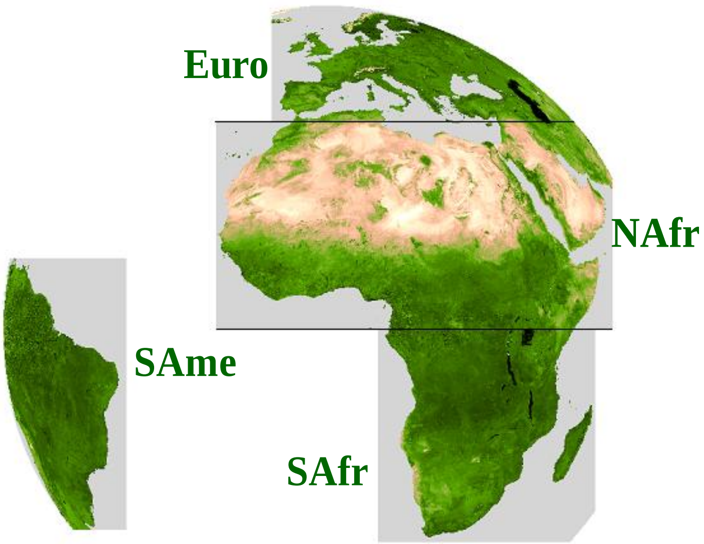

Figure 1 - The LSA SAF geographical areas.

MetOp derived parameters are currently available at level 1b full spatial resolution and for the processed Product Distribution Units (PDUs), each corresponding to about 3 minutes of instrument-specific observation data. Composite and re-projected products are foreseen for a later stage of the LSA SAF.

The LSA SAF system is fully centralized at IPMA and will be able to operationally generate, archive, and disseminate the operational products. The monitoring and quality control of the operational products, also centralized at IPMA, is performed automatically by the LSA SAF software, which provides quality information to be distributed with the products.

The LSA SAF products are currently available from LSA SAF website (http://landsaf.ipma.pt) that contains real time examples of the products as well as updated information.

This document is one of the product manuals dedicated to LSA SAF users. The algorithm and the main characteristics of the Fire Detection and Monitoring (FD&M) product generated by the LSA SAF from SEVIRI data system is described in the following sections. The characteristics of the SEVIRI-based FD&M product provided by the LSA SAF are described in **Error! Reference source not found.**. Further details on the LSA SAF product requirements may be found in the Product Requirements

Document / Table (SAF_LAND_IM_PRT_1.7.XLS) available at the LSA SAF website http://landsaf.ipma.pt).

Table 2 – Requirements of the Fire Detection and Monitoring Product – 2 (FD&M 2).

LSA-512	Fire Detection and Monitoring – 2		FD&M
Type	Product		
Applications and users	Research or Environmental monitoring		
Characteristics and Methods	Contextual analysis of IR3.9 and IR10.8 and dynamic thresholds taking advantage of SEVIRI temporal frequency		
Comments	This product will supersede LSA-501.		
Generation frequency	15-min		
Input satellite data	MSG: SEVIRI		
Dissemination			
Format	Means	Type	
HDF5	EUMETCast, HTTP	NRT, Offline	
Accuracy			
Threshold	Target	Optimal	
A successful detection of a significant fraction of active fires such that the spatial and temporal distribution is adequately reproduced.	POD=25% FAR=30% Computed against MODIS fires with FRP> 50 MW on a 3×3 MSG pixel grid	POD=50% FAR=20% Computed against MODIS fires with FRP> 50 MW on a 3×3 MSG pixel grid	
Verification method	MODIS		
Coverage, resolution and timeliness			
Spatial coverage	Spatial resolution	Vertical resolution	Timeliness
MSG disk	SEVIRI pixel Resolution		3 h

LSA-501	Fire Detection and Monitoring	FD&M
Type	Product	
Applications and users	Research or Environmental monitoring	

Characteristics and Methods	Contextual analysis of IR3.9 and IR10.8			
Comments	Operational			
Generation frequency	15-min			
Input satellite data	MSG: SEVIRI			
Dissemination				
Format	Means	Type		
HDF5	EUMETCast, HTTP	NRT, Offline		
Accuracy				
Threshold	Target	Optimal		
A successful detection of a significant fraction of active fires such that the spatial and temporal distribution is adequately reproduced.	POD=5% FAR=33% Computed against MODIS on a 3×3 MSG pixel grid	POD=10% FAR=33% Computed against MODIS on a 3×3 MSG pixel grid		
Verification method	MODIS			
Coverage, resolution and timeliness				
Spatial coverage	Spatial resolution	Vertical resolution	Timeliness	
MSG disk	SEVIRI pixel Resolution		3 h	

2. Algorithm Description

Depending on whether they are smouldering or flaming, most fires burn at temperatures between 500 and 1200 K (Dwyer et al., 2000b) but even higher temperatures (>1400 K) may occur in forested areas (Giglio et al., 1999). At these temperatures and in accordance with Planck's theory of blackbody radiation, there is a very strong emission in the middle-infrared (MIR) at wavelengths of 3-5 µm, as opposed to the background where the peaks of emission are located in the long-wave infrared (IR) at wavelengths of the order of 10 µm.

The FD&M product is based on the so-called FiDAlgo algorithm which takes advantage of the temporal resolution of SEVIRI (one image every 15 min), and relies on information from SEVIRI channels (namely 0.6, 0.8, 3.9, 10.8 and 12.0 µm) together with information on illumination angles. The method is based on heritage from contextual algorithms designed for polar, sun-synchronous instruments, namely NOAA/AVHRR and MODIS/TERRA-AQUA (Amraoui et al., 2010).

A potential fire pixel is compared with the neighbouring ones and the decision is made based on relative thresholds as derived from the pixels in the neighbourhood. As schematically shown in Figure 2, the method consists of the following four main steps; 1) Pre-processing, where pixels associated to land, desert regions urban zones and volcanoes are excluded using appropriated masks (Figure 3); 2) Selection of potential fire pixels; 3) Detection of contaminated pixels by clouds, highly reflective surfaces and sun glint; and 4) Confirmation of active fire pixels based on contextual test. Details about the procedure may be found in the ATBD of the FD&M product (document SAF/LAND/IPMA/ATBD_FD&M).

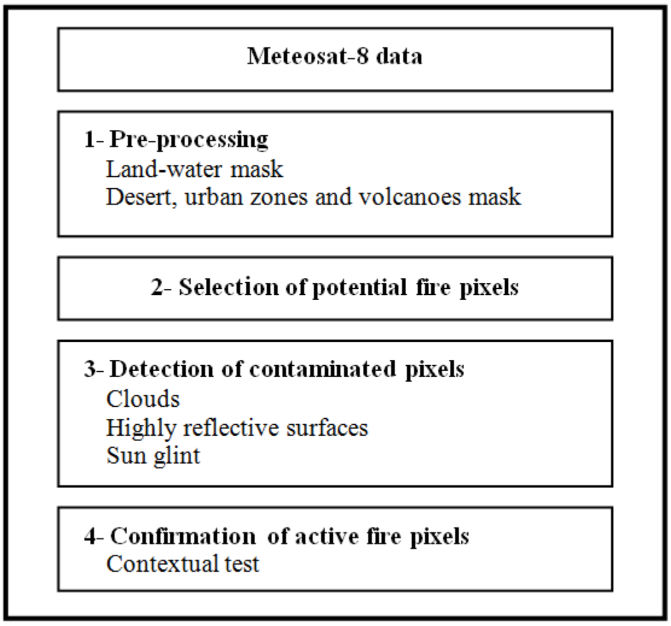

Figure 2 - Schematic overview of the processing stages of FiDAlgo.

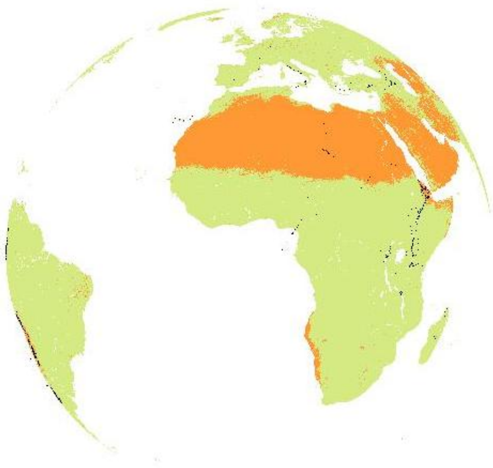

Figure 3 - Mask of desert and urban regions (orange pixels), inland water bodies (white pixels) and volcanoes (black pixels) over the MSG disk.

The procedure allows identifying both active fires (i.e. occurrences in a given pixel of a given image) and fire pixels (i.e. pixels where at least one active fire was detected, throughout the study period). Figure4 presents the spatial distribution of identified active fires and fire pixels over the entire MSG disk during August 2015. Regions of high burning activity may be observed in southern Africa, namely in northern Angola, the southern Democratic Republic of Congo and western Zambia as well as in South America, in Brazil, Bolivia and Colombia. A belt of burning activity, albeit less intense, may also be observed in the tropical savannas of northern Africa. Fire activity is also present in the Mediterranean coast of North Africa (Morocco, Algeria and Tunisia) and in southern Europe, especially in the Iberian Peninsula, Italy, the Balkans, Greece and Turkey, around the Black Sea, Moldavia, Ukraine and South Russia.

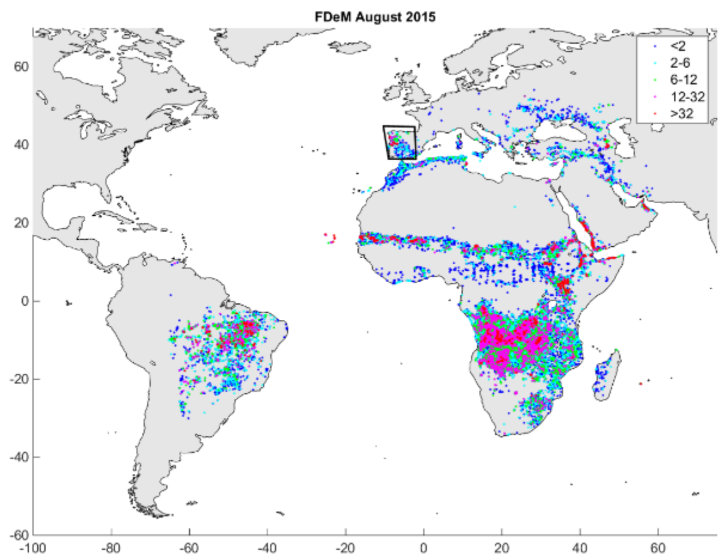

Figure 4 - Fire pixels over the Meteosat disk during August 2015. The colour of each fire pixel is according to the number of active fires identified. The black box delimits an area over the Iberian Peninsula where the spatial distribution of fire activity and its daily cycle are analysed.

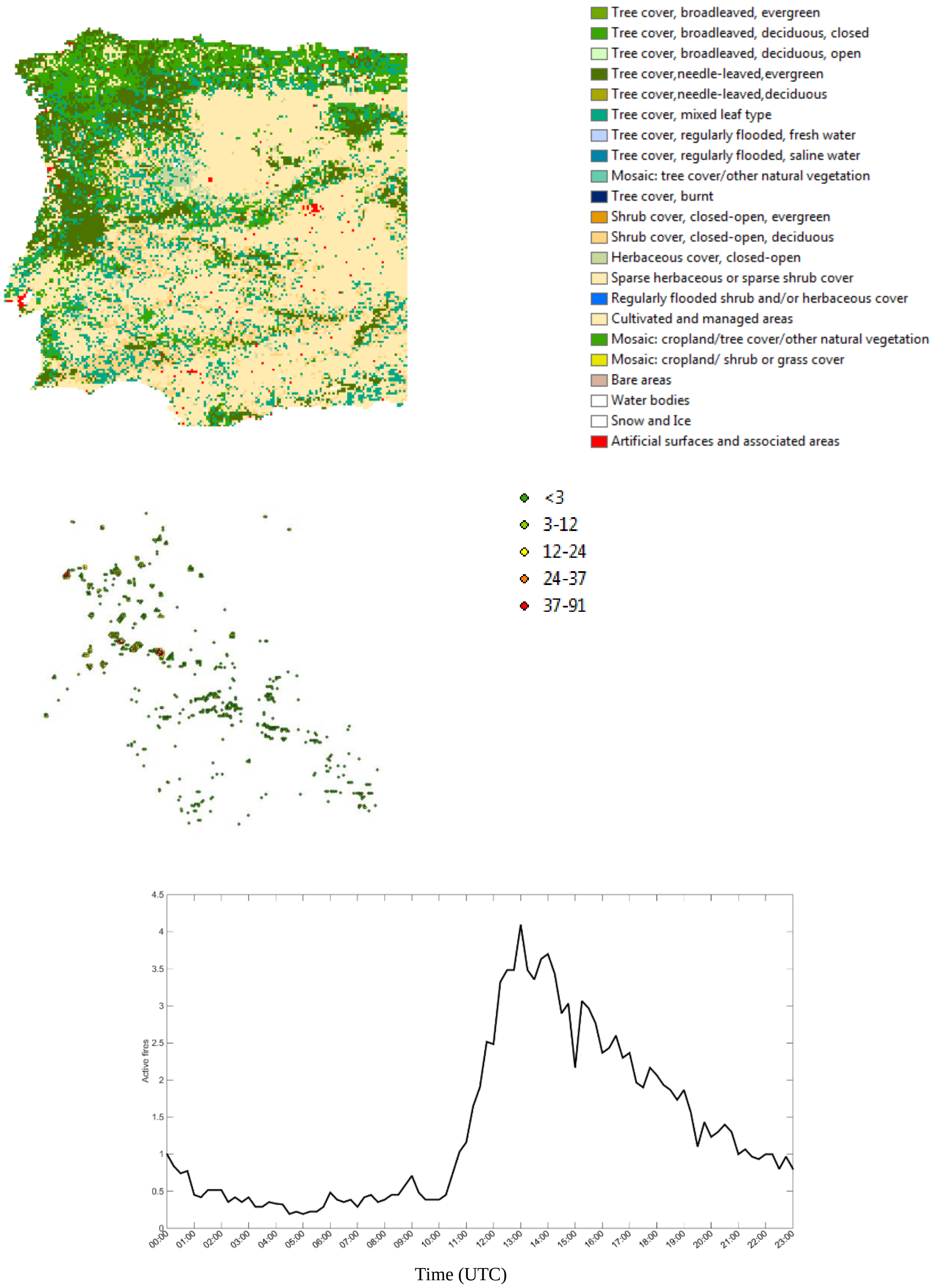

Figure 5 - Fire activity during August 2015 over the selected region Covering the Iberian Peninsula; land cover based on GLC2000 (upper panel), spatial distribution of fire pixels and active fires (middle panel) and daily cycle of fire activity (lower panel). The selected region is defined by the black box in Figure 4 and is delimited by lines 450 and 650 and by columns 1600 and 1800 of the MSG disk.

The selected region over the Iberian Peninsula (Figure 5) is mostly covered by “cultivated and managed areas” (48%), followed by “tree cover, mixed leaf type” (13%), “tree cover, needle-leaved, evergreen” (13%), “tree cover broadleaved, deciduous, closed” (11%) and “shrub cover, closed-open, deciduous” (11%). Highest fire activity (red and orange dots) mainly occurs in “tree cover, needle-leaved, evergreen”. The daily cycle is highly asymmetric with a sharp increase from 10:00 to 13:00 UTC (~10:00 to ~13:00 solar time) when there is a peak of fire activity, followed by a slow decrease until 02:00 UTC (~02:00 solar time). There is almost no activity between 02:00 and 10:00 UTC (~02:00 and ~10:00 solar time).

2.1. Data description

2.1.1. Geolocation/Rectification

The **FD&M** SEVIRI-based fields are generated pixel-by-pixel, maintaining the original resolution of SEVIRI level 1.5 data. These correspond to rectified images to 0º longitude, which present a typical geo-reference uncertainty of about 1/3 of a pixel. Data are kept in the native geostationary projection.

Files containing the latitude and longitude of the centre of each pixel may be downloaded from the Land-SAF website (http://landsaf.ipma.pt; under “Static Data and Tools”):

Longitude

HDF5_LSASAF_MSG_LON_Euro_4bytesPrecision.bz2
HDF5_LSASAF_MSG_LON_NAfr_4bytesPrecision.bz2
HDF5_LSASAF_MSG_LON_SAfr_4bytesPrecision.bz2
HDF5_LSASAF_MSG_LON_SAme_4bytesPrecision.bz2
HDF5_LSASAF_MSG_LON_MSG-Disk.bz2

Latitude

HDF5_LSASAF_MSG_LAT_Euro_4bytesPrecision.bz2
HDF5_LSASAF_MSG_LAT_NAfr_4bytesPrecision.bz2
HDF5_LSASAF_MSG_LAT_SAfr_4bytesPrecision.bz2
HDF5_LSASAF_MSG_LAT_SAme_4bytesPrecision.bz2
HDF5_LSASAF_MSG_LAT_MSG-Disk.bz2

Alternatively, since the data are in the native geostationary projection, centred at 0º longitude and with a sampling distance of 3 km at the sub-satellite point, the latitude and longitude of any pixel may be easily estimated. Given the pixel column number, *ncol* (where *ncol*=1 correspond to the westernmost column of the file), and line number, *nlin* (where *nlin*=1 correspond to the northernmost line), the coordinates of the pixel may be estimated as follows:

$$lon = arctg\left(\frac{s_2}{s_1}\right) + sub\_lon$$ longitude (deg) of pixel centre

$$lat = arctg\left(p_2 \cdot \frac{s_3}{s_{xy}}\right);$$ latitude (deg) of pixel centre

where

sub_lon is the sub-satellite point ($sub\_lon = 0$)

and

$$s_1 = p_1 - s_n \cdot \cos x \cdot \cos y$$
$$s_2 = s_n \cdot \sin x \cdot \cos y$$
$$s_3 = -s_n \cdot \sin y$$
$$s_{xy} = \sqrt{s_1^2 + s_2^2}$$
$$s_d = \sqrt{(p_1 \cdot \cos x \cdot \cos y)^2 - (\cos^2 y + p_2 \cdot \sin^2 y) \cdot p_3}$$
$$s_n = \frac{p_1 \cdot \cos x \cdot \cos y - s_d}{\cos^2 y + p_2 \cdot \sin^2 y}$$

where

$$x = \frac{ncol - COFF}{2^{-16} \cdot CFAC}$$ (in Degrees)

$$y = \frac{nlin - LOFF}{2^{-16} \cdot LFAC}$$ (in Degrees)

$p_1 = 42164$

$p_2 = 1.006803$

$p_3 = 1737121856$

$CFAC = 13642337$

LFAC=13642337

The CFAC and LFAC coefficients are column and line scaling factors which depend on the specific segmentation approach of the input SEVIRI data. Finally, COFF and LOFF are coefficients of Land-SAF geographical area within the Meteosat disk (Table 3). These are included in the file metadata (HDF5 attributes; Annex A), and correspond to one set of the values detailed below per SEVIRI/MSG area:

Table 3 - Maximum values for number of columns (ncol) and lines (nlin), for the Land-SAF geographical area, and the respective COFF and LOFF coefficients needed to geo-locate the data.

Region Name	Description	Maximum *ncol*	Maximum *nlin*	COFF	LOFF
Euro	Europe	1701	651	308	1808
NAfr	Northern Africa	2211	1151	618	1158
SAfr	Southern Africa	1211	1191	-282	8
SAme	Southern America	701	1511	1818	398
Disk	Full Disk	3712	3712	1857	1857

2.1.2. Input data

There are two kinds of input data required to properly run the algorithm:

i) static data, which are delivered and updated by the developers of the FD&M algorithm;
ii) dynamic data, which are generated during the pre-processing phase at every time step.

2.1.2.1. Static data

FiDAlgo static data include the following input files:

1) file with the geographical location (longitude and latitude) of all volcanoes in a specific region (see Figure 3), provided by the Global Volcanism Program (http://www.volcano.si.edu)
2) GLC2000 land cover data file, provided in the MSG projection for the MSG disk in HDF5 format.

2.1.2.2. Dynamic data

As shown in Table 4, remotely-sensed information consists of top of the atmosphere (TOA) radiances of SEVIRI/Meteosat-8 at the maximal temporal resolution (i.e. every 15 minutes) for the following bands; visible channels centred at 0.635 µm (VIS0.6) and 0.81 µm (VIS0.8) and infrared channels centred at 3.92 µm (IR3.9) and 10.8 µm

(IR10.8). TOA visible radiances from VIS0.6 and VIS0.8 were converted into reflectances, respectively referred to hereafter as R(0.6) and R(0.8). TOA infrared radiances from channels IR3.9 and IR10.8 were in turn converted into brightness temperatures, respectively denoted hereafter as BT(3.9) and BT(10.8). For each pixel and time-step, FiDAlgo also makes use of the respective solar zenith angle (SZA).

Output matrices from the CMa product (developed by the NWC SAF) are also used at pixel resolution and maximal temporal resolution (i.e. every 15 minutes). Matrices contain information about cloud-free and cloud-contaminated pixels, as well as about results of the tests performed for cloud detection.

Table 4 - SEVIRI channels used in FiDAlgo.

Channel	Purpose
R(0.6)	Bright surface detection
R(0.8)	Sunglint detection
BT(3.9)	Active fire detection
BT(10.8)	Active fire detection
BT(12.0)	Cloud detection

2.1.3. Exception Handling

The geographical area allowed by the algorithm is presented in Table 5. It is defined by the name and the corners position, relative to an MSG image of 3712 columns per 3712 lines, starting from North to South and from West to East.

Table 5 - Characteristics of geographical area to process the algorithm.

Region Name	Initial Column	Final Column	Initial Line	Final Line	Size in Columns	Size in Lines	Total Number of Pixels
MSG Disk	1	3712	1	3712	3712	3712	13.778.944

When input values for a given pixel are not physically acceptable then a set of filters (Table 6) is applied to the input data to mask out all in this context. The filters are applied to the reflectances of channels VIS0.6 and VIS0.8 (Ref006 and Ref008) and to the brightness temperature of channel IR3.9 (BT039).

Table 6 - Input data filters.

Variable	Condition	Assigned Value
BT039	<0	-999
Ref006	≥2	1
Ref006	<-1	-1
Ref008	≥2	1
Ref008	<-1	-1

2.1.4. Output data

The above-described procedure allows identifying fire activity at pixel resolution and at maximal temporal resolution (i.e. every 15 minutes) over the MSG disk.

2.2. File Formats

At each time step the FD&M algorithm generates two external output files with: 1) FD&M classification and 2) the quality product, according to the following name convention:

1) **HDF5_LSASAF_MSG_FDeM_MSG-Disk_YYYYMMDDHHMM**

and

2) **HDF5_LSASAF_MSG_FDeM-QualityProduct_MSG-Disk_YYYYMMDDHHMM**

where **YYYY**, **MM**, **DD**, **HH** and **MM** denote the year, the month, the day, the hour and the minute of data acquisition, respectively.

The FD&M classification is provided in the HDF5 format as requested by the LSA-SAF system. This format allows defining a set of attributes that provide the relevant information. As described in Annex A, the main output file of FD&M product includes the general attributes (Table A1) and the dataset attributes (Table A2), together with a raster dataset with the classification (Table 7) of each MSG within the MSG disk.

Table 7 – Description of FD&M classification.

# Class	Description
0	Water
1	Land (no fire activity)
2	Fire

The quality product files respect to pixels with confirmed fires and provide information about several relevant variables as described in Table 8. Each file includes one matrix dataset (named ELEM_CF) where columns correspond to the relevant variables (Table 9) and lines correspond to each confirmed fire occurrence. If no confirmed fire activity is detected, the output file is composed only by the general attributes and no datasets are included. The datasets named ELEM_HR, ELEM_SG and ELEM_NC are only written if the "`minimize_metadata`" flag is turned OFF (=0).

Table 8 – Names and description of dataset that composes output quality product files of FD&M.

Dataset Name	Description
ELEM_HR	Pixel ELEMents identified with High Reflectivity
ELEM_SG	Pixel ELEMents identified with Sun Glint
ELEM_CF	Pixel ELEMents with a Confirmed Fire
ELEM_NC	Pixel ELEMents with a Non Confirmed Fire

Table 9 – Description of variables in the dataset ELEM_CF.

# Column	Variable Description
1	Line of the pixel identified as a confirmed fire
2	Column of the pixel identified as a confirmed fire
5	Brightness temperature of SEVIRI channel IR039 [K]
6	Difference of brightness temperatures IR039 – IR108 [K]
7	Satellite zenith angle [º]
3	Reflectivity of SEVIRI channel VIS006 []
4	Reflectivity of SEVIRI channel VIS008 []
8	Brightness temperature of SEVIRI channel IR108 [K]
9	Brightness temperature of SEVIRI channel IR120 [K]

The algorithm also provides logging messages by using the **reportLog** (APID) [RD.2] function. The logging messages allow tracking the processing, which can help in debugging eventual errors each time step the FD&M algorithm generates an external output file according to the following name convention:

HDF5_LSASAF_MSG_FDeM_MSG-Disk_YYYYMMDDHHMM

where **YYYY**, **MM**, **DD**, **HH** and **MM** respectively, denote the year, the month, the day, the hour and the minute of data acquisition.

Libraries for handling HDF5-files in Fortran and C are available at ftp://ftp.ncsa.uiuc.edu/HDF/HDF5/hdf5-1.6.2/. A user friendly graphical interface to open and view HDF5-files may be downloaded from http://hdf.ncsa.uiuc.edu/hdf-java-html/hdfview/.

2.3. Summary of Product Characteristics

Product Name: Fire Detection and Monitoring

Product Code: FD&M

Product Level: Level 3

Description of Product**:** Fire Detection and Monitoring

Product Parameters:

Coverage: MSG Disk

Packaging:

Units: Adimensional

Geo-location Requirements:

Format: 16 bits signed integer

Appended Data:
Frequency of generation: every 15-min

Size of Product:

2.4. Algorithm Version Summary

Table 10 – Algorithm version summary of FD&M.

Version	Date	Description
4.0	201004100900	First pre-operational version
4.1.2	201511110945	1) Adapted to a new MSG system; i) Product generated in a single region: MSG-Disk; ii) Distribution through EUMETCast in the 3 geographical regions: NAfr, SAfr, Euro; 2) Small changes on the Landcover static file: different interpolation method used to reproject global map to MSG projection; 3) MSG3 coefficients (to calculate brightness temperatures and reflectances) added; 4) Minor bugs corrected
4.1.3	201601131515	Fix a bug on the scaling_factor of ELEM_CF dataset
4.1.3	201607070000	Corrected a bug on the interpolation of forecasted atmospheric input data in the coastal regions

3. References

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ANNEX A – Product Metadata – SEVIRI FD&M

Table A 1 General attributes of the files for the SEVIRI FD&M product.

Attribute	Data Type	Values
SAF	String<3>	LSA
CENTRE	String<5>	IPMA-PT
ARCHIVE_FACILITY	String<5>	IPMA-PT
PRODUCT	String<79>	FDeM (main output file) FDeM-QualityProduct (QualityProduct file)
PARENT_PRODUCT_NAME	Array(4) of string<79>	-,-,-,-
SPECTRAL_CHANNEL_ID	Int	18582 Channels VIS006, VIS008, IR039, IR108, and IR120
PRODUCT_ALGORITHM_VERSION	String<4>	4.1.2
CLOUD_COVERAGE	String<20>	-
OVERALL_QUALITY_FLAG	String<3>	OK
ASSOCIATED_QUALITY_INFORMATION	String<511>	-
REGION_NAME	String<4>	MSG-Disk
COMPRESSION	Int	0
FIELD_TYPE	String<255>	Product
FORECAST_STEP	Int	0
NC	Int	3712 (main output file) 9 (QualityProduct file)
NL	Int	3712 (main output file) Depends on number of fires (QualityProduct file)
NB_PARAMETERS	Int	1 (main output file) 0 to 4 (QualityProduct file)
NOMINAL PRODUCT_TIME	String<14>	YYYYMMDDhhmmss
SATELLITE	Array[10] of String<9>	{MSG}*
INSTRUMENT_ID	Array [10] of String<6>	SEVI
INSTRUMENT_MODE	String<511>	STATIC_VIEW

* {MSG}='MSG1', 'MSG2', 'MSG3',...

Attribute	Data Type	Values
IMAGE_ACQUISITION_TIME	String<14>	YYYYMMDDhhmmss
ORBIT_TYPE	String<3>	GEO
PROJECTION_NAME	String<15>	Geos<+000.0>
NOMINAL_LONG	Real	Read from SZA input file
NOMINAL_LAT	Real	Read from SZA input file
CFAC	Int	Read from SZA input file
LFAC	Int	Read from SZA input file
COFF	Int	Read from SZA input file
LOFF	Int	Read from SZA input file
START_ORBIT_NUMBER	Int	0
END_ORBIT_NUMBER	Int	0
SUB_SATELLITE_POINT_START_LAT	Real	0
SUB_SATELLITE_POINT_START_LON	Real	0
SUB_SATELLITE_POINT_END_LAT	Real	0
SUB_SATELLITE_POINT_END_LON	Real	0
SENSING_START_TIME	String<14>	YYYYMMDDhhmmss
SENSING_END_TIME	String<14>	YYYYMMDDhhmmss
PIXEL_SIZE	String<10>	3.1km
GRANULE_TYPE	String<2>	DP
PROCESSING_LEVEL	String<2>	03
PRODUCT_TYPE	String<8>	LSAFDeM
PRODUCT_ACTUAL_SIZE	Integer > 0, encoded as String<11>	Depends on number of bytes per pixel
PROCESSING_MODE	String<1>	N
DISPOSITION_FLAG	String<1>	0
TIME_RANGE	String<20>	15-min
STATISTIC_TYPE	String<20>	-
MEAN_SSLAT	Real	Read from SZA input file
MEAN_SSLON	Real	Read from SZA input file
PLANNED_CHAN_PROCESSING	Integer	2

Attribute	Data Type	Values
FIRST_LAT		0
FIRST_LON		0

Table A 2 Attributes of the FD&M/SEVIRI dataset.

Attribute	Data Type	Value
CLASS	String	Data
PRODUCT	String	CF (main output file) ELEM_HR, ELEM_SG, ELEM_CF or ELEM_NC 8 (QualityProduct file)
PRODUCT_ID	Int	255
N_ COLS	Int	3712 (main output file) 9 (QualityProduct file)
N_ LINES	Int	3712 (main output file) Depends on number of fires (QualityProduct file)
NB_BYTES	Int	2 (main output file) 4 (QualityProduct file)
SCALING_FACTOR	Real	1 (main output file) 1 (QualityProduct file)
OFFSET	Real	0
MISSING_VALUE	Int	-1 (main output file) 0 (QualityProduct file)
UNITS	String	-
CAL_SLOPE	Real	0
CAL_OFFSET	Real	0