EUMETSAT Satellite Application Facility on
Support to Operational Hydrology and Water Management

Algorithm Theoretical Basis Document (ATBD) for product H43 – SE-D-FCI

Snow detection (snow mask) MTG/FCI by VIS/IR radiometry

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1 Introduction to product H43

1.1 Sensing principle

The Flexible Combined Imager (FCI) on the MTG-I (Meteosat Third Generation - Imager) satellite continues the very successful operation of the Spinning Enhanced Visible and Infrared Imager (SEVIRI) on Meteosat Second Generation (MSG). The satellite's three axes stabilised platform provides additional channels with better spatial, temporal and radiometric resolution, compared to the MSG satellites.

Requirements for the FCI were formulated by regional and global Numerical Weather Prediction (NWP) and Nowcasting communities. These requirements are reflected in the design which allows for Full Disk Scan (FDS), with a basic repeat cycle of 10 minutes, and a European Regional-Rapid-Scan (RRS) which covers one-quarter of the full disk with a repeat cycle of 2.5 minutes.

The FCI takes measurements in 16 channels, of which eight are placed in the solar spectral domain between 0.4 µm to 2.1 µm, delivering data with a 1 km spatial resolution. The additional eight channels are in the thermal spectral domain between 3.8 µm to 13.3 µm, delivering data with a 2 km spatial resolution. In the RRS mode there are two additional channels in the solar domain, with a spatial resolution of 0.5 km, and two in the thermal domain, with a spatial resolution of 1 km. The spatial and spectral resolutions of FCI and SEVIRI are given in Table 1.

Table 1. The spatial and spectral resolutions of FCI and SEVIRI

MTG/FCI			MSG/SEVIRI		
Spectral Channel	Central Wavelength	Spatial Sampling Distance (SSD)	Spectral Channel	Central Wavelength	Spatial Sampling Distance (SSD)
VIS0.4	0.444 µm	1.0 km			
VIS0.5	0.510 µm	1.0 km			
VIS0.6	0.640 µm	1.0 km 0.5 km (HR)	VIS0.6	0.635 µm	3.0 km
VIS0.8	0.865 µm	1.0 km	VIS0.8	0.81 µm	
VIS0.9	0.914 µm	1.0 km			
NIR1.3	1.380 µm	1.0 km			
NIR 1.6	1.610 µm	1.0 km	NIR 1.6	1.6 µm	
NIR 2.2	2.250 µm	1.0 km 0.5 km (HR)			
IR 3.8	3.800 µm	1.0 km 1.0 km (HR)	IR 3.9	3.92 µm	
WV 6.3	6.300 µm	2.0 km	WV 6.2	6.25 µm	
WV 7.3	7.350 µm	2.0 km	WV 7.3	7.35 µm	
IR 8.7	8.700 µm	2.0 km	IR 8.7	8.70 µm	
IR 9.7	9.660 µm	2.0 km	IR 9.7	9.66 µm	
IR 10.5	10.500 µm	2.0 km 1.0 km (HR)	IR 10.8	10.80 µm	
IR 12.3	12.300 µm	2.0 km	IR 12.0	12.00 µm	
IR 13.3	13.300 µm	2.0 km	IR 13.4	13.40 µm	

The visual and IR channels can be used for snow cover detection only in cloud free conditions. Different surface types and materials have different reflectance properties which suggest that these differences can be used to separate different surfaces. Typical spectral properties of different surfaces have been measured in laboratory and in situ (see e.g., Baldridge et al, 2008) although these cannot be used directly as a basis for satellite algorithms as there is always significant variability in natural surface types. The grain size of the snow cover changes over time and space, the wetness of snow changes and the reflecting properties change when the surface is viewed from different angles and in different lighting conditions. Also, the vegetation is highly variable even in winter. This natural variability makes it quite difficult to develop general classification algorithms for snow cover. Finally, there is also the atmosphere which must be taken in account when surface and laboratory measurements are compared to satellite measurements.

Errore. L'origine riferimento non è stata trovata. shows examples of reflective properties of three surface types: fine snow, coniferous trees and pale brown silty loam. These are based on laboratory measurements and models. Some commonly used satellite instrument channels are also presented. The figure shows that the SEVIRI channels 1, 2 and 3 and AVHRR channel 1, 2 and 3A can be used for snow classification at least if the type of snow is known. This has been shown in practise in LSA SAF and later in H SAF, when snow detection products have been developed for MSG/SEVIRI and Metop/AVHRR (see Siljamo and Hyvärinen 2011, Siljamo 2020 and Siljamo et al 2020).

Geostationary satellites are not the best option for snow detection because the spatial resolution is usually quite low in high latitudes i.e., in the region most often covered by seasonal snow. However, excellent temporal resolution is an advantage when the algorithm is based on visual and IR channels of the FCI instrument. Polar satellites can acquire images from specified regions 2-4 times each day provided that the area is cloud free during the satellite overpass. Geostationary instruments can acquire images at high frequency (e.g. MTG/FCI every 10 minutes) and it is much more likely that observations will be made during clear-sky periods. If the cloud free period is long enough the changing lighting conditions can help in classification.

Cloud cover is also a severe limitation on optical channels. Active and passive microwave methods would be better suited for cloud covered areas, but the spatial resolution of the passive microwave instruments is quite poor when compared to optical channels. Active microwave instruments i.e., radars have better resolution, but unfortunately these instruments need much more processing before the data is in practical form.

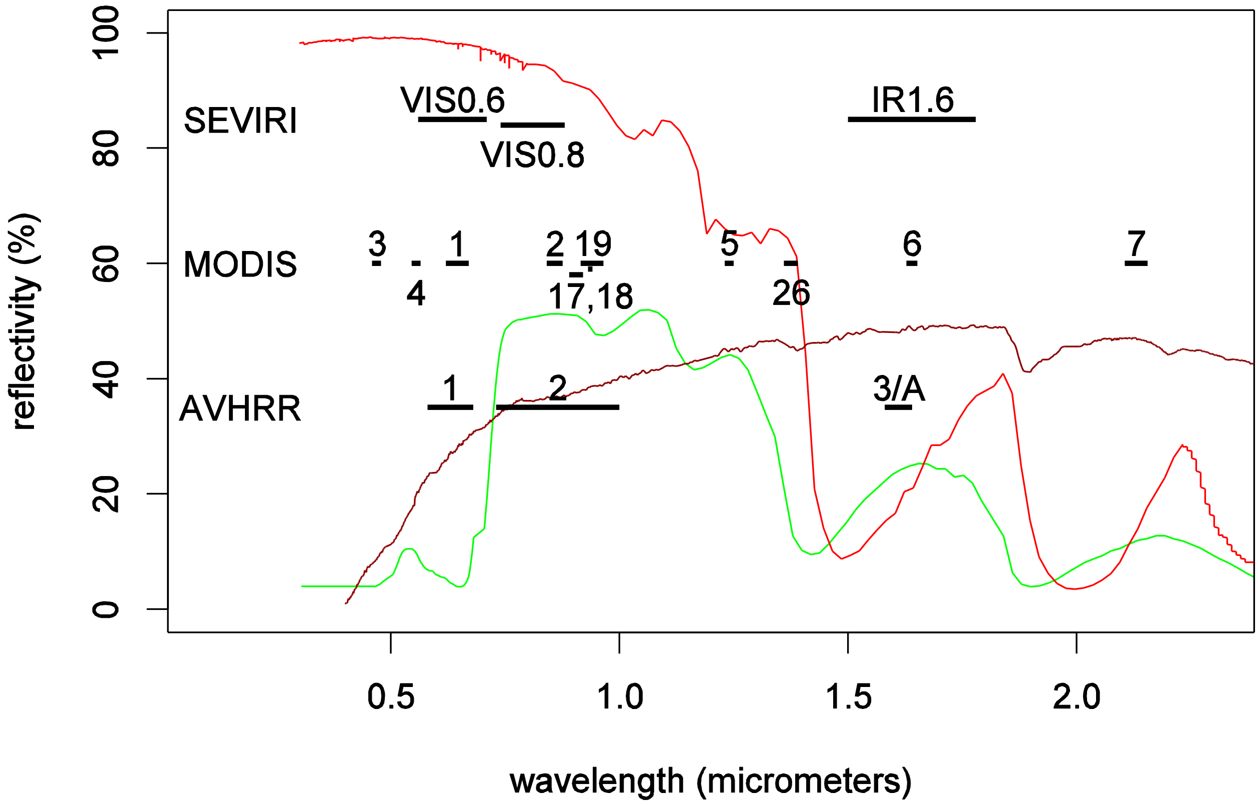

Figure 1 Example reflectances of three different surfaces and commonly used satellite instrument channels. Surface reflectances (snow (red), vegetation (green) and bare earth (brown)) based on ASTER Spectral Library v 2.

1.2 Main operational characteristics

1.2.1 Horizontal resolution and sampling

The product resolution is about 2 km × 2 km at nadir. In Europe the resolution is lower, about 2 to 4 km depending on the region.

1.2.2 Observing cycle and time sampling

The H43 product is generated daily for the previous 24-hour period.

1.2.3 Timeliness

H43 product is available ~2h hours after the last repeat cycle data of the day are received.

1.2.4 Summary of product characteristics

The MTG/FCI H43 snow extent product provides daily data of the snow cover in the MTG/FCI disk. See the details in Table 2.

Table 2. Summary of the product characteristics

Product Name	Snow Cover
Product Code	SC
Product Level	Level 3
Description of Product	Snow Cover
Product Parameters	Snow Extent
Coverage	MTG/FCI full disk
Units	N.A.
Range	0-255
Sampling	pixel by pixel basis
Spatial resolution	2 km × 2 km at nadir
Format	netCDF
Frequency of generation	Daily

2 Processing concept

The H43 snow extent product contains three variants which cover land areas in the FCI detection disk. The variants are flatland snow extent, mountain snow extent and merged snow extent. The flatland snow extent targets especially flatland and forest areas, mountain snow extent mountain regions and merged variant combines both using a predefined mountain mask (Figure 2). All three variants cover the full MTG/FCI disk.

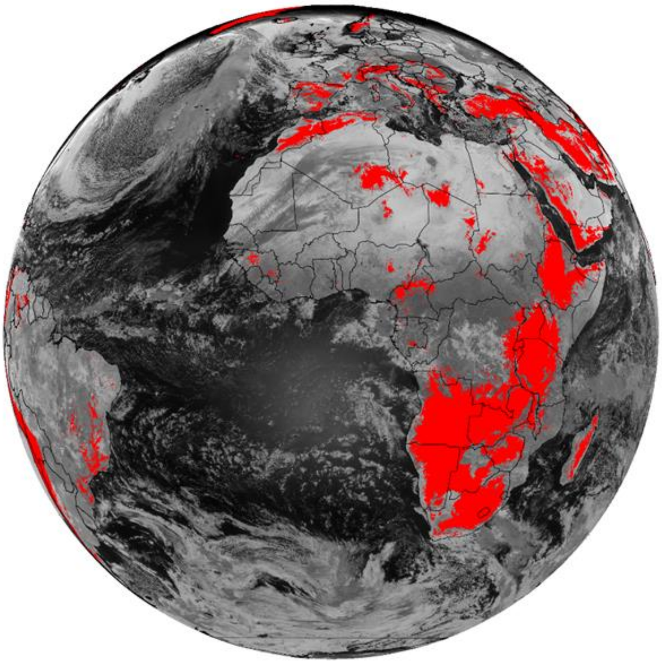

Figure 2 Mask for flat/forested versus mountainous regions for MTG full disk

2.1.1 Flatland snow extent

The H SAF MTG/FCI flatland snow extent algorithm is a thresholding method based on the different properties of the snow covered and snow free surfaces and clouds. The daily product is generated in two separate phases. Phase 1 is the production of the intermediate RC snow cover product which is based on one cycle of FCI images (called RCs). In the phase 1 pixels in the FCI image are classified into several classes (snow, snow free, water, unclassified (e.g. clouds, darkness), not processed).

The phase 2 runs once per day after the phase 1 processing has finished. For the daily MTG/FCI snow extent product, all snow cover maps which are produced in phase 1 are merged based on the number of different classifications in each pixel during the day. The same classifications as in phase 1 are used.

2.1.2 Mountain snow extent

Snow recognition for mountainous regions through multi-spectral threshold technique has been implemented on VIS and IR satellite imagery from MTG/FCI. Figure 3 illustrates the processing chain. *Pre-processing Step* represents geometric and radiometric correction process as described in MTG FCI level 1c data guide. Binary Cloud, Land and Snow Cover Maps have been produced. The cloud mask is retrieved from NOWCASTING Cloud product (CM: Cloud Mask and CT: Cloud Type are used).

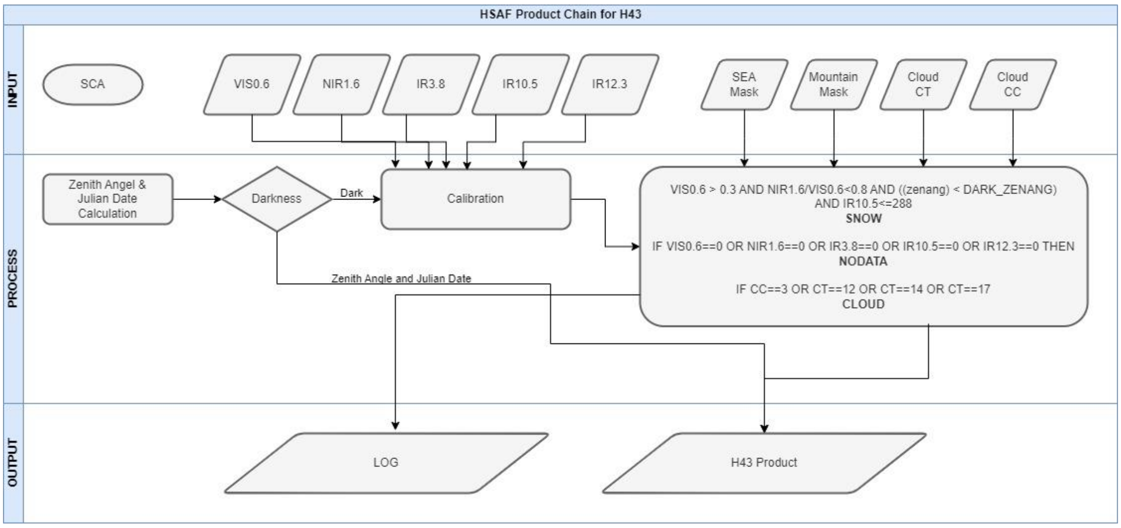

Figure 3 Flow chart of the Snow Recognition processing chain in mountainous areas

2.1.3 Merged snow extent

Merged snow extent is obtained by combining flatland snow extent and mountain snow extent variants. These two variants are merged using a mountain mask which can be seen in Figure 2 where regions denoted with red are mountainous areas and the remaining lands are flat/forested areas. Details of the merging process are explained in section 3.1.3.

2.2 Architecture of the products generation chain

MTG/FCI data are received through EUMETCAST or from other sources if necessary. The processing takes mainly place in FMI premises in Sodankylä where an Arctic satellite data centre is located. The conceptual design of the H43 production chain is presented in Figure 4.

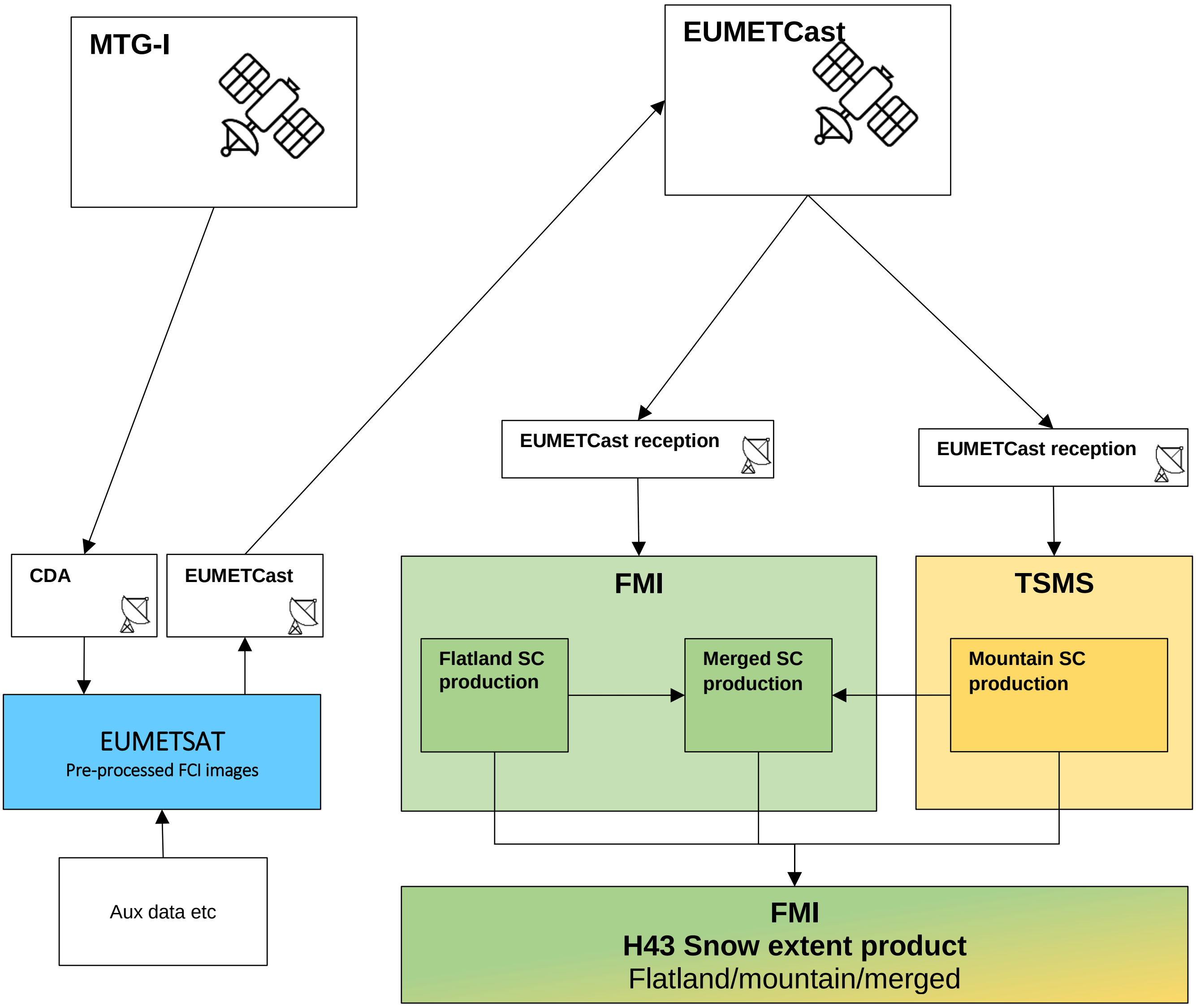

Figure 4 Conceptual design of the H43 production chain

2.3 Product development team

Names and references of the main participants for H43 algorithm development and integration are listed in following table:

Table 3. Development team for product H43

Institute	Responsible for:	Name	Email address
Finnish Meteorological Institute (FMI)	Flatland snow and daily merging	Niilo Siljamo	niilo.siljamo@fmi.fi
		Burak Simsek	burak.simsek@fmi.fi
		Matias Takala	matias.takala@fmi.fi
Turkish State Meteorological Service, TSMS and METU	Mountain snow	Zuhal Akyurek	zakyurek@metu.edu.tr
		Cagri Karaman	cagri.karaman@hidrosaf.com
		Emine Say	esay@mgm.gov.tr

3 Algorithms description

3.1 The Processing details

The H43 snow extent is a Day-1 product which has been developed partly before the satellite launch and then improved based on actual satellite data after the launch. Due to technical issues in the FCI instrument, availability of the actual satellite data was limited during the development work. Data was available from November 2023 to January 2024 and then again from August 2024. No FCI data were available from late winter, spring and early summer periods during the development phase.

The H43 product employs three different algorithm types: 1) single image algorithms (different for flatlands and mountains) which process single satellite scenes (RC) and produce intermediate snow extent products, 2) daily merging algorithms, which merge single image intermediate snow products to daily flatland and mountain products and 3) an algorithm which merges daily flatland snow extent and daily mountain snow extent into the merged daily snow variant. The final daily product file includes all three daily variants (flatland, mountain, and merged), allowing users to select the most suitable option for their specific application needs. Simplified schematic diagram of the product generation is presented in the Figure 5.

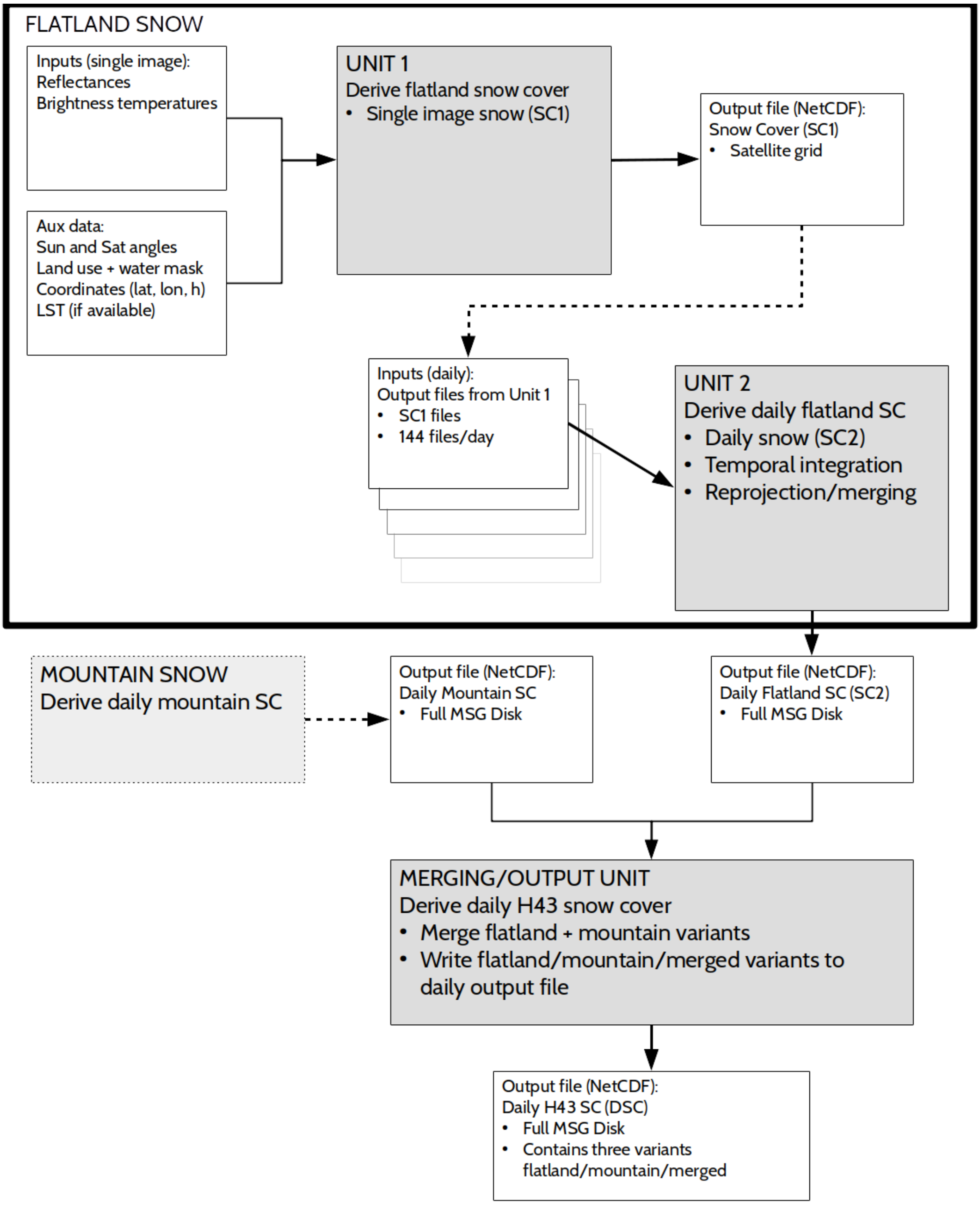

Figure 5 Flowchart of the H SAF MTG/FCI snow extent algorithm (product H43).

3.1.1 Flatland snow extent

The flatland snow detection algorithms developed at FMI are based on earlier algorithms and trial runs with latest MTG/FCI test data sets and then improved using the actual FCI data. The flatland snow extent algorithm processes the satellite data in two phases. Phase one classifies single satellite scene data (every 10 minutes) and creates intermediate product (single image or RC snow) which are then merged in the phase 2 to create the daily flatland snow extent (SC2).

The RC algorithm employs several channels: vis06, vis08, nir16, ir38, wv63, ir87, ir105, and ir123. It also uses land cover, elevation, satellite and sun angles and water mask data. The objective of the algorithm is to distinguish between snow-covered and snow-free areas. If classification is not successful, the pixel remains unclassified; therefore, a separate cloud mask is not needed. The algorithm aims for high accuracy and therefore errs on the side of caution by setting uncertain pixels unclassified. Current single scene algorithm contains 19 rules (or rule groups) which classify each pixel as snow covered, snow free or water. Pixel is set as unclassified if the algorithm cannot determine whether the pixel is snow covered or snow free. Most often the reason is cloud cover or poor illumination. Pixel can also be non-processed e.g. when pixel is outside of the FCI detection disk (in space).

The default value is always unclassified. The rules in Table 4 are applied to each pixel in order from top. The final snow classification in each pixel is the value in effect after all the rules are applied. Normalized Difference Snow Index (NDSI), which is a well-established method for snow detection is used in many rules. NDSI is defined as

$$\text{NDSI} = \frac{nir16 - vis06}{nir16 + vis06}$$

Even though NDSI work reasonably well in many conditions, there are situations where it may not provide correct classification. Rest of the rules aim to improve classification and remove misclassifications. Note that some corrections are also applied in the daily merging phase. We have also defined the following abbreviations to simplify the rules:

$$\text{LST} = \frac{ir105 + ir123}{2}$$

$$\text{ND22\_16} = \frac{nir22 - nir16}{nir22 + nir16}$$

$$\text{ND16\_08} = \frac{nir16 - vis08}{nir16 + vis08}$$

Table 4 H43 single scene flatland algorithm rules. Description explains the rule or other conditions required for the result in current pixel. ‘Snow’ means that the rule is applied only in pixels which are currently classified as snow

Rule #	Result	Description	Note
0	Unclassified	All pixels unclassified	Init
1	No snow	NDSI >= 0.1	NDSI based
2	Unclassified	NDSI < 0.0	NDSI based
3	No snow	NSDI >= -0.2 and ND22_16 < -0.32	NDSI based
4	Snow	NSDI < -0.4	NDSI based
10	Unclassified	LST < 240	Fix
11	Unclassified	Snow and (ir105-ir87)/(ir105+ir87) < -0.002)	Fix
12	Unclassified	Snow and ND16_08 > -0.50	Ice cloud fix
13	Unclassified	Snow and (LST < 265) and ND22_16 > 0 and ND16_08 > -0.7	Cloud fix
14	Unclassified	Snow and (LST < 270) and ND22_16 > 0.06 and ND16_08 > -0.7	Cloud fix
15	Unclassified	Snow and (LST < 260) and (SZA < 40)	Cold fix
16	Unclassified	Snow and ND22_16 > 0.0 and (LST < 250)	Fix
17	Unclassified	Snow and (ir87+ir105)/2 > 280)	Too warm?
18	Unclassified	Snow and $\lvert ir105 - wv63 \rvert < 1$	Fix
19	Unclassified	Snow and height <3000 and –20 < LAT < 20	Ice cloud fix
20	Unclassified	SZA > 80.0	Sun too low
21	Unclassified	SZA > 74.0 and (SAA>210 or SAA < 150)	Sun fix
22	Unclassified	VZA > 85.0	Satellite angle fix
30-32	Water	Landmask or landcover = water	No water pixels
35-37	Nonproc	Landmask or landcover = space	No space pixels

When all RC snow extent products are available, the results are merged to create the daily flatland snow extent. In this phase, intermediate RC products are loaded and different classifications in each pixel are counted (n_snow, n_nosnow, n_unclass, n_water and n_nonproc). Number of classifications in each pixel is calculated (tcl = n_snow + n_nosnow). Then the rules in Table 4 are applied from top. Again, the default value is ‘unclassified’. The final daily flatland snow extent value is the value in effect after all the rules are applied.

Table 5 H43 daily flatland merging rules. Description explains the conditions used to determine whether the result applies in the pixel based on the classifications in each RC product.

Rule #	Result	Description	Note
0	Unclassified	Set daily pixels unclassified	Init
1	Non-processed	All RCs non-processed	Space
2	Water	All water	Water bodies
3	Snow	tcl >= 12 and n_snow > tcl/4	Some snow detected
4	Snow	tcl >= 12 and n_snow > tcl/2	Mostly snow detected
6	No snow	tcl >= 12 and nosnow > tcl/2	Snow free
20	Unclassified	If snow, check neighbouring pixels: n_water >= 2 and n_snow <= 2	Coastal fix for misclassifications near water
21	Unclassified	If snow, check neighbouring pixels: n_unclass >= 7 and n_snow <= 2	Fix small snow patches inside unclassified pixels

After the daily merging, final error correction is applied. E.g. partly water covered pixels can be misclassified as snow coverer pixels. For that reason, sparse snow-covered pixels near the coastline may be misclassifications and should be reset as unclassified. Each pixel and the nearest pixels in 3x3 pixel are checked. If pixel is a snow-pixels and there are at least 2 water pixels and at most 2 snow pixels in that 3x3 pixel area, pixel is set as unclassified. Similar fix is applied to small snow patches inside unclassified areas, because these are often misclassified (ice) clouds.

3.1.2 Mountain snow extent

The product covering the mountainous areas is developed by METU. The developed algorithm is revised from the snow mask product retrieved from MSG/SEVIRI. The algorithm is explained in detail by Surer et al. (2014) and Surer and Akyurek (2012). The algorithm is based on a spectral thresholding method applied on sub-pixel scale of MTG/FCI images. No atmospheric correction was applied for the images and top of the atmosphere (TOA) values were used in the algorithm. The different spectral characteristics of cloud, snow and land determines the structure of the algorithm.

The threshold values for the mountainous areas were collected from the RGB composites where red, green, blue channels are VIS0.6, VIS0.5, VIS0.4 respectively. Discriminating cloud and snow pixels is the challenging part in snow cover mapping. In order to get rid of cloud covered pixels, cloud mask (Cma) and cloud type (CT) products of Nowcasting Satellite Application Facilities (SAFNWC) (SAF/NWC/IOP/MFL/SCI/SUM/01 2007: the User Manual for the Cloud Products of the SAFNWC/MSG) have been used. As cloud mask (Cma) cloud filled class (pixel value class 3), indicating the opaque clouds completely filling the IFOV, was used. As cloud types: high opaque and stratiform, very high opaque and stratiform and high semi-transparent thick clouds were used. If the cloud mask and cloud type products of SAFNWC were not available, clouds were determined based on thresholds for channel 1, channel 3, channel 4 and channel 9. The cloud mask will be replaced with the new SAFNWC cloud mask retrieved from MTG-FCI.

Snow cover maps using MTG/FCI data have been produced for each 10-minute cycle between 6:00-16:00 UTC that makes 61 individual images a day. All individual 10-minute images acquired during a day are subjected to a series of thresholding tests based on spectral signatures and temporal stability criteria. First, the high visible reflectance of snow was considered and pixels having reflectance values higher than 0.30 were collected. The classification algorithm uses the snow index (SI), obtained by dividing NIR1.6 to VIS0.6. Due to a low reflectance of the snow cover in the middle infrared and a high reflectance in the visible, the snow index enhances the difference of the spectral response of the snow cover from the response of other surfaces. The pixels having NIR1.6 / VIS0.6 values lower than a fixed threshold value of 0.80 have been collected. To establish channel 1T and channel 3T and the model approximating the land surface reflectance anisotropy in the visible and in the shortwave infrared, the statistics of MTG cloud-clear observations accumulated during snow-free periods were used. Then, pixels having low sun zenith angle (SZA) were discarded by a filter accepting pixels having sun zenith angle higher than 5°. The pixels higher than this threshold were classified as dark pixels. A final test for covering all cold pixels below freezing point has been applied and pixels having temperature lower than 288 K on channel-4 (IR10.5) were accepted considering that the temperature of snow cannot exceed the freezing point (Romanov et al., 2003).

Daily snow cover map is obtained from the snow cover maps obtained for each individual 10 minutes image by accepting pixels having at least 3 snow hits among 60 images during a day. Finally, a daily thematic map has been produced which is consisting of 5 different classes: snow, cloud, water, bare ground and dark. The flowchart of the algorithm is given in Figure 6.

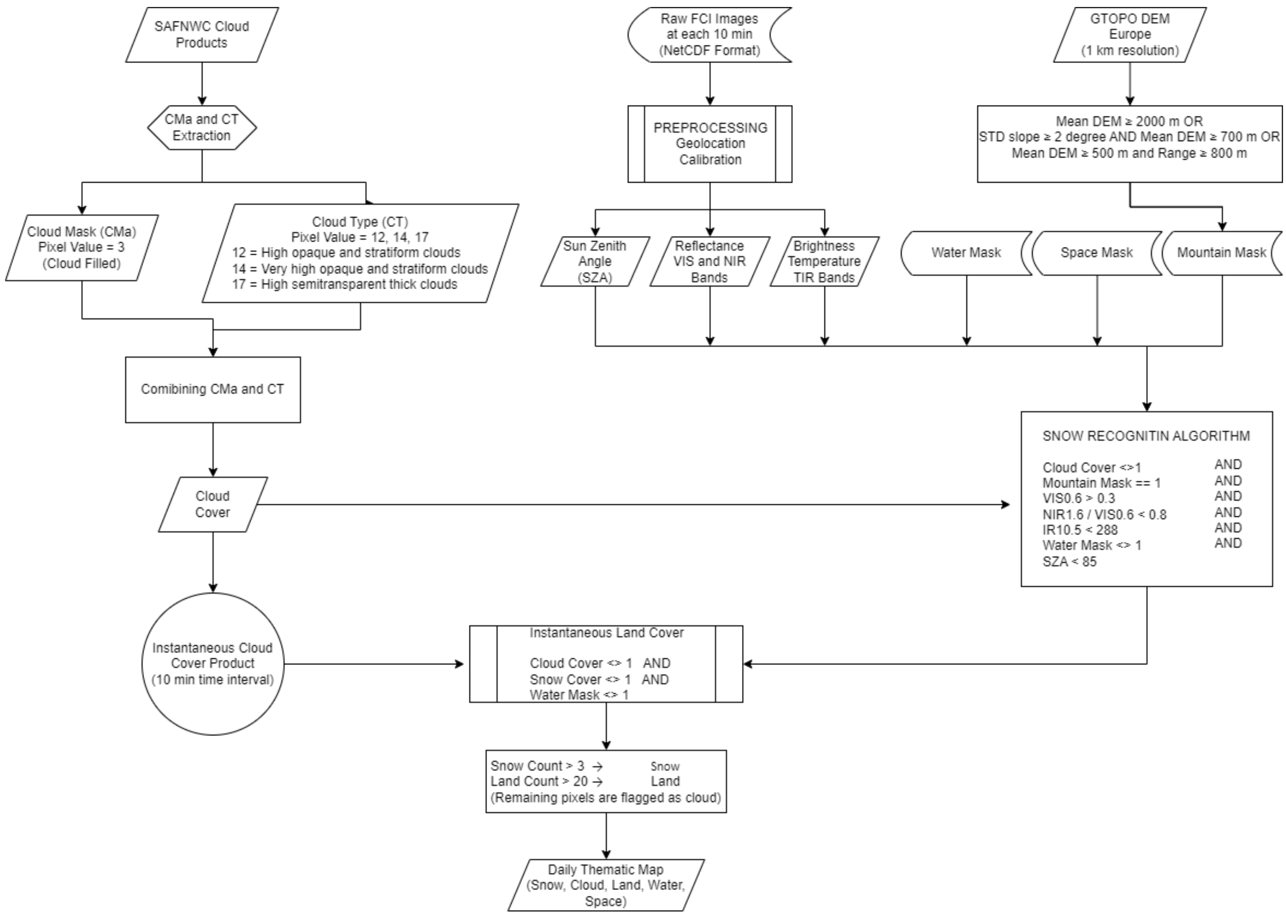

Figure 6 Flowchart of the snow recognition algorithm for mountainous areas

3.1.3 Merged snow extent

In merging algorithm developed at FMI, flatland and mountain product variants (described earlier) are combined as the merged variant (see Figure 7). In the merged product, the mountain mask that is shown in Figure 2, is used to select which variant is used in in the product: flat/forested regions pixels are taken from the flatland variant and mountainous pixels are taken from the mountain variant. During this process, the inherent differences between the approaches of flatland and mountain algorithms are considered. Flatland algorithm classifies a pixel as snow/no-snow only when it is sufficiently confident and sets the remaining pixels as unclassified (i.e. cloud, darkness etc.). Mountain algorithm, however, classifies every pixel as snow, no-snow or cloud. When merging, all the unclassified pixels flatland areas are set as cloud to have coherency on the merged product. Therefore, this product must not be used as a substitute for actual cloud products.

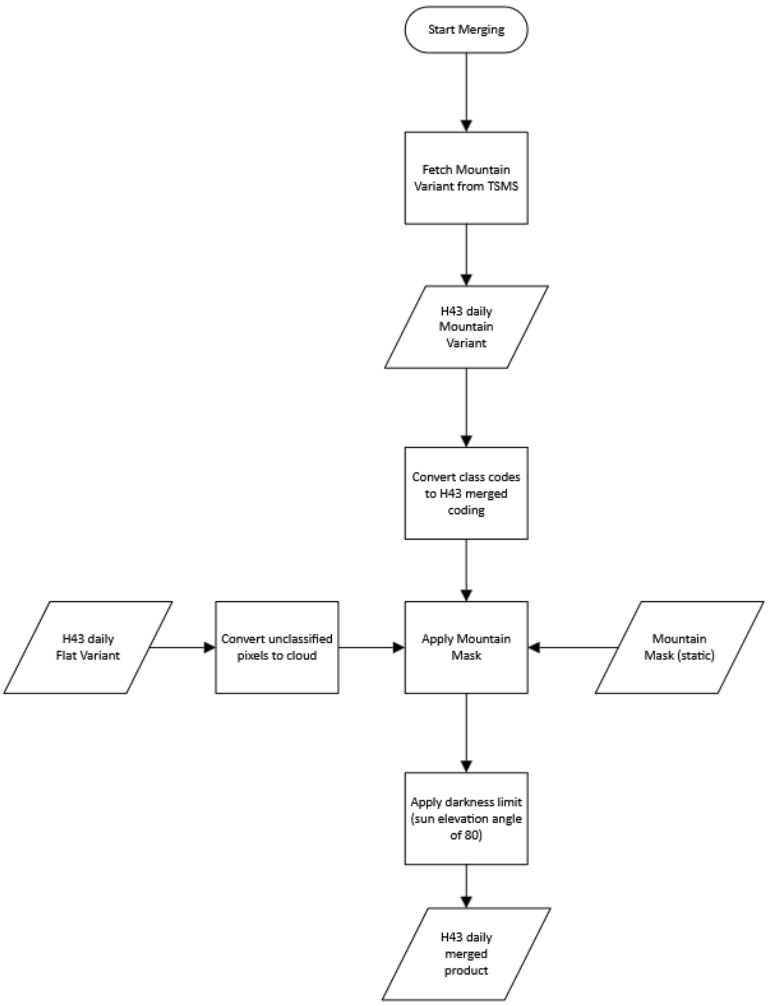

Figure 7 Flowchart of the merging process

3.2 The Algorithm validation

Product validation will be based on surface observations of snow cover (snow depth and state of the ground observations) and/or other satellite snow products (e.g., H SAF MSG/SEVIRI, H SAF Metop/AVHRR, IMS, etc). Validation will be performed during the winter 2024-2025.

3.3 Examples of product H43

Since the MTG/FCI instrument has just started to disseminate data, there are limited example products. Example figures of all MTG/FCI H43 product variants are presented in Figures **Errore. L'origine riferimento non è stata trovata.Errore. L'origine riferimento non è stata trovata.** and **Errore. L'origine riferimento non è stata trovata.**.

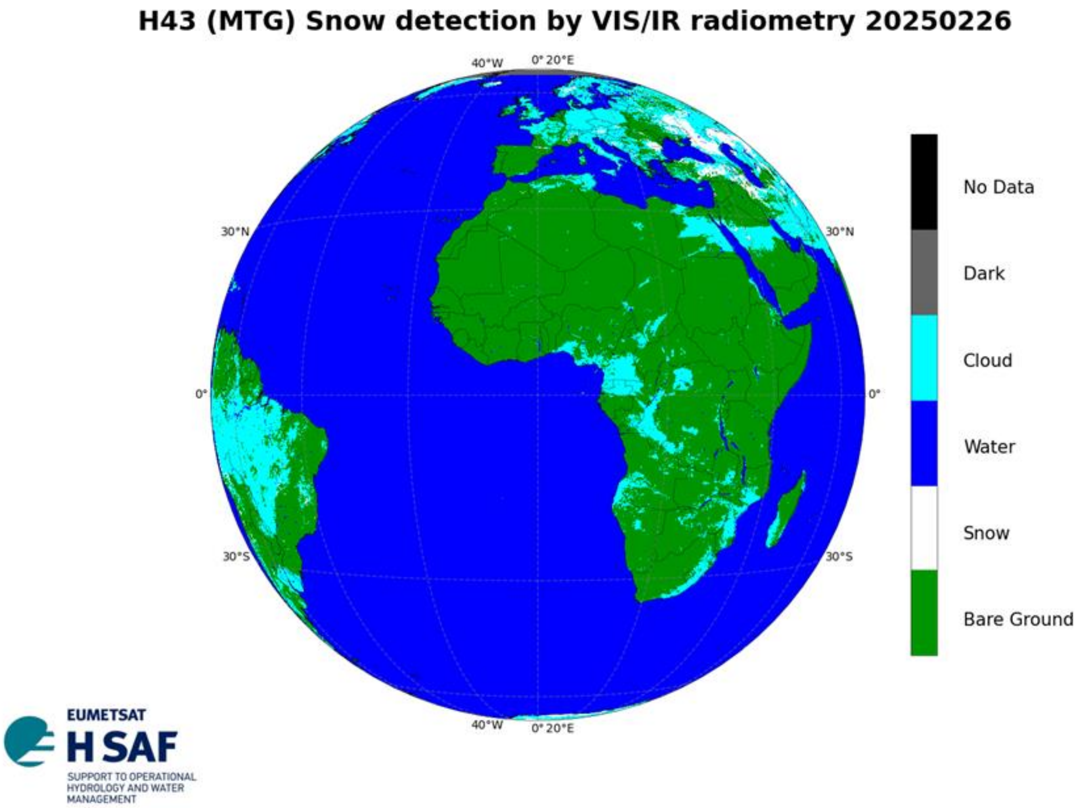

Figure 8 H43 merged variant on February 26, 2025

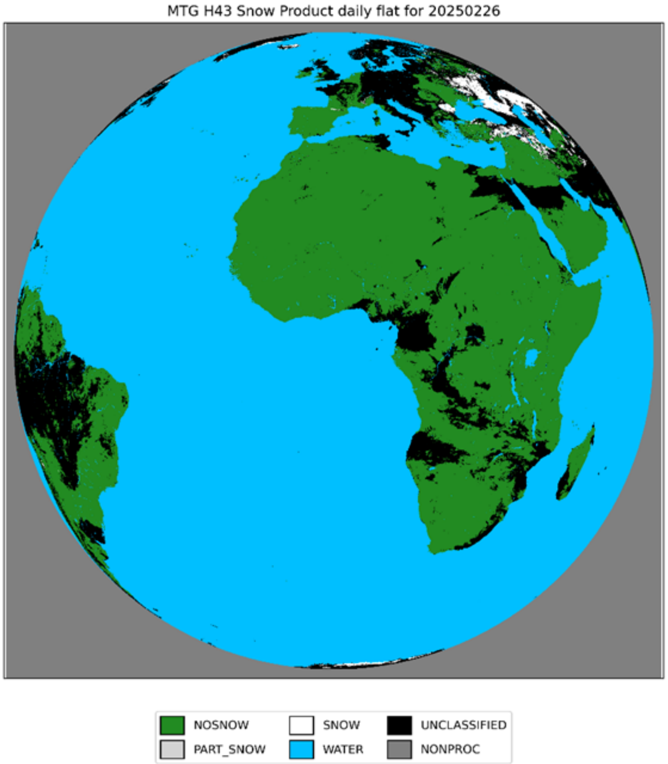

Figure 9 H43 flatland variant on February 26, 2025

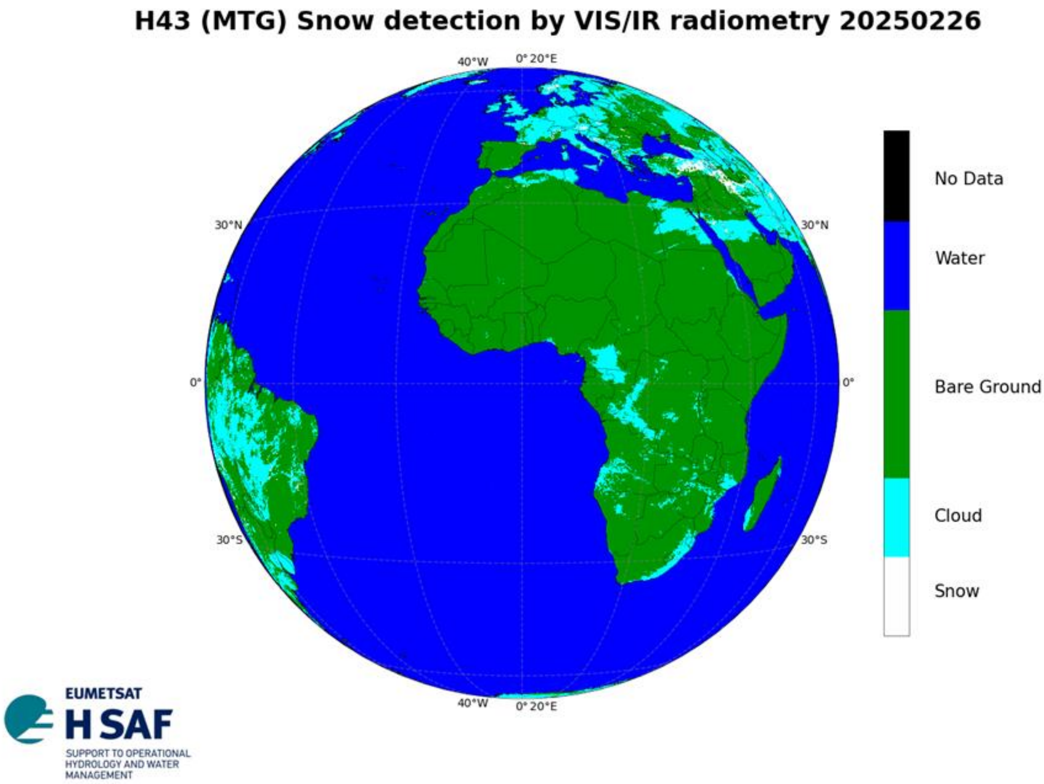

Figure 10 H43 mountain variant on February 26, 2025

4 Applicable documents

1- CDOP3 PRD – H-SAF CDOP3 Product Requirement Document Rel. 1.0,
Ref: SAF/HSAF/CDOP3/PRD/1.0

5 References

MTGdesign:
http://www.eumetsat.int/website/home/Satellites/FutureSatellites/MeteosatThirdGeneration/MTGDesign/index.html#fci

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Surer S., and Z. Akyurek, "Evaluating the utility of the EUMETSAT HSAF snow recognition product over mountainous areas of eastern Turkey", Hydrological Science Journal, 57 (8), 1-11, 2012, http://dx.doi.org/10.1080/02626667.2012.729132

Annex 1: Introduction to H-SAF

The EUMETSAT Satellite Application Facilities

H-SAF is part of the distributed application ground segment of the "*European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)*". The application ground segment consists of a "*Central Application Facilities*" located at EUMETSAT Headquarters, and a network of eight "*Satellite Application Facilities (SAFs*)", located and managed by EUMETSAT Member States and dedicated to development and operational activities to provide satellite-derived data to support specific user communities (see **Errore. L'origine riferimento non è stata trovata.**):

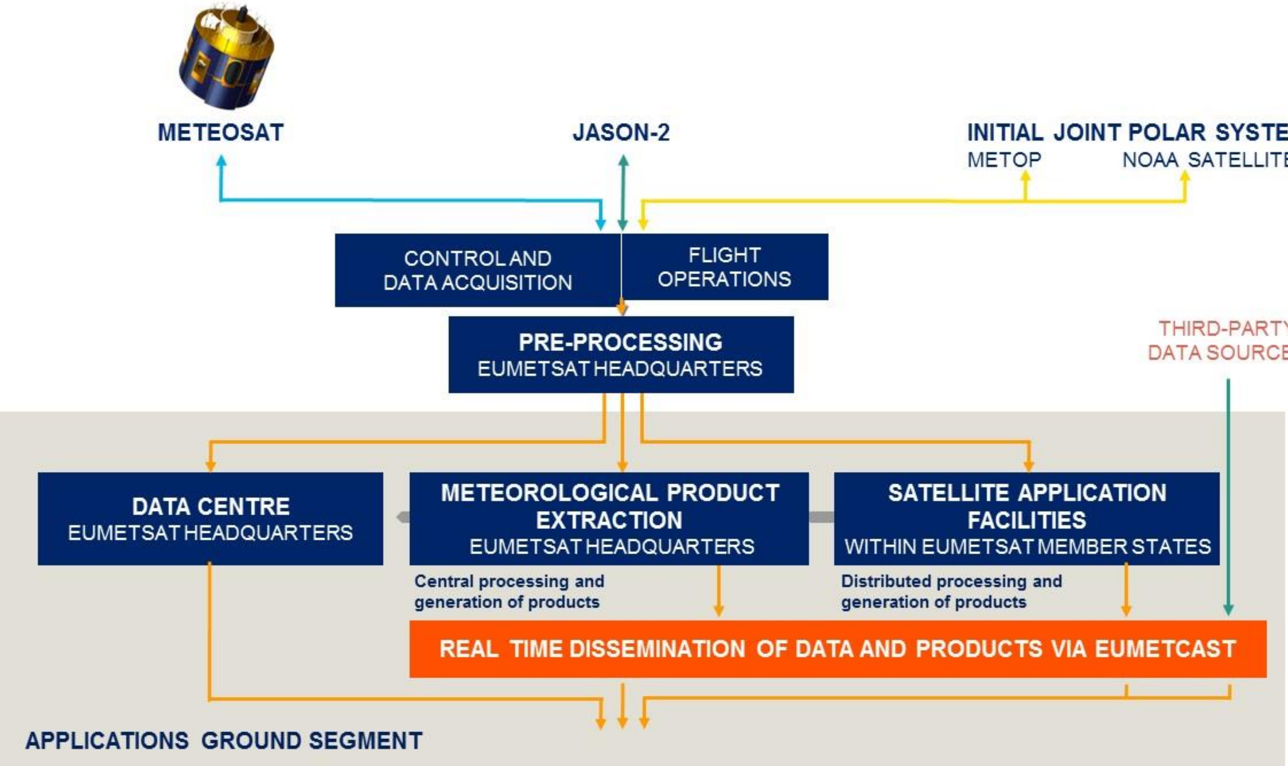

Figure 11 Conceptual scheme of the EUMETSAT Application Ground Segment

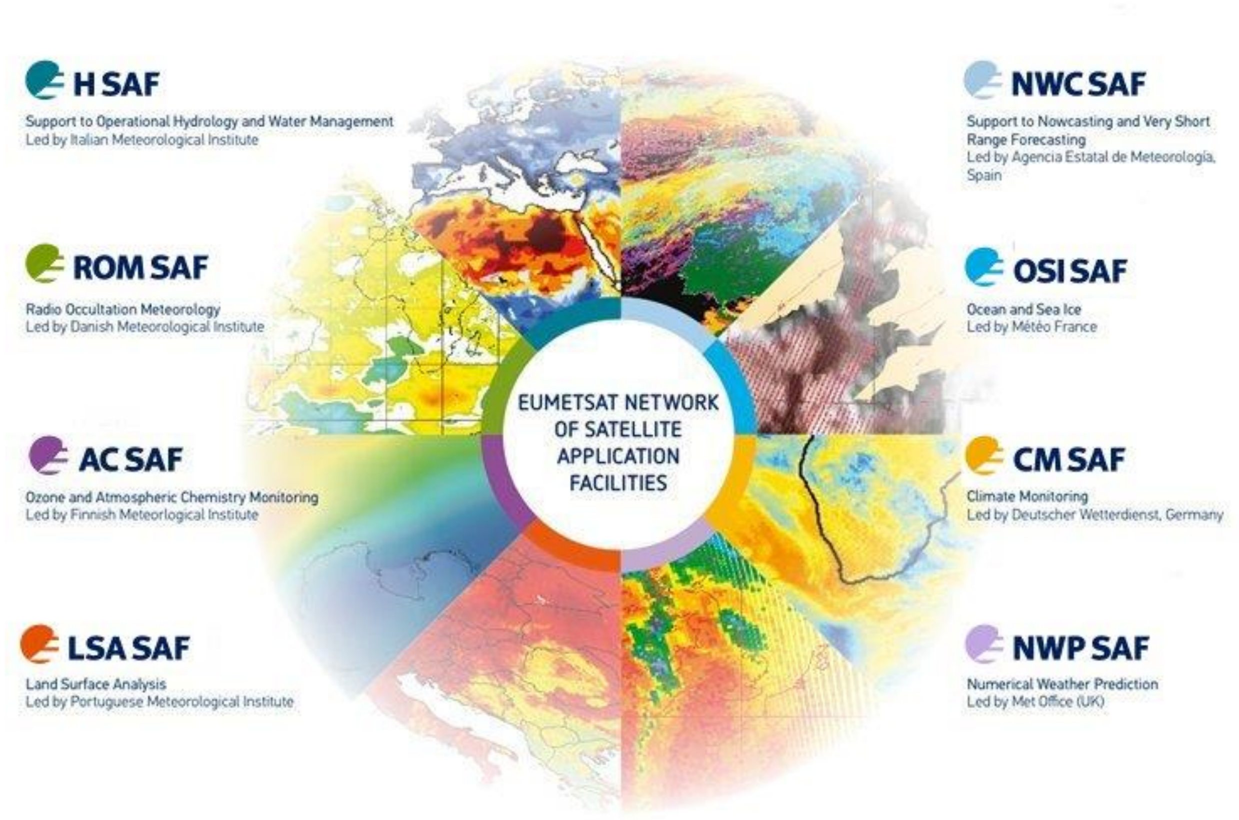

Figure 12 Current composition of the EUMETSAT SAF Network

Purpose of the H-SAF

The main objectives of H-SAF are:

a. ***to provide new satellite-derived products*** from existing and future satellites with sufficient time and space resolution to satisfy the needs of operational hydrology, by generating, centralizing, archiving and disseminating the identified products:

- precipitation (liquid, solid, rate, accumulated);
- soil moisture (at large-scale, at local-scale, at surface, in the roots region);
- snow parameters (detection, cover, melting conditions, water equivalent);

b. ***to perform independent validation of the usefulness of the products*** for fighting against floods, landslides, avalanches, and evaluating water resources; the activity includes:

- downscaling/upscaling modelling from observed/predicted fields to basin level;
- fusion of satellite-derived measurements with data from radar and raingauge networks;
- assimilation of satellite-derived products in hydrological models;
- assessment of the impact of the new satellite-derived products on hydrological applications.

Products / Deliveries of the H-SAF

For the full list of the Operational products delivered by H-SAF, and for details on their characteristics, please see H-SAF website hsaf.meteoam.it.
All products are available via EUMETSAT data delivery service (EUMETCast, http://www.eumetsat.int/website/home/Data/DataDelivery/EUMETCast/index.html), or via ftp download; they are also published in the H-SAF website hsaf.meteoam.it.
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System Overview

H-SAF is lead by the Italian Air Force Meteorological Service (ITAF USAM) and carried on by a consortium of 21 members from 11 countries (see website: hsaf.meteoam.it for details)
Following major areas can be distinguished within the H-SAF system context:

- Product generation area
- Central Services area (for data archiving, dissemination, catalogue and any other centralized services)
- Validation services area which includes Quality Monitoring/Assessment and Hydrological Impact Validation.

Products generation area is composed of 5 processing centres physically deployed in 5 different countries; these are:

- for precipitation products: ITAF CNMCA (Italy)
- for soil moisture products: ZAMG (Austria), ECMWF (UK)
- for snow products: TSMS (Turkey), FMI (Finland)

Central area provides systems for archiving and dissemination; located at ITAF CNMCA (Italy), it is interfaced with the production area through a front-end, in charge of product collecting.
A central archive is aimed to the maintenance of the H-SAF products; it is also located at ITAF CNMCA.
Validation services provided by H-SAF consists of:

- Hydrovalidation of the products using models (hydrological impact assessment);
- Product validation (Quality Assessment and Monitoring).

Both services are based on country-specific activities such as impact studies (for hydrological study) or product validation and value assessment.
Hydrovalidation service is coordinated by IMWM (Poland), whilst Quality Assessment and Monitoring service is coordinated by DPC (Italy): The Services' activities are performed by experts from the national meteorological and hydrological Institutes of Austria, Belgium, Bulgaria, Finland, France, Germany, Hungary, Italy, Poland, Slovakia, Turkey, and from ECMWF.

Annex 2: Glossary

AMSR2	Advanced Microwave Scanning Radiometer 2
AMSU	Advanced Microwave Sounding Unit (on NOAA and MetOp)
ATDD	Algorithms Theoretical Definition Document
ATMS	Advanced Technology Microwave Sounder
AU	Anadolu University (in Turkey)
BfG	Bundesanstalt für Gewässerkunde (in Germany)
CAF	Central Application Facility (of EUMETSAT)
CDOP	Continuous Development-Operation Phase
CESBIO	Centre d'Etudes Spatiales de la BIOsphere (of CNRS, in France)
CGMS	Coordination Group for Meteorological Satellites
CMAP	Climate Prediction Center Merged Analysis of Precipitation
CM-SAF	SAF on Climate Monitoring
COMet	Centro Operativo per la Meteorologia (in Italy)
CNR	Consiglio Nazionale delle Ricerche (of Italy)
CNRS	Centre Nationale de la Recherche Scientifique (of France)
COSMO-ME	Consortium for Small-Scale Modelling - version for Mediterranean
DMSP	Defence Meteorological Satellite Program
DPC	Dipartimento Protezione Civile (of Italy)
EARS	EUMETSAT Advanced Retransmission Service
ECMWF	European Centre for Medium-range Weather Forecasts
EDC	EUMETSAT Data Centre, previously known as U-MARF
EUM	Short for EUMETSAT
EUMETCast	EUMETSAT’s Broadcast System for Environmental Data
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FCI	Flexible Combined Imager
FMI	Finnish Meteorological Institute
FTP	File Transfer Protocol
GEO	Geostationary Earth Orbit
GPCP	Global Precipitation Climatology Project
GPI	GOES Precipitation Index
GPM	Global Precipitation Measurement
GRAS-SAF	SAF on GRAS Meteorology
H SAF	SAF on Support to Operational Hydrology and Water Management
IMWM	Institute of Meteorology and Water Management (in Poland)
IPF	Institut für Photogrammetrie und Fernerkundung (of TU-Wien, in Austria)
IPWG	International Precipitation Working Group
IR	Infrared
IRM	Institut Royal Météorologique (of Belgium) (alternative of RMI)
ISAC	Istituto di Scienze dell’Atmosfera e del Clima (of CNR, Italy)
ITU	İstanbul Technical University (in Turkey)
LATMOS	Laboratoire Atmosphères, Milieux, Observations Spatiales (of CNRS, in France)
LEO	Low Earth Orbit
LHN	Latent Heat Nudging

LSA-SAF	SAF on Land Surface Analysis
Météo France	National Meteorological Service of France
METU	Middle East Technical University (in Turkey)
MHS	Microwave Humidity Sounder (on NOAA 18 and 19, and on MetOp)
MSG	Meteosat Second Generation
MTG	Meteosat Third Generation
MW	Microwave
NMA	National Meteorological Administration (of Romania)
NOAA	National Oceanic and Atmospheric Administration (Agency and satellite)
NWC-SAF	SAF in support to Nowcasting & Very Short Range Forecasting
NWP	Numerical Weather Prediction
NWP-SAF	SAF on Numerical Weather Prediction
O3M-SAF	SAF on Ozone and Atmospheric Chemistry Monitoring
OMSZ	Hungarian Meteorological Service
OSI-SAF	SAF on Ocean and Sea Ice
PMW	Passive Micro-Wave
PP	Project Plan
PUM	Product User Manual
PVR	Product Validation Report
QPF	Quantitative Precipitation Forecast
REMET	Reparto di Meteorologia (in Italy)
RMI	Royal Meteorological Institute (of Belgium) (alternative of IRM)
SAF	Satellite Application Facility
SEVIRI	Spinning Enhanced Visible and Infra-Red Imager (on Meteosat from 8 onwards)
SHMÚ	Slovak Hydro-Meteorological Institute
SSM/I	Special Sensor Microwave / Imager (on DMSP up to F-15)
SSMIS	Special Sensor Microwave Imager/Sounder (on DMSP starting with S-16)
STD	Standard Deviation
SYKE	Suomen ympäristökeskus (Finnish Environment Institute)
TKK	Teknillinen korkeakoulu (Helsinki University of Technology)
TSMS	Turkish State Meteorological Service
TU-Wien	Technische Universität Wien (in Austria)
U-MARF	Unified Meteorological Archive and Retrieval Facility
UniFe	University of Ferrara (in Italy)
URD	User Requirements Document
UTC	Universal Coordinated Time
VIS	Visible
WMO	World Meteorological Organization
ZAMG	Zentralanstalt für Meteorologie und Geodynamik (of Austria)