# Snow products and activities in the EUMESTAT Network of Satellite Application facilities (SAFs)

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**EUMETSAT**

**GlobSnow Workshop**        **Innsbruck**                    **12-13 January 2010**     EUMETSAT

# Outline

Introduction

Satellite Application Facility Concept

EUMETSAT SAF operational snow products

- Land Surface Analysis SAF

- Hydrology SAF

Outlook: CDOP-2 2012-2017

Summary and Conclusions

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# The SAF Concept

- In 1992 EUMETSAT adopted the concept of a Distributed Application Ground Segment including:

    - *the EUMETSAT Central Facilities in Darmstadt*

    - *and a network of elements known as Satellite Application Facilities (SAF), as specialised development and processing centres.*

- SAFs utilise the **specific expertise** available in EUMETSAT's Member and Cooperating States.

- The SAF network **complements** the production of standard meteorological products derived from satellite data at the central facilities in Darmstadt and also distributes user software packages.

- SAFs are developed by **consortia** of organisations from the EUMETSAT Member States and Cooperating States, and are located at the National Meteorological Services in Member States.

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# The EUMETSAT Application Ground Segment

**EUM Geostationary Systems**

**Data Acquisition and Control**

**Systems of the EUM/NOAA Cooperation**

other data sources

**Data Processing EUMETSAT HQ**

## Application Ground Segment

**Meteorological Products Extraction EUMETSAT HQ**

**Archive & Retrieval Facility (U-MARF) EUMETSAT HQ**

**Satellite Application Facilities (SAFs)**

SAF
The EUMETSAT SAF Network

Centralised processing and generation of products

Decentralised processing and generation of products

**USERS**

# The SAF Network Deployment

- Seven SAF projects were approved, related Cooperation Agreements established, and development activities initiated in the period 1997-1999.

- The first 7 SAFs incrementally initiated operational activities, using first MSG data and then Metop (EPS) Data.

- An 8th SAF theme on support to Operational Hydrology and Water Management (H-SAF) was approved by the EUMETSAT Council in November 2002, thus creating a new SAF opportunity.

- An H-SAF Project started in September 2005, following approval by EUMETSAT Council of the proposal prepared under coordination of the Italian Meteorological Service.

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# Objectives

Member State

Cooperating State

1 Support to Nowcasting and Very Short Range Forecasting

2 Ocean and Sea Ice

3 Climate Monitoring

4 Numerical Weather Prediction

5 Land Surface Analysis

6 Ozone and Atmospheric Chemistry Monitoring

7 GRAS Meteorology

8 Support to Operational Hydrology and Water Management

● SAF Consortium Member

○ Additional Met Service Users

## SAF
The EUMETSAT SAF Network
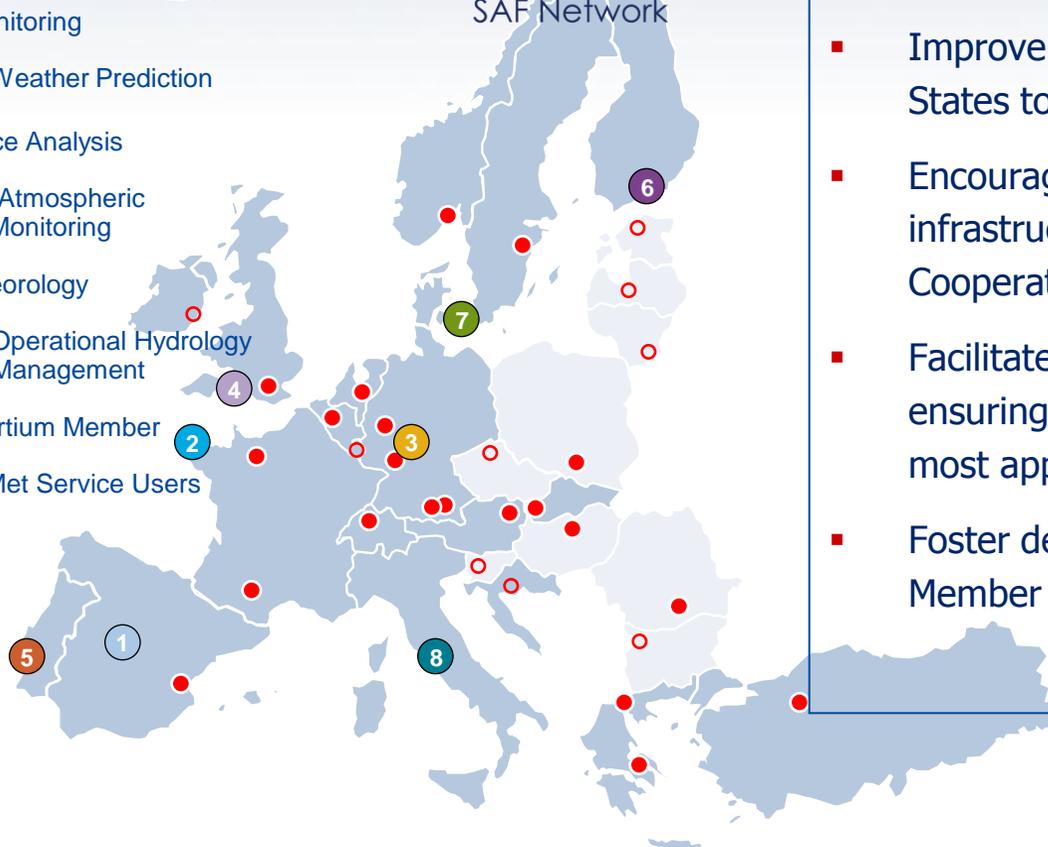
## Objectives of the SAF Network

▪ Improve the ability of EUMETSAT's Member States to exploit satellite data;

▪ Encourage the utilisation of existing skills and infrastructure in Member States and Cooperating States;

▪ Facilitate cost-effective exploitation by ensuring that services are distributed in the most appropriate way;

▪ Foster development of cooperation with non-Member States and other organisations.

# Land Surface Analysis SAF

- **SAF on Land Surface Analysis  (LSA SAF)**

- established to increase the benefit from MSG and EPS (Metop) data related to land, land-atmosphere interaction and biospheric applications

- Generates operationally data services related to Surface Radiation,  Snow, and Vegetation

- Leading entity is the Portuguese Institute for Meteorology IM, Lisbon

- **Snow activities lead  by FMI, Finland**



12.02.2003 13:30 UTC

DSSF in W/m²

MSG-1/SEVIRI

METEO FRANCE

LandSAF

# LSA SAF Snow Cover Product



26 January 2007
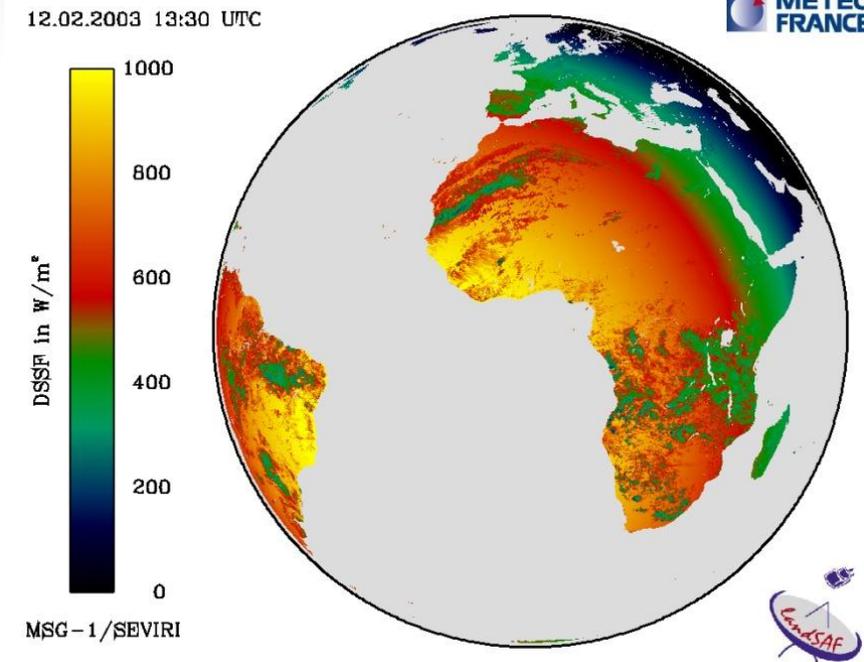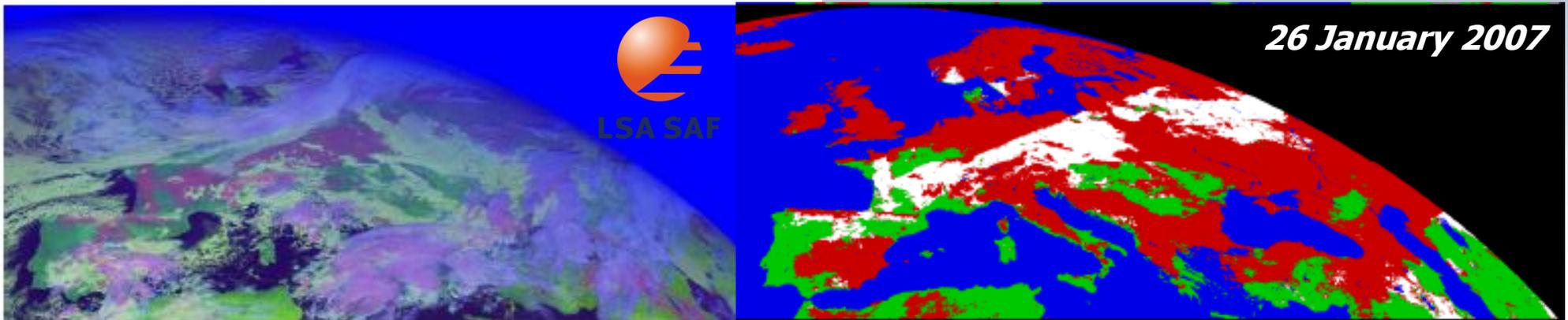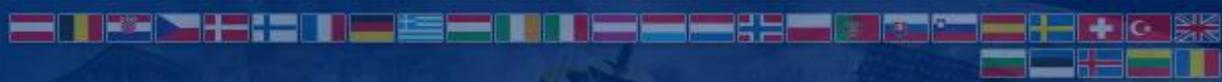
| | | | | | | |
|---|---|---|---|---|---|---|
| **MSG Snow Cover** | **Multichannel (VIS, NIR, IR) analysis** | **MSG/ SEVIRI** | **MSG disk** | **1 day** | **MSG pixel resolution** | **False Alarm: 15%; Hit Rate: 80%** |
| **EPS Snow Cover** | **Multichannel (VIS, NIR, IR) analysis** | **EPS (Metop) AVHRR** | **global** | **1 day** | **0.01° x 0.01°** | **False Alarm: 15%; Hit Rate: 80%** |
| **Merged MSG and EPS Snow Cover** | **Multichannel (VIS, NIR, IR), multisensor analysis** | **MSG + Metop** | **Europe & HighLatitudes** | **1 day** | **0.05° x 0.05°** | **False Alarm: 15%; Hit Rate: 80%** |

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# Hydrology SAF

- SAF on Support to Operational Hydrology and Water Management

- Host institute: Italian Meteorological Service (USAM), involving Member States and 4 Cooperating States

- SAF products focuses on
  - ▸ Precipitation (lead: USAM, Italy)
  - ▸ soil moisture (lead: ZAMG, Austria)
  - ▸ snow parameters (lead: FMI, Finland)
  - ▸ utilisation of these parameters in hydrological models and NWP

- The H-SAF started Development Phase in September 2005 until September 2010

- H-SAF submitted proposal for a 18 month bridging phase covering September 2010 to February 2012

- Planning for CDOP-2 (2012-2017) started

The EUMETSAT Network of Satellite Application Facilities

H SAF

Support to Operational Hydrology and Water Management

# SAF Development and operational phases

**DP**: Development Phase
**IOP**: Initial Operations Phase
**CDOP**: Continuous Development and Operations Phase

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DP | | IOP | | CDOP1 | | | | | CDOP2 | | | |
| 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |

HSAF — DEVELOPMENT PHASE — CDOP1
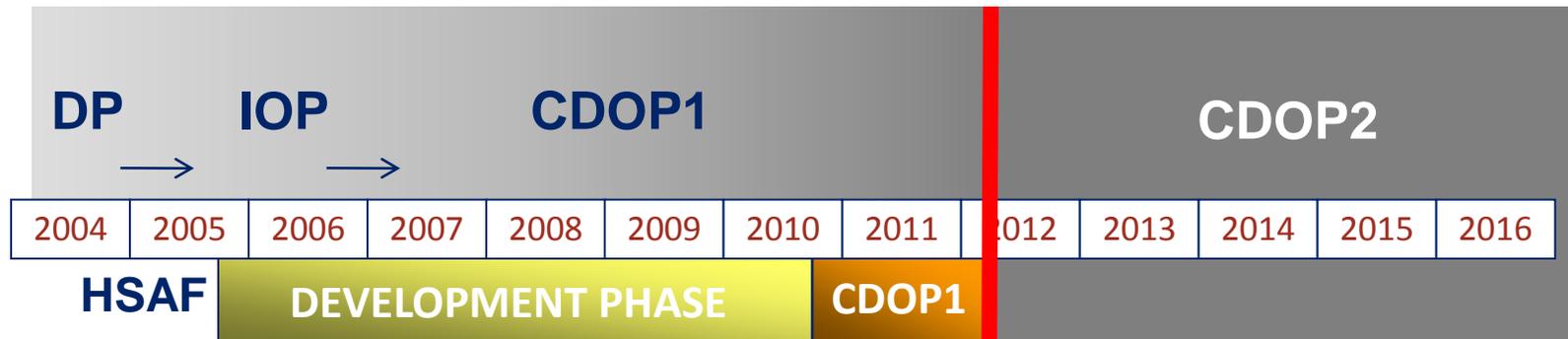
# Snow Products of the H SAF

| SNOW PRODUCTS | | ESTIMATED STATUS | |
|---|---|---|---|
| | | End of DP | CDOP1 |
| SN-OBS-1 | Snow detection (snow mask) by VIS/IR radiometry | Pre-Operational | Operational |
| SN-OBS-2 | Snow status (dry/wet) by MW radiometry | Pre-Operational | Operational |
| SN-OBS-3 | Effective snow cover by VIS/IR radiometry | Pre-Operational | Operational |
| SN-OBS-4 | Snow water equivalent by MW radiometry | In development | Pre-Operational |

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Satellite Application
Facilities

H SAF

Support to Operational
Hydrology and Water
Management

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## SN-OBS-1: Snow Detection

- Daily binary map of snow / no-snow situation.
- Uses VIS/IR images from MSG-SEVIRI
- Different algorithms for flat areas (Finland) and mountains (Turkey)
- The algorithm is based on thresholding of several channels of SEVIRI
- Dissemination of NRT product via EUMETCast
- Resolution: 8 km



H SAF

| | |
|---|---|
| | No data |
| | Dark |
| | Water |
| | Bare ground |
| | Cloud |
| | Snow |
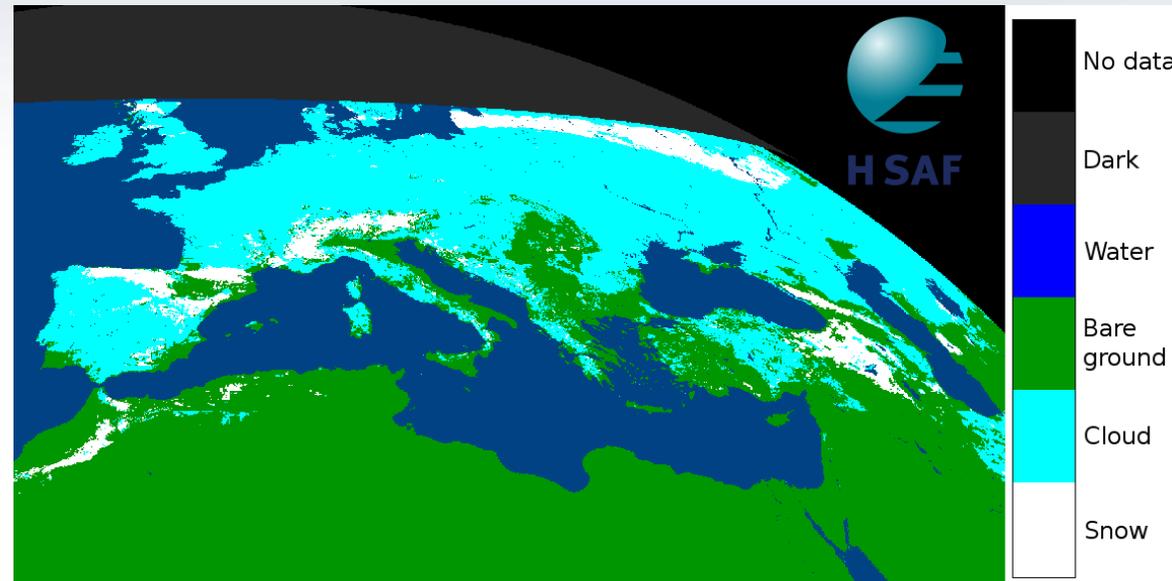
*H SAF Snow map 10 January 2010*

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# Snow status (dry/wet) by MW radiometry

## SN-OBS-2: Snow Status

- Daily Status of the snow mantle (wet or dry) and, in time series, thawing or freezing.

- Uses Multi-channel MW (microwave) observations from AMSR-E and SSM/I

- Development of the Helsinki Technical University (TKK)

- Dissemination of NRT product via EUMETCast

- Resolution : 20 km



Legend:
- No data
- Dark
- Water
- Bare ground
- Cloud
- Wet snow
- Dry snow

*H SAF Snow Status Product 10 January 2010*

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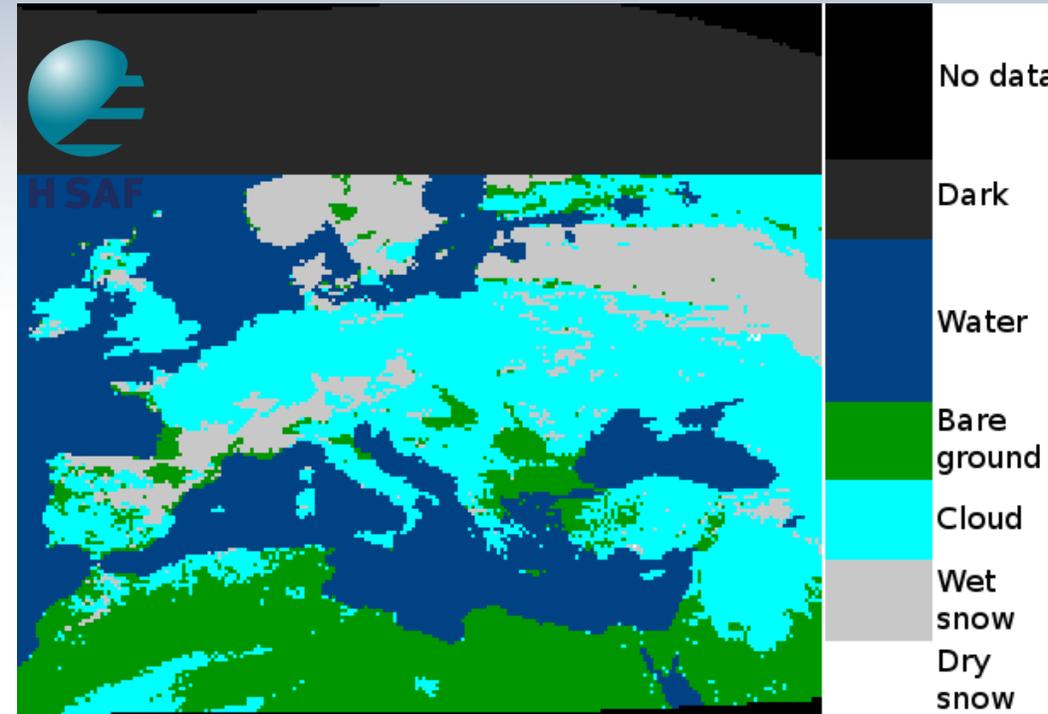
# Effective snow cover by VIS/IR radiometry

## SN-OBS-3: Effective Snow Cover

- Daily estimate of fractional cover at resolution element level.

- multi-channel analysis using AVHRR (on NOAA and Metop satellites)

- Different algorithms for flat areas (Finland) and mountains (Turkey)

- Dissemination of NRT product via EUMETCast

- Resolution: 8 km



*H SAF Effective Snow Cover Product 29 March 2010*

# Snow water equivalent by MW radiometry

**SN-OBS-3: Snow water equivalent by MW radiometry**

- Maps of snow water equivalent derived from MW (AMSR-E, SSM/I) measurements sensitive to snow thickness and density.

- The algorithm is based on assimilating MW brightness temperatures of several channels at frequencies with different penetration in snow, into a first-guess field built by the (sparse) network of stations

- Different algorithms for flat areas (Finland) and mountains (Turkey)

- Dissemination of NRT product via EUMETCast

- Resolution: 25 km

- 
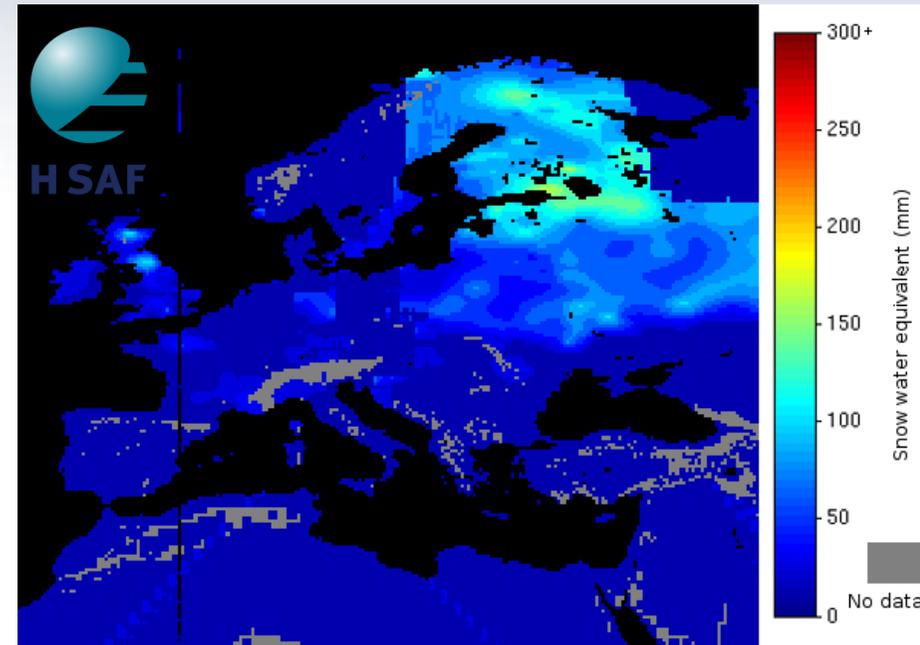


*H SAF Snow Water Equivalent Product 29 March 2010*

# H SAF Webpage and Workshop

http://www.meteoam.it/modules.php?name=hsaf

User name : satelliti

Password   : satelliti


**H SAF user workshop:**


**16-18 March 2010**
**in Zakopane, Poland**

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# Outlook: SAF CDOP-2



**EUMETSAT SAF Network after 2012:**

- funding for 5 years 2012-2017 of CDOP-2 foreseen within the MTG budget (subject to Council approval of the MTG programme)
- SAFs started planning for activities and products for the 2012-2017 timeframe
- CDOP-2 will contain the development activities of Meteosat Third Generation (MTG) based products
- Integration and interfacing with other initiatives: ESA, GMES, WMO SCOPE-CM, EUMETCal, GHRSST, GODAE, etc.
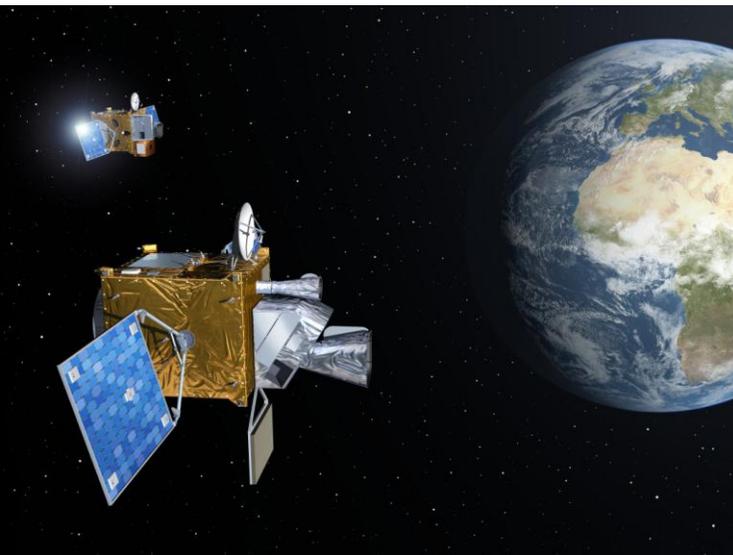
# Research to Operations Transition 1

SAFs as excellent opportunity for R2O transition

R2O: Mature products/algorithms developed in the science community / other frameworks (e.g. GlobSnow) are brought into operational context

Benefits for the SAF :
- Complementing SAF portfolio with high-quality products without long and expensive R&D
- Improved links to science community
- Synergy effects for other SAF products

Benefits for the original developer
- Ensures the future of his/her development
- Increased visibility and community
- Increased feedback for product improvement through larger number of users
- Concentration to scientific development through release from engineering/operations/documentation tasks

# R2O Transition 2

Benefits for the user:

- Guarantees long term availability of products proven useful in the research area due to long term funding.

- Standard SAF infrastructure:
    - User interface, help desk, documentation structure
    - Continuous quality monitoring and improvement of data and services
    - Data distribution and dissemination (e.g. through EUMETCast for NRT)

- Improves science source codes by re-engineering, i.e., some codes are written again. Most of the time they are much faster after the cure.

- Increases the amount of people working on a data set as it keeps the original developers in the activity.

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# Summary



The EUMETSAT SAF Network

OSI SAF

H SAF

NWP SAF

O3M SAF

GRAS SAF

LSA SAF

CM SAF

NWC SAF

- SAF = EUMETSAT Satellite Application Facility
- providing products and services to users on an operational basis with a long-term perspective
- part of the EUMETSAT application ground segment
- LSA SAF snow cover product (MSG) operational, AVHRR and merged MSG/AVHRR products in development
- H SAF snow products to become pre-operational in 2010 (snow detection/status/cover) and SWE in 2011
- Excellent opportunity in 2010 for users to influence the availability of operational products in the 2012-2017 timeframe (CDOP-2)

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