SAF in support to NoWCasting & Very Short Range Forecasting

PEP 25 years

Valladolid, 7-8 May 2005

P. Fernández

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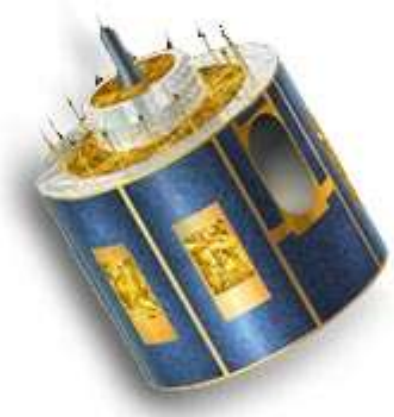
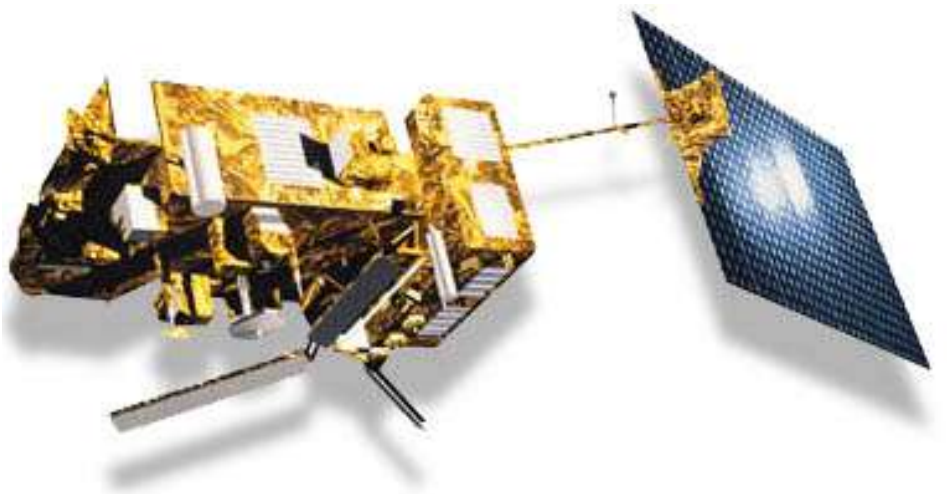
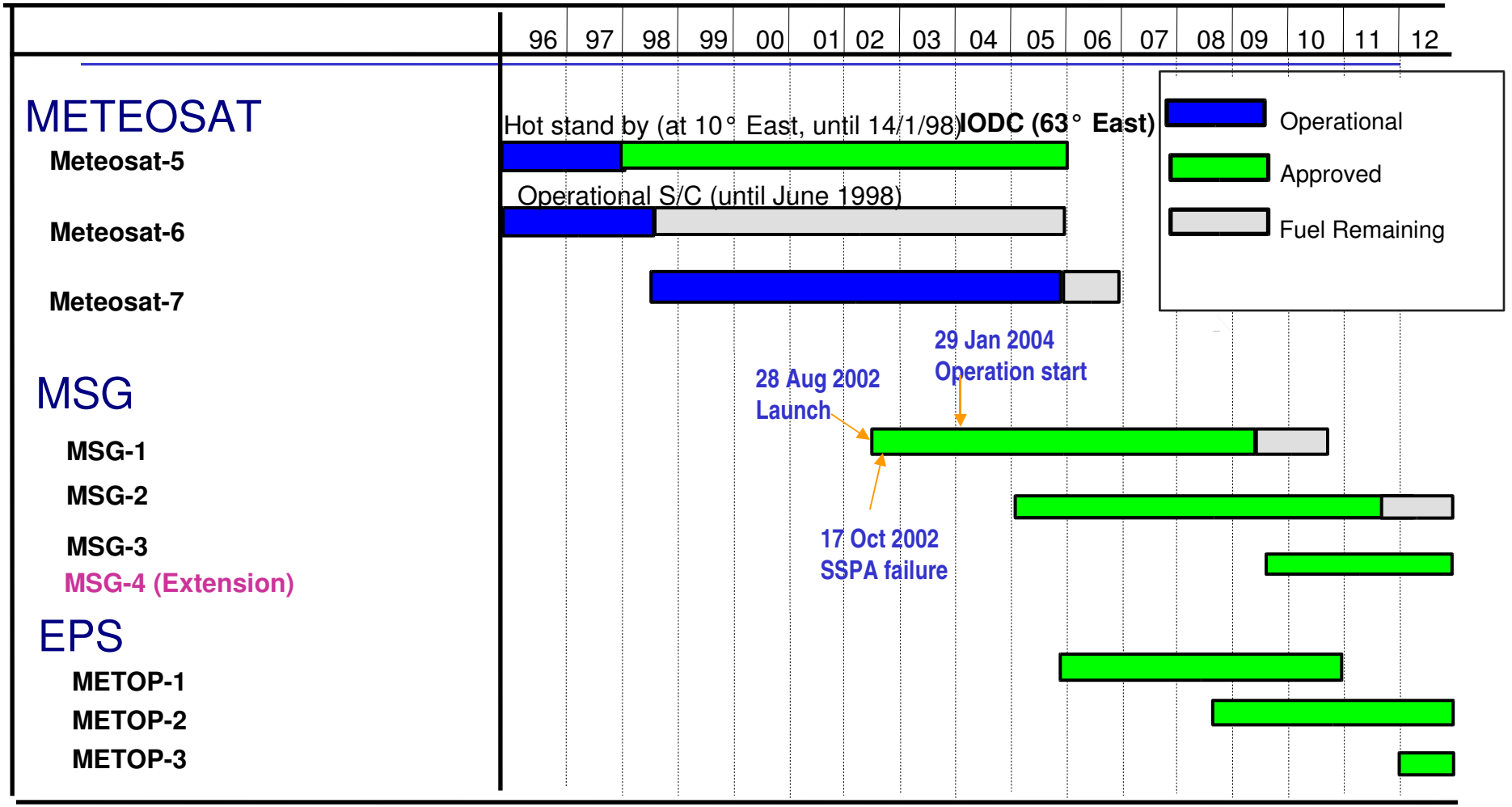
EUMETSAT: Objectives

- European Organization for Operational Meteorological Satellites.
  - Operational Meteorology
  - Climate y Climate Change
  - World coordination

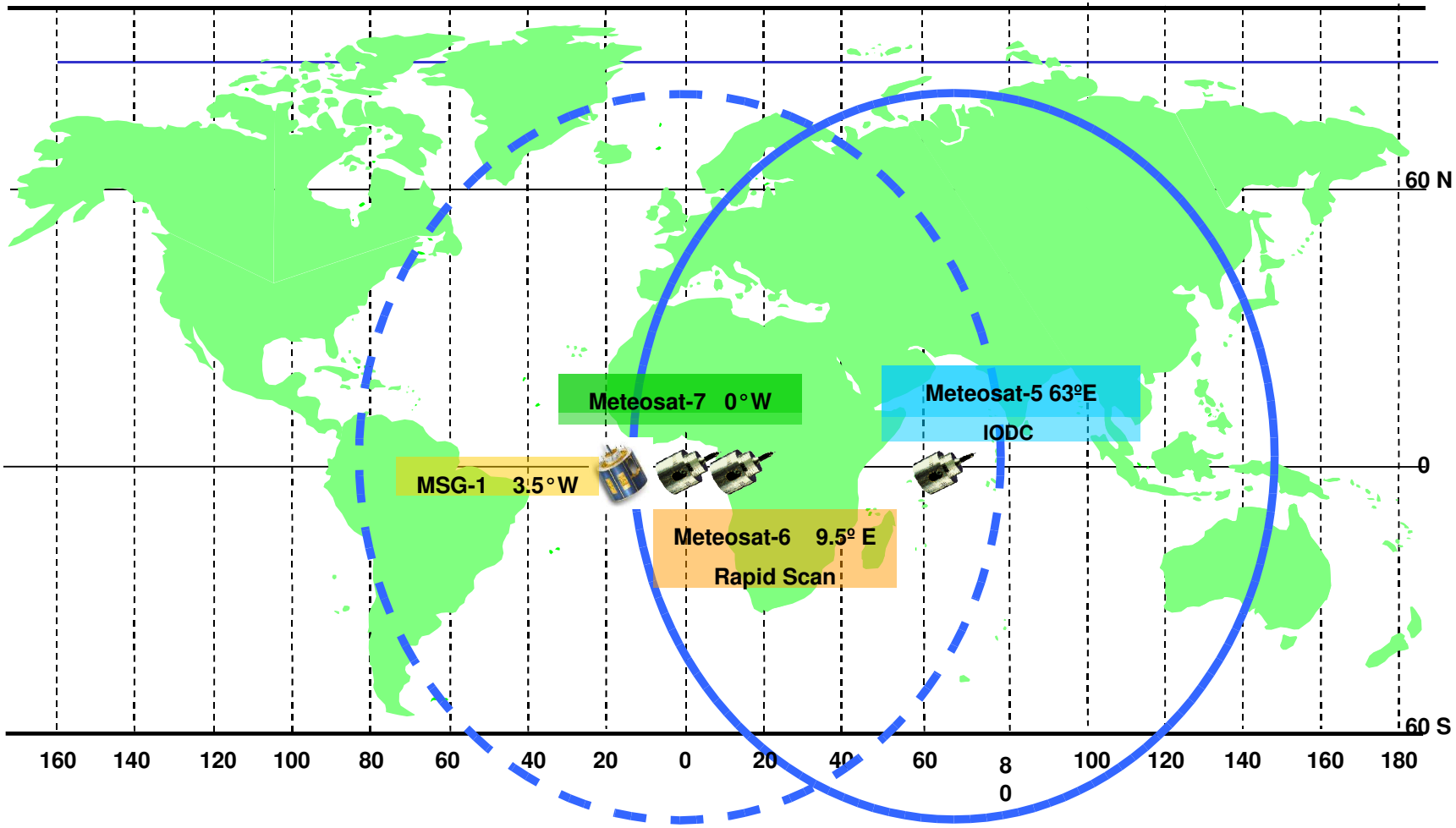




EUMETSAT: Programs



Meteosat: November 2004 configuration



MSG: On board payload

- ***SEVIRI*** (Spinning Enhanced Visible and Infrared Imager) radiometer for earth disc continuous observation

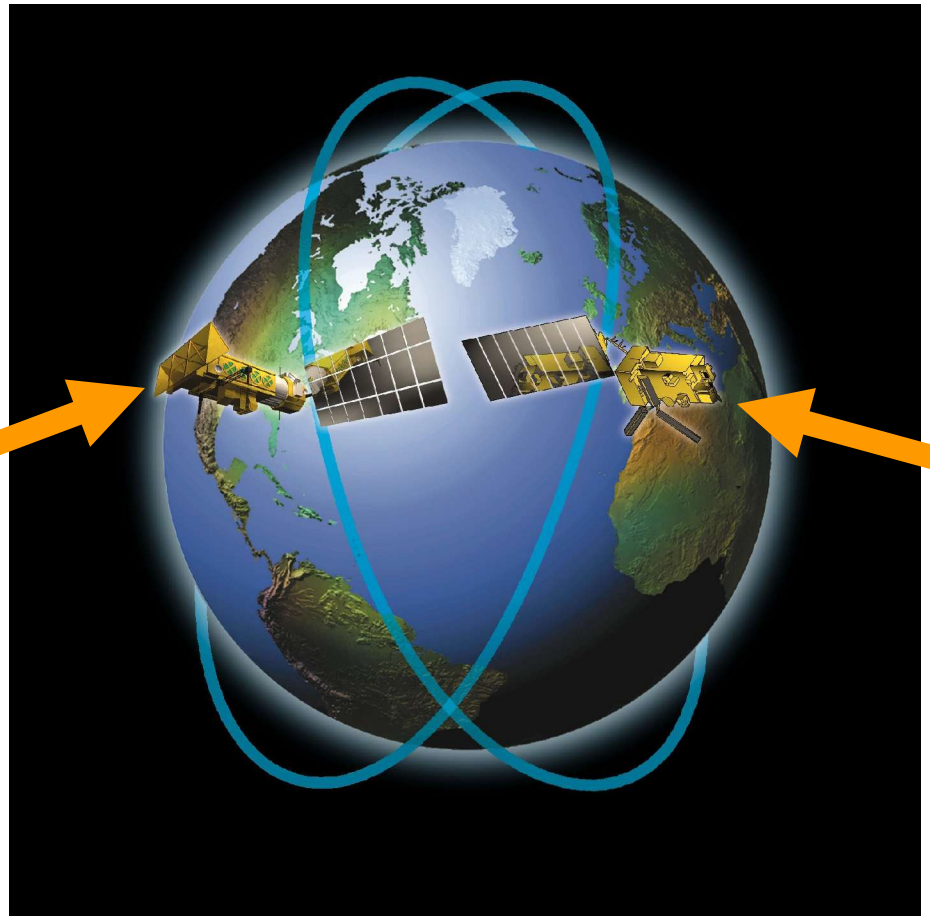
Meteorological purposes

http://www.eumetsat.de

- ***GERB*** (Geostationary Earth Radiation Budget) for Short Wave (SW) and Long Wave (LW) radiation components on the top of the atmosphere

Climatological purposes

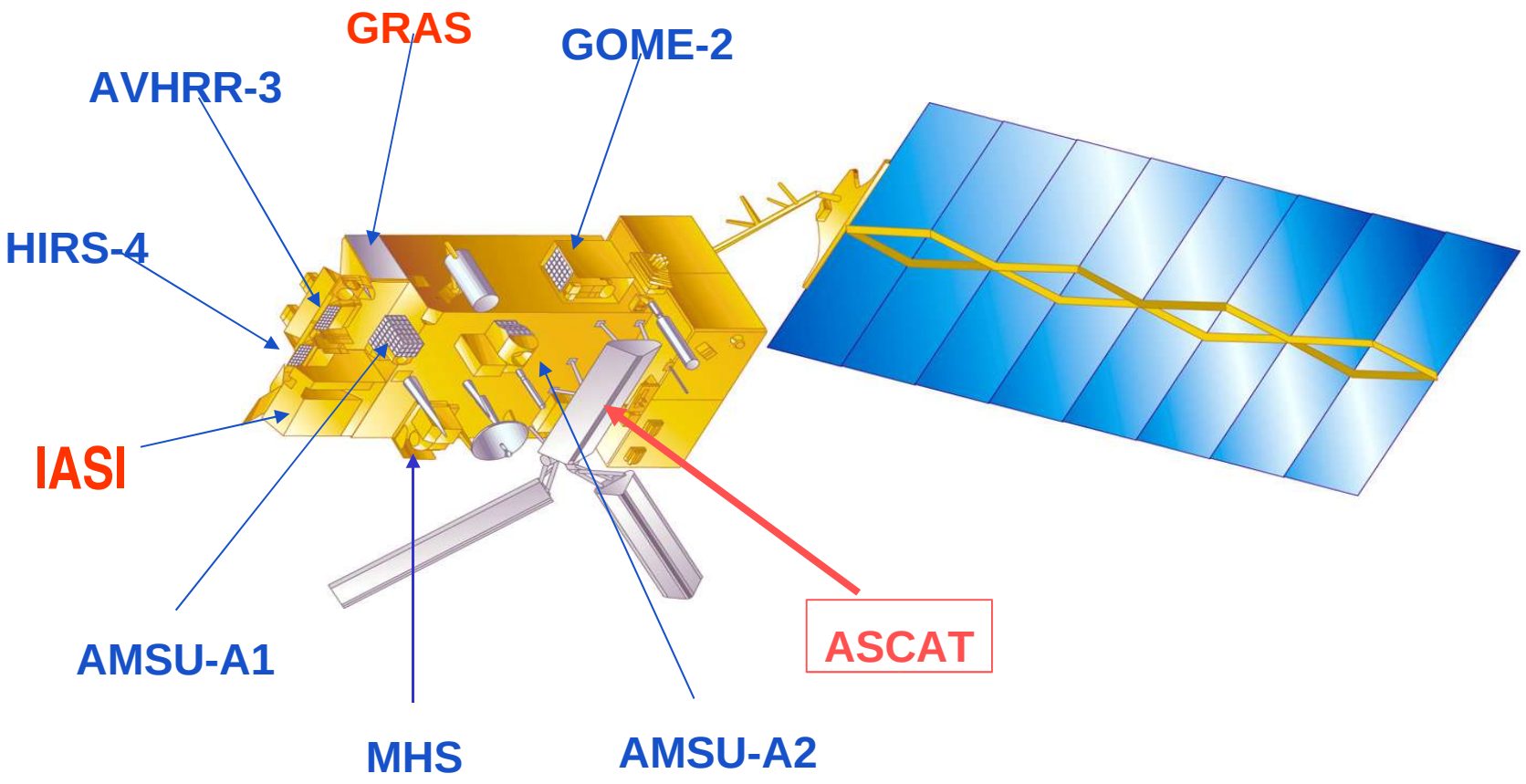
EPS: Initial Joint Polar System (IJPS)



NOAA-N, -N'

METOP-1, -2

METOP: On board payload



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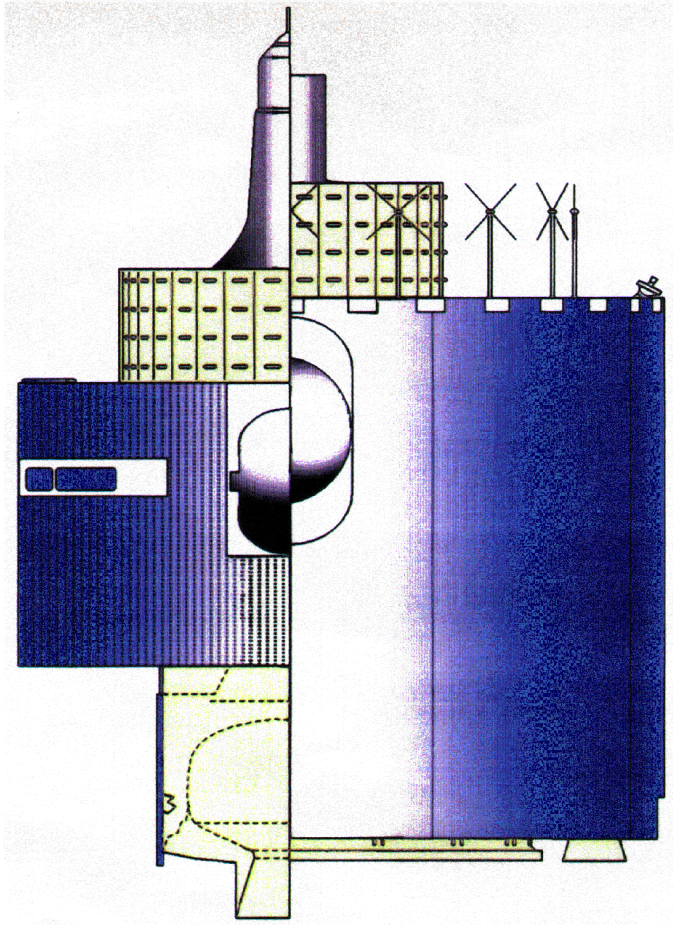
Comparison Meteosat (MTP)-MSG

METEOSAT

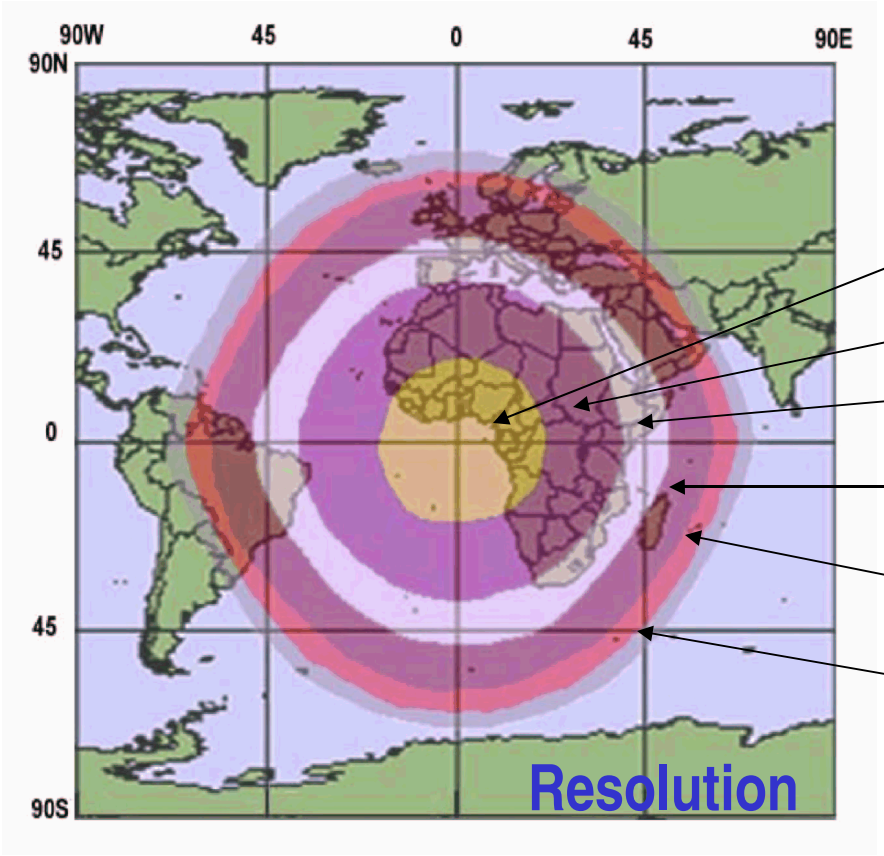
- 30 minutes repetition cycle
- **3 channels**
- 8 bits per pixel
- 5km nadir resolution
- 2.5km VIS channel



MSG (SEVIRI)

- 15 minutes repetition cycle
- **12 channels**
- 10 bits per pixel
- 3km nadir resolution
- 1km High Resolution VIS channel

MSG: Spatial Resolution SEVIRI
Canales VISIR



3.1 km.

4 km.

5 km.

6 km.

8 km.

11km.

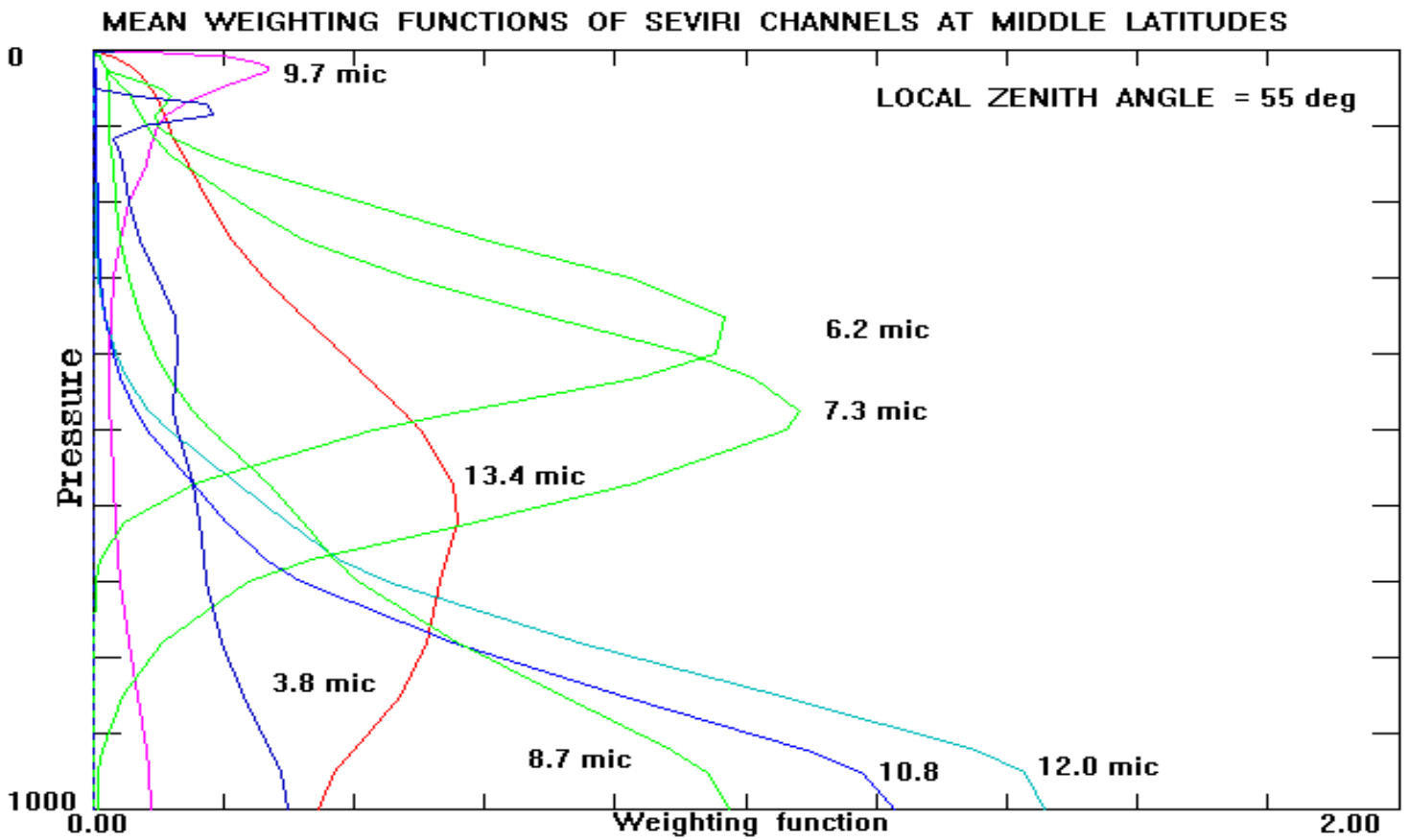
MSG: SEVIRI channels

Basics	Band (µm)	Air Mass	Band (µm)
VIS 0.6	0.56-0.71	WV 6.2	5.35-7.15
VIS 0.8	0.74-0.88	WV 7.3	6.85-7.85
IR 1.6	1.50-1.78	IR 8.7	8.30-9.10
IR 3.9	3.48-4.36	IR 9.7	9.38-9.94
IR 10.8	9.80-11.80	IR 13.4	12.40-14.40
IR 12.0	11.00-13.00		
HR VIS	0.5-0.9		

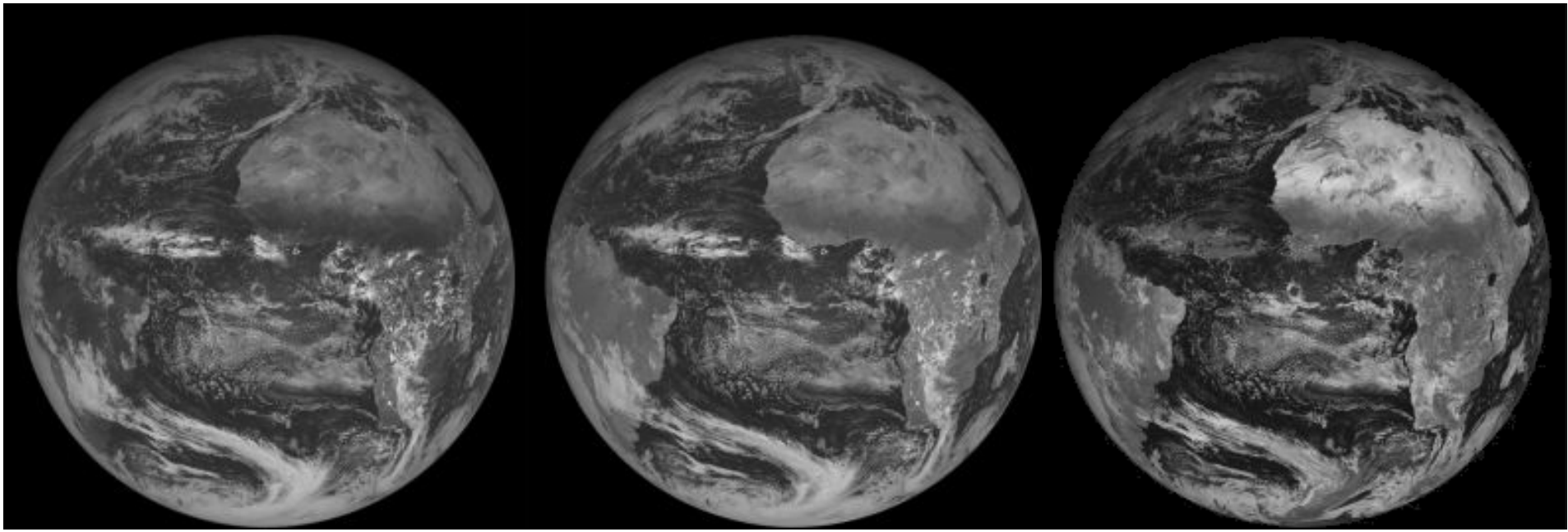
3 km resolution, except HRV (1 km)

15 minutes image cycle

MSG:SEVIRI channels Weighting Function

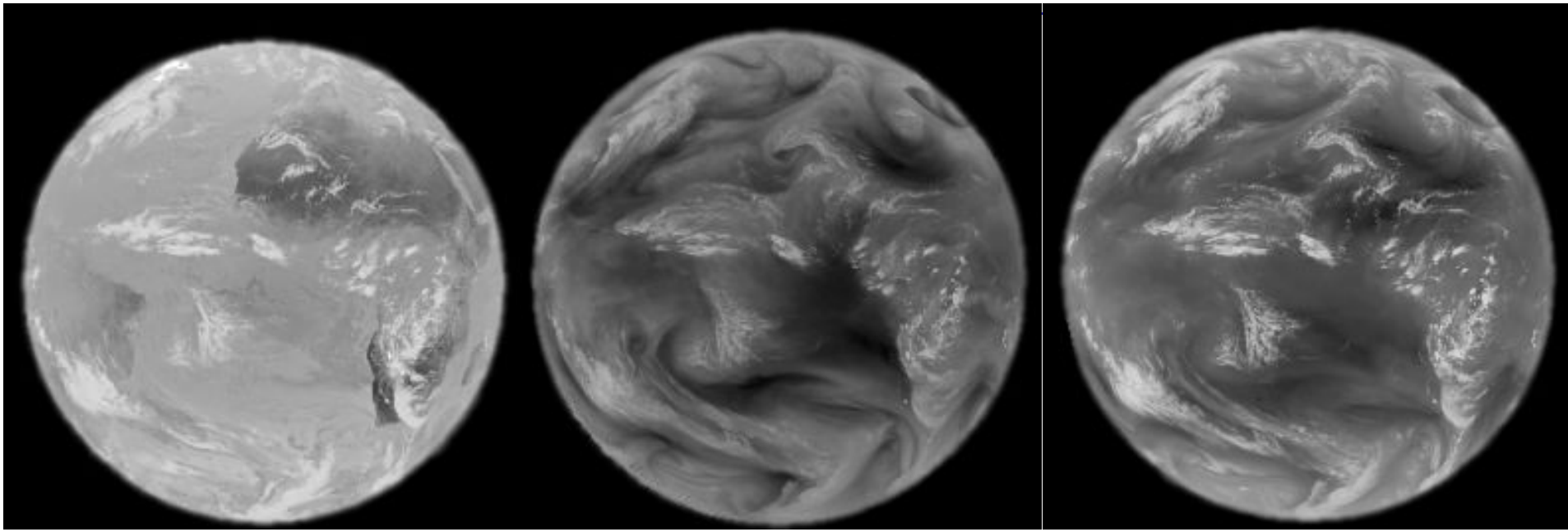


MSG first images: 28th November 2002



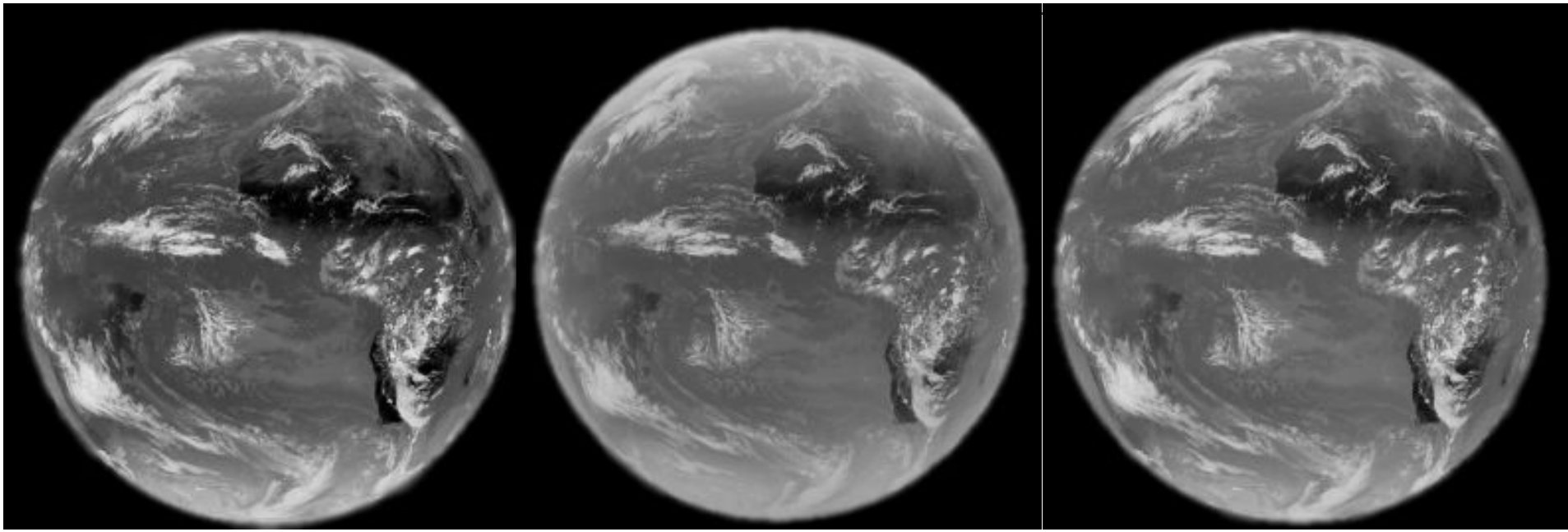
VIS0.6 VIS0.8 NIR1.6

MSG first images: 28th November 2002



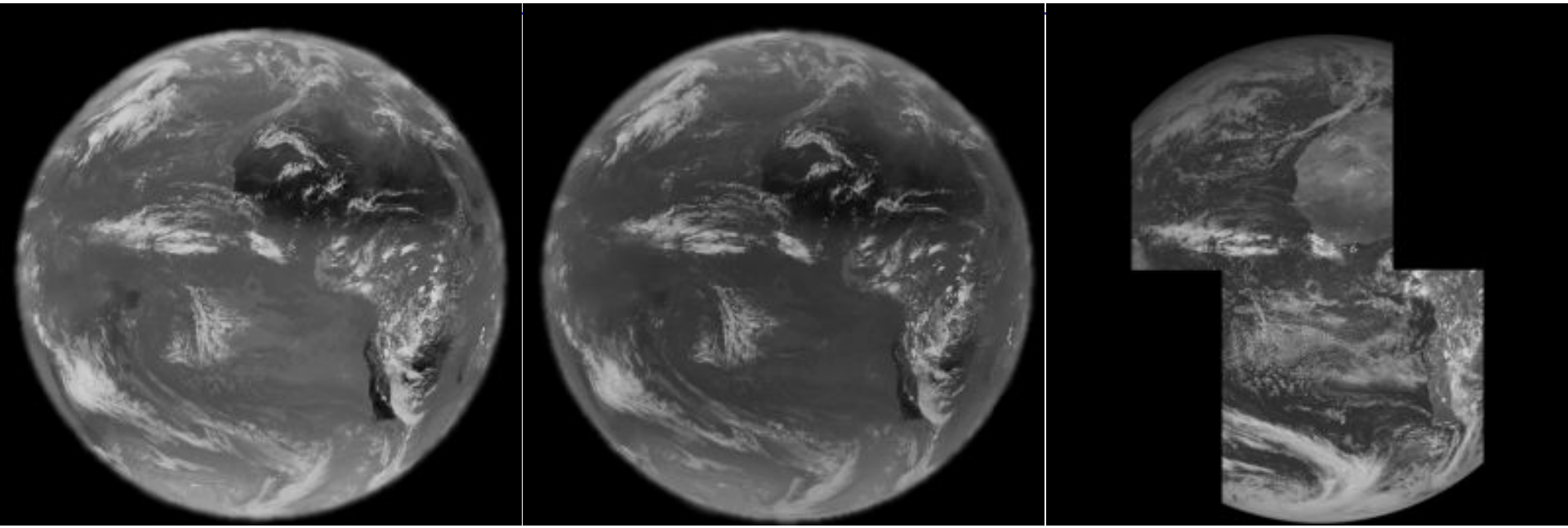
IR3.9 WV6.2 WV7.3

MSG first images: 28th November 2002



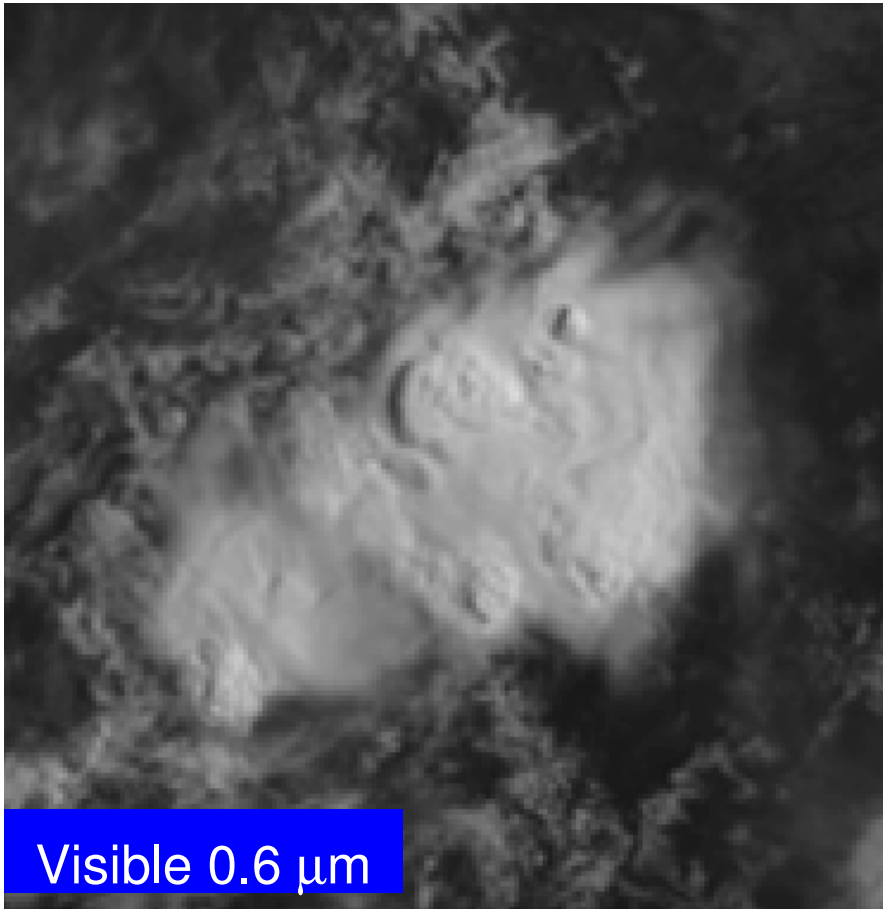
IR8.7 IR9.7 IR10.8

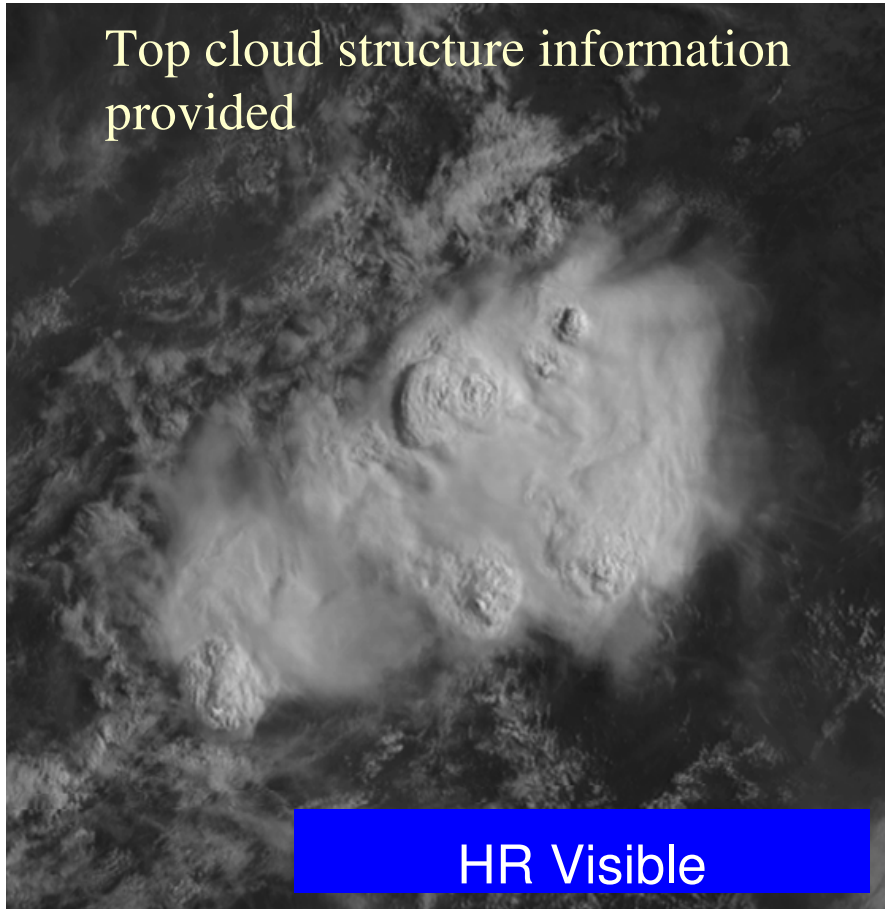
MSG first images: 28th November 2002



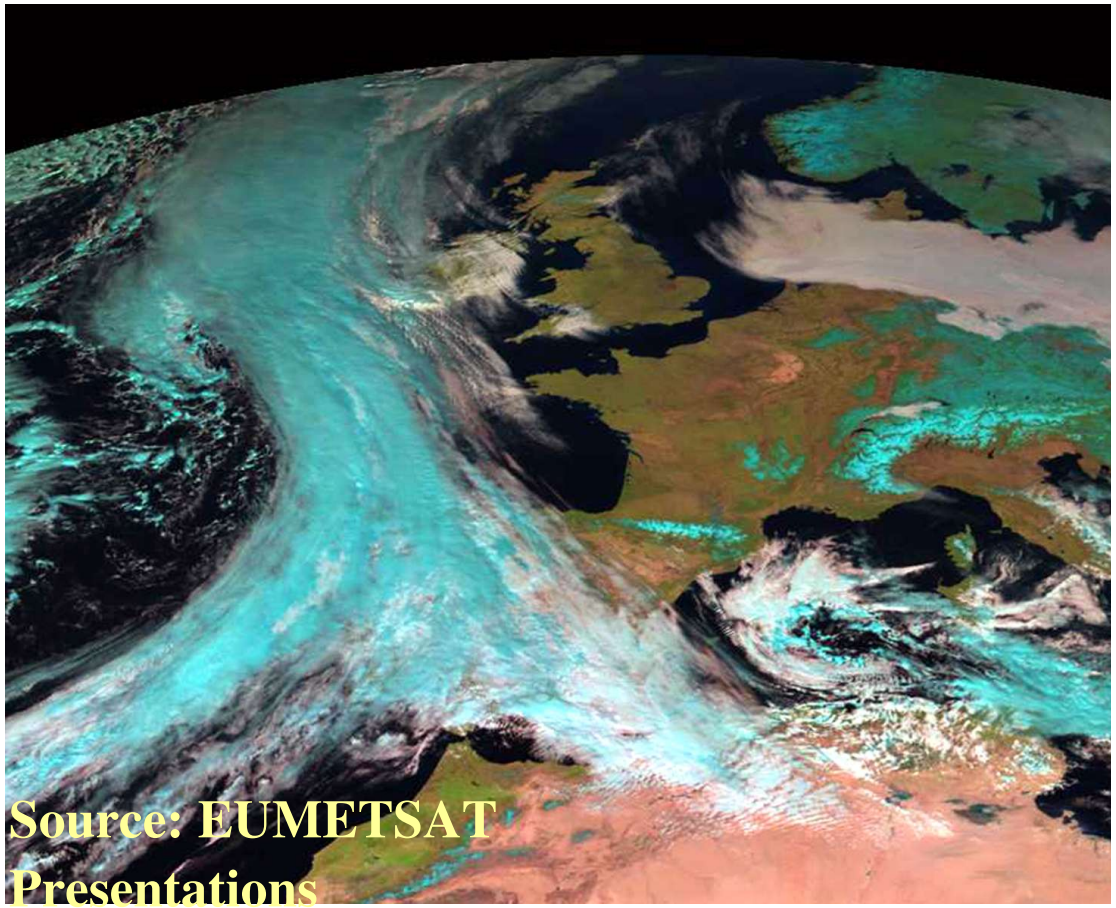
IR12.0 IR13.4 VIS-HRV

Cumulonimbus: VIS0.6 / HRV comparison





Cloud Phase (Ice/Water)

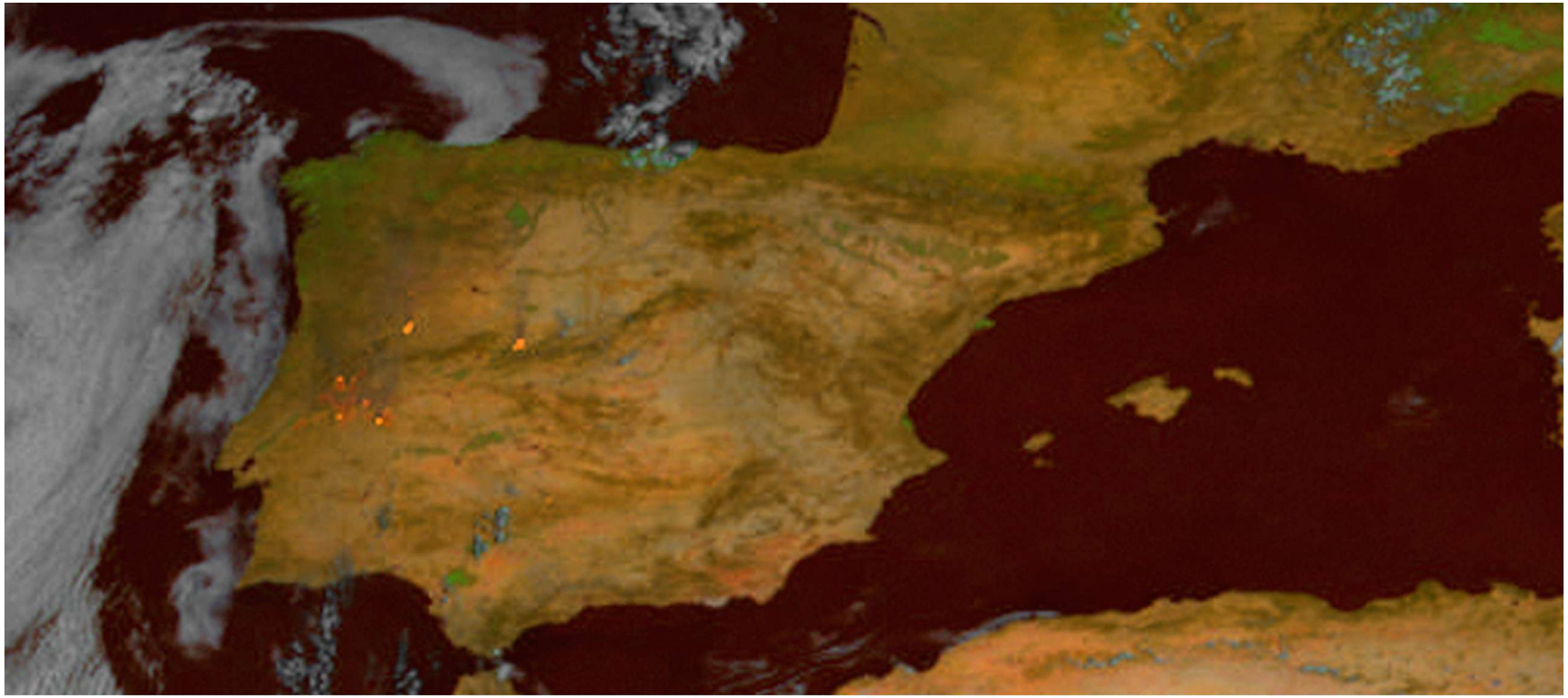


Ice

Water

MSG-1
28th February 2003
13:00 UTC
RGB Image
IR 1.6 / VIS 0.8 / VIS 0.6

Fire

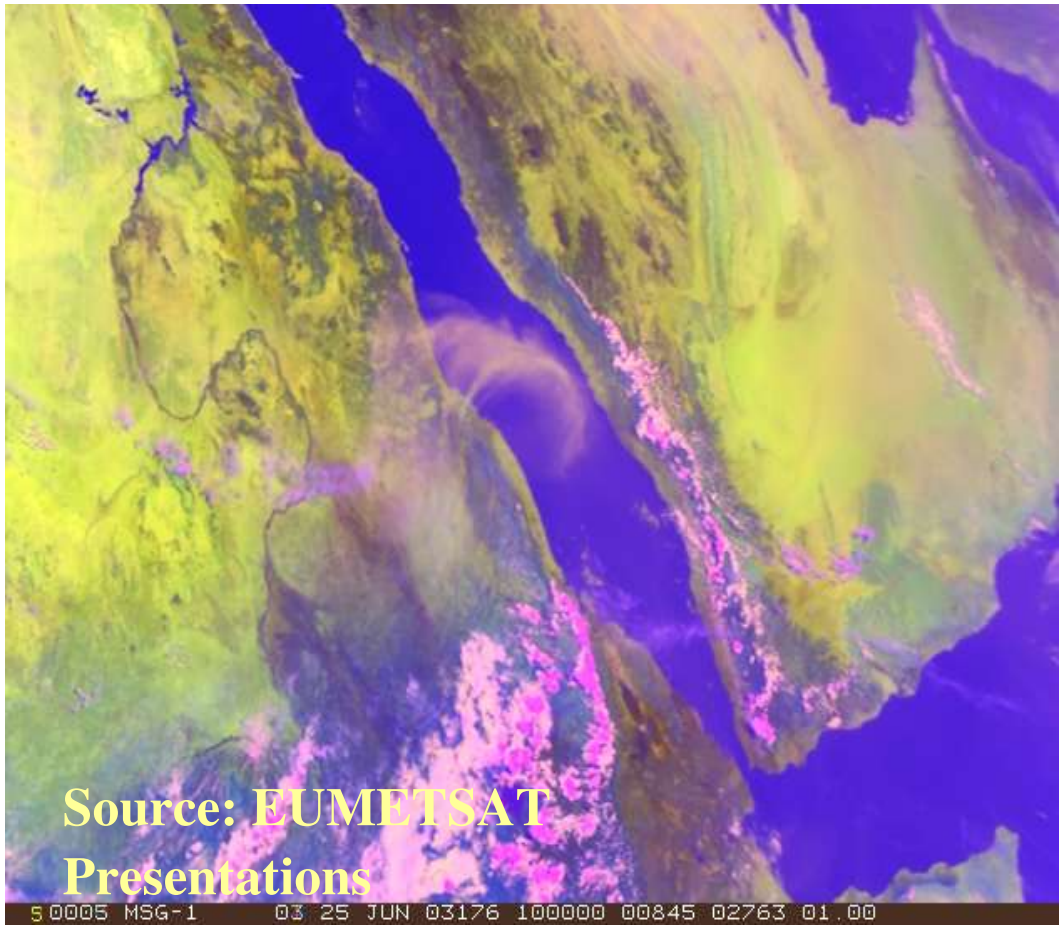


Meteosat - 8 04/08/2003 10:45 Fires in Portugal & S

RGB: 3.9 / 0.8 / 0.6

Source: EUMETSAT Presentations

Dust & Aerosols



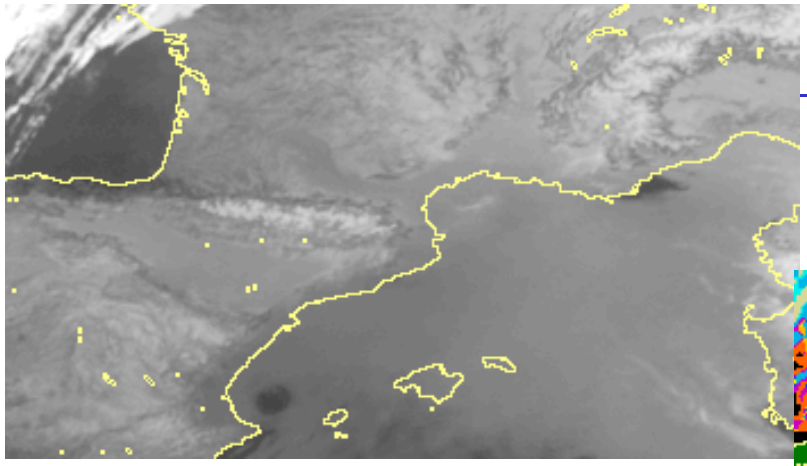
MSG-1
25th June 2003
10:00 UTC

Dust storm over the Red Sea

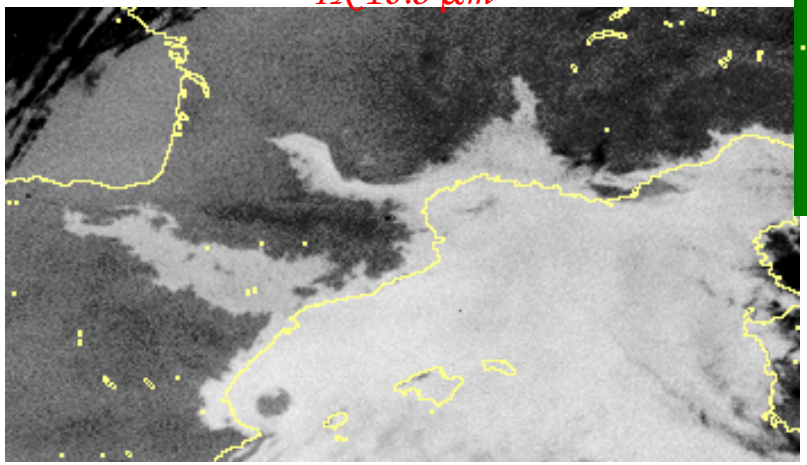
RGB Image:

VIS 0.6 / NIR 1.6 / IR 3.9

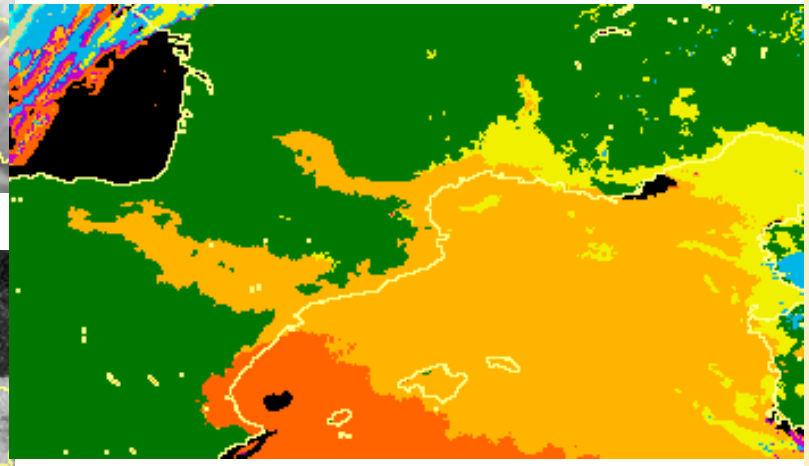
Low clouds & fog: 5th February 2004 00 UTC

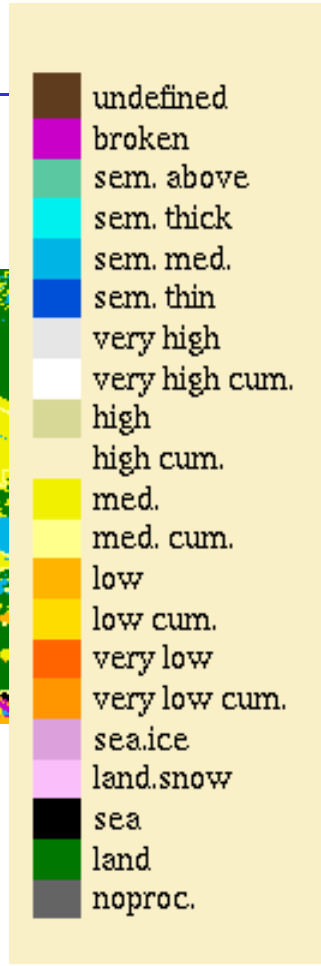


IR 10.8 μm



T10.8μm – T3.9μm (night)





Source: Météo-France Presentation: CMa & CT (Cloud Mask and Type) NWC SAF products.

(First Joint Training Workshop (MFL.ZIP), http://nwcsaf.inm.es).

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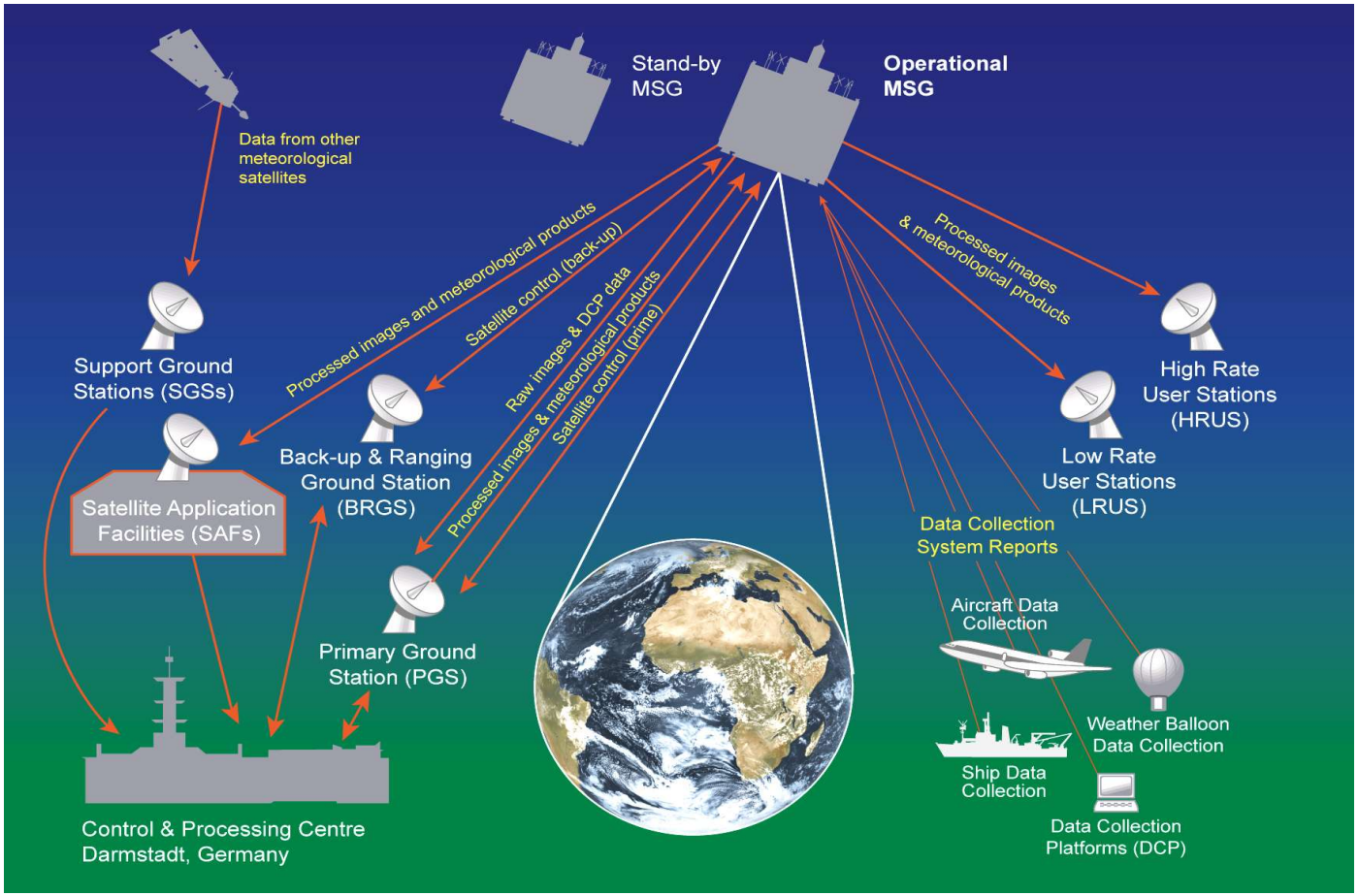
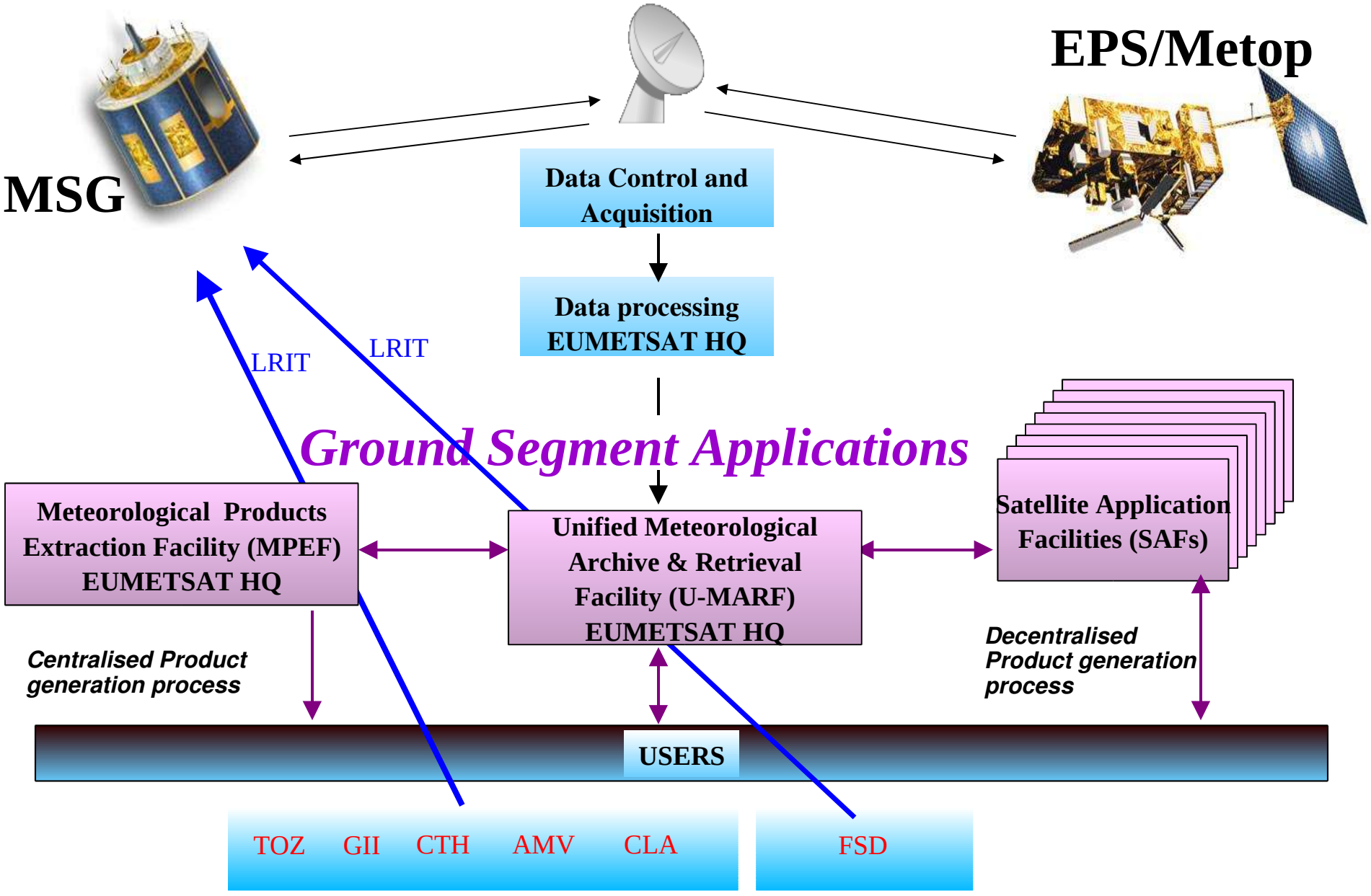
EUMETSAT SAF Structure




MSG
EPS/Metop
Data Control and Acquisition
Data processing EUMETSAT HQ
LRIT
LRIT
Ground Segment Applications
Meteorological Products Extraction Facility (MPEF) EUMETSAT HQ
Unified Meteorological Archive & Retrieval Facility (U-MARF) EUMETSAT HQ
Satellite Application Facilities (SAFs)
Centralised Product generation process
Decentralised Product generation process
USERS
TOZ GII CTH AMV CLA
FSD

EUMETSAT SAF Network

7 SAFs have been approved by the EUMETSAT Council

- SAF on support to Nowcasting and VSRF
- SAF on Ocean and Sea Ice
- SAF on Ozone Monitoring
- SAF on Climate Monitoring
- SAF on Numerical Weather Prediction
- SAF on GRAS Meteorology
- SAF on Land Surface Analysis

- Possible: Hydrology & Water management SAF

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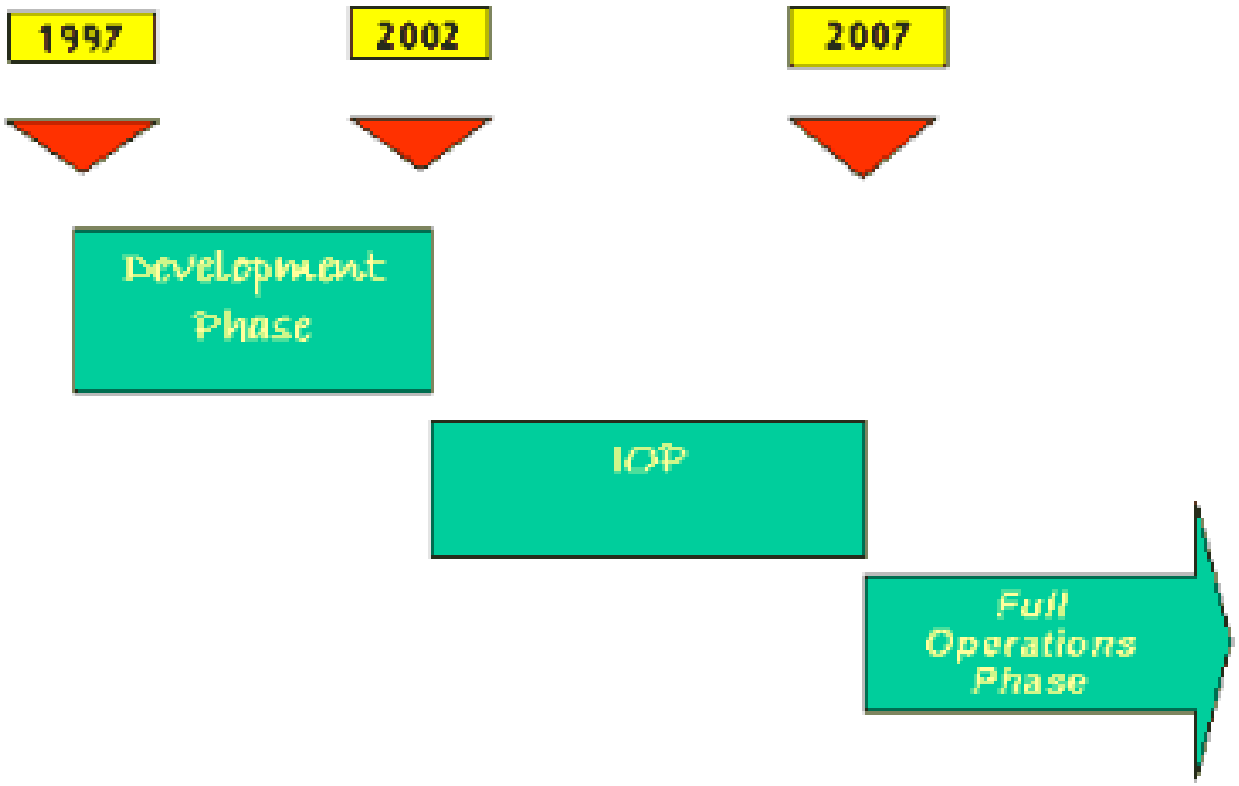
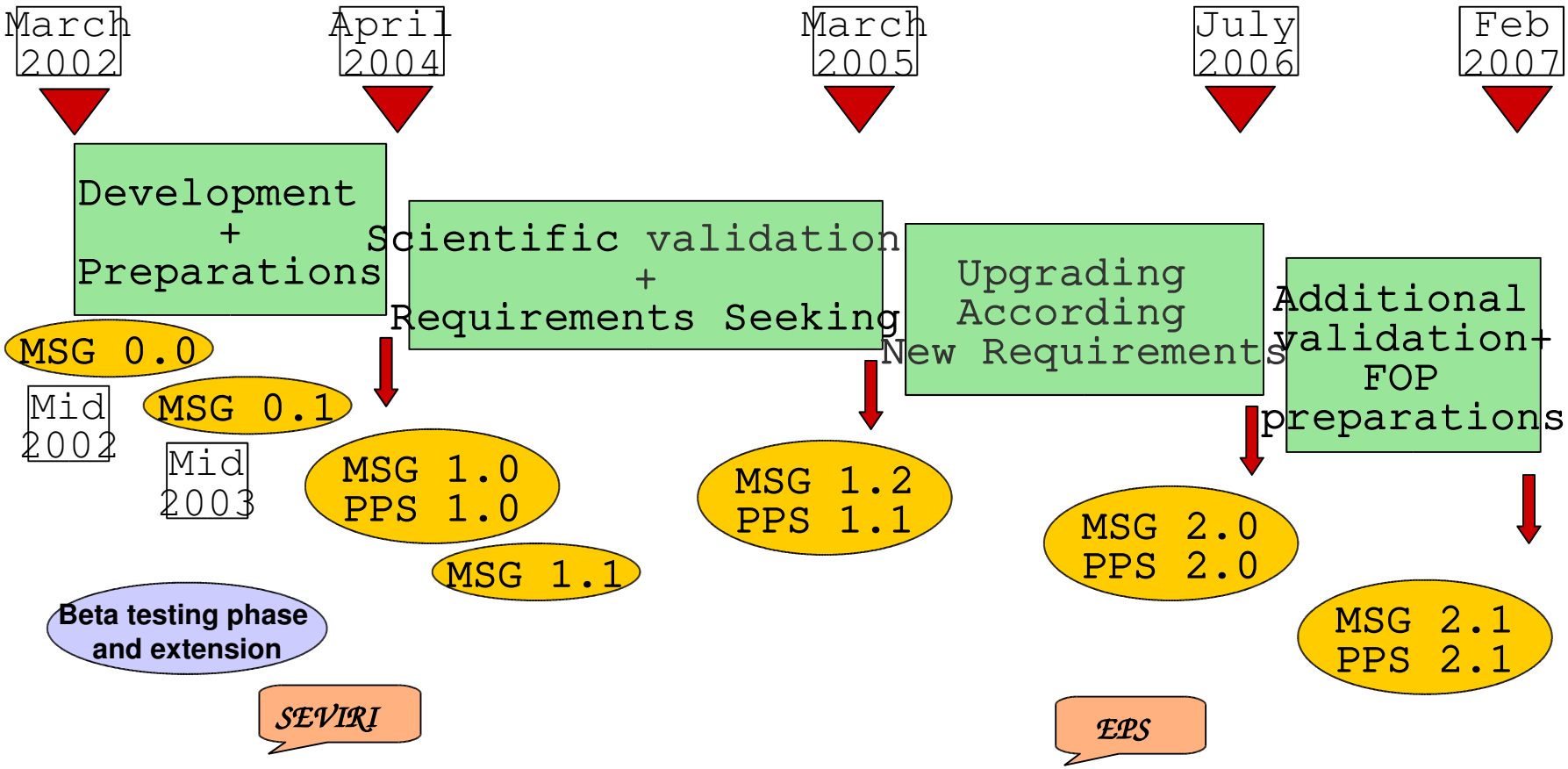
SAFNWC Objectives & involved organizations

- Under the leadership of the Spanish Meteorological Institute (INM), the SAFNWC is developed by a Project Team involving Météo-France, Sweden (SMHI) and Austria (ZAMG) Meteorological Institutes.
- The main goal is the development of Nowcasting products derived from both MSG and PPS satellite systems to be delivered to users as SW Packages.
- The SAFNWC is responsible for the development and maintenance of the appropriate SW Packages, as well as all related User's support tasks.
- The User's support is made through dedicated Help Desk.
- The SAFNWC intends to be a Centre of Excellence for Nowcasting in EUMETSAT.

SAFNWC Plan


1997
2002
2007
Development Phase
IOP
Full Operations Phase

SAFNWC IOP Scheduler



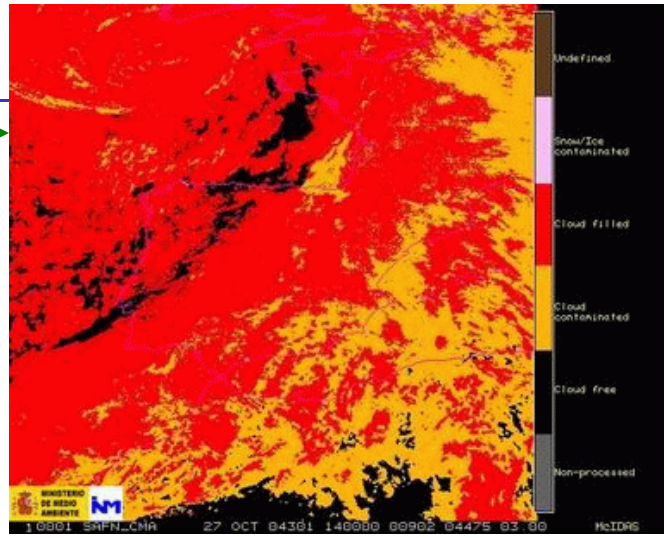
SAFNWC Products

Product Group	Products based on data from MSG (Acronym, Product No.)	EPS/NOAA (Acronym, Product No.)
Cloud products	• Cloud Mask (CMa, 1) • Cloud Type (CT, 2) • Cloud Top Temperature & Height (CTTH, 3)	• Cloud Mask (CMa, 1) • Cloud Type (CT, 2) • Cloud Top Temperature & Height (CTTH, 3)
Precipitation products	• Precipitating Clouds (PC, 4) • Convective Rainfall Rate (CRR, 5)	• Precipitating Clouds (PC, 4)
Air mass products	• Total Precipitable Water (TPW, 6) • Layer Precipitable Water (LPW, 7) • Stability Analysis Imagery (SAI, 8) • Air Mass Analysis (AMA, 12)	
Wind product	• High-Resolution Winds (HRW, 9)	
Thunderstorm product	• Rapidly Developing Thunderstorms (RDT, 11)	
Conceptual Models product	• Automatic Satellite Image Interpretation (ASII, 12)	

Cloud Products

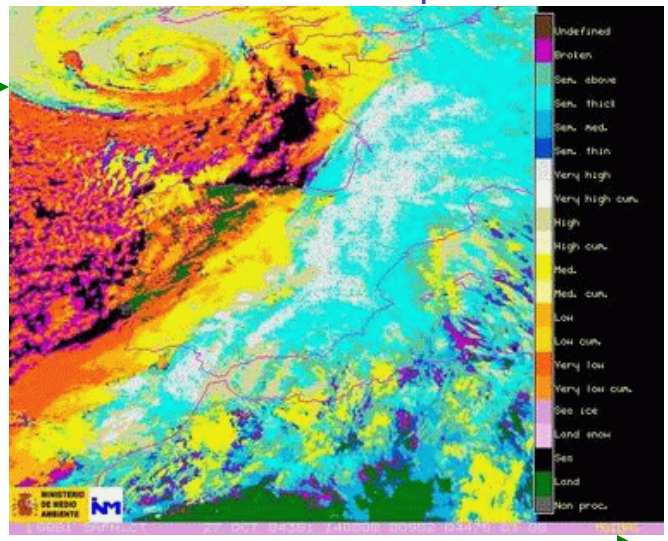
- ***Cloud Mask (CMa)***

Delineate all cloud-free pixels in a satellite scene with a high confidence. The product also provides information on the presence of snow/sea ice, dust clouds and volcanic plumes.



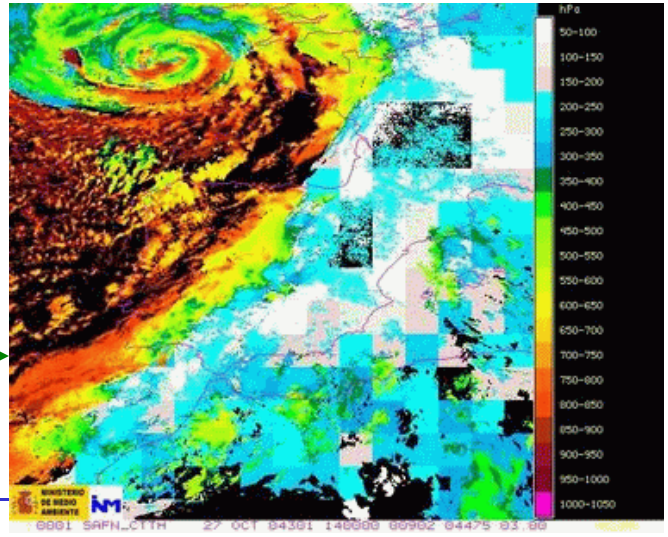
- ***Cloud Type (CT)***

Delineate all cloud-free pixels in a satellite scene with a high confidence. The product also provides information on the presence of snow/sea ice, dust clouds and volcanic plumes



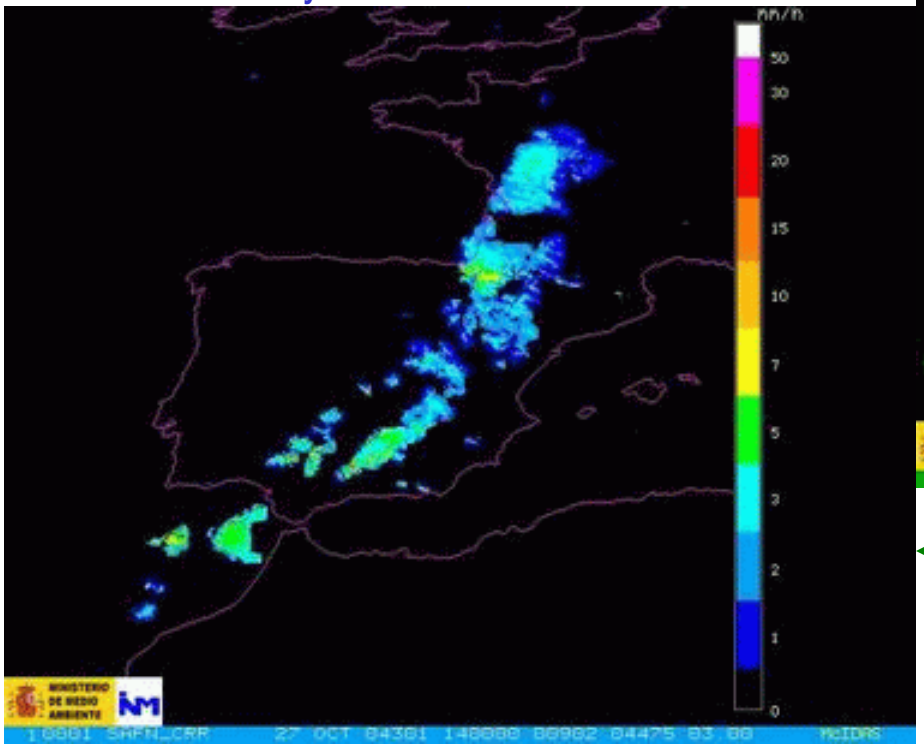
- ***Cloud Temperature & Heigh (CTTH)***

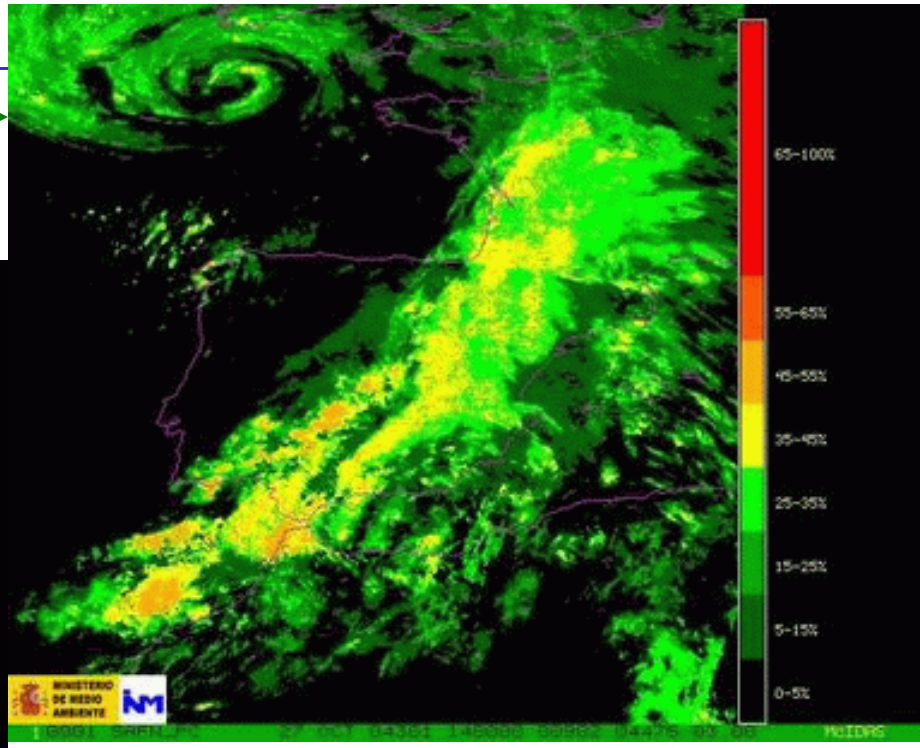
Contains information on the cloud top temperature, pressure and height for all pixels identified as cloudy in the satellite scene.



Precipitation Products

- ***Precipitating Clouds (PC)***
  Probability of precipitation intensities in pre-defined intensity intervals.



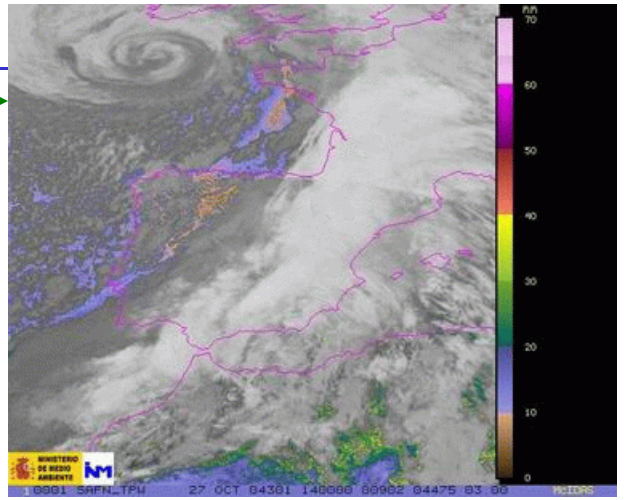


- ***Convective Rainfall Rate (CRR)***
  Precipitation estimated rate associated to convective clouds in mm/hr divided into classes in an image format.

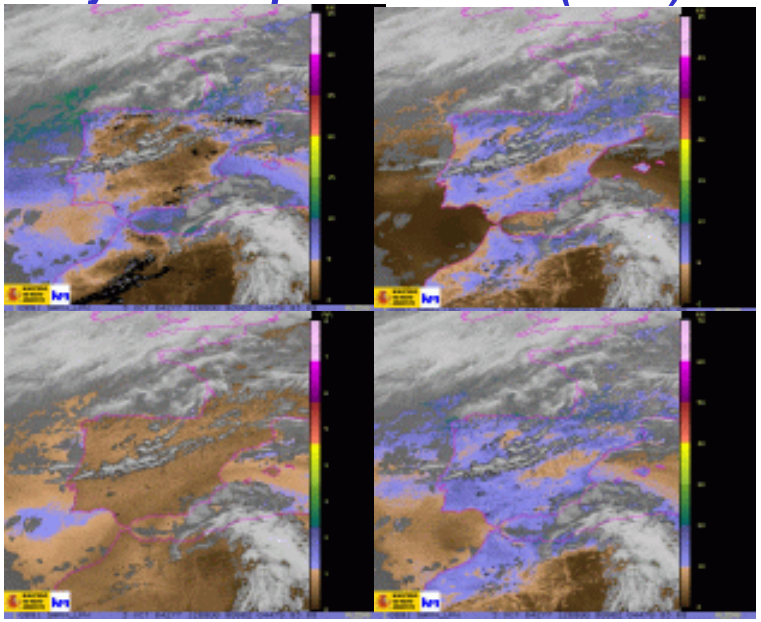
Clear Air Mass Products

- ***Total Precipitable Water (TPW)***

Total amount of liquid water, in mm, if all the atmospheric water vapour in the column from the Earth's surface to the "top" of the atmosphere were condensed.

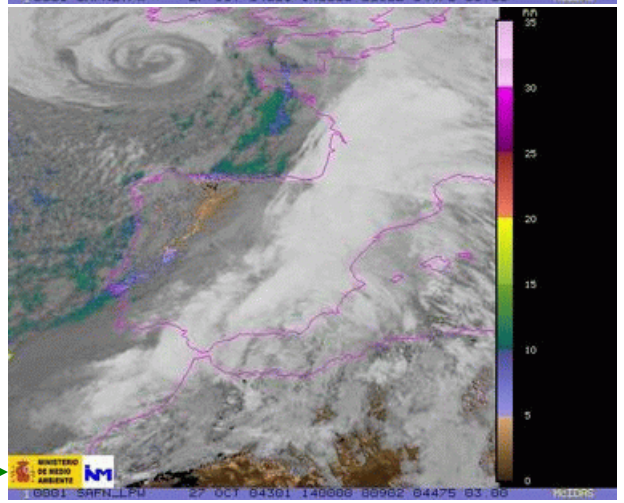


- ***Layer Precipitable Water (LPW)***



Water vapour contained in a vertical column of unit cross-section area in three layers in the troposphere: Low Layer, Middle Layer & High Layer.

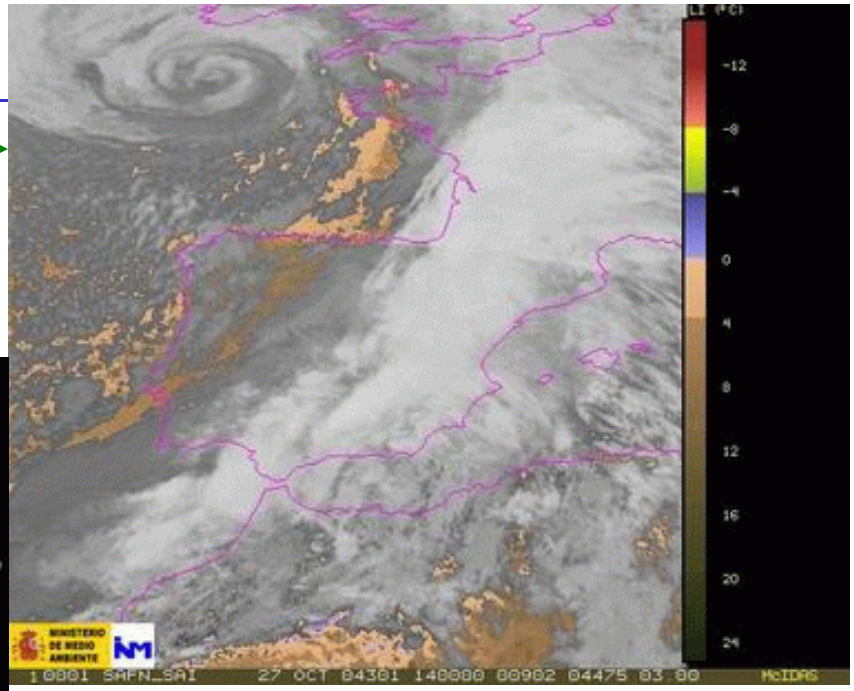
TPW is provided for validation purposes

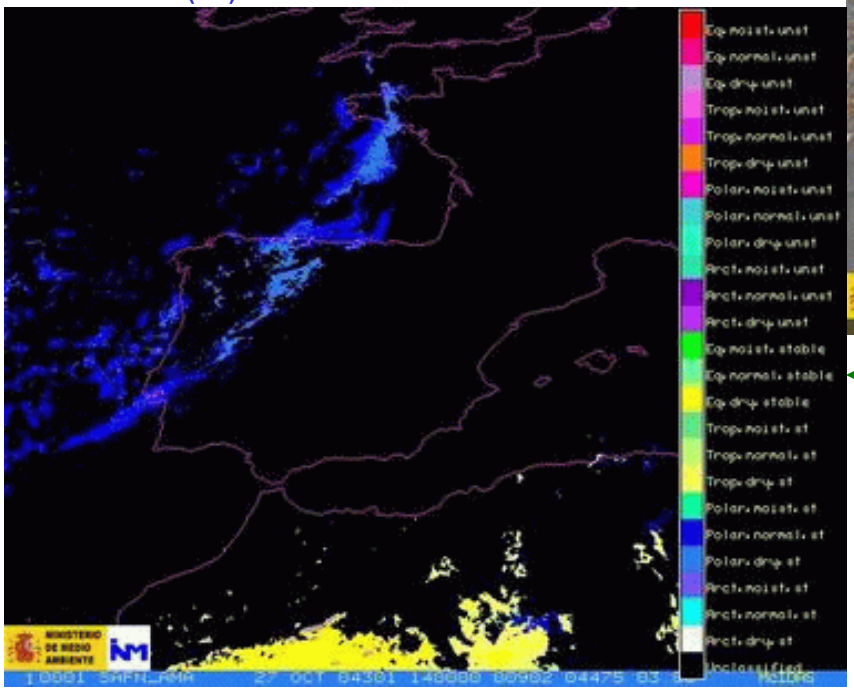


Clear Air Mass Products

- ***Stability Air Imagery (SAI)***

Provides estimations of the atmospheric instability in cloud-free areas. Among all stability indexes, Lifted Index (LI) has been chosen.

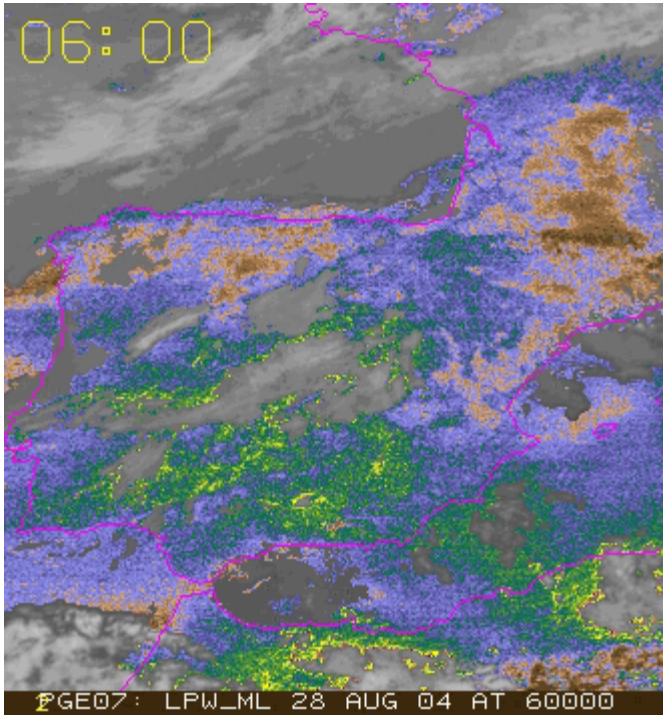




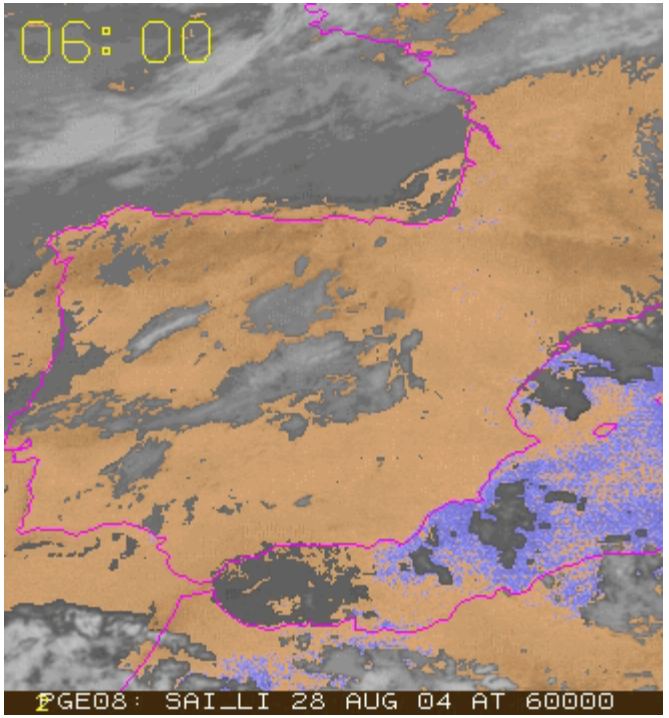
- ***Air Mass Analysis (AMA)***

Evaluates basic quantities describing air masses (upper and middle level humidity, mean temperature atmospheric stability, cloud pattern, etc) to combine them into one integrated classification of the air mass.

Case Study
28th August 2004: Pre-convective situation



LPW: Middle levels



SAI: Lifted Index

Winds and Conceptual Model Products (BUFR)

- ***High Resolution Wind (HrW)***

Detailed and frequently updated sets of daytime winds from HRV SEVIRI data including wind pressure level information and wind quality control flags giving as well some indication of its error in probabilistic terms.

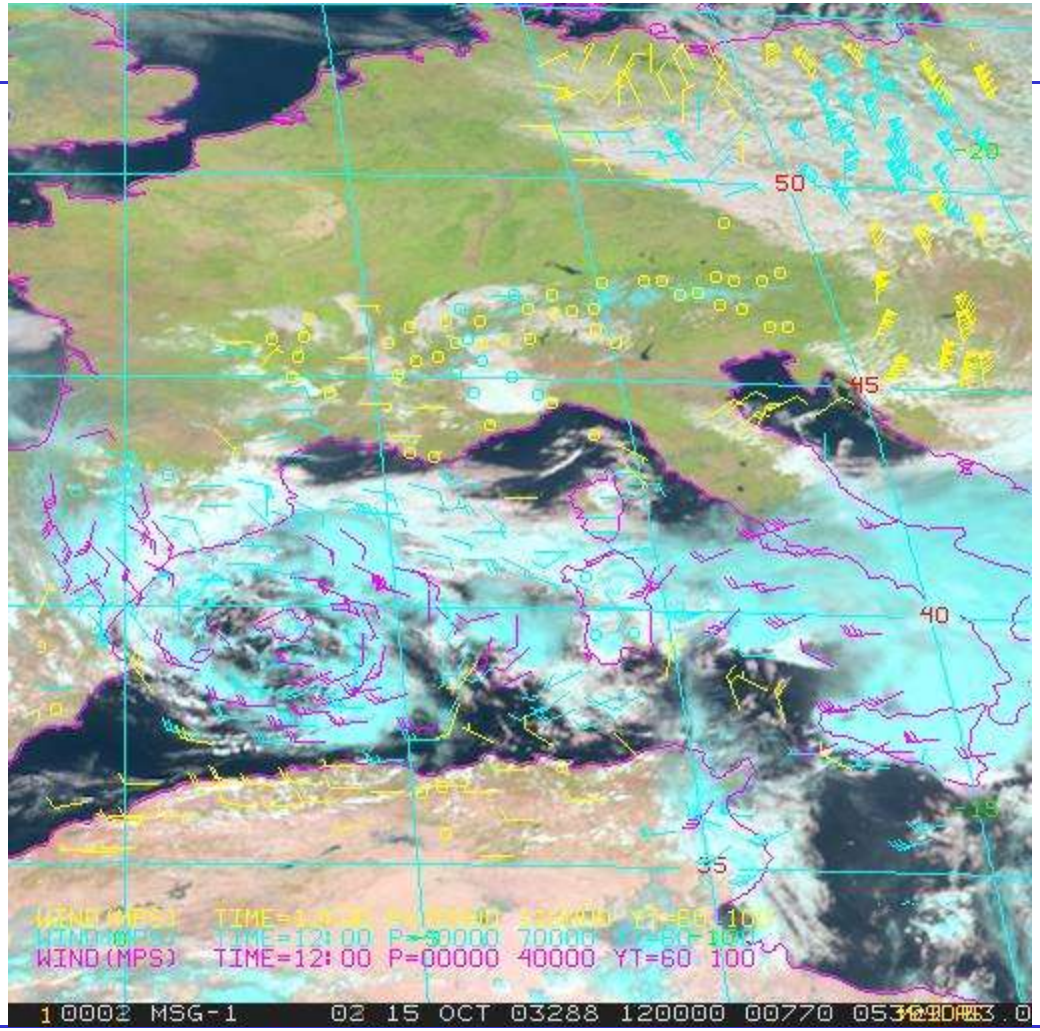
- ***Rapid Development Thunderstorm (RDT)***

Twofold objectives: identification, monitoring and tracking of intense convective systems, and detection of rapidly developing convective cells

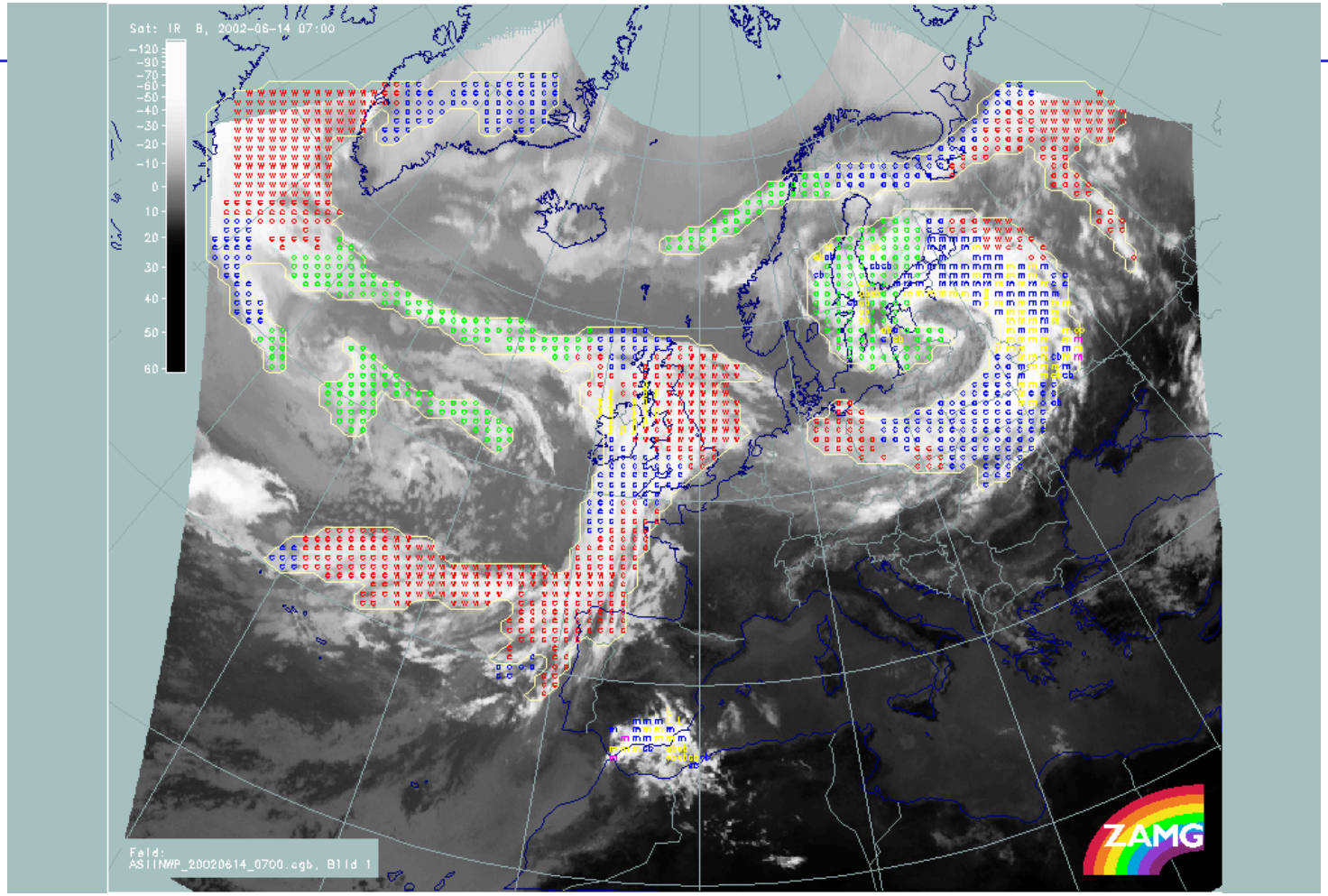
- ***Automated Satellite Interpretation Imagery (ASII)***

Automatic interpretation of features seen on satellite images identifying fronts, wave structures, areas of intensification at fronts by jet streak crossing, position of the jet axis, comma clouds, enhanced convection areas, etc.

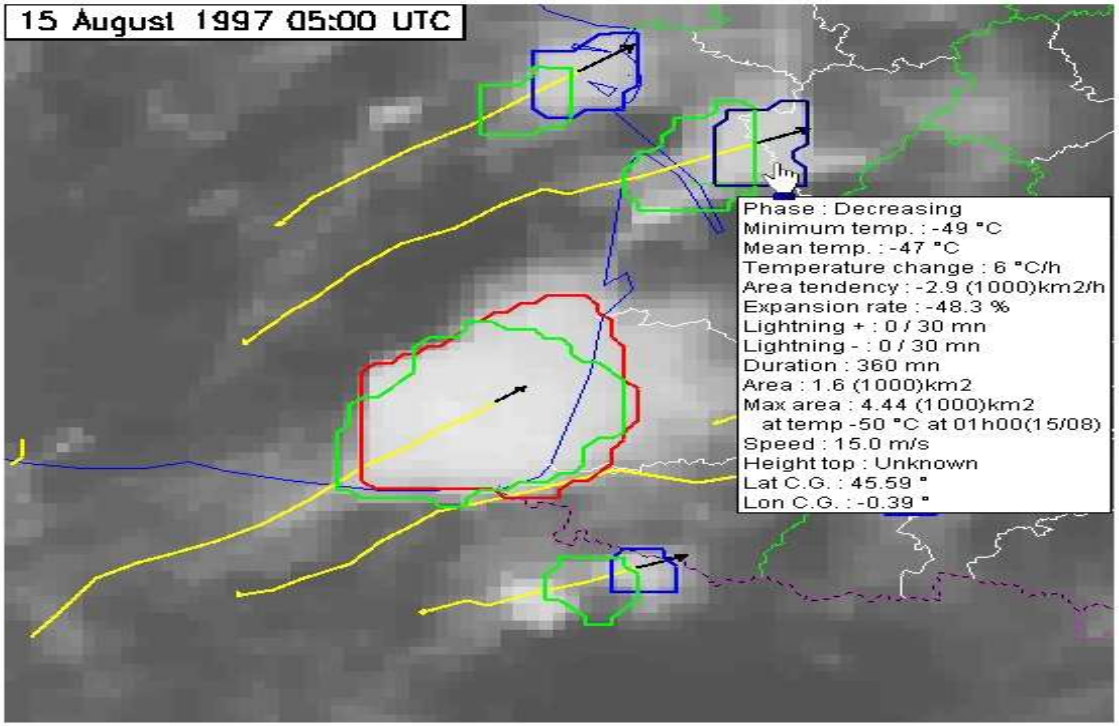
HRW

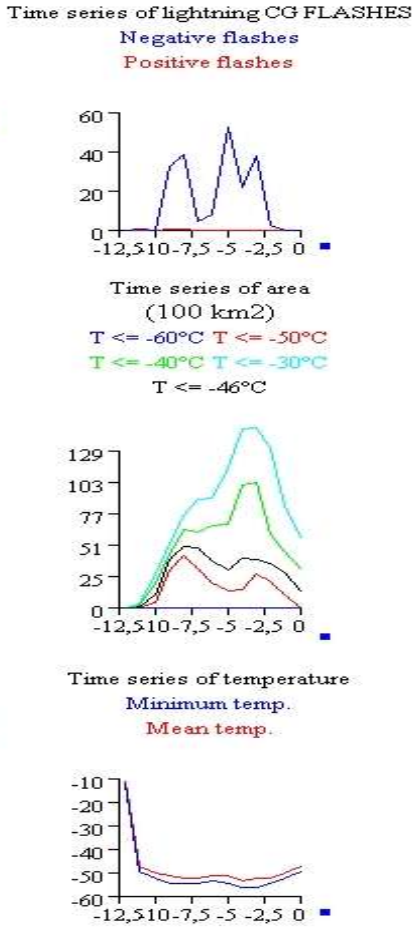

50
45
40
35
WIND(MPS) TIME=12:00 P=00000 40000 YT=60 100
1 0002 MSG-1 02 15 OCT 03288 120000 00770

ASII


Sat: IR 8, 2002-06-14 07:00
Feld:
ASIINWP_20020614_0700.cgb, Bild 1
ZAMG

RDT


15 August 1997 05:00 UTC
Phase : Decreasing
Minimum temp. : -49 °C
Mean temp. : -47 °C
Temperature change : 6 °C/h
Area tendency : -2.9 (1000)km2/h
Expansion rate : -48.3 %
Lightning + : 0 / 30 mn
Lightning - : 0 / 30 mn
Duration : 360 mn
Area : 1.6 (1000)km2
Max area : 4.44 (1000)km2
at temp -50 °C at 01h00(15/08)
Speed : 15.0 m/s
Height top : Unknown
Lat C.G. : 45.59 °
Lon C.G. : -0.39 °


Time series of lightning CG FLASHES
Negative flashes
Positive flashes
60
40
20
0
-12,5 -10 -7,5 -5 -2,5 0
Time series of area
(100 km2)
T <= -60°C T <= -50°C
T <= -40°C T <= -30°C
T <= -46°C
129
103
77
51
25
0
-12,5 -10 -7,5 -5 -2,5 0
Time series of temperature
Minimum temp.
Mean temp.
-10
-20
-30
-40
-50
-60
-12,5 -10 -7,5 -5 -2,5 0

The Help Desk tool http://nwcsaf.inm.es

- Supports the SAFNWC application providing a single entry for the SAF Users Group (SUG)
- Easy access, update and retrieval of all configuration items (documentation, SW, SPRs, actions, …) by the Consortium Members.
- Friendly tool for SW recovery, Mail Box interaction (questions, comments), Software Problem Reports (SPRs), Real time products display, Documentation, FAQs, …

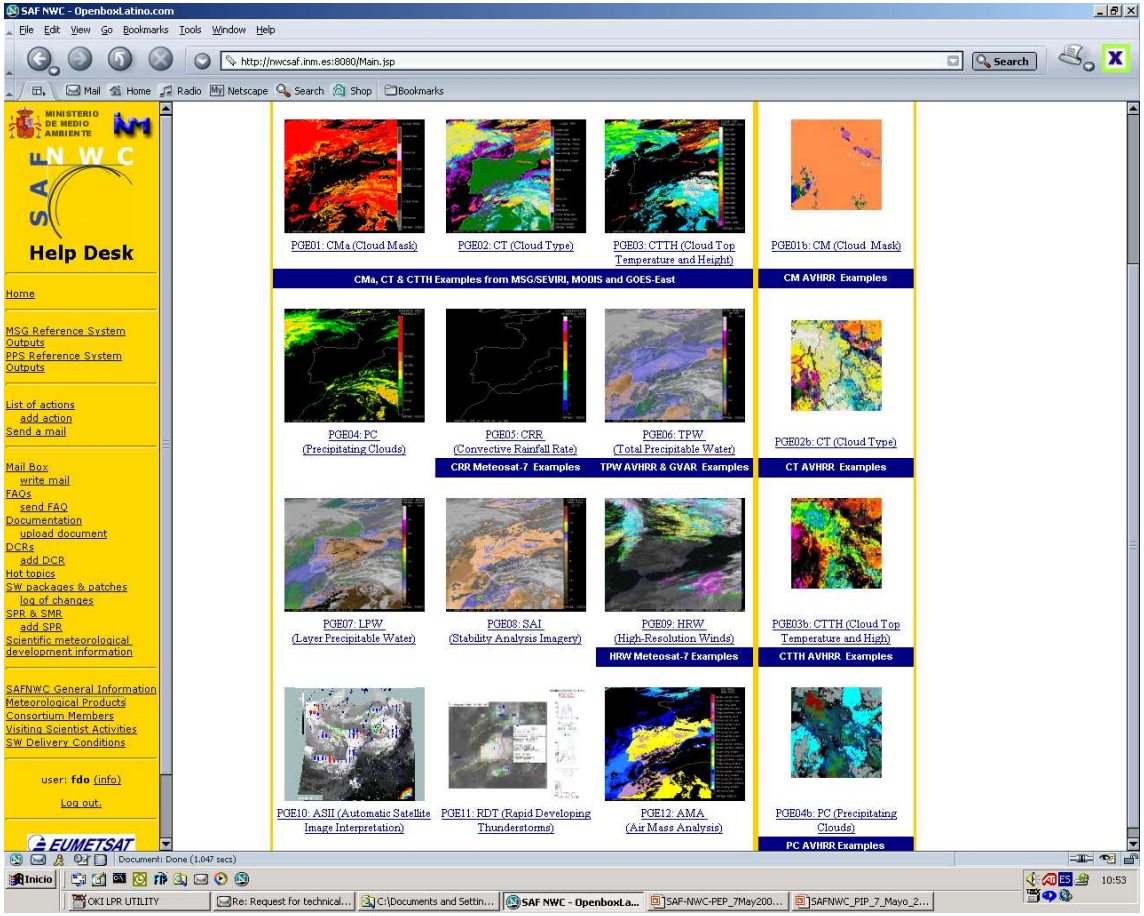
Help Desk open area: Meteorological Products

MINISTERIO DE MEDIO AMBIENTE

SAFNWC

- SAFNWC General Information
- Meteorological Products
- Consortium Members
- Visiting Scientist Activities
- SW Delivery Conditions

Meteorological products from the previous day



23 License Agreements signed

DWD (Germany)
FMI (Finland)
SMHI (Sweden)
TMS (Turkey)
OMS (Hungary)
INMH (Romania)
Météo Swiss (Switzerland)
Météo-France (France)
IM (Portugal)
SMFAI (Italy)
Met Eireann (Ireland)
SHMU (Slovakia)
KNMI (The Netherlands)
ZAMG (Austria)
BGIO (Germany)
DNMI (Norway)
DMI (Denmark)
RMBI (Belgium)
HNMS (Greece)
DMHZ (Croatia)
ARSO (Slovenia)
Met Office (UK)
IMGW (Poland)

Access Credentials to the Help Desk have been provided

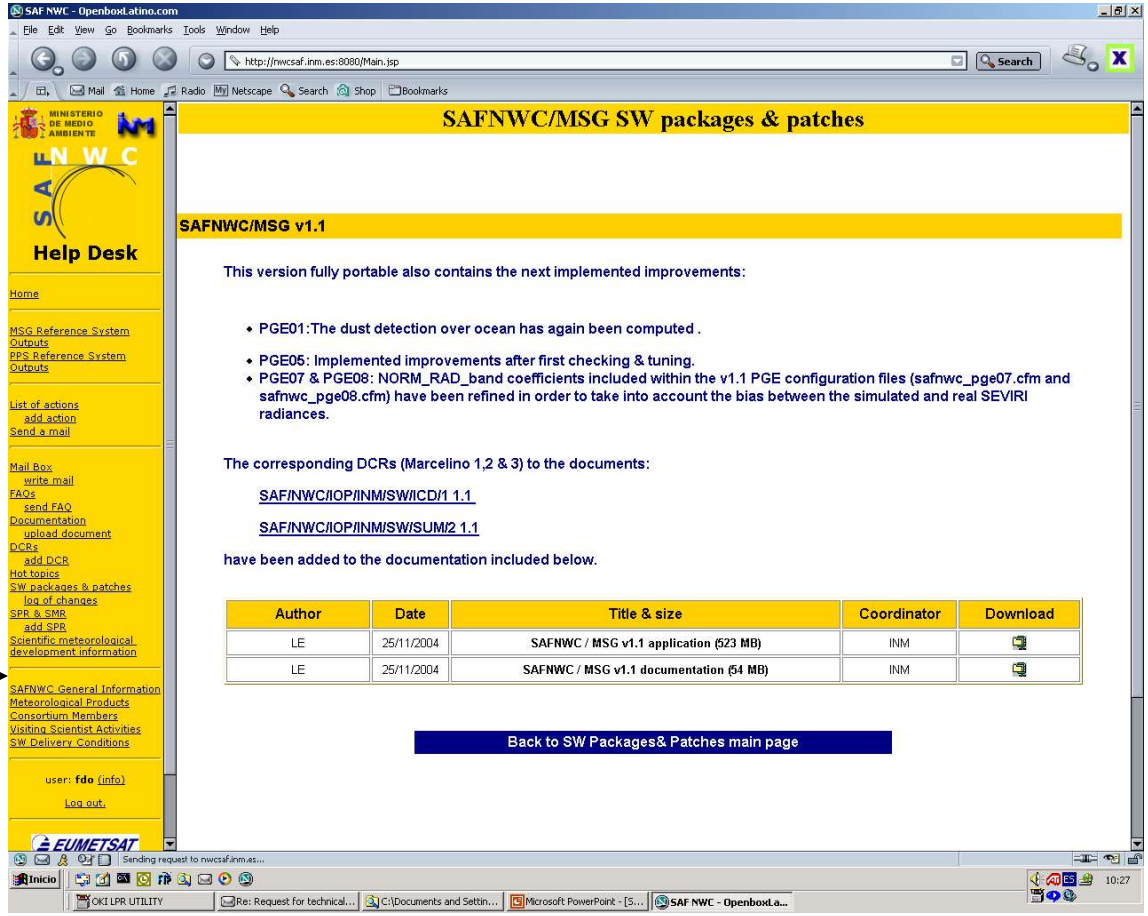
Help Desk users area: SW Packages & Patches

MINISTERIO DE MEDIO AMBIENTE

SAFNWC

- Mail Box
- FAQS
- Documentation
- DCR
- Hot Topics
- SW Packages and Patches
- SPR & SMR
- Development information

To access and recover the latest version and patches for the SAFNWC software application



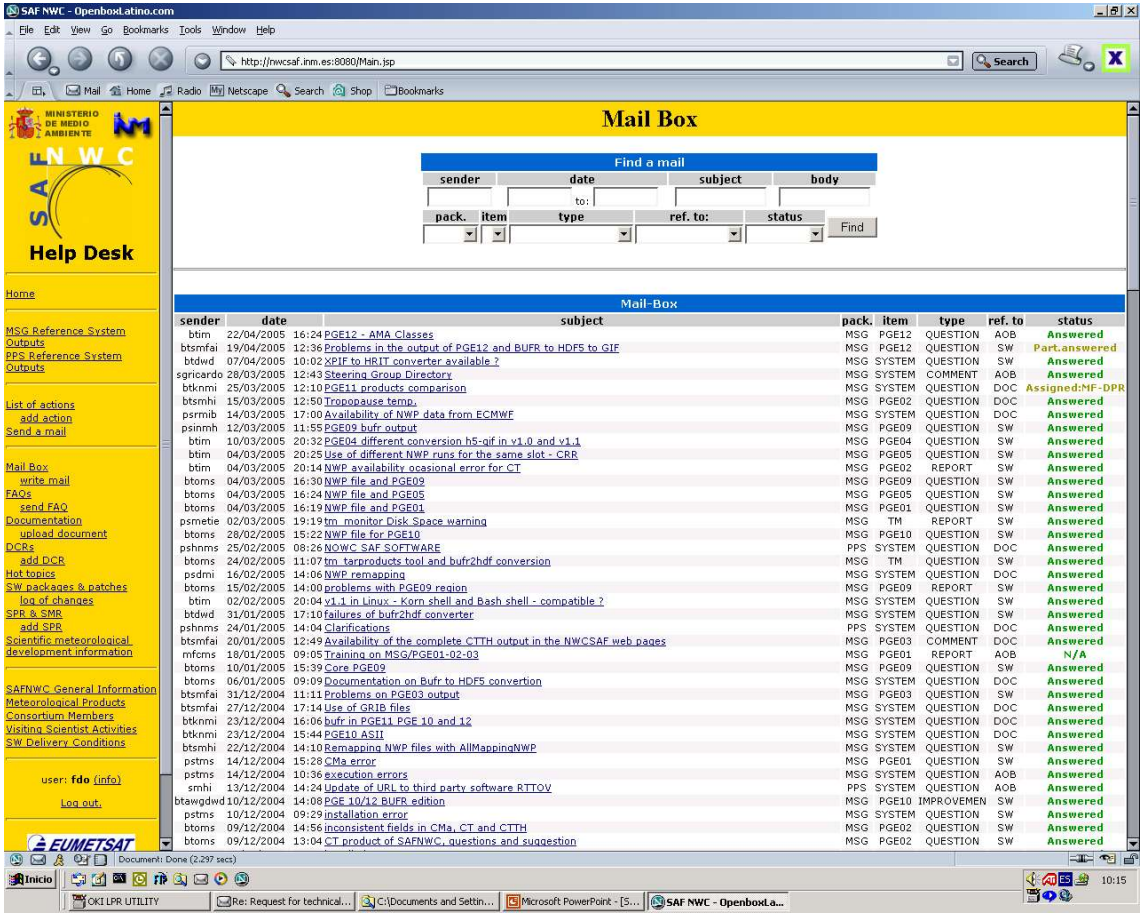
Help Desk users area: Mail Box

MINISTERIO DE MEDIO AMBIENTE

SAF NWC

- Mail Box
- FAQS
- Documentation
- DCR
- Hot Topics
- SW Packages and Patches
- SPR & SMR
- Development information

Place where all SUG members are able to introduce questions or comments to be answered by the SAFNWC project members



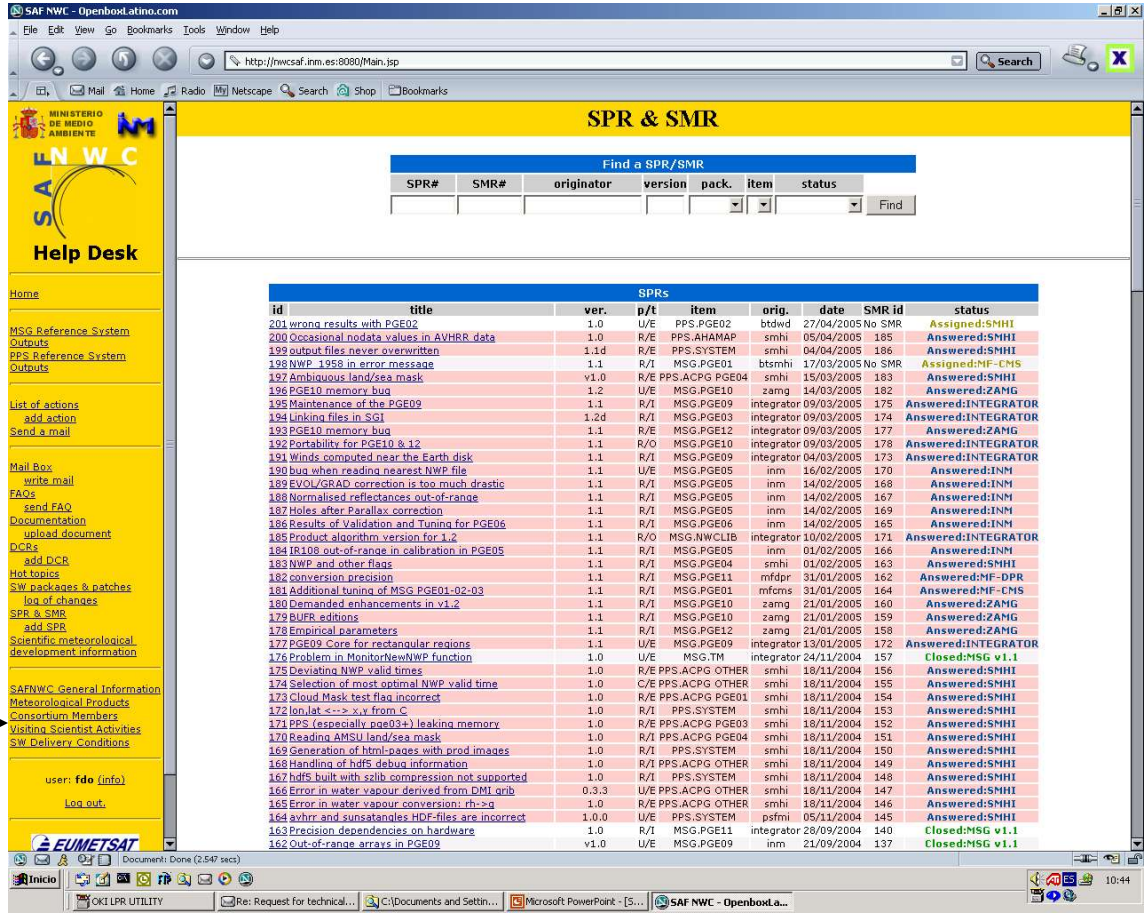
Help Desk users area: SPR & SMR

MINISTERIO DE MEDIO AMBIENTE

SAF NWC

- Mail Box
- FAQS
- Documentation
- DCR
- Hot Topics
- SW Packages and Patches
- SPR & SMR
- Development information

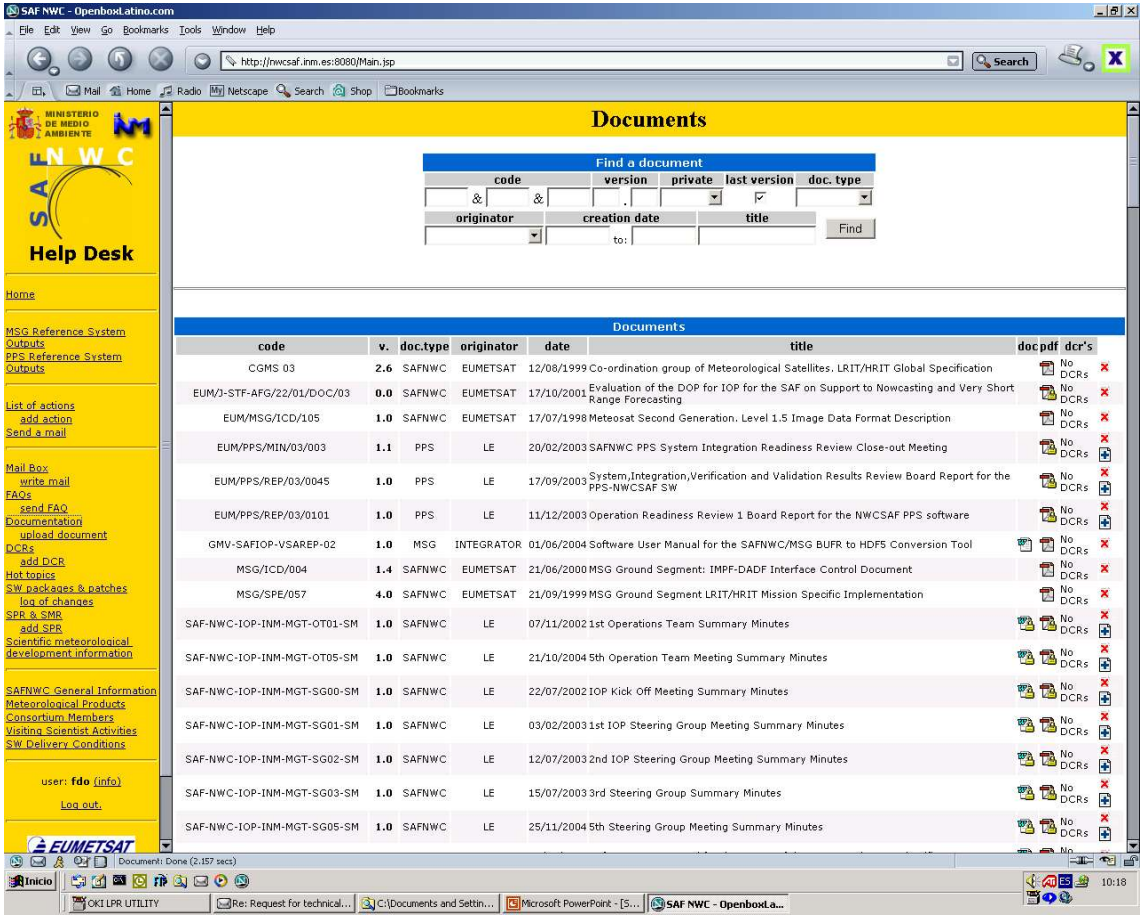
A SPR (Software Problem Report) is the way to the user report a detected problem in the SW application. A SMR (Software Modification Reports) describes the changes to be implemented in the code in order to solve the detected problem



Help Desk users area: Documentation

- Mail Box
- FAQS
- Documentation
- DCR
- Hot Topics
- SW Packages and Patches
- SPR & SMR
- Development information

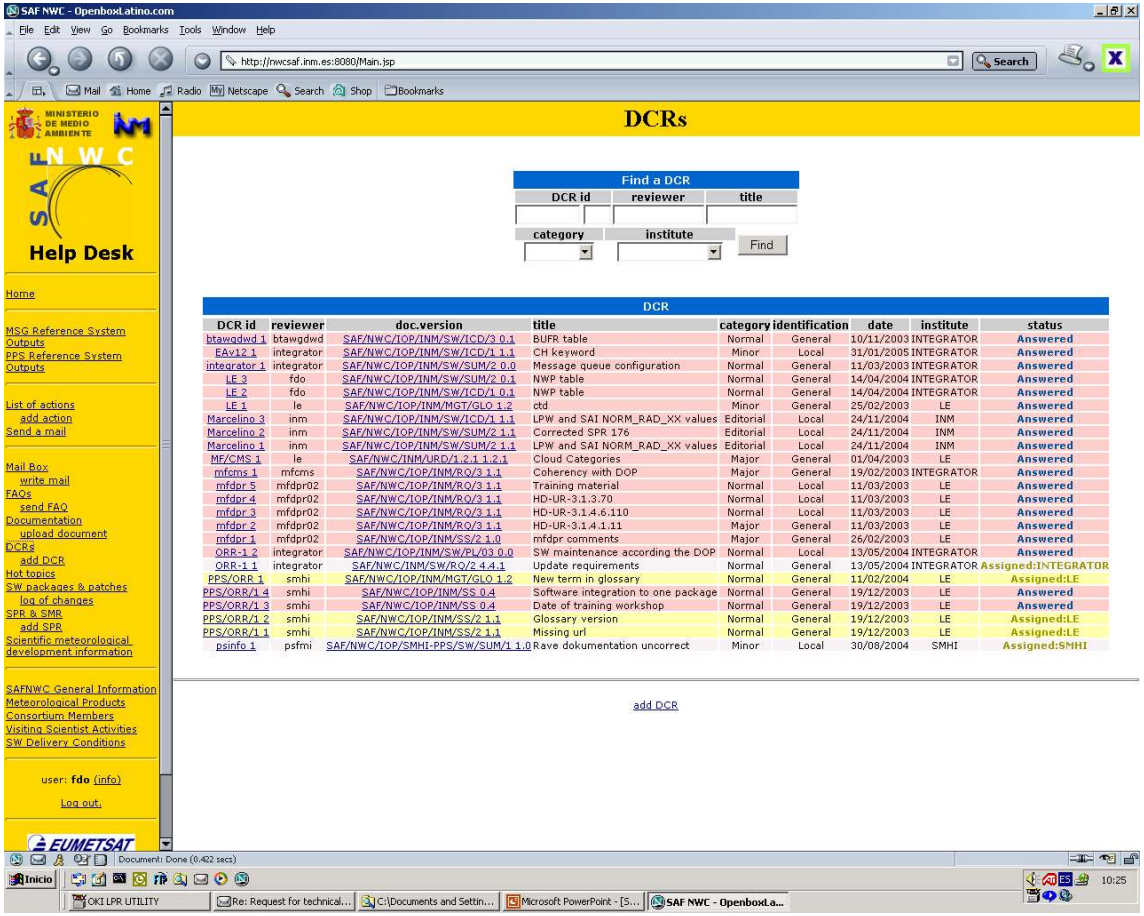
Documentation Data Base of the Project allowing the uploading and downloading of the documents, as well as a searching tool.



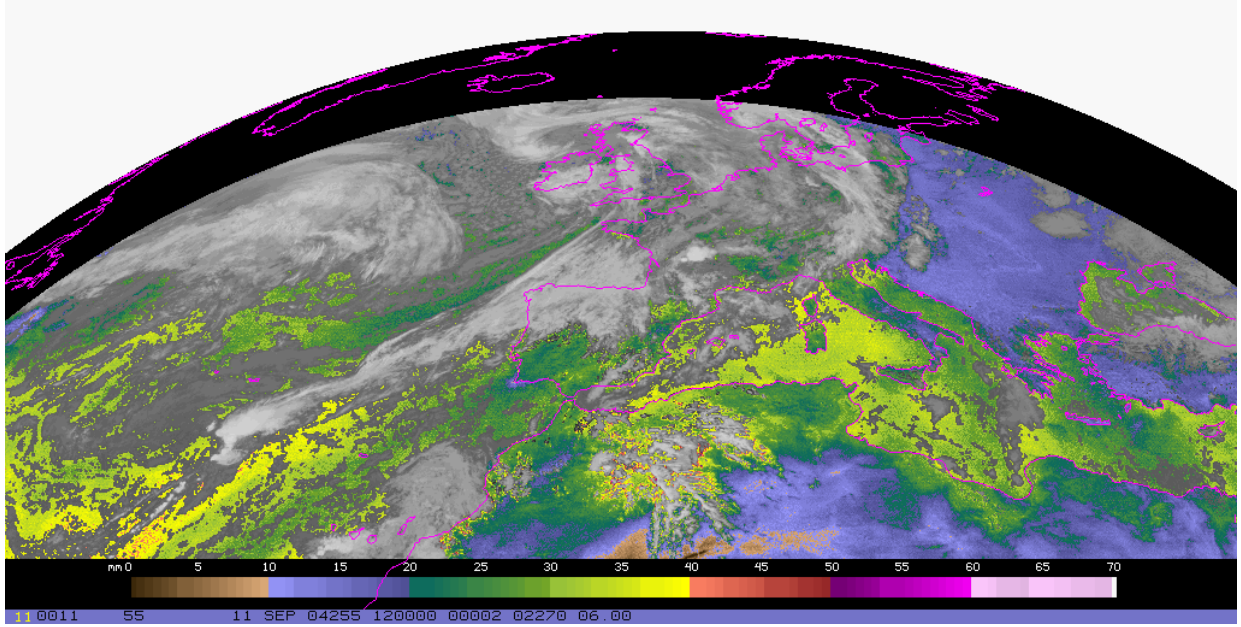
Help Desk users area: DCR

- Mail Box
- FAQS
- Documentation
- DCR
- Hot Topics
- SW Packages and Patches
- SPR & SMR
- Development information

To register all Document Change Request sent by the users when a problem is detected in an applicable document.

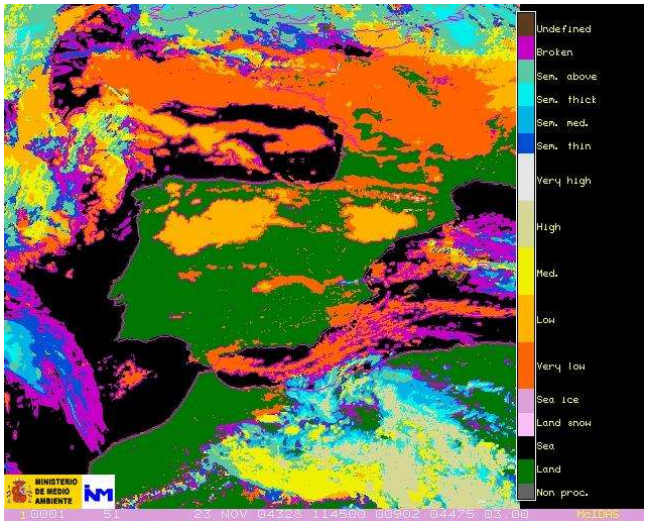


Reference System: Processing Areas



MSGN

IBER



Help Desk users area: Reference System Outputs

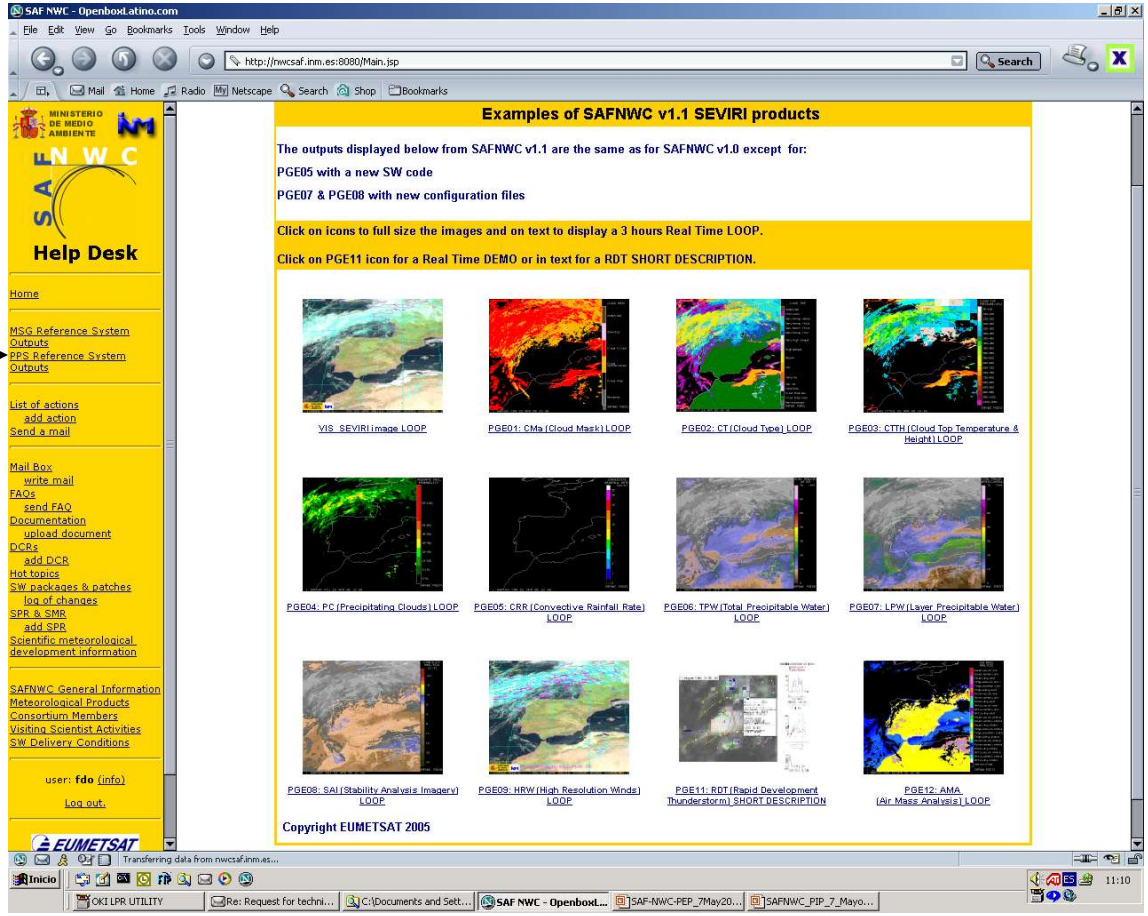
MINISTERIO DE MEDIO AMBIENTE

SAF NWC

MSG Reference System Outputs

PPS Reference System Outputs

Products obtained from the INM Reference System. Users can compare their products with the referenced.



SAFNWC Conclusions

- The SAF in support of NoWCasting & Very Short Range Forecasting delivered its first operational versions in June 2004.
- Users from 23 National Meteorological Services along Europe have been authorised to recover and use the SAFNWC SW packages.
- A new portable version for the MSG part (running in Linux) was delivered in November 2004.
- The last Training Workshop was held in Madrid in May 2004.
- Two new versions SAFNWC/MSG v1.2 & SAFNWC/PPS v1.1 have successfully passed the EUMETSAT review and will be delivered early June 2005.
- Next Workshop on Product Applicability and User Requirement Upgrading to be held in Madrid, the 3rd Week October 2005 (17^{th} to 21^{st})