H SAF
Support to Operational Hydrology and Water Management

H-SAF 3rd Open Workshop

Reading, 3-6 November 2014

H-SAF introduction to HEPEX

Flavio Gattari

H-SAF Project Management

H SAF
Support to Operational Hydrology and Water Management

H-SAF Objectives

- To generate, disseminate, archive and **guarantee operational provision** of high quality **precipitation**, **soil moisture** and **snow products** for operational hydrological applications derived from Earth observation satellites in geostationary and polar orbits operated both by EUMETSAT other satellite organizations.
- To perform a continuous and independent **quality monitoring and assessment** of the products for hydrological applications.

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Support to Operational Hydrology and Water Management

The Consortium and Partners

ITALY
USAM-CNMCA
PROTEZIONE CIVILE
CNR -ISAC
UNIFE
TELESPAZIO

AUSTRIA
ZENTRAL ANSTALT FUR METEOROLOGIE UN GEODYNAMIC
TU WIEN

ECMWF
EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

FINLAND
FINNISH METEOROLOGICAL INSTITUTE

POLAND
INSTITUTE OF METEOROLOGY AND WATER MANAGEMENT

TURKEY
TURKISH STATE METEOROLOGICAL SERVICE
MIDDLE EAST TECH. UNIV.
ISTANBUL TECH. UNIV.
ANADOLU UNIVERSITY
ONDOKUZ MAYIS UNIV.

BELGIUM
ROYAL METEOROLOGICAL INSTITUTE

BULGARIA
NATIONAL INSTITUTE OF METEOROLOGY AND HYDROLOGY

FRANCE
METEO-FRANCE

GERMANY
BUNDESANSTALT FUR GEWASSERKUNDE

HUNGARY
HUNGARIAN METEO SERVICE

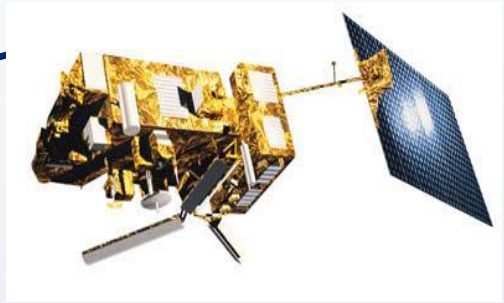
SLOVAKIA
HYDRO-METEOROLOGICAL INSTITUTE

The Context: The SAF Concept

EUM Geostationary Systems

Data Acquisition and Control

Data Processing EUMETSAT HQ



EPS

Other Data Sources

Application Ground Segment

EUMETSAT Central Application Facility

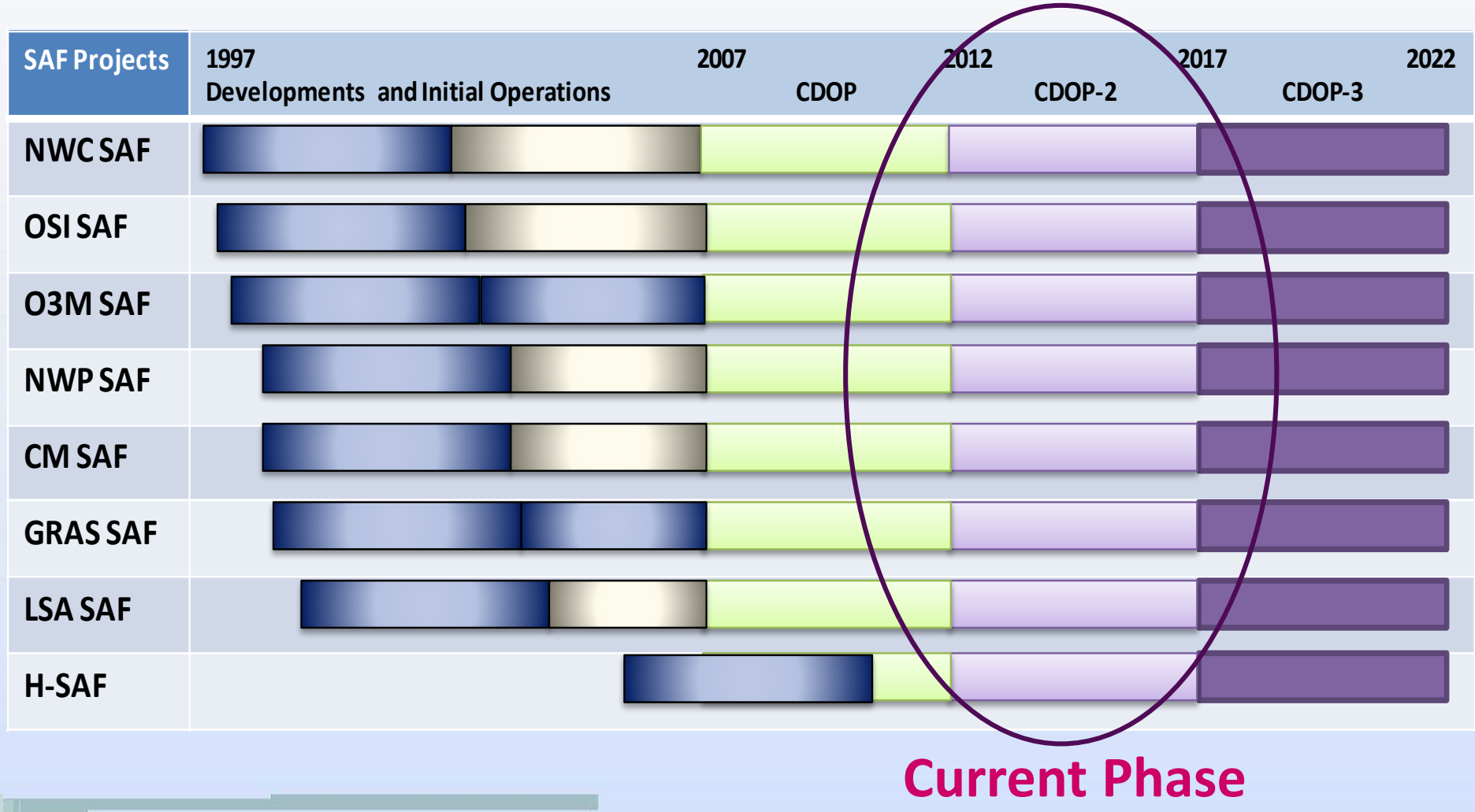
Satellite Application Facilities (SAFs)

Central Processing

Distributed Processing and generation of specific products

USERS

The Context: The SAF Schedule



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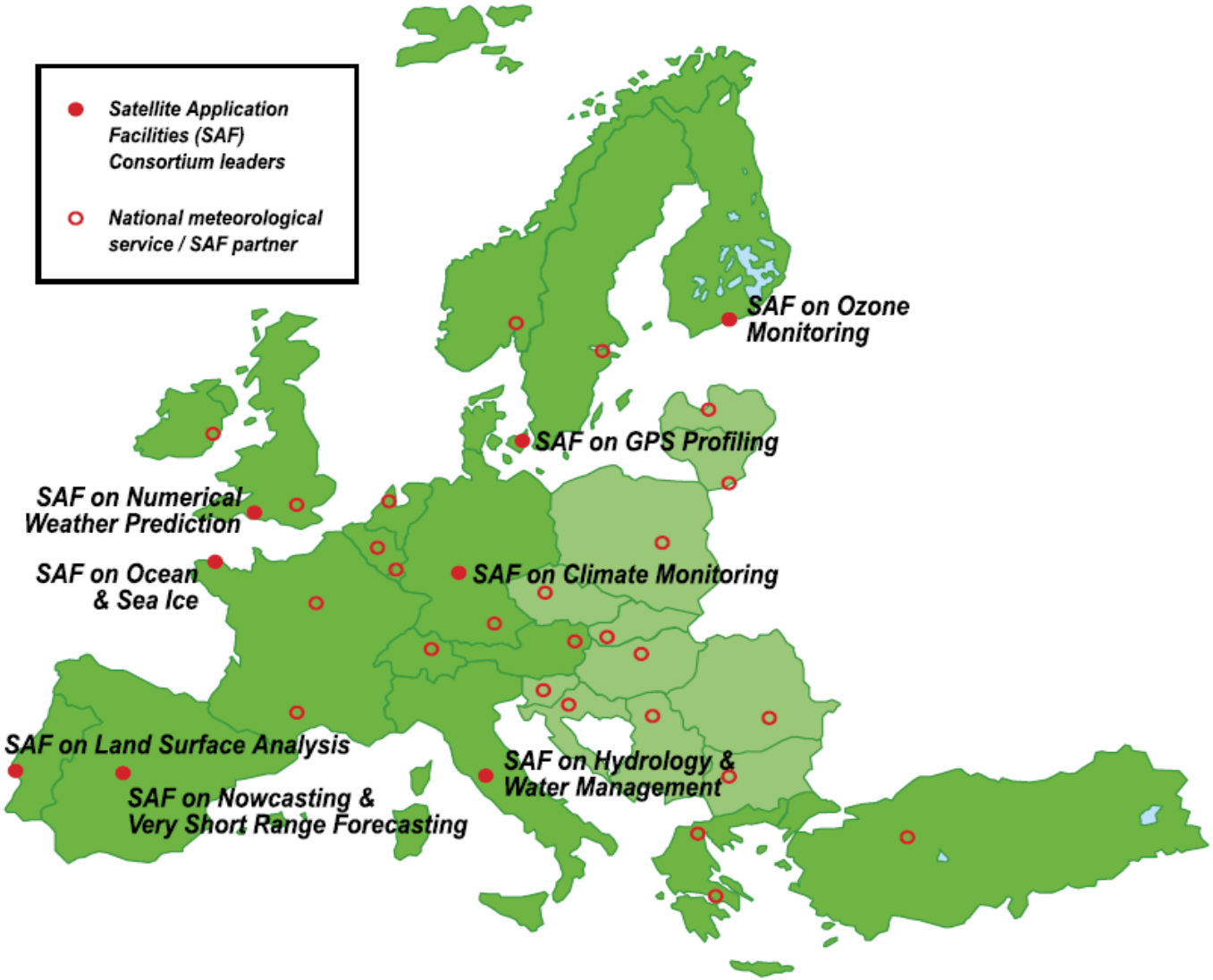
The Context: The SAF Network

SAF
The EUMETSAT Network of Satellite Application Facilities



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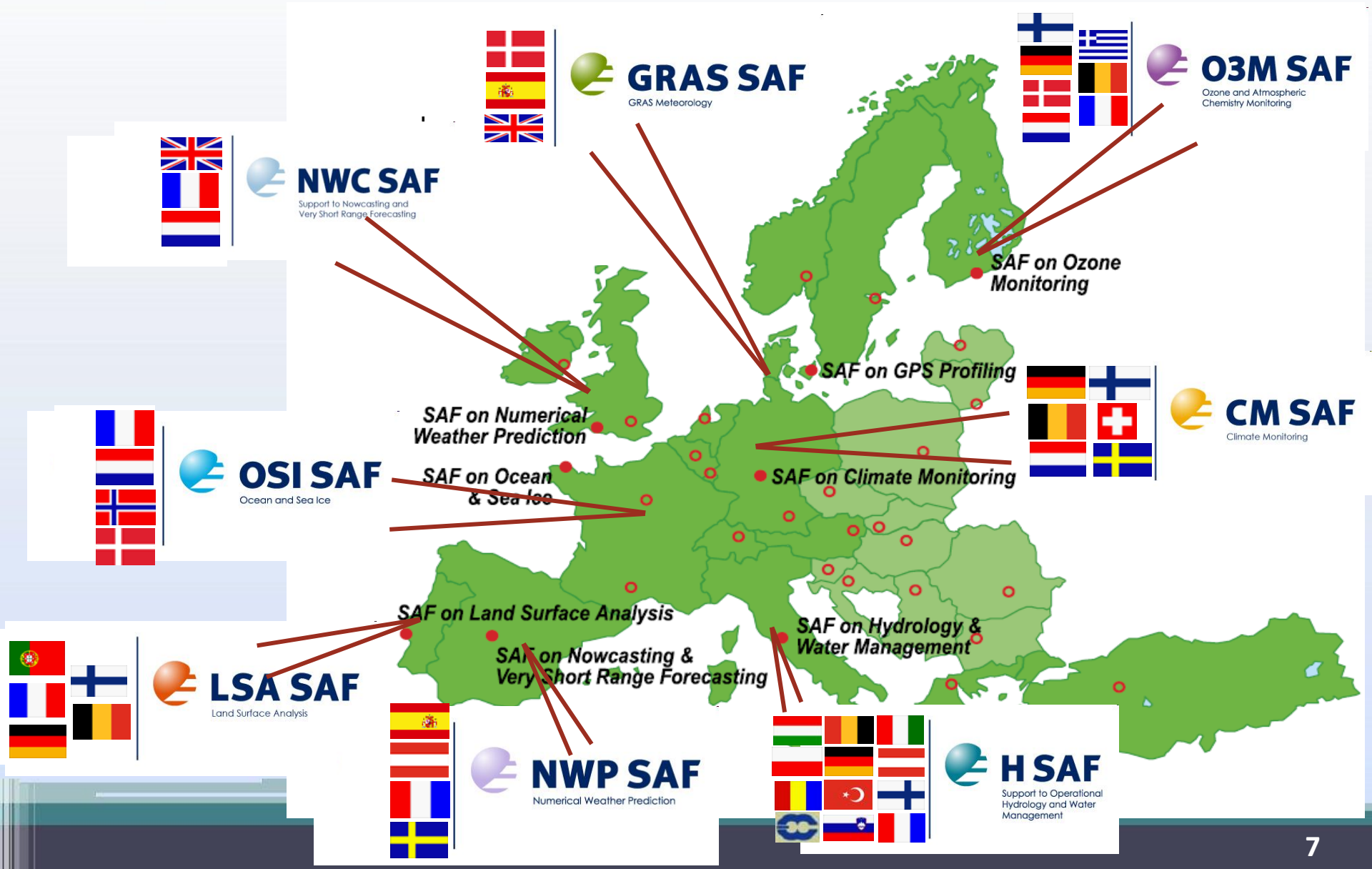
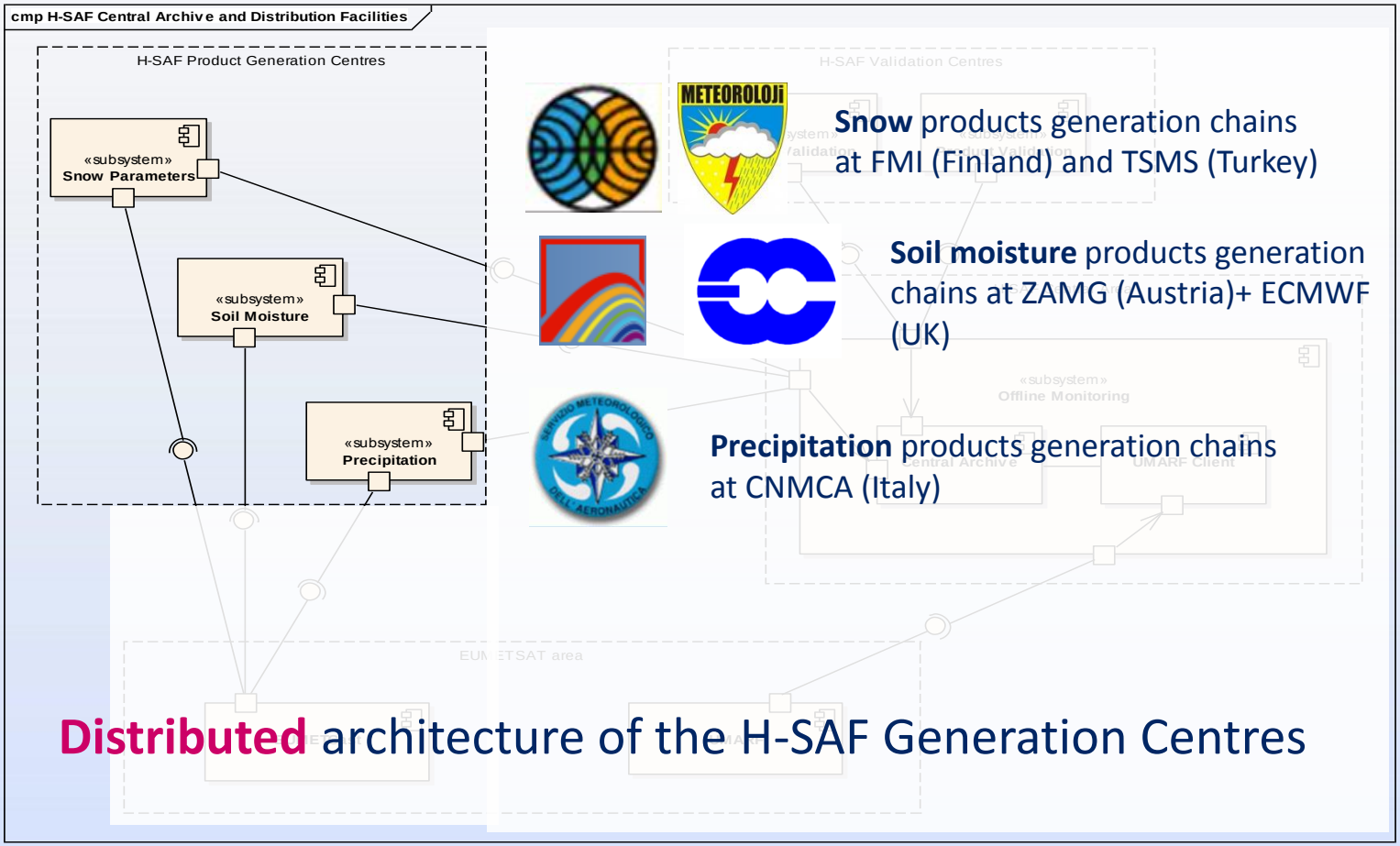
The Context: The SAF Network



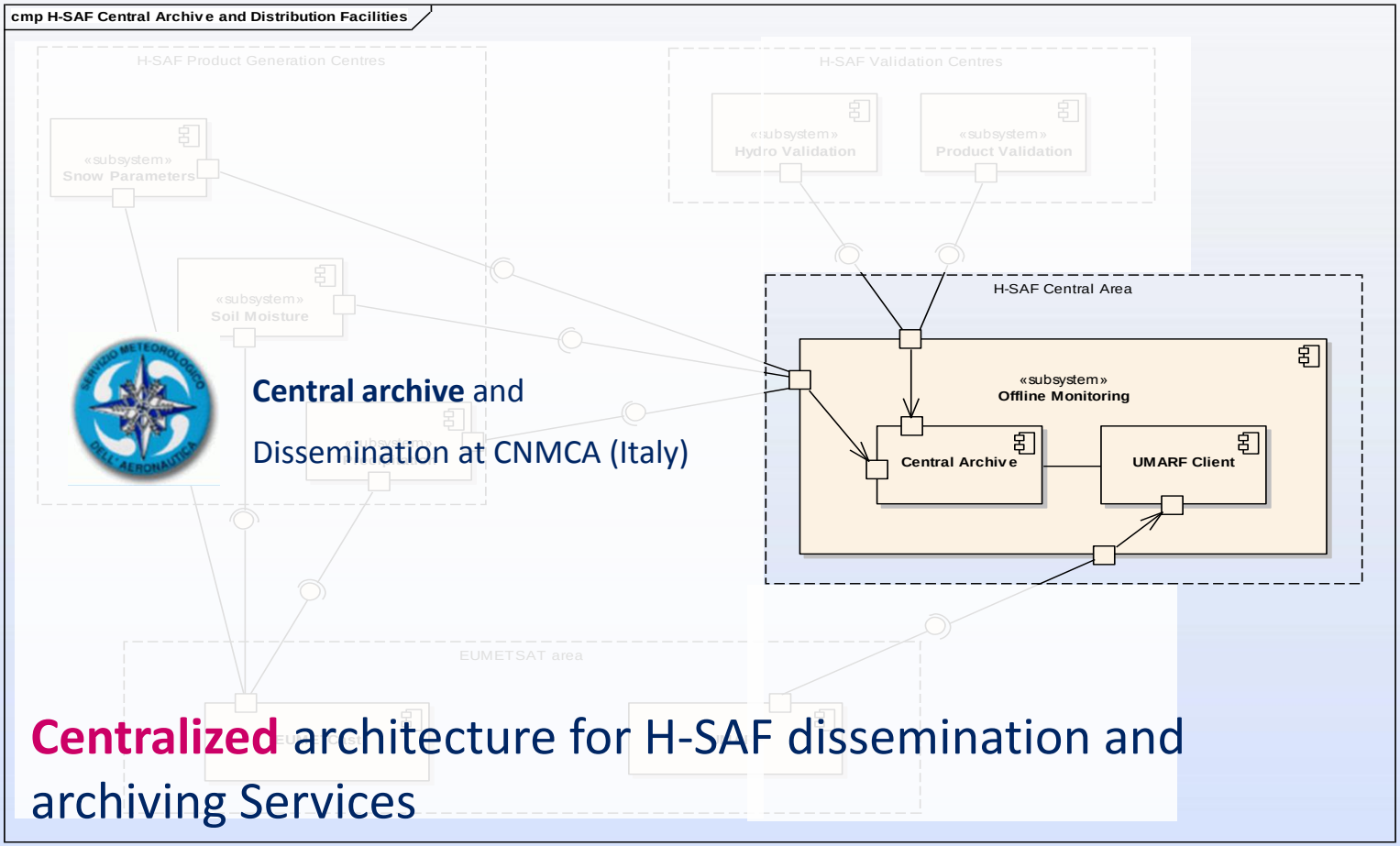
H-SAF Architecture

Product Generation Centers



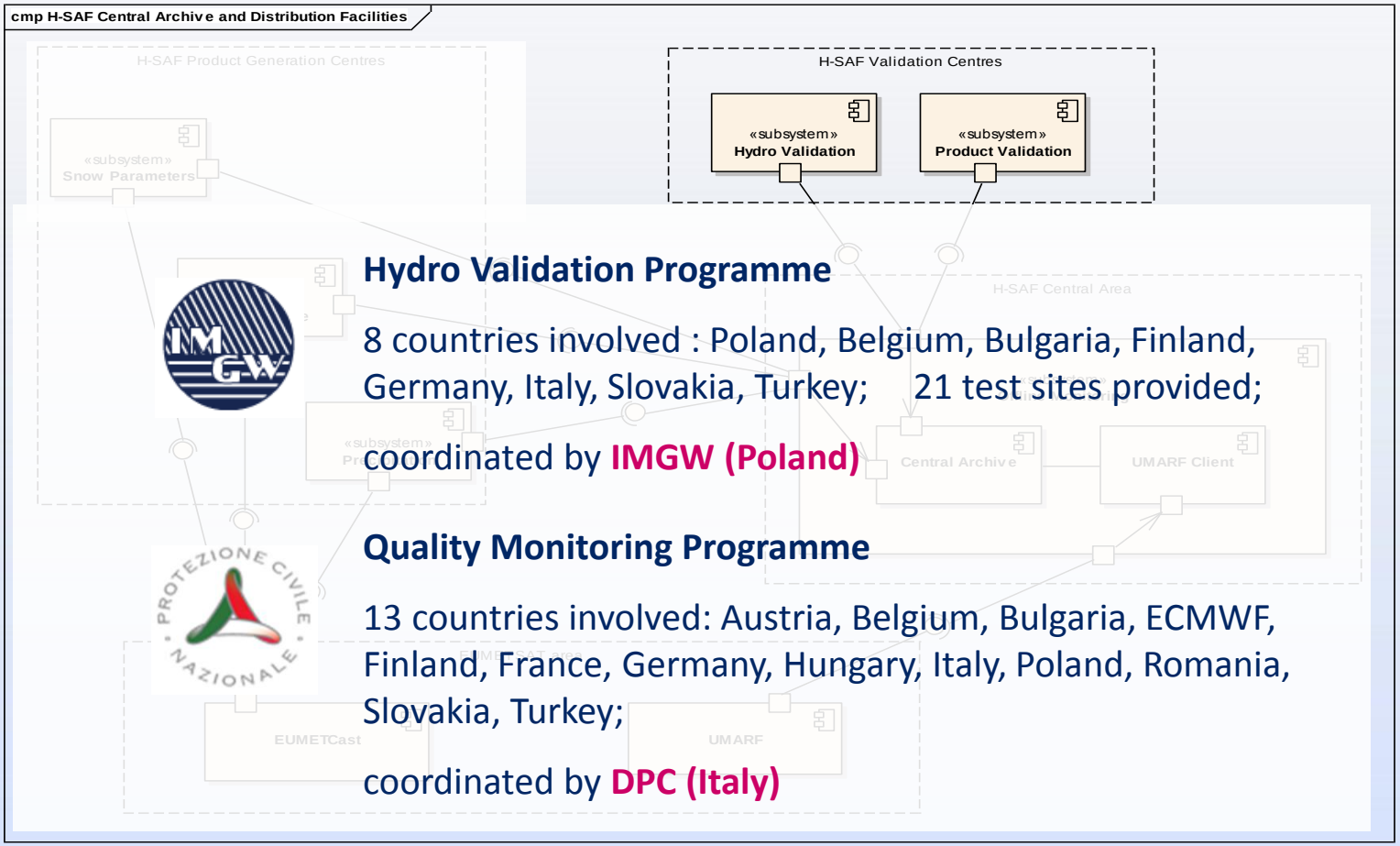
H-SAF Architecture

H-SAF Central Services



H-SAF Architecture

Validation Centers



Hydro Validation Programme

8 countries involved : Poland, Belgium, Bulgaria, Finland, Germany, Italy, Slovakia, Turkey; 21 test sites provided;

coordinated by **IMGW (Poland)**

Quality Monitoring Programme

13 countries involved: Austria, Belgium, Bulgaria, ECMWF, Finland, France, Germany, Hungary, Italy, Poland, Romania, Slovakia, Turkey;

coordinated by **DPC (Italy)**

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H-SAF Operational Products

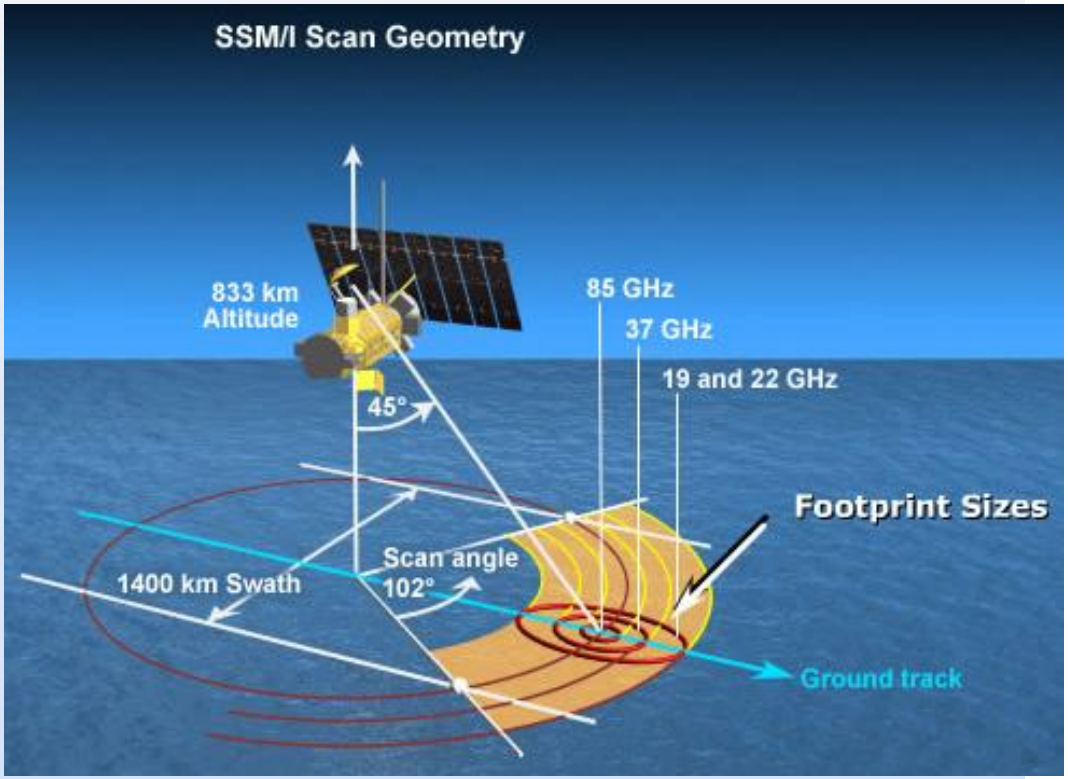
Precipitation Products

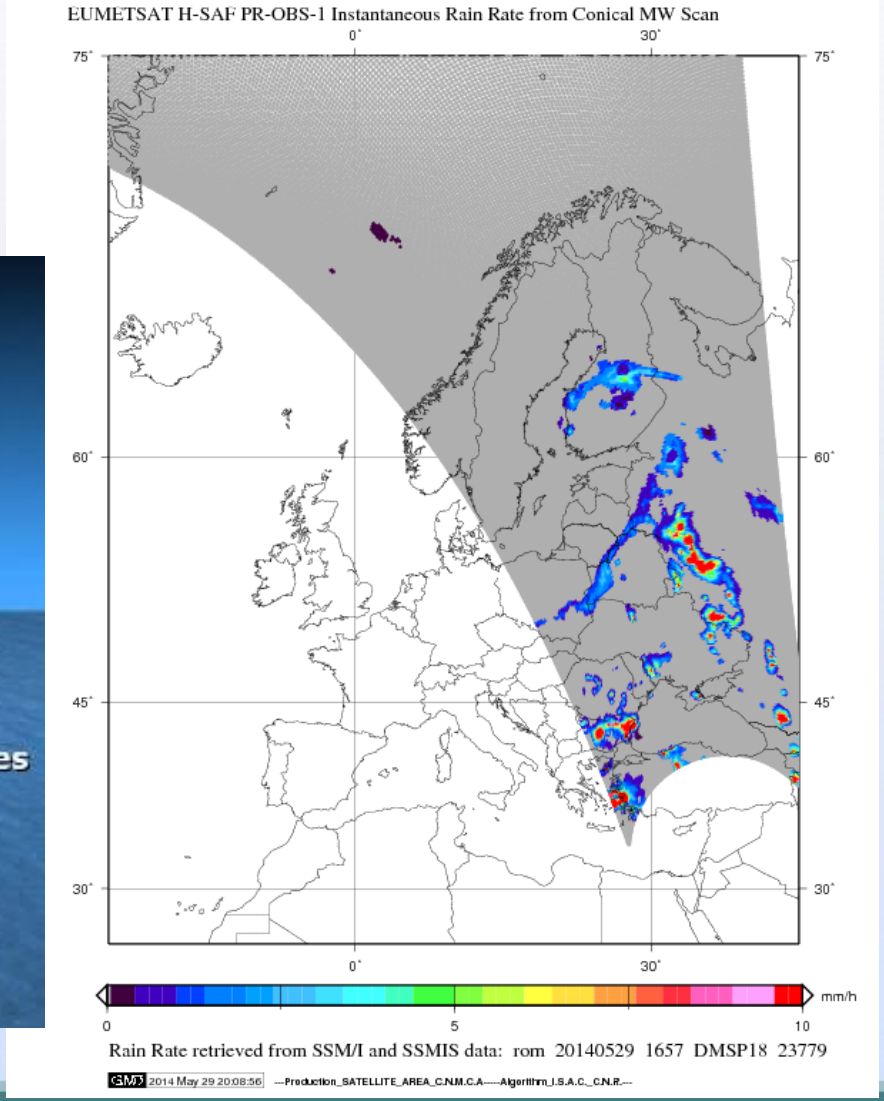
H01 PR-OBS-1	Precipitation rate at ground by MW conical scanners	Operational
H02A PR-OBS-2A	Precipitation rate at ground by MW cross-track scanners	Operational
H03A PR-OBS-3A	Precipitation rate at ground by GEO/IR supported by LEO/MW	Pre-operational
H04A PR-OBS-4A	Precipitation rate at ground by LEO/MW supported by GEO/IR	Pre-operational
H05A PR-OBS-5A	Accumulated precipitation at ground by blended MW and IR	Pre-operational

H-SAF Operational Products: examples

PR-OBS1 / H01

Precipitation from Microwave Conical scan satellite (SSMI/S)

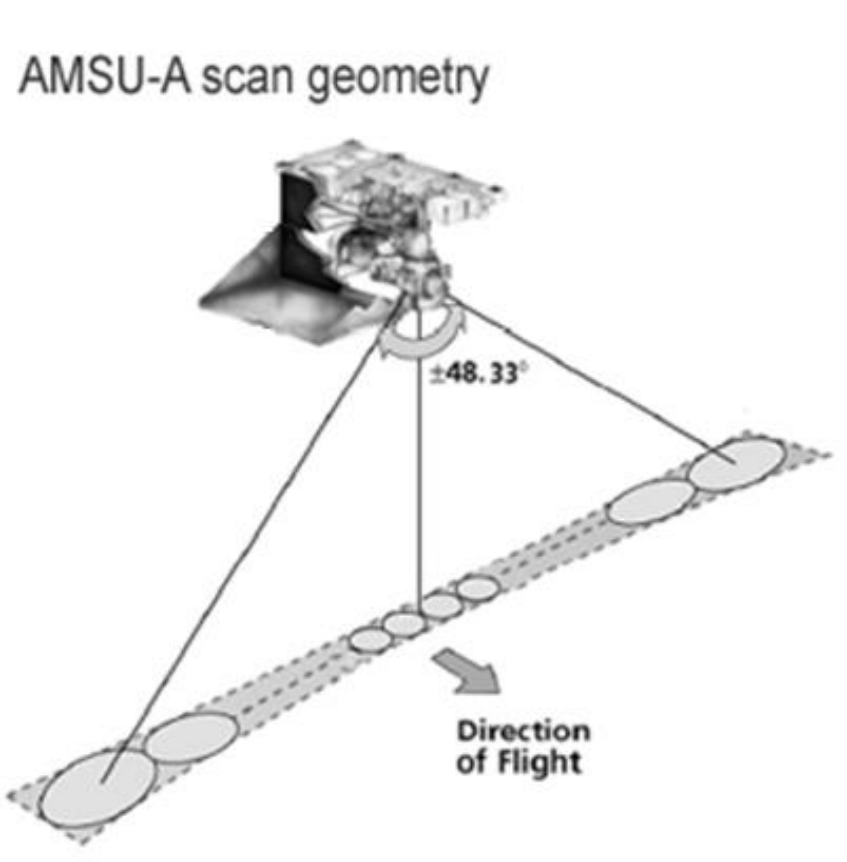


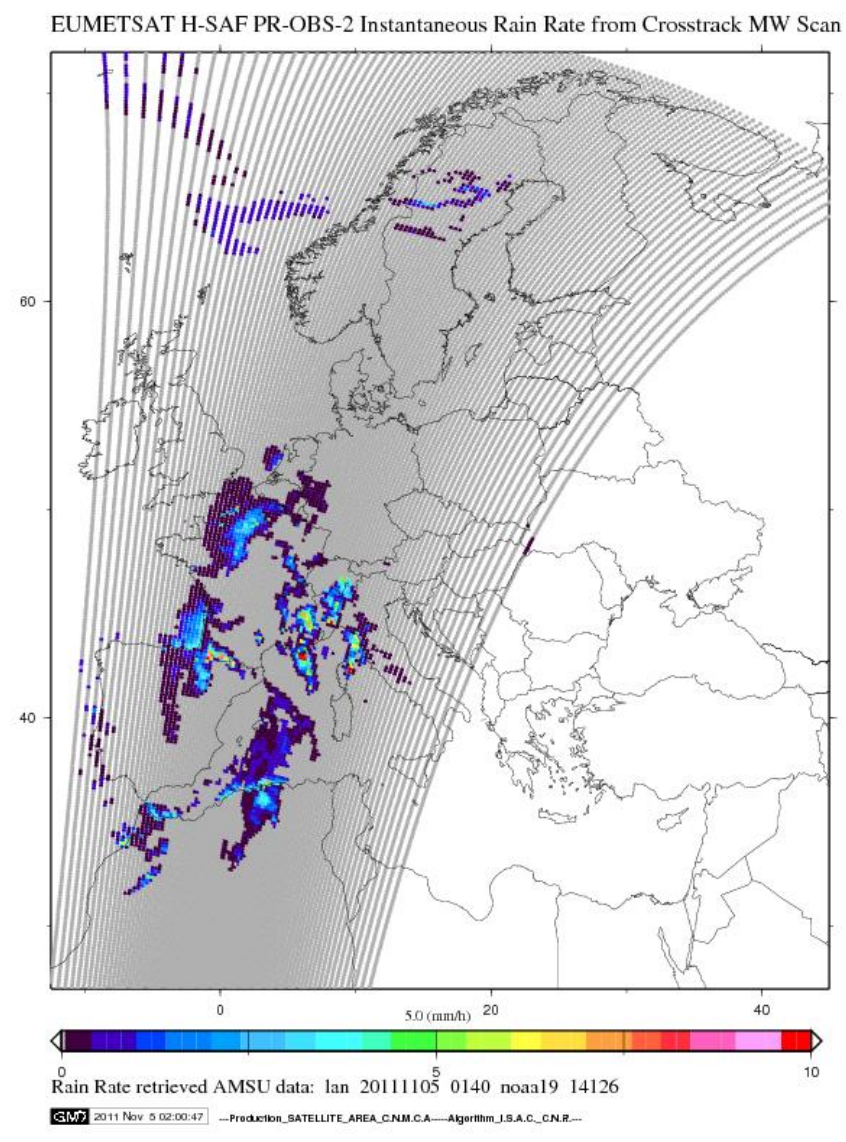


H-SAF Operational Products: examples

PR-OBS2 / H02

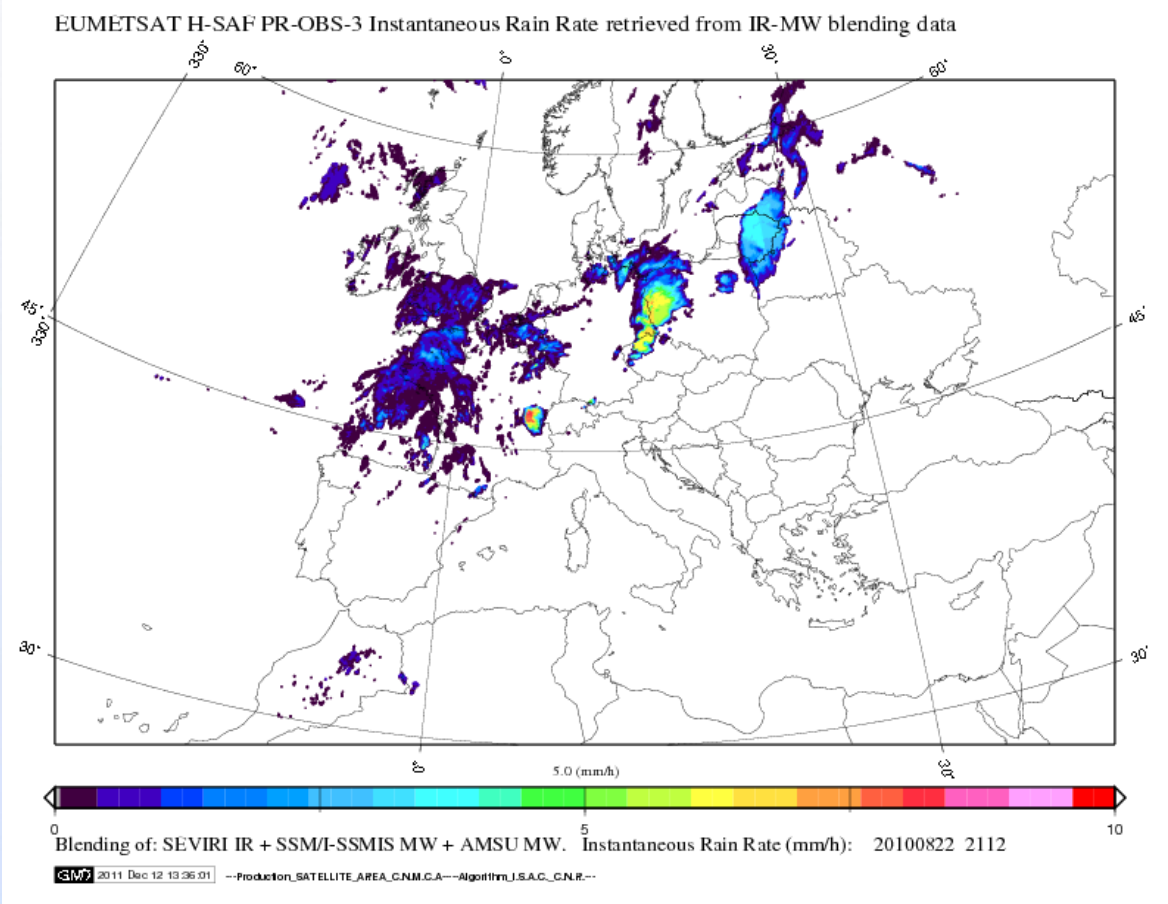
Precipitation from Microwave Cross scan satellite (AMSU/MHS)





H-SAF Operational Products: examples

PR-OBS3 / H03 Multi-platform algorithm: BLENDING Technique

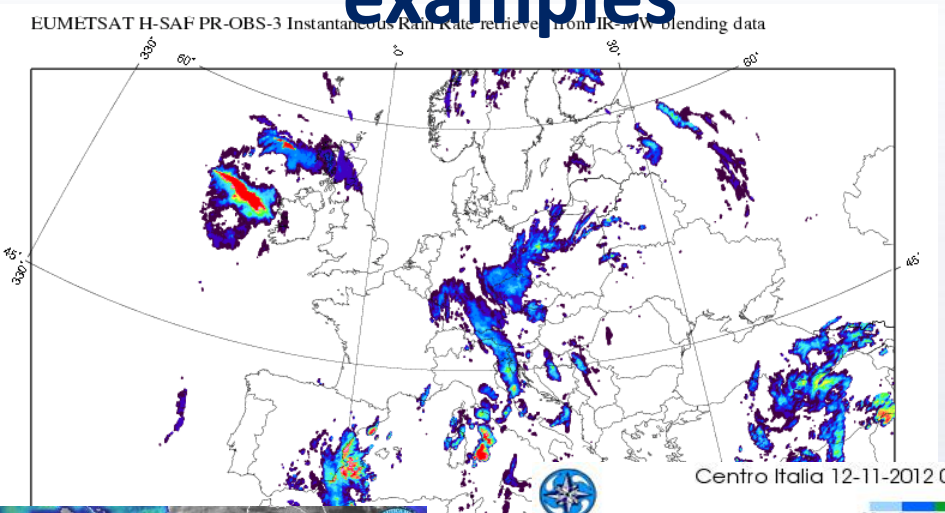


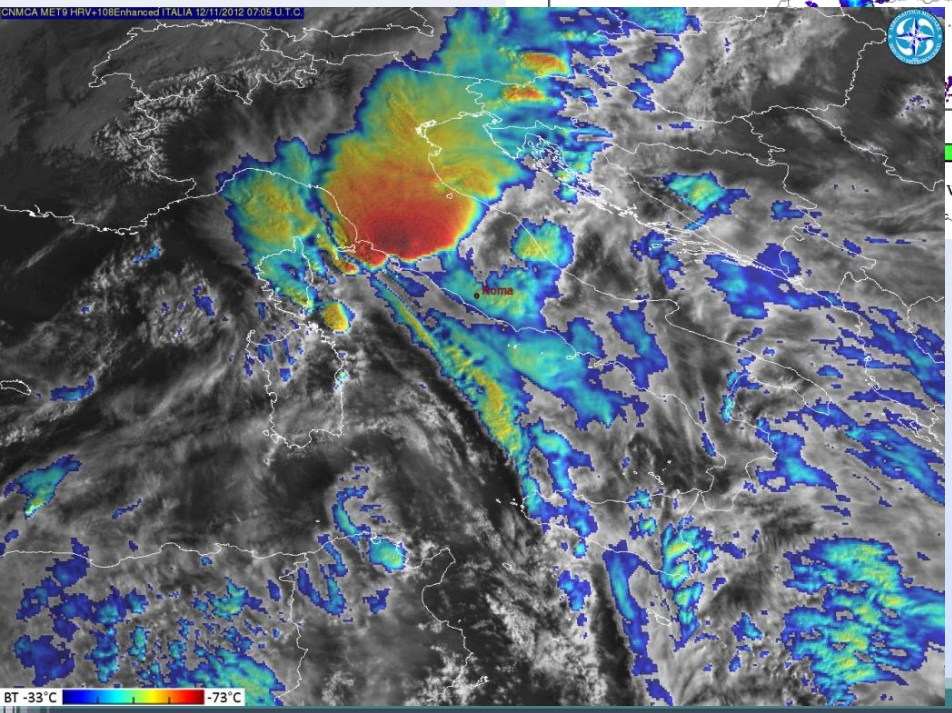
The "Rapid Update" tecnique allows to compute instantaneous rain intensities at the ground at the geostationary time-space scale (Turk et al. 2000, Torricella et al. 2007).

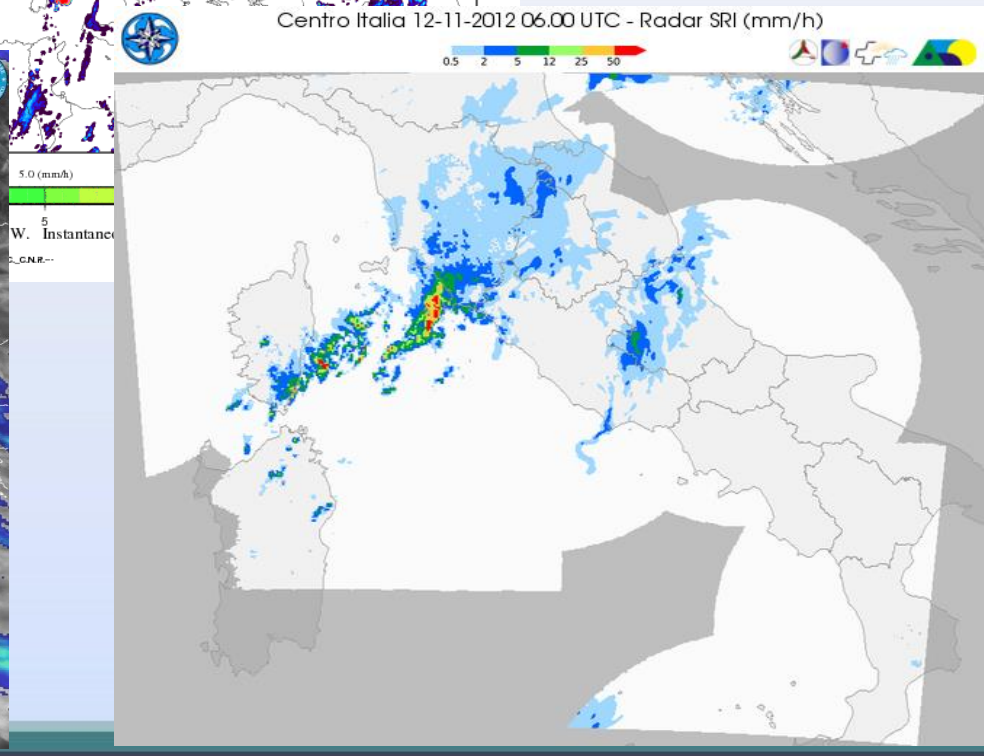
It is based on a blended MW-IR technique that correlates, by means of the statistical probability matching, brightness temperatures measured by the IR geostationary sensors and PMW-estimated precipitation rates at the ground.

H-SAF Operational Products: examples

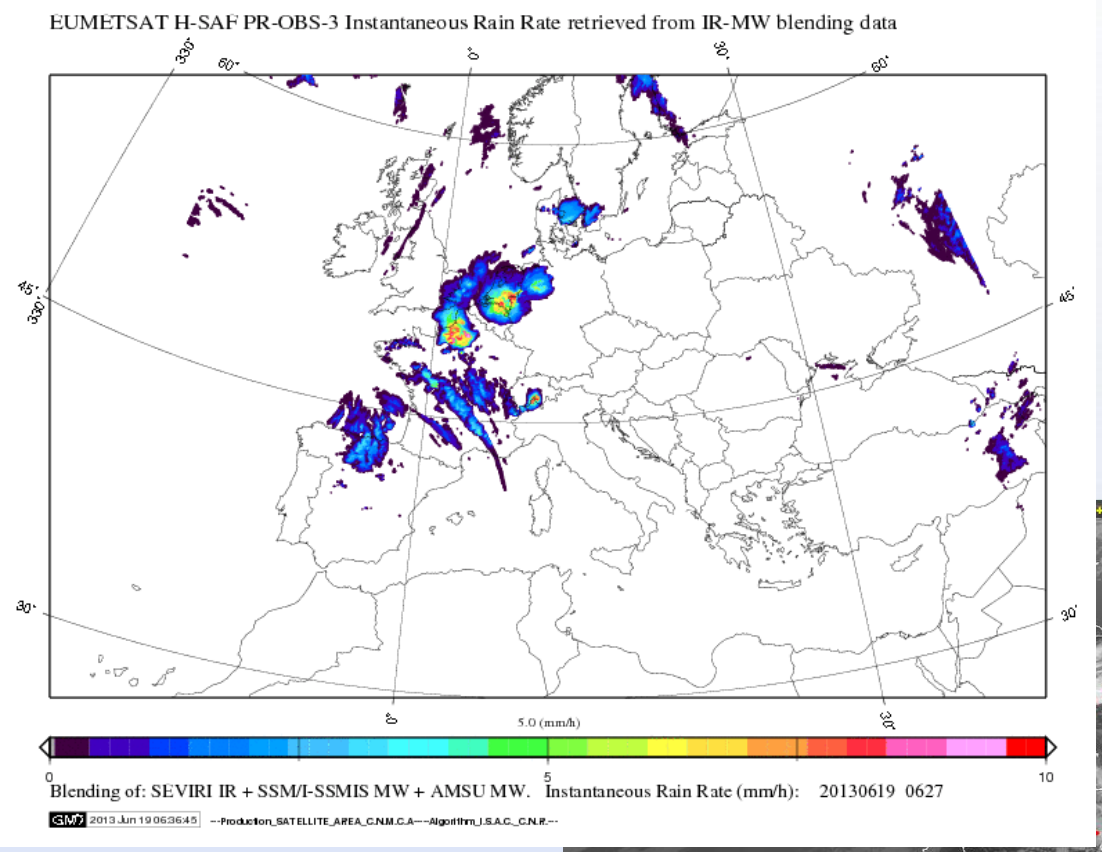
H03 Case study:
11-12 /11/ 2012
Grosseto (Italy)



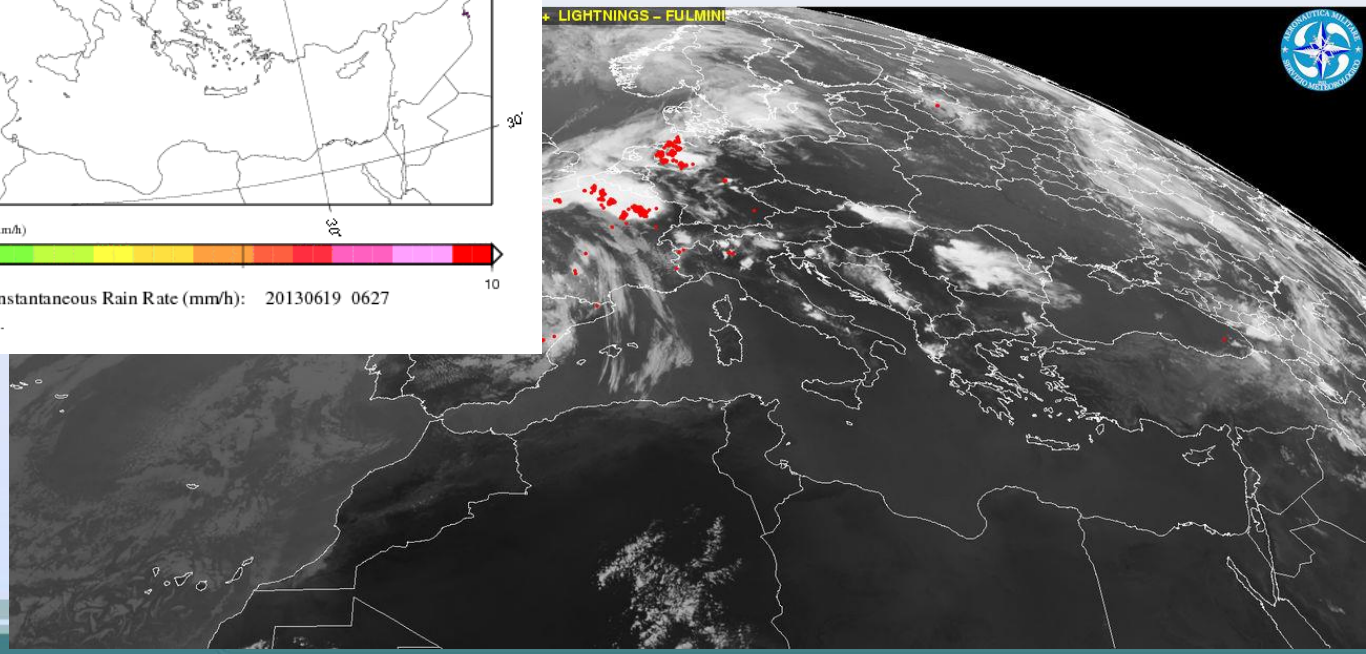




H-SAF Operational Products: examples

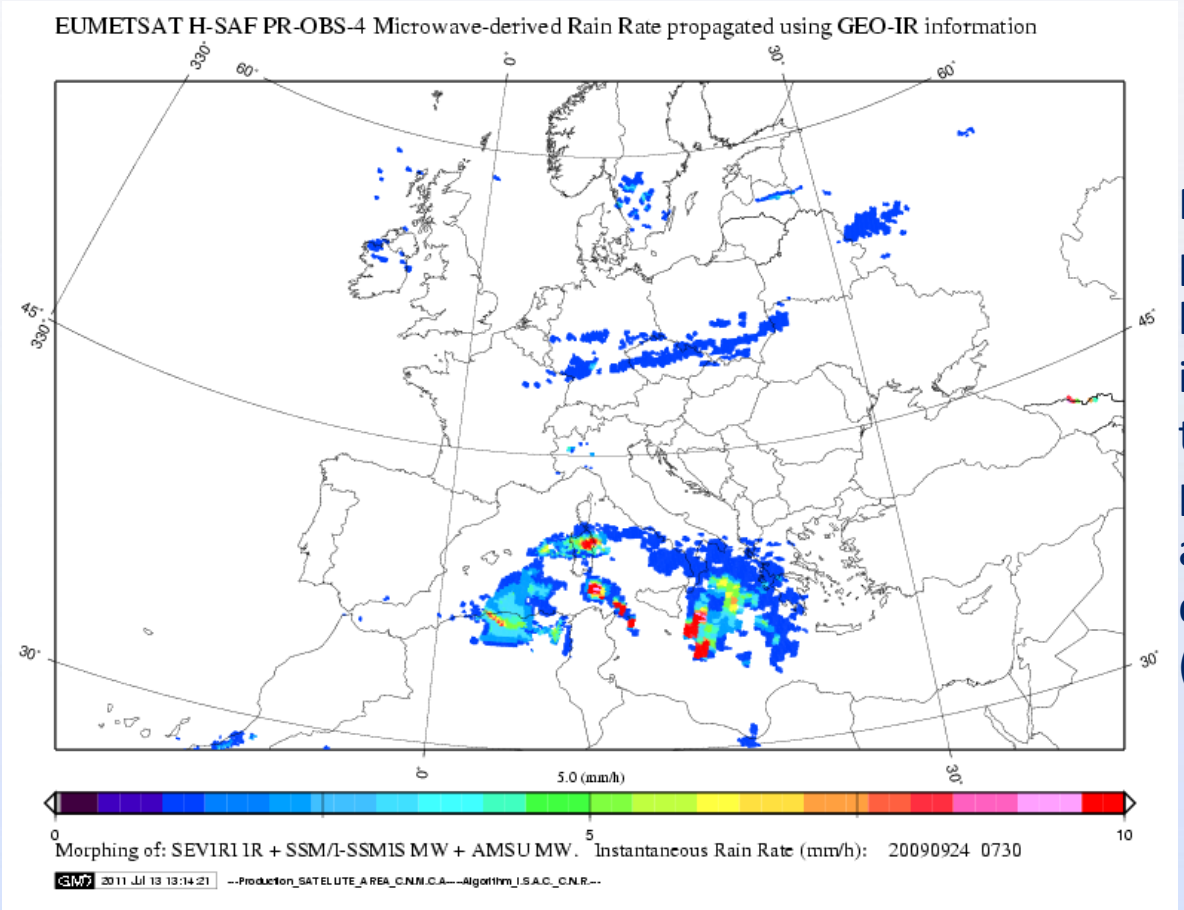


H03 Case study:
19 June 2013
Germany



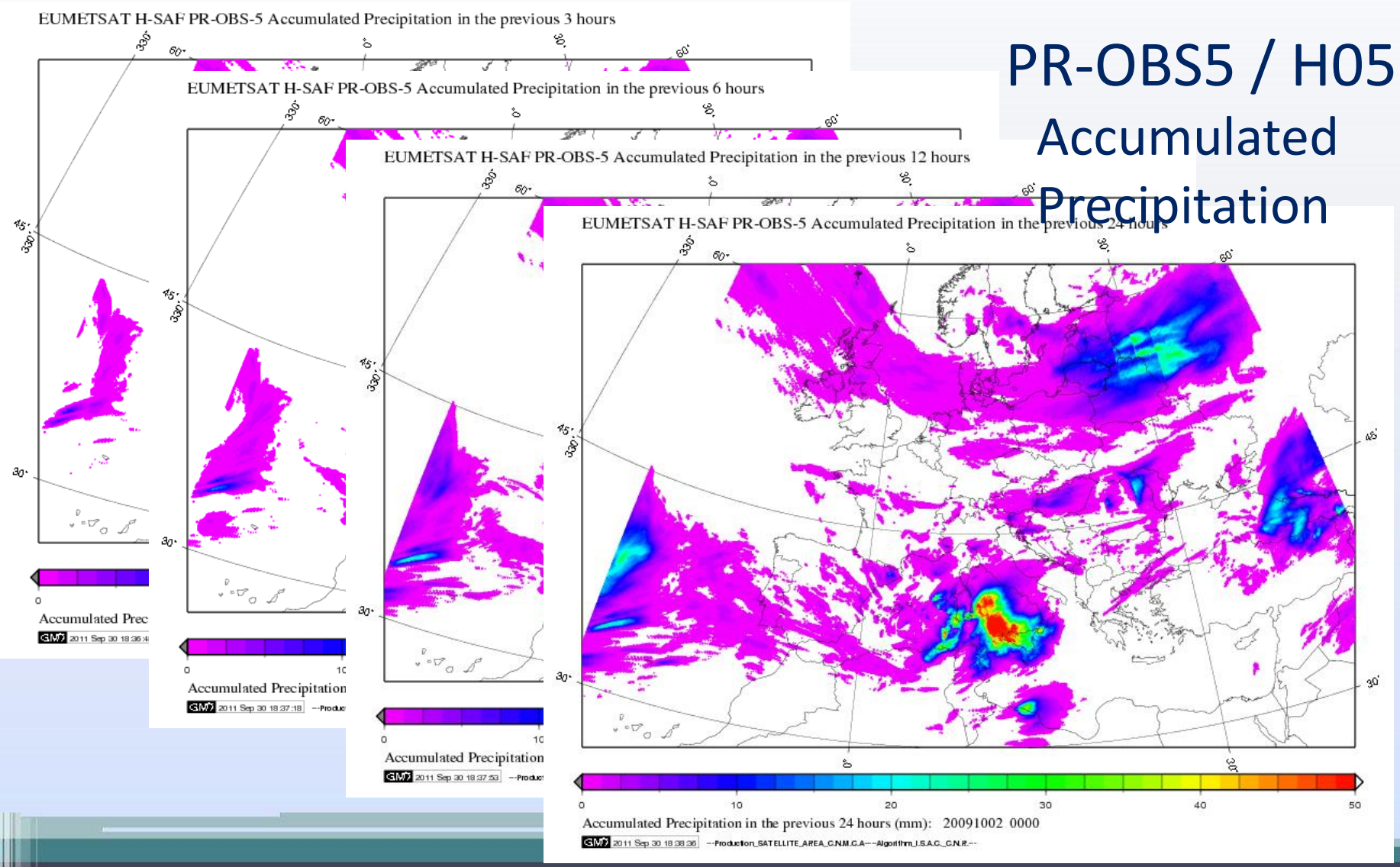
H-SAF Operational Products: examples

PR-OBS4 / H04 Multi-platform algorithm: MORPHING Technique



Propagation vector matrices are produced by computing spatial lag correlations over successive images of GEO/IR and then used to propagate the MW-derived precipitation estimates in time and space when updated MW data are unavailable
(OFFLINE PRODUCT)

H-SAF Operational Products: examples



PR-OBS5 / H05
Accumulated Precipitation

H-SAF Operational Products

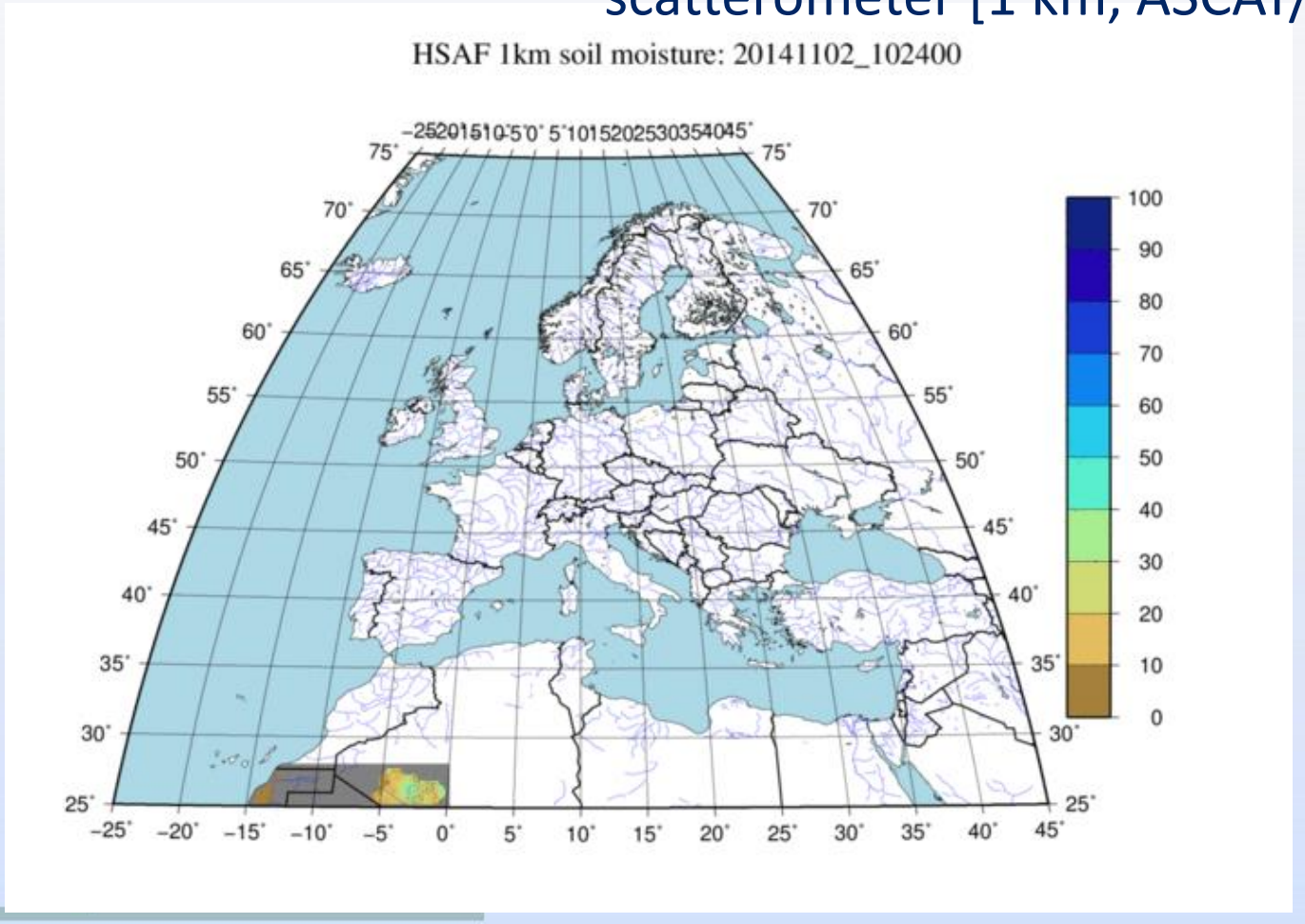
Soil Moisture Products

H08 SM-DIS-1	Small-scale surface soil moisture by radar scatterometer [1 km, ASCAT/SAR]	Pre-Operational
H14 PR-OBS-2	Soil Moisture Profile Index in the roots region retrieved by surface wetness scatterometer assimilation method	Operational

H-SAF Operational Products: examples

SM-DIS-1 / H08

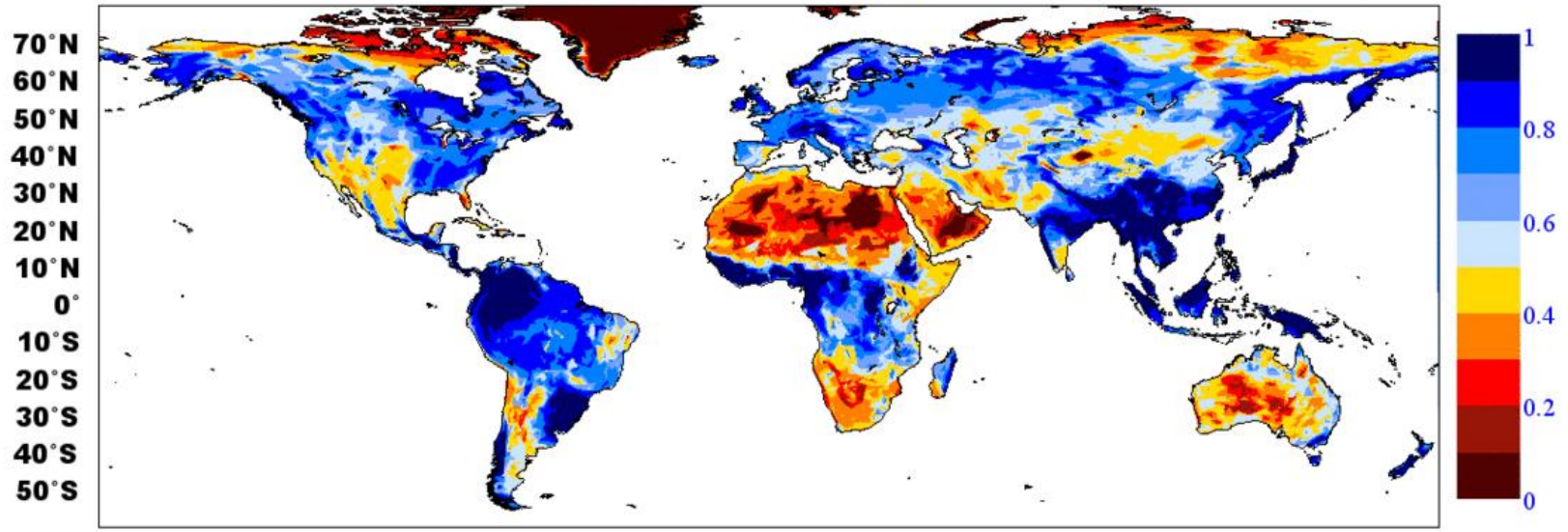
Small-scale surface soil moisture by radar scatterometer [1 km, ASCAT/SAR]



H-SAF Operational Products: examples

SM-DAS-2 / H14 Soil Moisture Profile Index in the roots region retrieved by surface wetness scatterometer assimilation method

]



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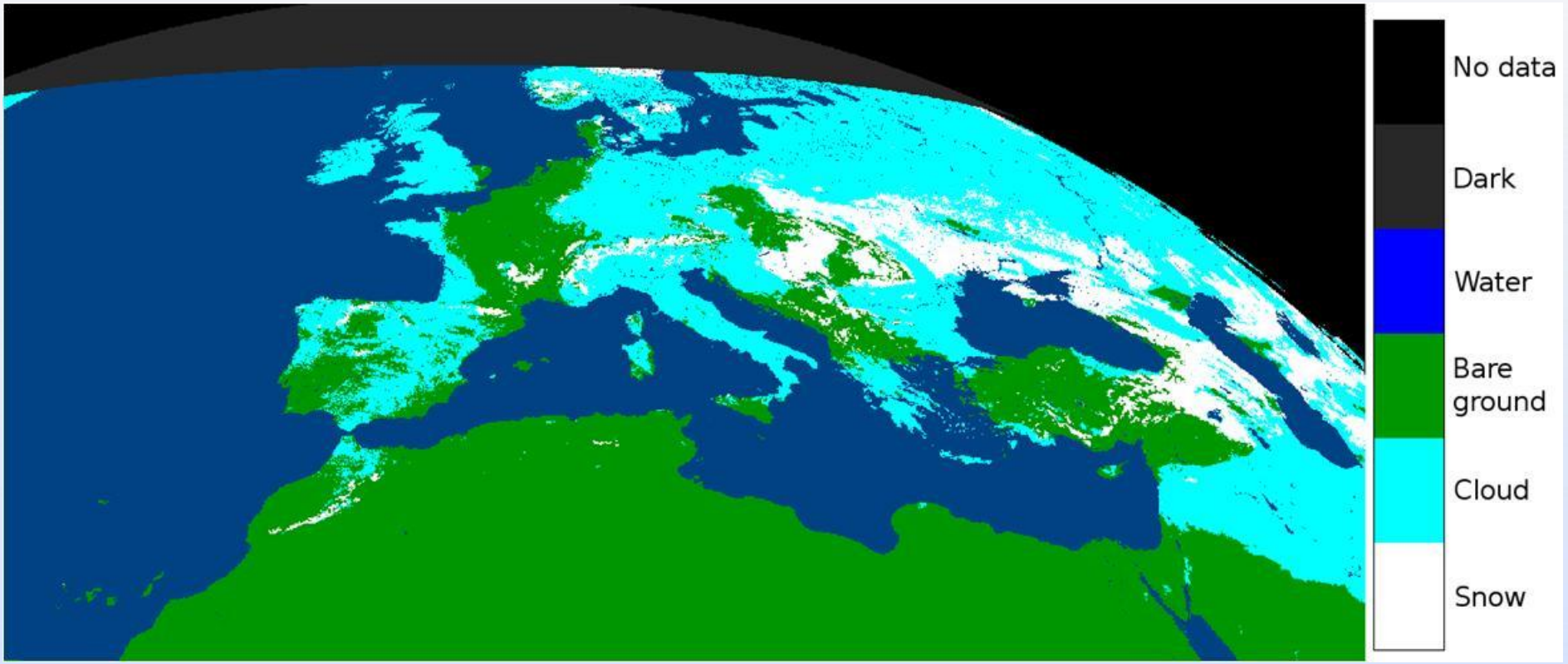
H-SAF Operational Products

Snow Products

H10 PR-OBS-1	Snow detection (snow mask) by VIS/IR radiometry	Operational
H11 PR-OBS-2	Snow status (dry/wet) by MW radiometry	Pre-Operational
H12 PR-OBS-3	Effective snow cover by VIS/IR radiometry	Operational
H13 PR-OBS-4	Snow water equivalent by MW radiometry	Pre-Operational

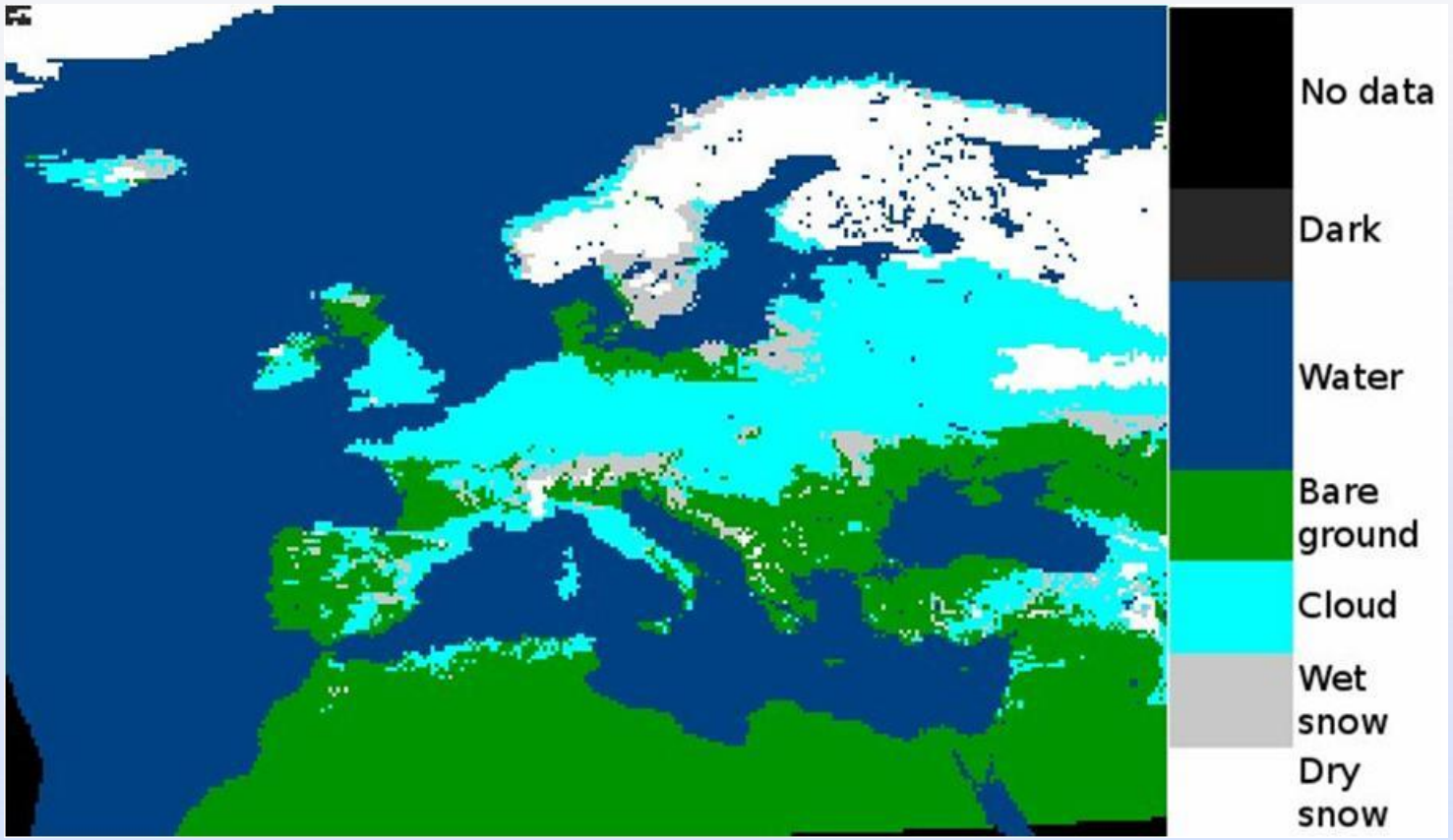
H-SAF Operational Products: examples

SN-OBS-1 / H10 Snow detection (snow mask) by VIS/IR



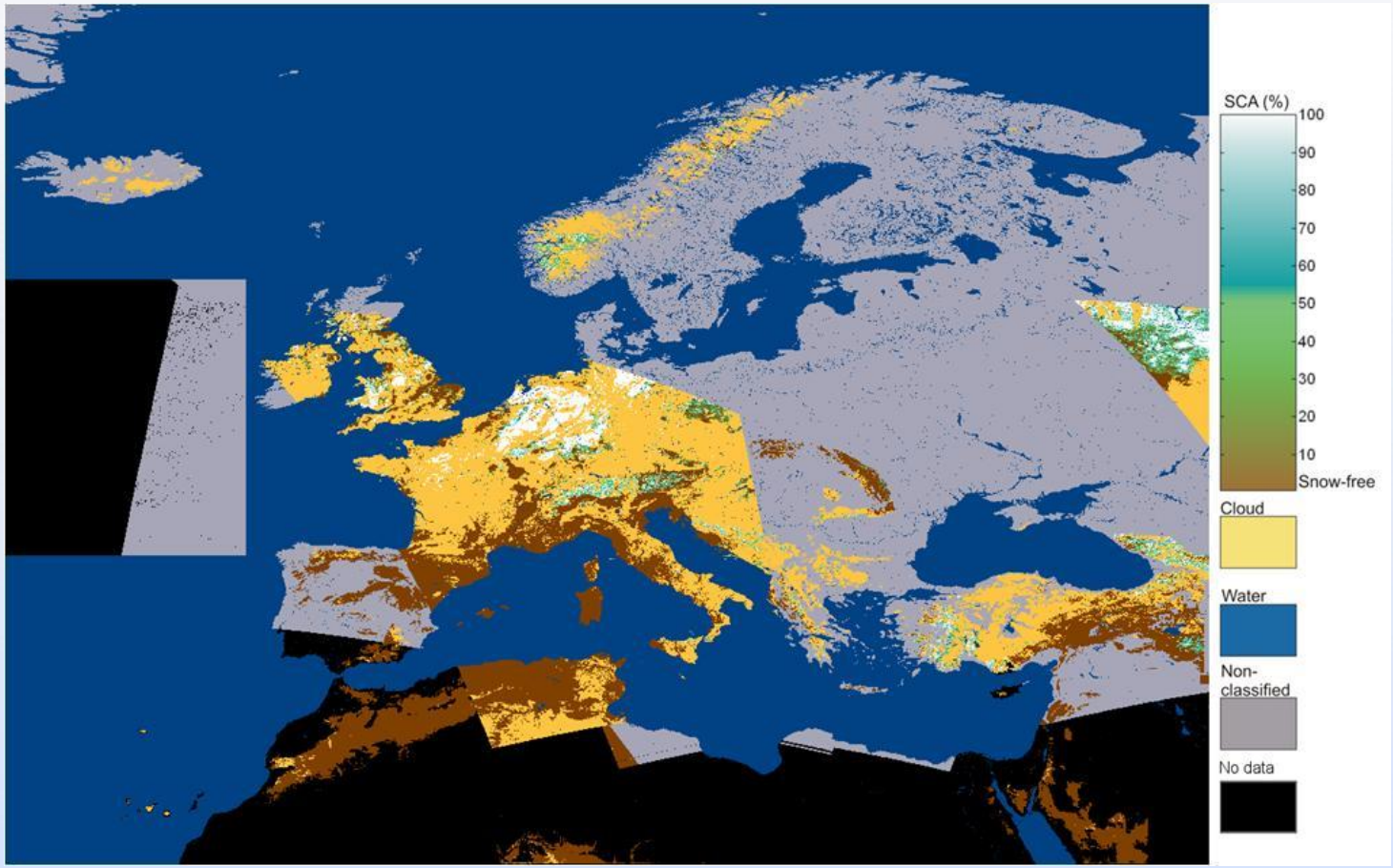
H-SAF Operational Products: examples

SN-OBS-2 / H11 Snow status (dry/wet) by MW



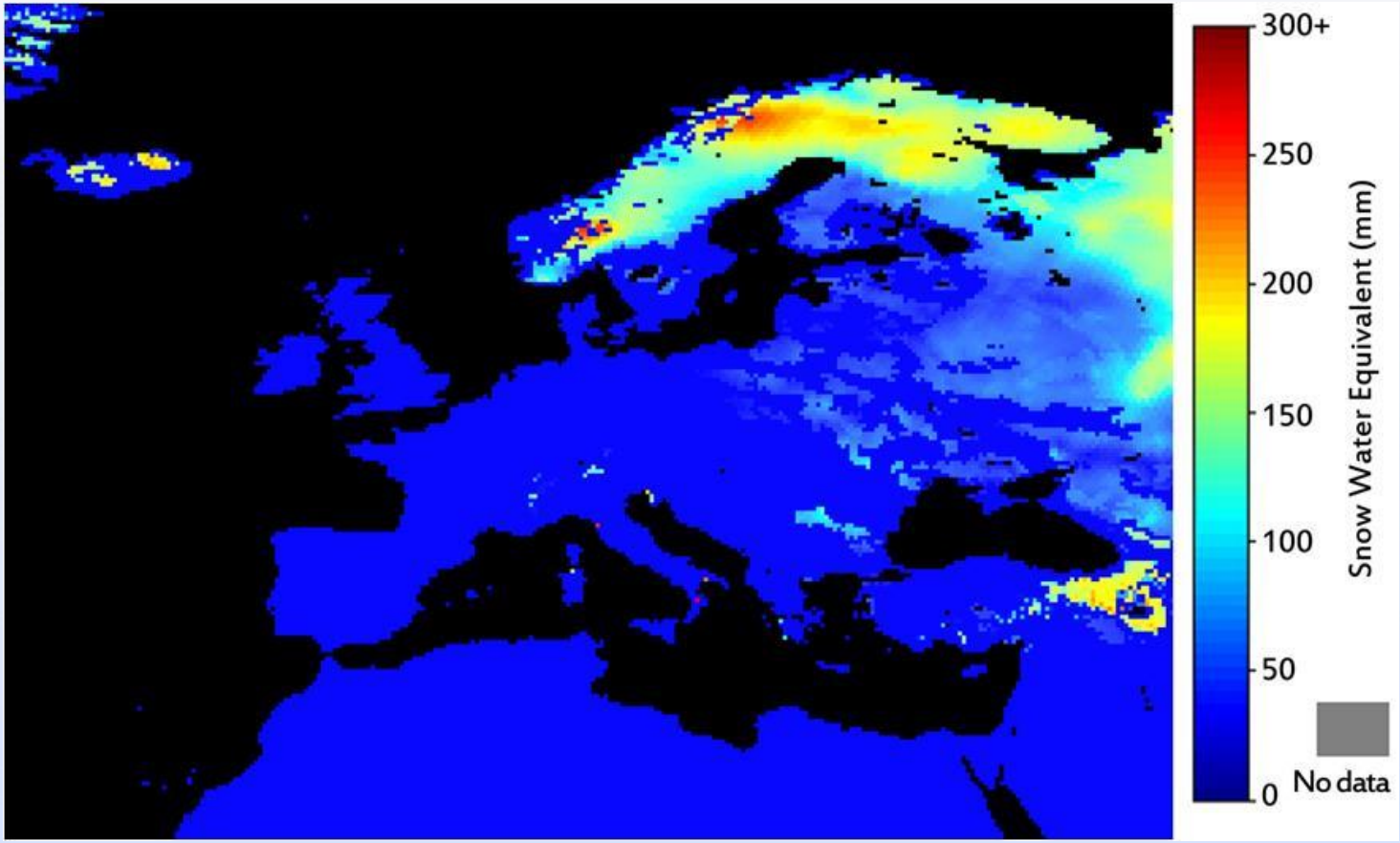
H-SAF Operational Products: examples

SN-OBS-3 / H12 Effective snow cover by VIS/IR



H-SAF Operational Products: examples

SN-OBS-4 / H13 Snow water equivalent by MW



In development Products

Enlargement to Full Disc

H02B PR-OBS-2B	Precipitation rate at ground by MW cross-track scanners	Algorithms to be assessed by end 2014 Expected Operations in 2016
H03B PR-OBS-3B	Precipitation rate at ground by GEO/IR supported by LEO/MW	
H04B PR-OBS-4B	Precipitation rate at ground by LEO/MW supported by GEO/IR	
H05B PR-OBS-5B	Accumulated precipitation at ground by blended MW and IR	

In development Products

New Precipitation Products

H15	Blended SEVIRI Convection area / LEO MW Convective Precipitation	Algorithms assessment expected in 2015 Expected Operations in 2016
H17	Precipitation rate at ground by MW conical scanners (GCOM-W1 AMSR2)	
H18	Precipitation rate at ground by MW cross-track scanners (Suomi NPP ATMS)	
H19	Rainfall intensity from GMI (GPM- Microwave Imager)	
H20	Rainfall intensity from GMI (GPM - Microwave Imager) [Neural Network] algorithm]	
H21	High frequency MW delineation of cloud areas with new development of hydrometeors (MHS)	
H22	Snowfall intensity (MHS)	

In development Products

MTG-based Products

H40 PR-OBS-3 -FCI	Precipitation rate at ground by GEO/IR supported by LEO/MW and MTG FCI	Algorithms assessment expected in 2016 Expected Operations in CDOP3 (next phase)
H41 PR-OBS-4-FCI	Precipitation rate at ground by LEO/MW supported by GEO/IR (with flag for phase) and MTG FCI	
H42 PR-OBS-5-FCI	Accumulated precipitation at ground by blended MW and IR and MTG FCI	
H50 PR-OBS-11	Rainfall intensity from MTG LI	
H43 SN-OBS-0G-FCI	Snow detection (snow mask) by VIS/NIR of MTG FCI	

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In development Products

Soil Moisture: Large Scale improvement and Time Series

H16 SM-OBS-3	Large-scale surface soil moisture by radar scatterometer (25 km, ASCAT)	Expected operations in 2015
H02 PR-OBS-2	ASCAT Large-scale surface soil moisture (25 Km) - Time Series	Released as Demonstrational
H03 PR-OBS-3	Soil Wetness Index in the roots region by scatterometer assimilation in a NWP model - Time Series	Expected release in 2016

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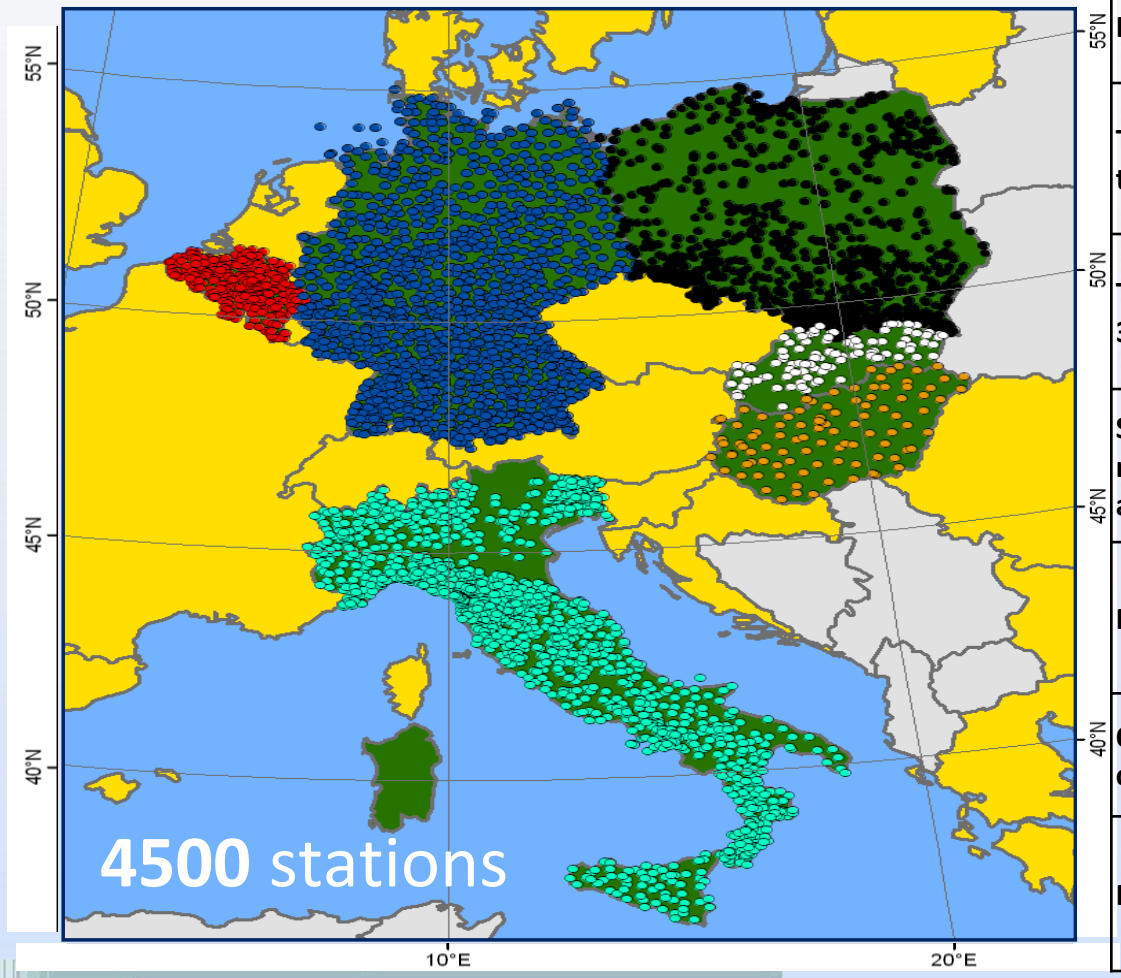
Support to Operational Hydrology and Water Management

Quality Monitoring and Hydrovalidation Programmes

- Quality Monitoring Programme provides a continuous assessment of the products quality and performances by evaluating **statistical scores** and case study analysis on the base of **comparison between satellite products and ground data;**
- Hydrovalidation Programme provides the impact with hydrological applications by **interfacing with hydrological models**, performed both through near real time and off-line impact studies

Quality Monitoring Programme

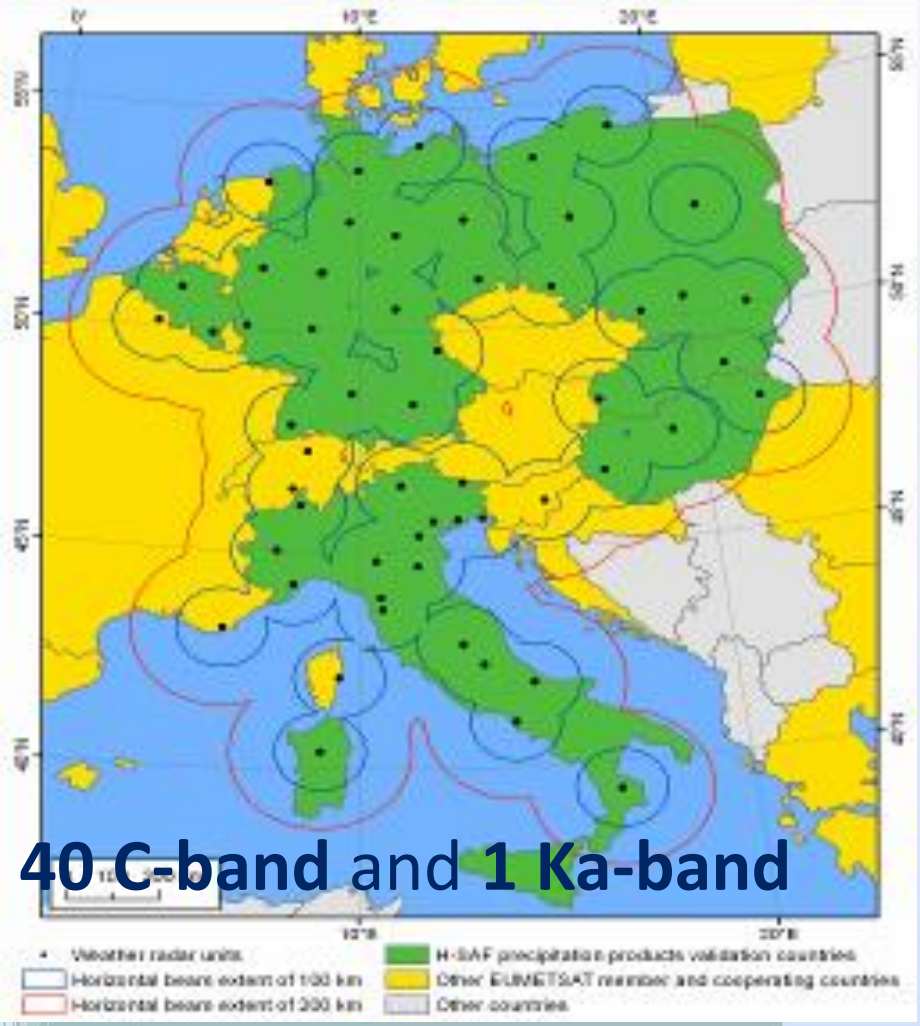
The Raingauge Network



Data Sources	Raingauges
Instrument characteristics	Telemetric and mechanic
Time domain (near real time/ case studies)	Near real time, case studies
Time resolution (15 min, 30 min)	10 – 30 min (telemetric), 3 – 24 h (mechanic)
Spatial distribution (whole national territory/ limited area)	Whole national territory
Number of station	~390 mechanic (RMI) + 12 telemetric (RMI) + 4160 telemetric (SETHY)
Operational/ for research only	Operational (RMI) + research (other networks)
Data quality check	Telemetric: automatically checked / mechanic: autom. + manually checked

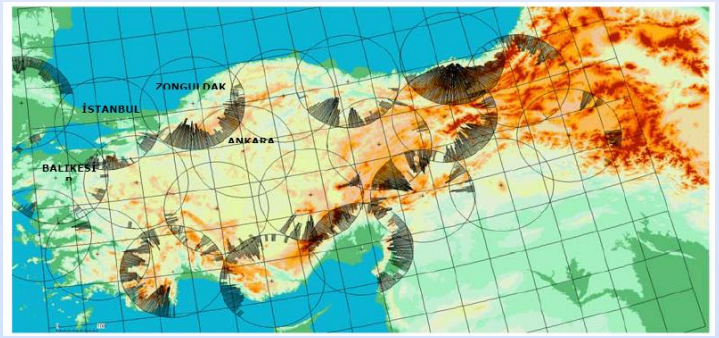
Quality Monitoring Programme

The Radar Network



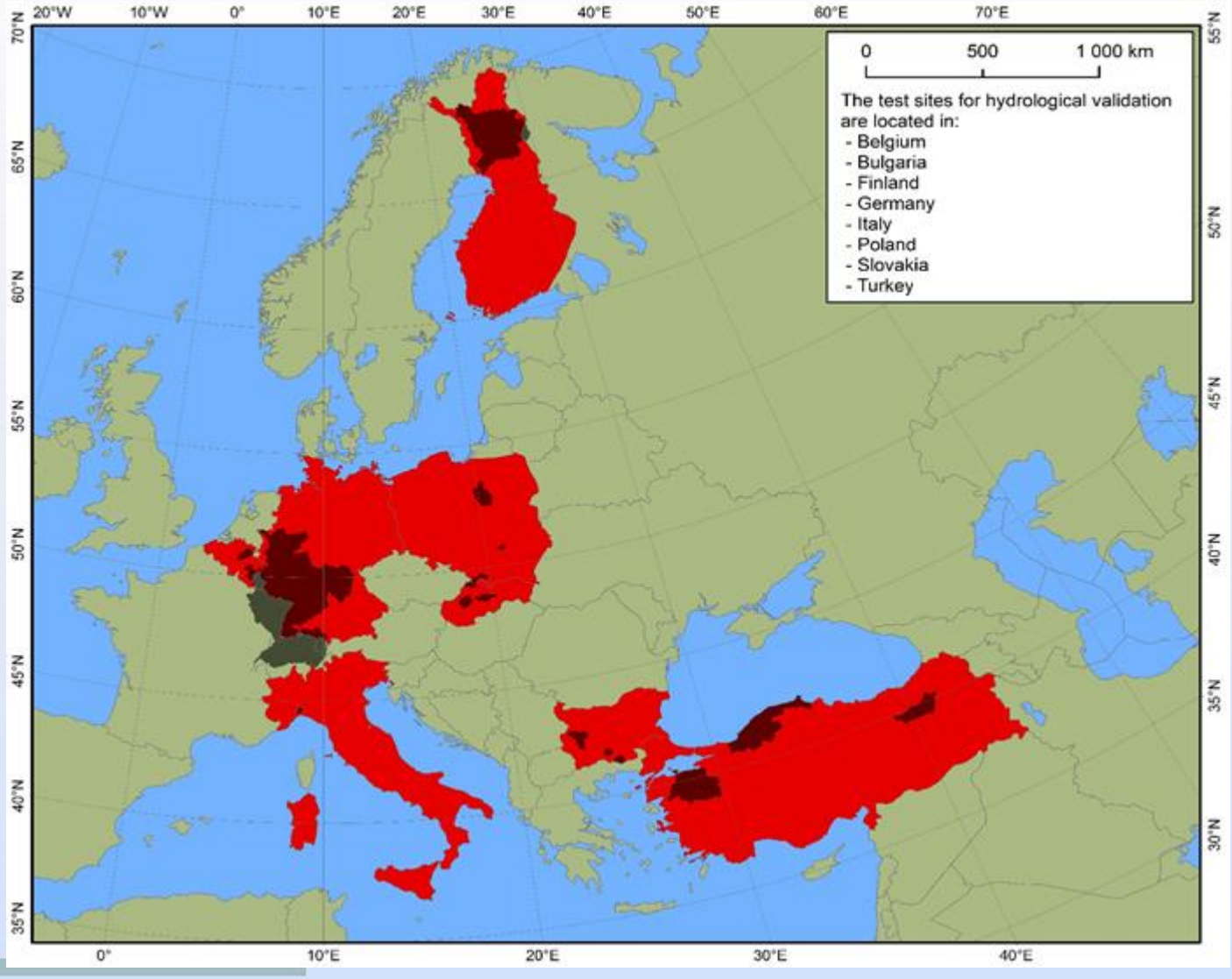
40 C-band and **1 Ka-band**

Data Sources	Radars
Instrument characteristics	Beam width ~1°, max range ~150 Km, 250m, C-band, single polarization, Doppler polarimetric
Time domain	Near real time/ case studies
Time resolution	5 min, 15 min, 30 min, 1h, 24h
Spatial distribution	Whole national territory
Number of station	40 C-band +1 Ka-band



Hydrovalidation Programme

The Test Sites



Central Services - Archiving

H-SAF Products are **centrally collected** by NRT ingestion from peripherals to Central Site at CNMCA.

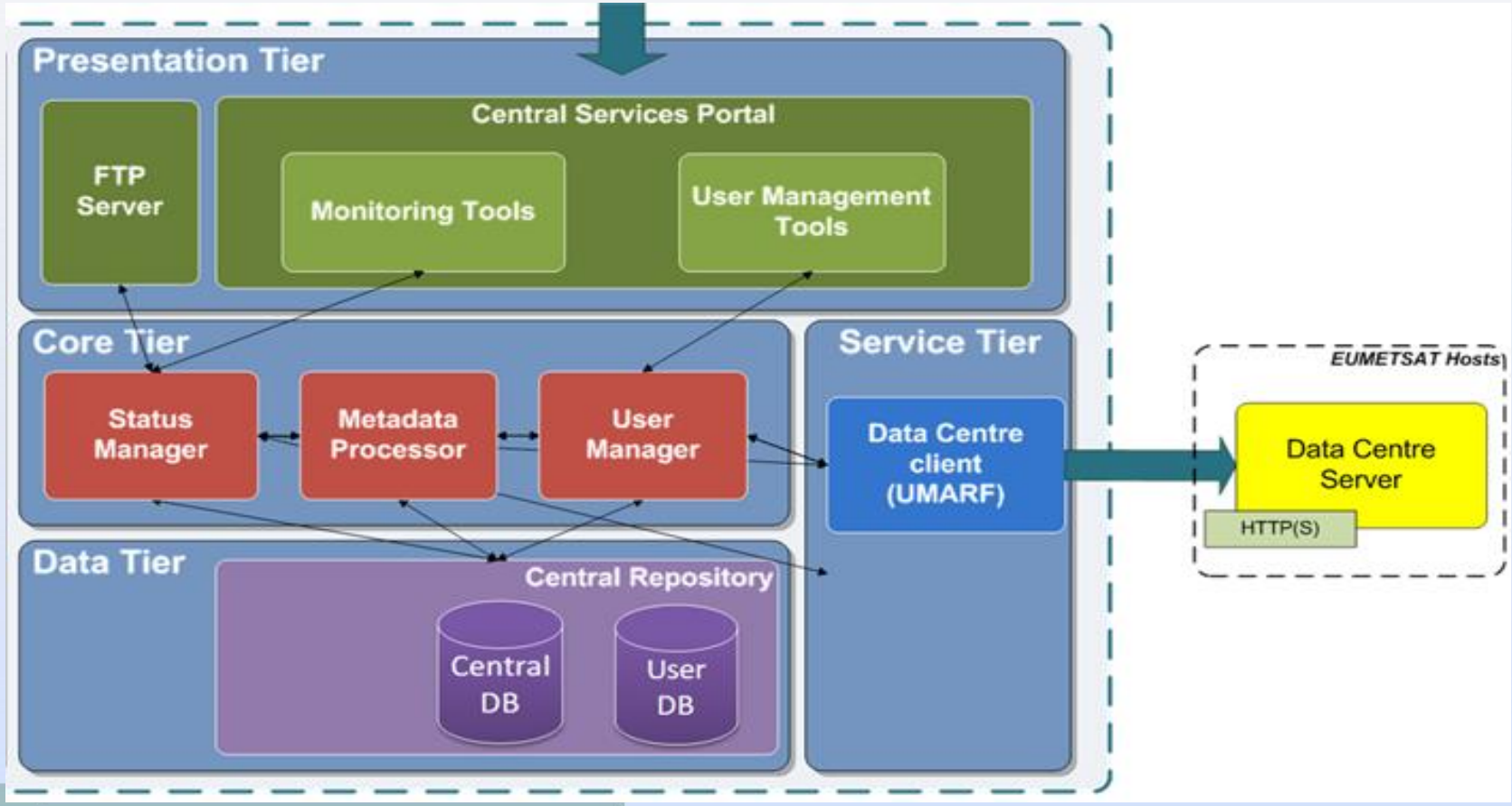
NRT availability requirement guaranteed to end users.

Products are maintained in two different storage areas:

- **On-line archive**: Latest 60 days of production constantly available (24 / 7). Immediate access to selected items, for registered users.
- **Off-line archive** : Entire production since the beginning of H-SAF operations. Items available through Order Management system, made available on demand in a FTP area for a limited temporal window

Central Services - Dissemination

Dissemination of products foresees use of both **EUMETSAT Data Delivery Service (EUMETCast)** and **ftp dedicated server** by H-SAF Central Facilities



Central Services – Operations Monitoring Tools

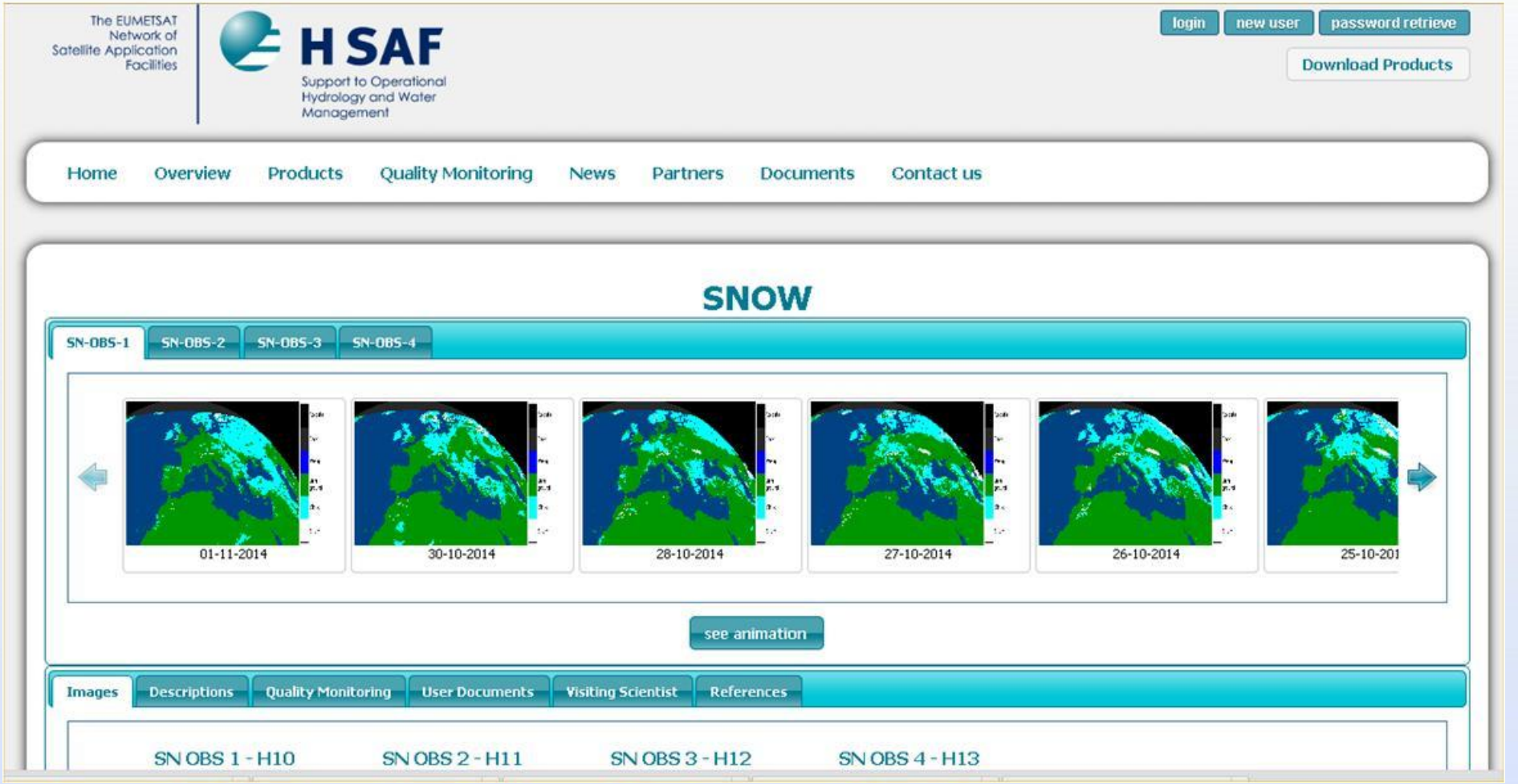
Automatic tools at Central Site continuously monitors: **production**, **ingestion** and **dissemination**

Main functionalities of monitoring:

- Central Ingestion of products coming from distributed production centers
- Product chains status
- EUMETCast broadcasting status
- User registration
- Product performances

Alerting messages in case of anomalies.

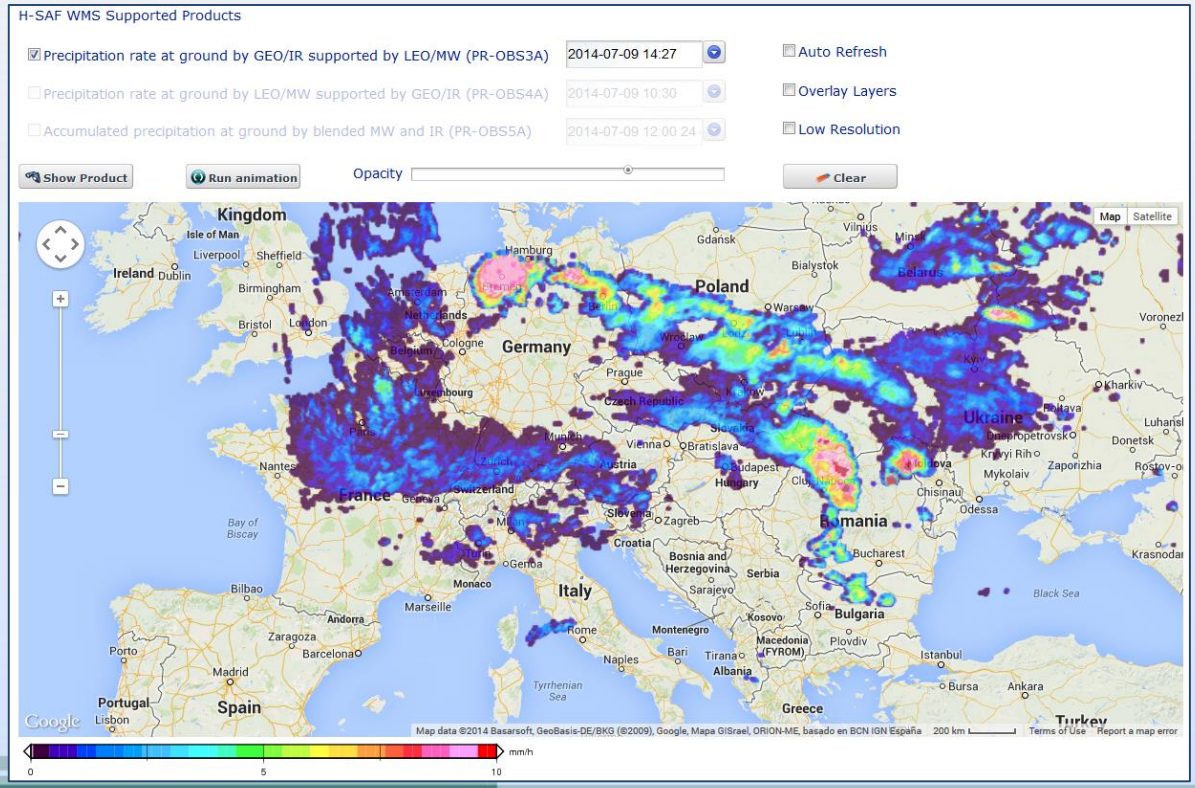
User Services – Website



hsaf.meteoam.it

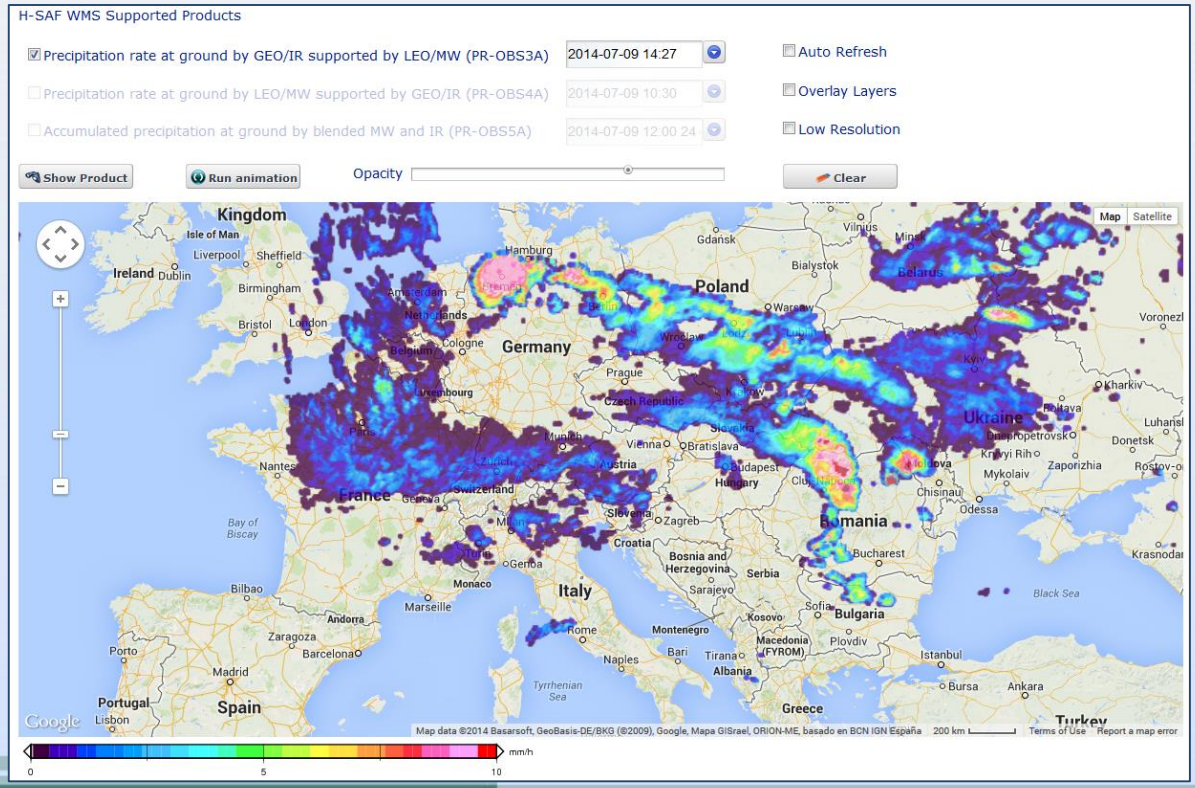
User Services – Map Tool

The **Map Tool** is a web application that provides an easy to use tool - you only need a web browser and a good internet connection - to display a set of precipitation products (H03, H04 and H05) on a **georeferenced map**.



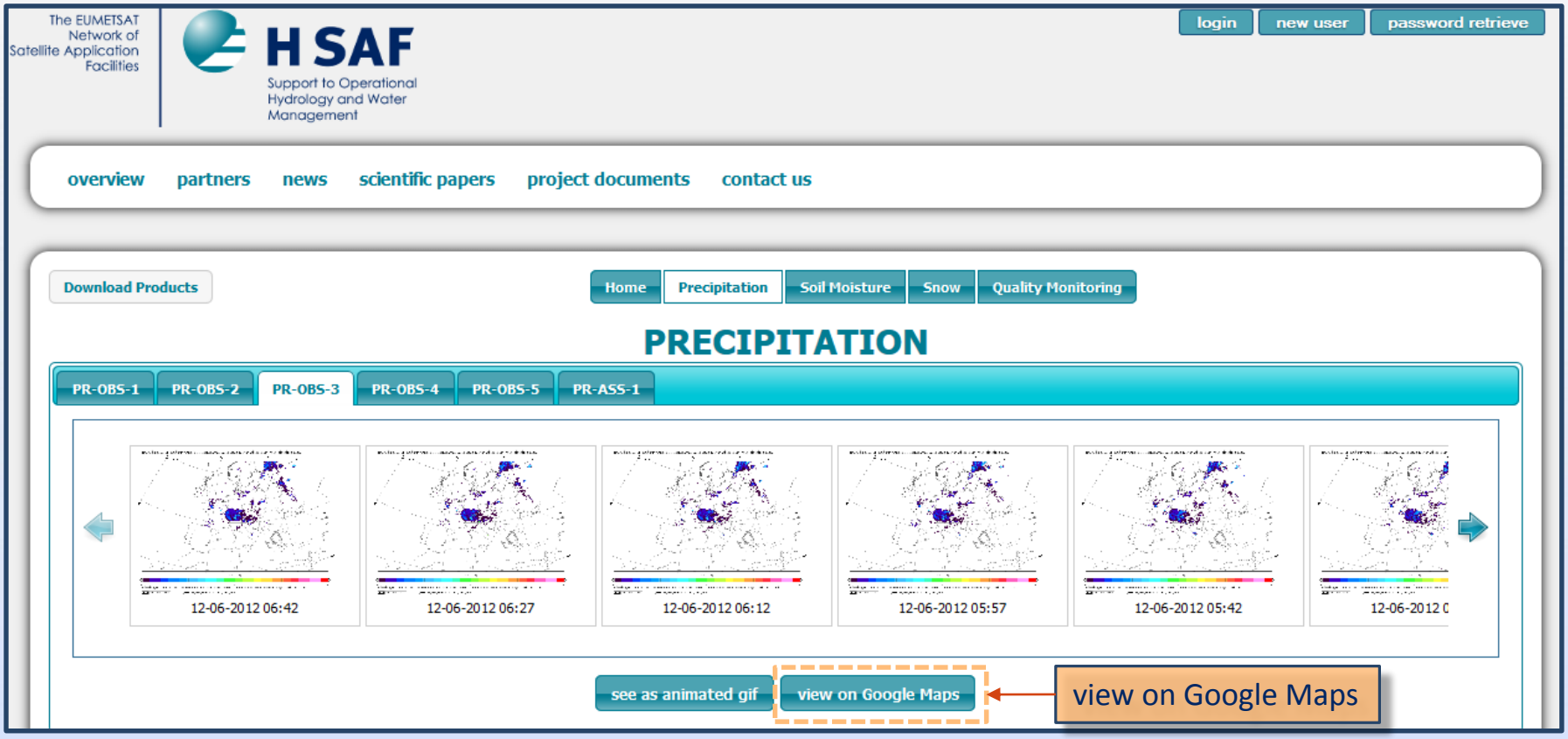
User Services – Map Tool

The **MAP Tool** is also an operational tool that allows users to monitor the current status of rainfall on the ground (H03, H04) or the status of the accumulated precipitation (H05), updating automatically the map with the last H-SAF product available.



User Services – Map Tool

The **MAP Tool** can be reached from the official website of HSAF hsaf.meteoam.it after registration.



Maps Viewer - H-SAF Cen...

hsaf.cs.telespazio.it/web/hsaf/maps-viewer

Google

MAPS TOOL (Beta v0.9.3)

H-SAF WMS Supported Products

- [x] Precipitation rate at ground by GEO/IR supported by LEO/MW (PR-OBS3A) — 2014-10-27 14:27
- [ ] Precipitation rate at ground by LEO/MW supported by GEO/IR (PR-OBS4A) — 2014-10-28 04:30
- [ ] Accumulated precipitation at ground by blended MW and IR (PR-OBS5A) — 27 12:00 24 cumulated

- [ ] Auto Refresh
- [ ] Overlay Layers
- [ ] Low Resolution

Show Product | Run animation | Opacity | Clear

H SAF
Support to Operational Hydrology and Water Management

Thank you for your attention