

# CURRENT AND FUTURE EUMETSAT ACTIVITIES: OVERVIEW



Vesa Nietosvaara  
Training Officer  
EUMETSAT





# Siberian Fires

Metop image captured at 02:46 UTC on 18 July 2014 shows smoke from fires burning near the town of Yakutsk in Yakutiya, part of geographic Siberia. The river Lena is visible in the centre of the picture.





**Kliuchevskoi Volcano, Kamchatka**

**Ash cloud visible from the Kliuchevskoi volcano on the snow-covered Kamchatka peninsula.**

**EUMETSAT's Metop-B polar-orbiting satellite on Sunday 03 May 2015, 23:28 (UTC)**



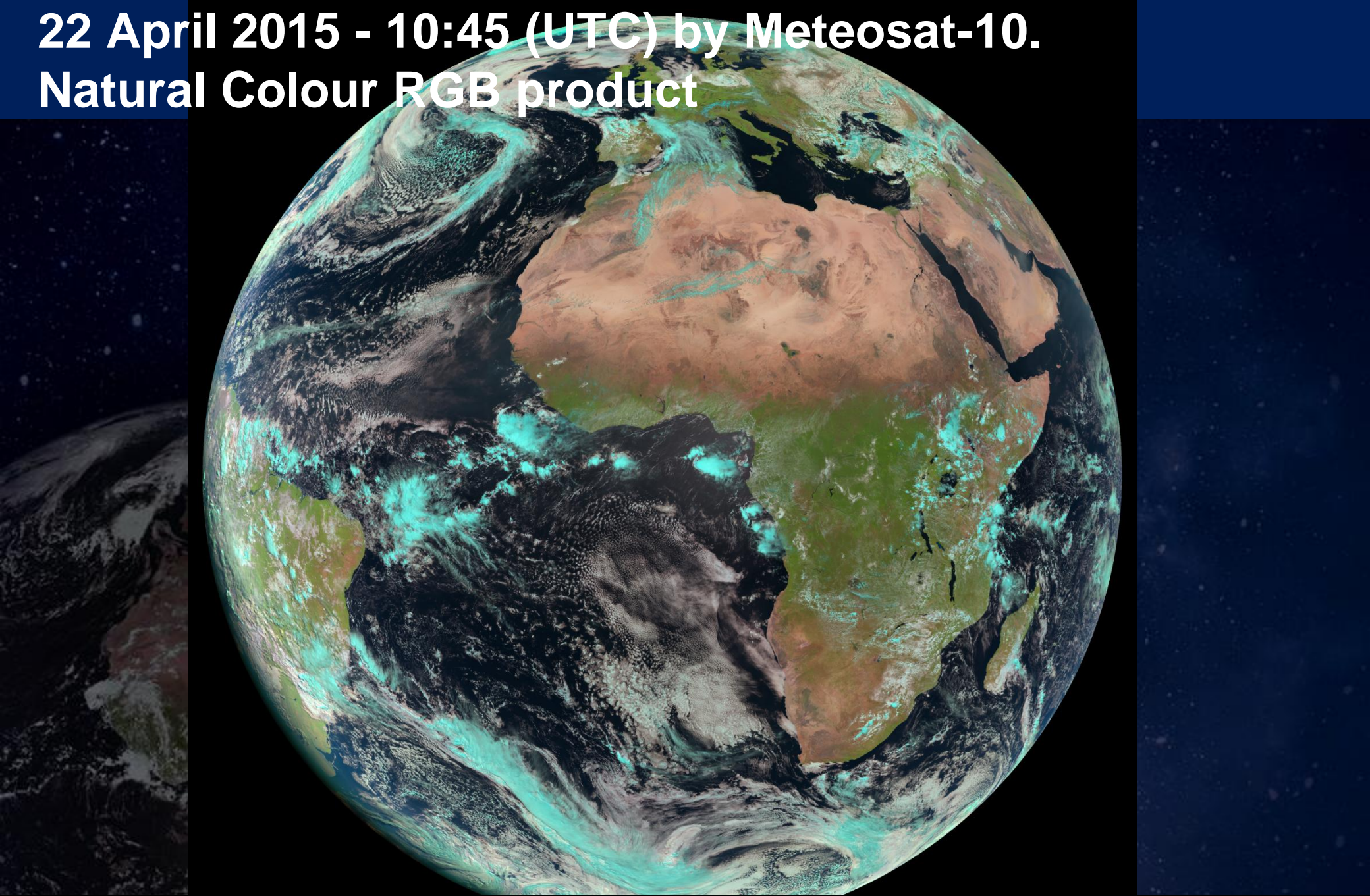
## **Meteor vapour trail, 15th Feb 2013**

**An image from the SEVIRI instrument aboard our Meteosat-10 geostationary satellite. The vapour trail left by the meteor that was seen near Chelyabinsk in Russia on 15th February 2013 is visible in the centre of the image.**





**22 April 2015 - 10:45 (UTC) by Meteosat-10.**  
**Natural Colour RGB product**



# EUMETSAT is an intergovernmental organisation with 30 Member and 1 Cooperating States

## Member States



AUSTRIA



BELGIUM



BULGARIA



CROATIA



CZECH REPUBLIC



DENMARK



ESTONIA



FINLAND



FRANCE



GERMANY



GREECE



HUNGARY



ICELAND



IRELAND



ITALY



LATVIA



LITHUANIA



LUXEMBOURG



THE NETHERLANDS



NORWAY



POLAND



PORTUGAL



ROMANIA



SLOVAK  
REPUBLIC



SLOVENIA



SPAIN



SWEDEN



SWITZERLAND



TURKEY



UNITED KINGDOM

## Cooperating States



SERBIA



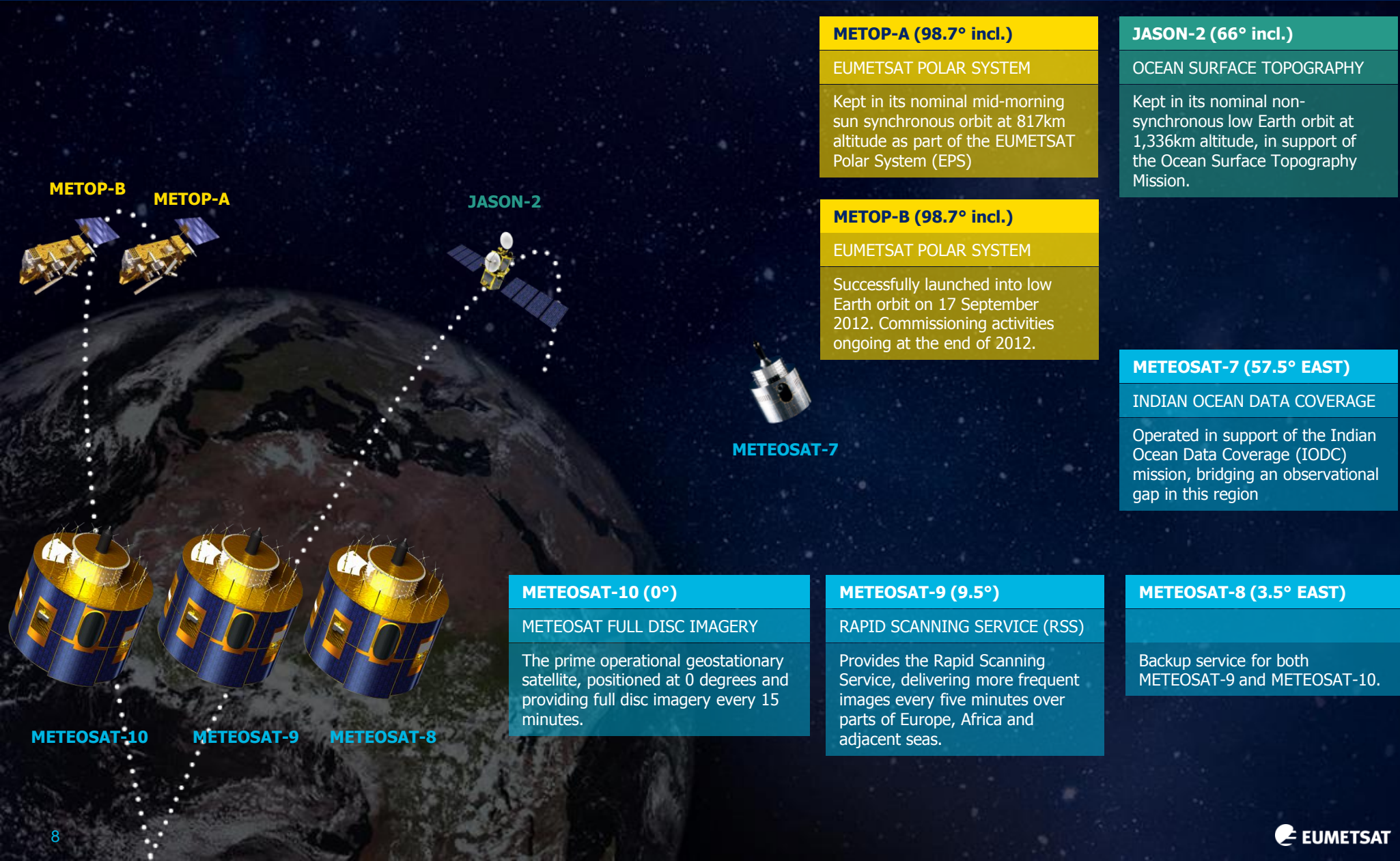


# EUMETSAT headquarters



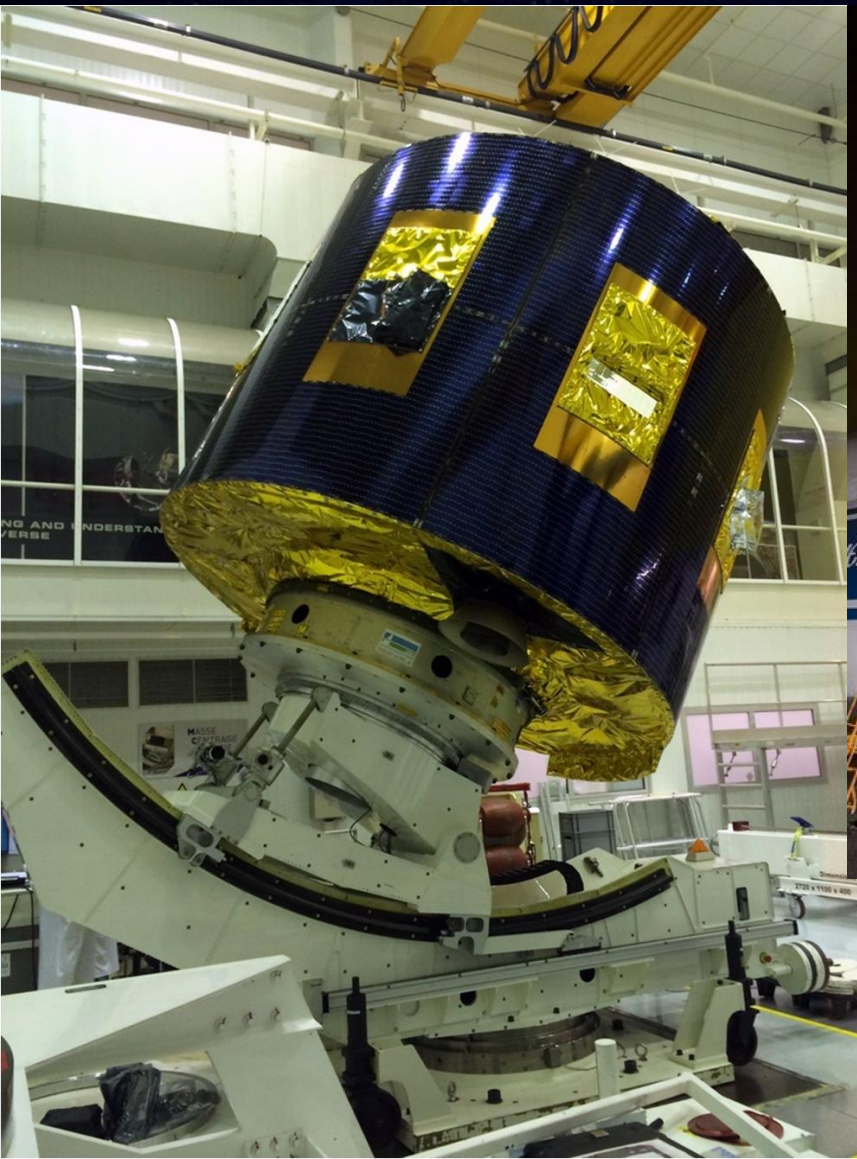


# Current EUMETSAT satellites





# METEOSAT-11 upcoming...



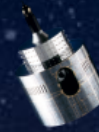


# Respective roles of EUMETSAT's geostationary and polar-orbiting satellite programmes

## Geostationary

Primary mission: “Nowcasting” of rapidly developing, high-impact weather up to six hours ahead.

- One of the most challenging tasks of the forecasters, vital for the safety of life, property and infrastructure
- Requires informative images of the atmosphere at a high frequency (some minutes) that can only be achieved from the geostationary orbit (36,000 km)





# Respective roles of EUMETSAT's geostationary and polar orbiting satellite programmes

## Polar Orbiting

A second system in lower orbit is needed to complement the data from geostationary orbit and provide global coverage

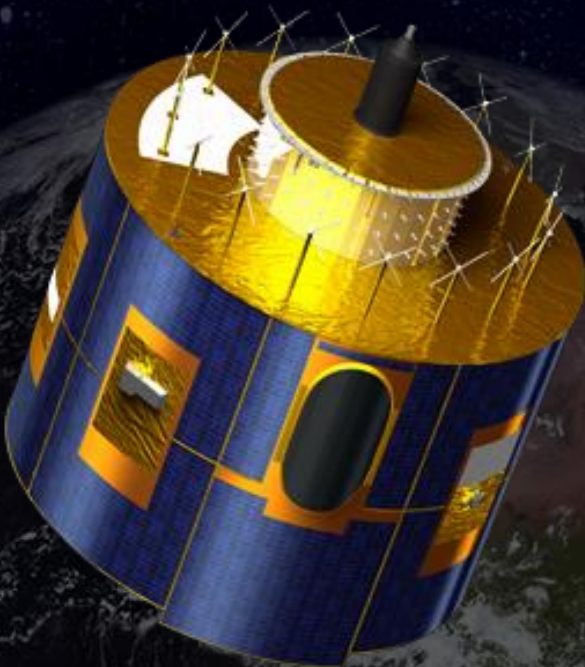
- Flying at a much lower altitude (817 km), Metop satellites deliver a wealth of less frequent but global and quantitative observations which are the most critical inputs to the Numerical Weather Prediction models used to forecast weather up to 10 days and for climate monitoring



# Meteosat Second Generation

The data provided by Meteosat satellites make a vital contribution to daily weather forecasting, in particular for nowcasting and very short range forecasting of high impact weather like thunderstorms and fog over Europe, Africa and adjacent seas.

- Operated as a two-satellite system since 2006:
- Meteosat-10 provides “full disk” images every 15 minutes over Europe, Africa and part of the Atlantic and Indian oceans
- Meteosat-9 provides “rapid scan” images every 5 minutes over European continent only

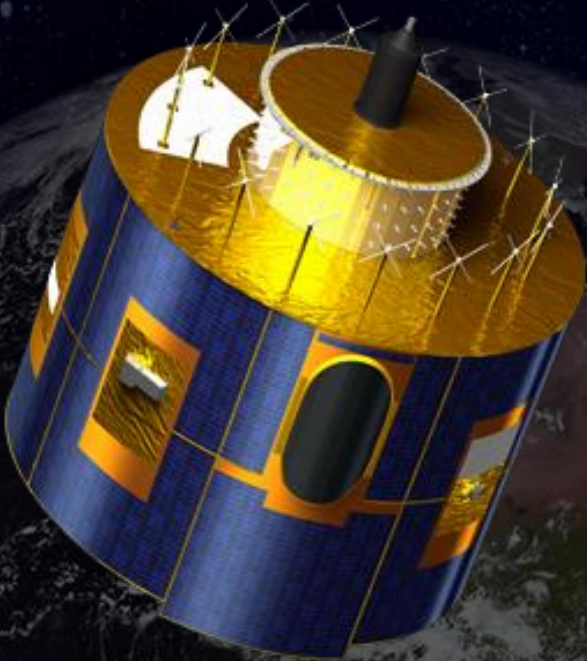




# Meteosat Second Generation

Carries two instruments:

- Spinning Enhanced Visible and InfraRed Imager (SEVIRI)  
– main operational instrument – observes the Earth in 12 spectral channels covering visible, near-infrared and thermal infrared part of the spectrum
- The Geostationary Earth Radiation Budget (GERB) instrument observes the reflected sunlight and thermal emissions from the Earth in two broadband channels
- Another mission is the data collection service that collects and relays environmental data collected from Data Collection Platforms to users

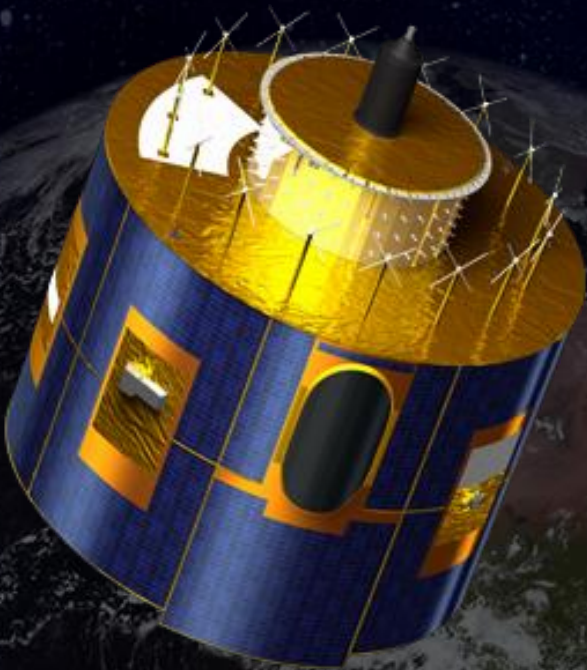




# Meteosat Second Generation

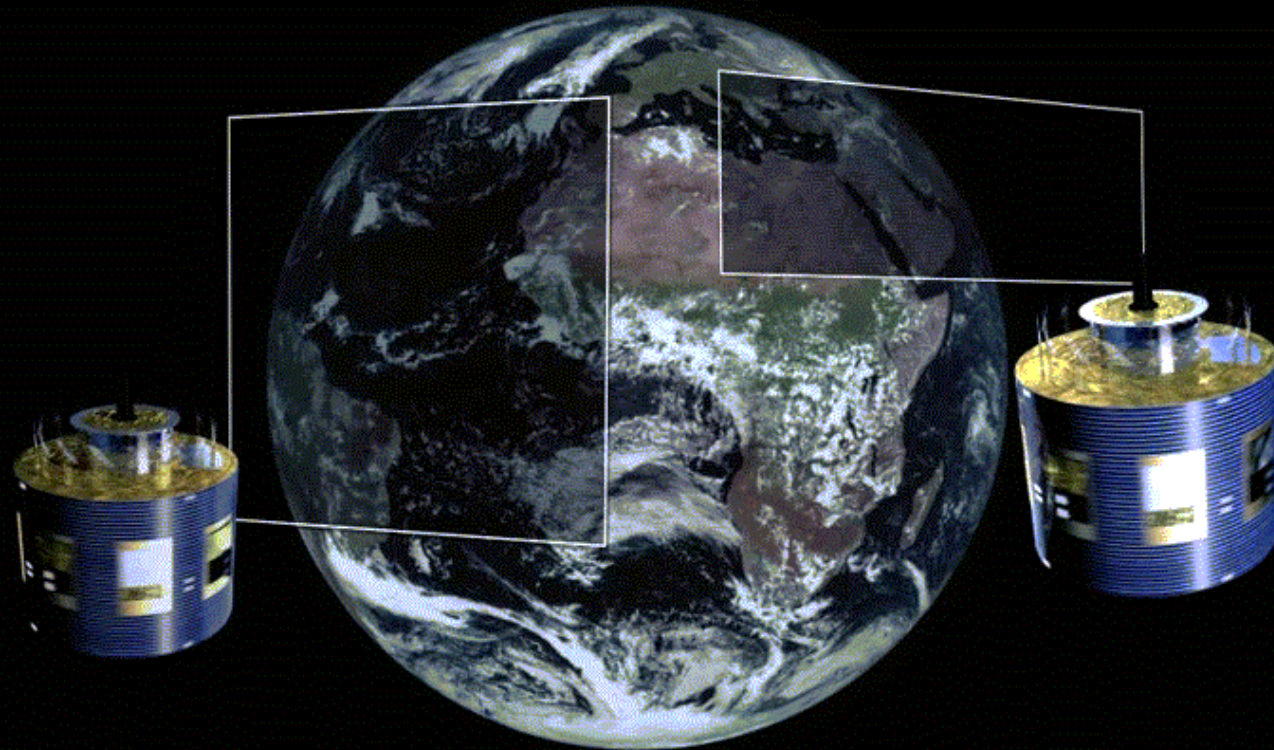
Other applications of MSG:

- Extraction of wind information from observed displacement of clouds and water vapour patterns as input for NWP models (to complement Metop observations which remain the primary source)
- volcanic ash monitoring
- climate monitoring





# The operational capability of a two-satellite system



Time-lapse  
00:00

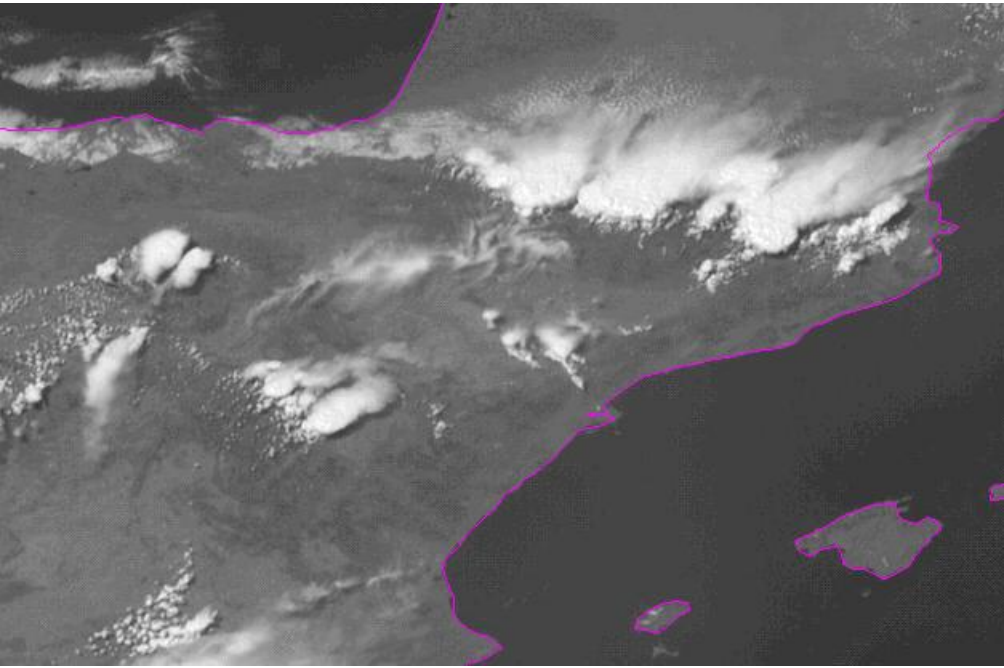
Animated representation

15-minute scan

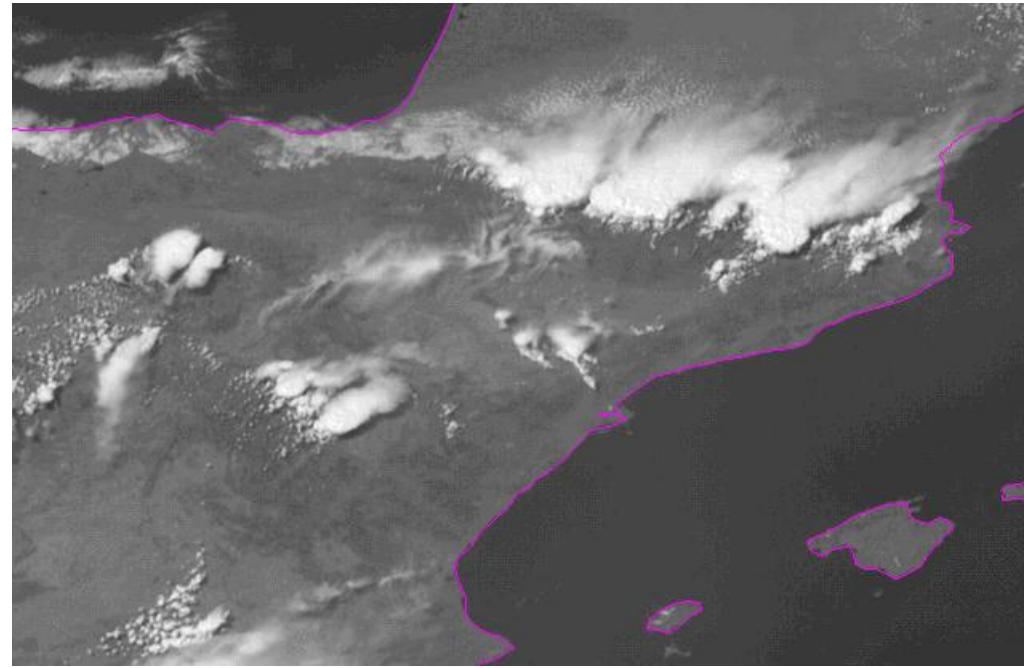
5-minute scan



# The operational capability of a two-satellite system



**15-minute scan**

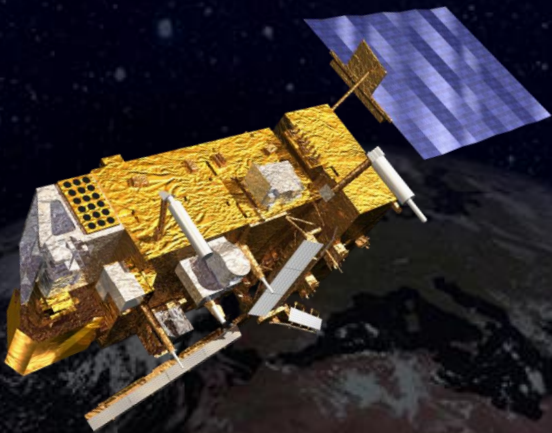


**5-minute scan**



# EUMETSAT Polar System (EPS)

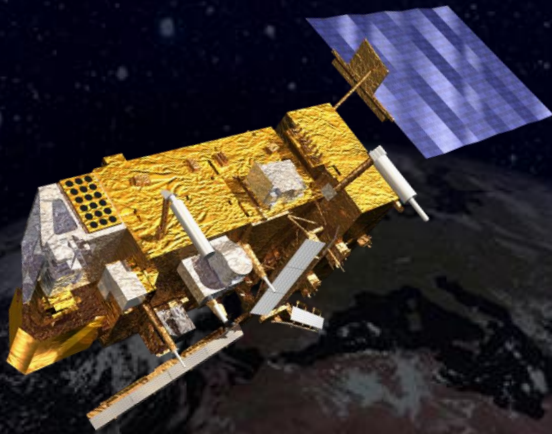
- They constitute the European contribution to the joint operational meteorological polar satellite system shared with the USA.
- This system is comprised of two polar-orbiting satellites and their respective ground segments;
- It delivers continuous global observations for meteorological applications and climate monitoring.






# EUMETSAT Polar System (EPS)

- Flying at an altitude of 817 km, each Metop satellite carries the same sophisticated suite of instruments;
- They provide fine-scale global data, which can only be gathered in the low Earth orbit, such as:
  - vertical profiles of atmospheric temperature and moisture;
  - wind speed and direction at the ocean surface;
  - some atmospheric trace gases
- They deliver data for NWP – the basis of modern weather forecasting – and climate and environmental monitoring;
- The three Metop satellites, launched sequentially (2006, 2012, 2017), will provide continuous data until 2020.



# The Jason series : Delivering High Precision Ocean Altimetry

- 
- Jason-2 delivers high-precision altimetry observations of:
    - wave height
    - mean sea level and ocean current, in support of operational oceanography; climate monitoring and marine meteorology.
  - The unique sea level data series accumulated since 1992 by Topex/Poseidon and Jason-1 are also continued, forming an invaluable Climate Data Record.
  - Jason-2 ocean surface topography mission continues successful partnership with NOAA, NASA and CNES.
  - Jason-2 provides an indispensable reference against which measurements of other altimeter missions are cross-calibrated.



# The Jason series: Delivering High-Precision Ocean Altimetry

- Jason-3, the follow-on satellite required to ensure continuity of measurements, is scheduled for launch in spring 2015.
- The Jason-3 mission will expand, into a third decade, the high precision altimetry observations required to monitor mean sea level and serve as a unique reference for other altimetry missions aimed at monitoring ocean circulation at various scales, including the altimetry mission of GMES Sentinel-3.
- Future altimetry missions (Jason-CS/Sentinel-6) are needed to secure the HPOA mission into the next decades.

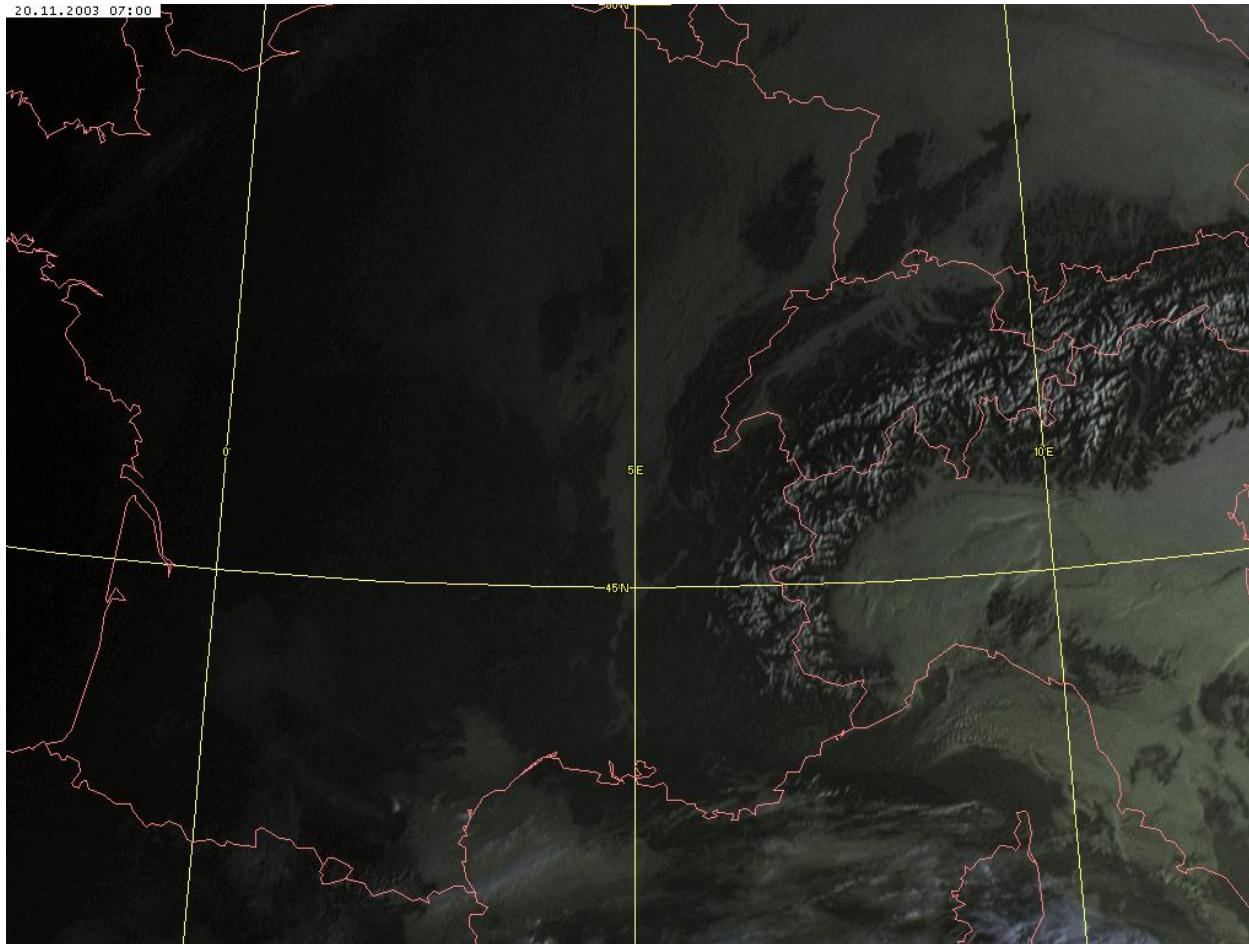


# METEOSAT PRODUCTS & APPLICATIONS





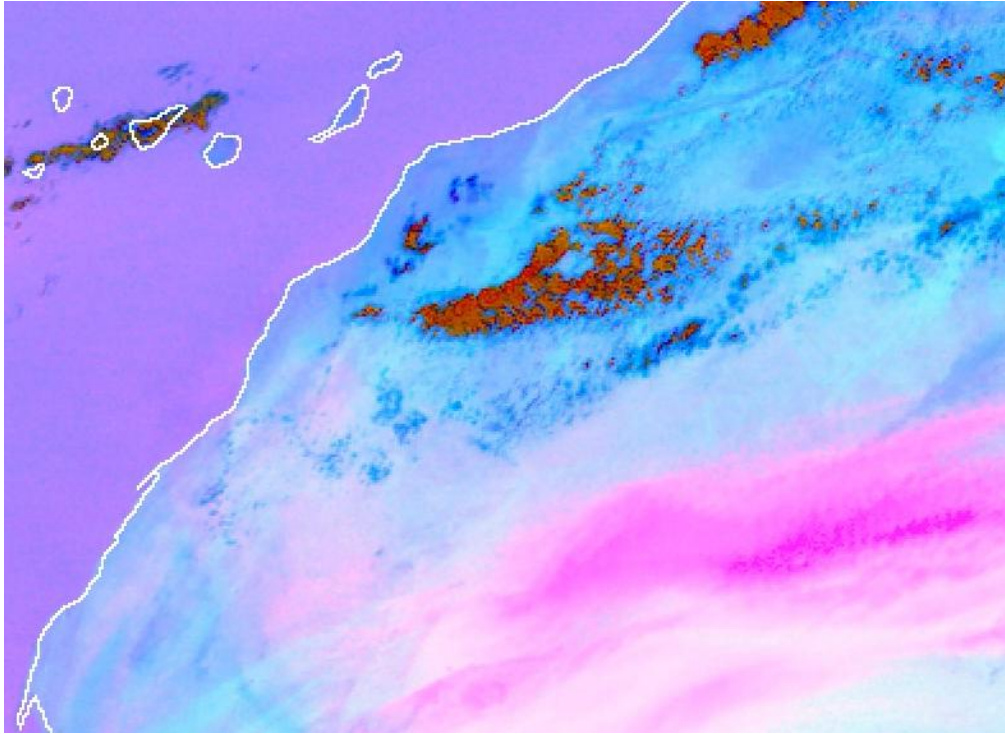
# Fog RGB (animated)



Application:

Nowcasting formation /  
dissipation of fog

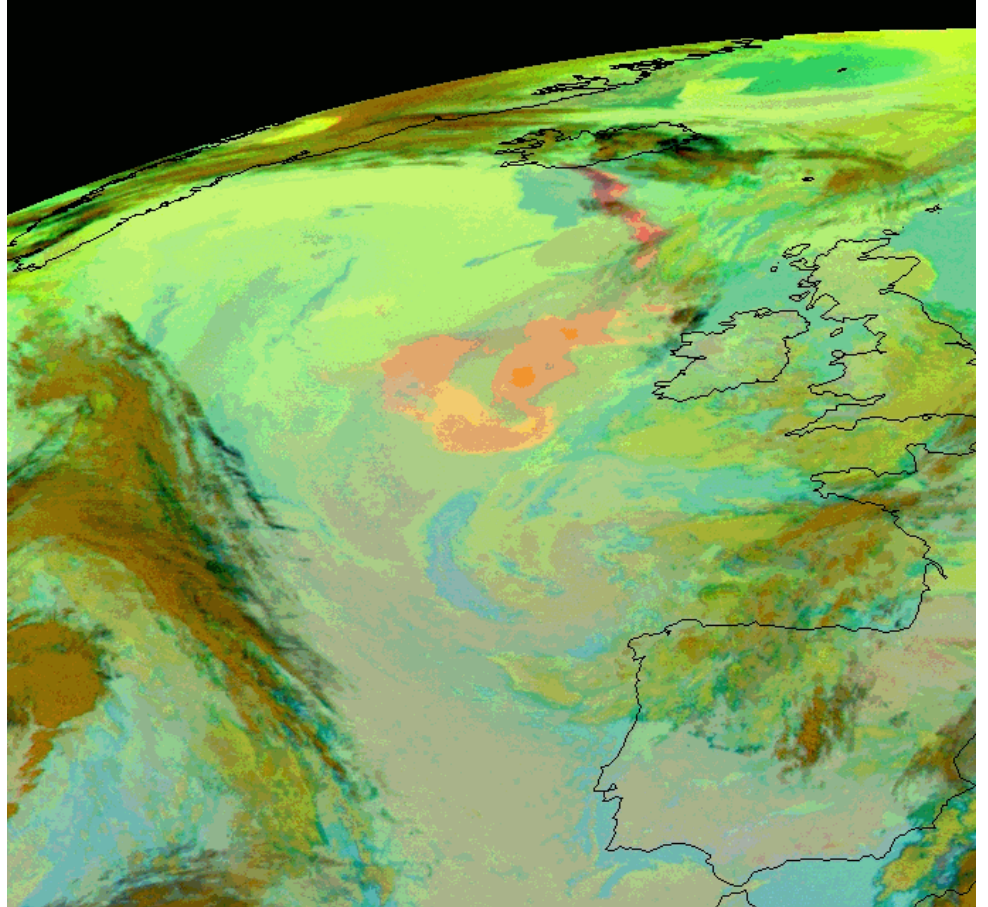
# Dust / Ash RGB



Applications:

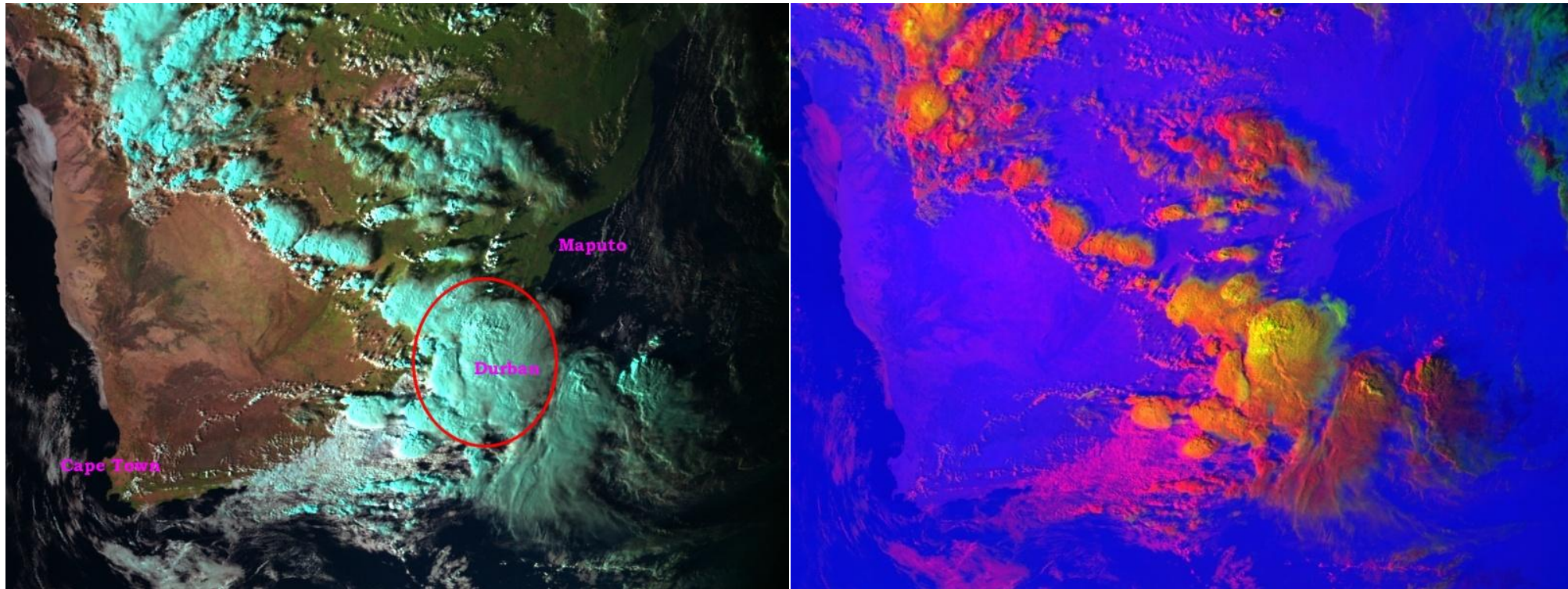
Visibility issues

Ash warnings





# Cloud Microphysics – e.g. Convection



Application:

Nowcasting most severe part of convective storms  
(aviation, weather on the ground)

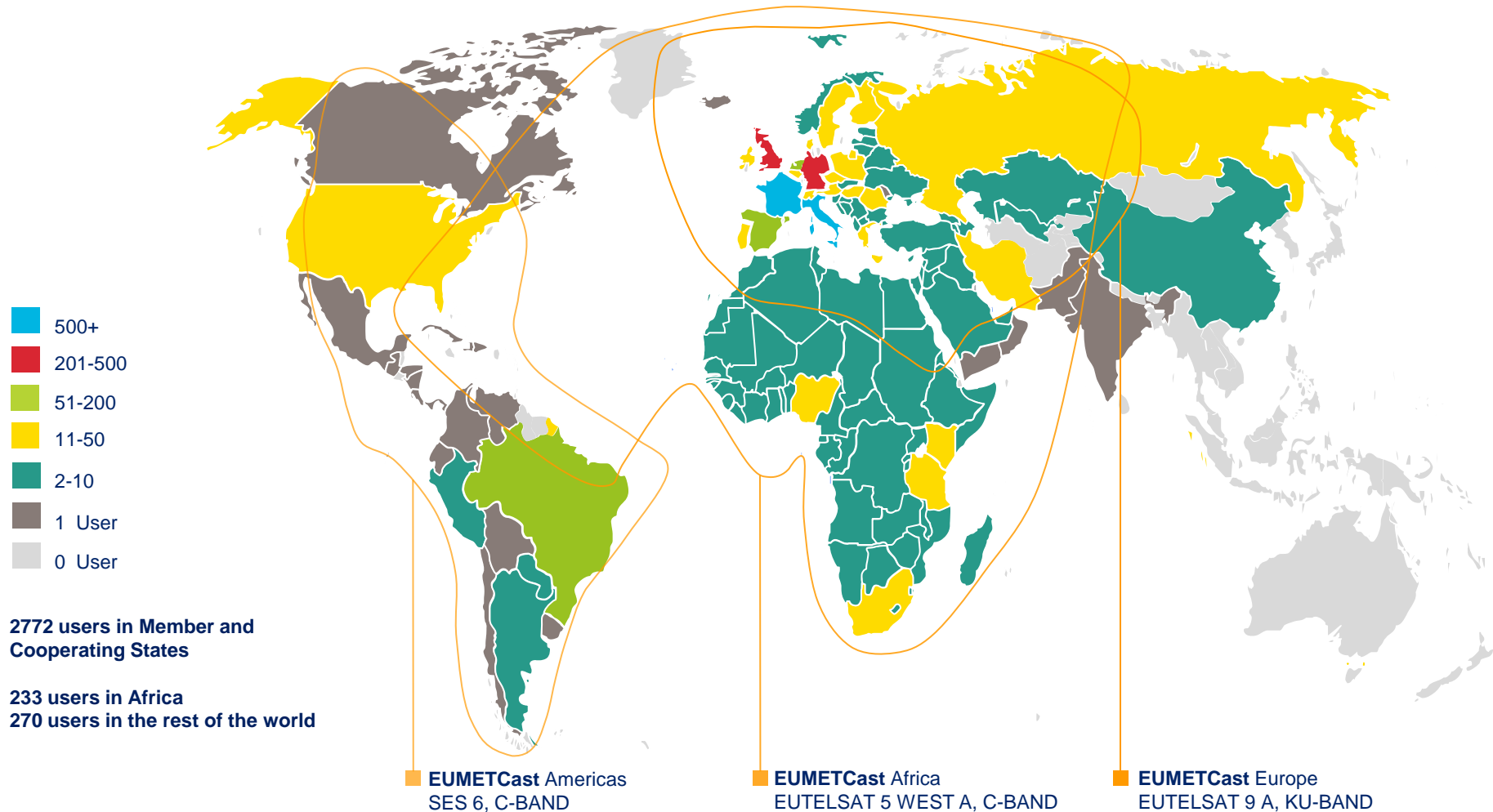
# DATA ACCESS



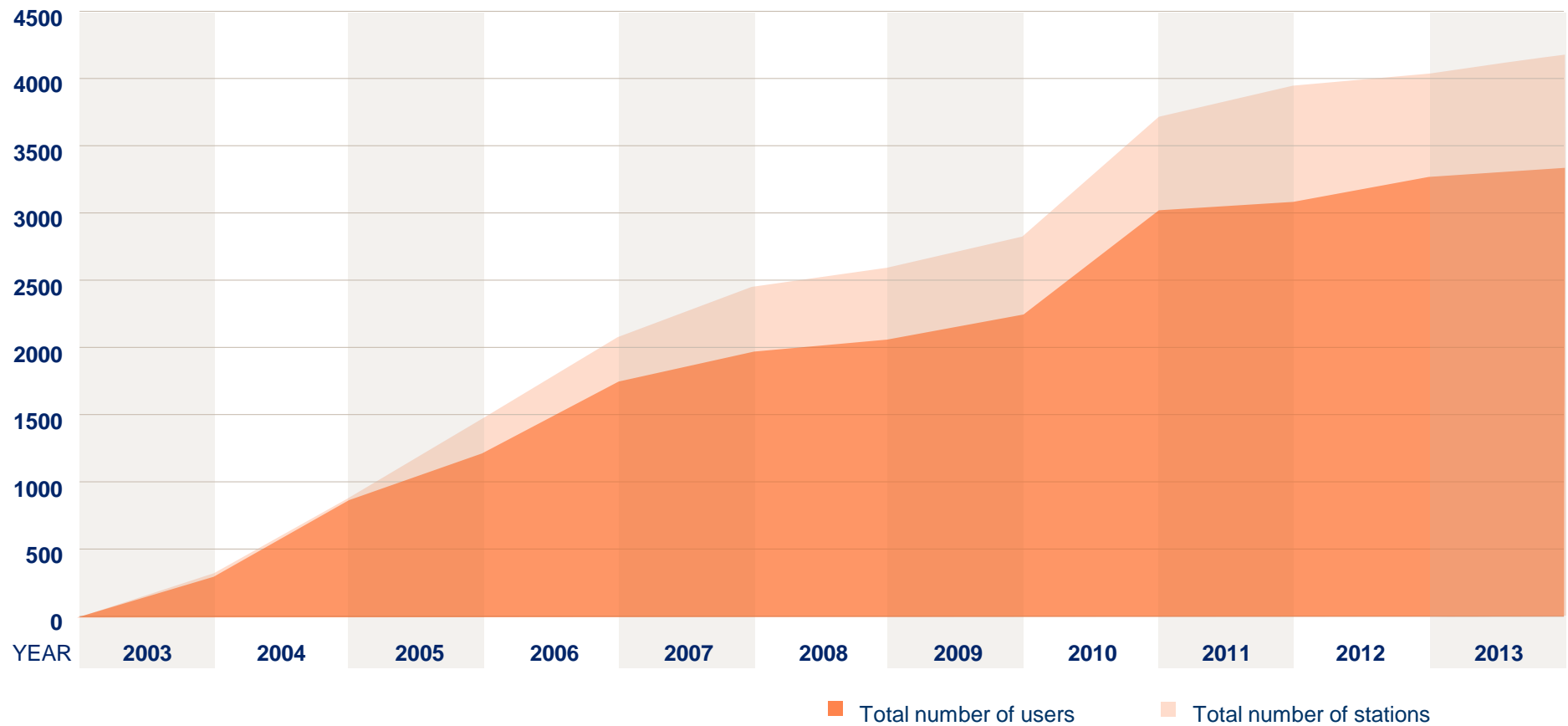


# Delivering to users worldwide

## EUMETCast Users Worldwide as of 31 December 2013



# Growth in EUMETCast stations/users 2002-2013





# PARTNERSHIPS AND COOPERATION



# EUMETSAT SAF network across Europe



**H SAF**  
Support to Operational Hydrology and Water Management  
Led by Italian Meteorological Institute



**ROM SAF**  
Radio Occultation Meteorology  
Led by Danish Meteorological Institute



**O3M SAF**  
Ozone and Atmospheric Chemistry Monitoring  
Led by Finnish Meteorological Institute



**LSA SAF**  
Land Surface Analysis  
Led by Portuguese Meteorological Institute



**NWC SAF**  
Support to Nowcasting and Very Short  
Range Forecasting  
Led by Agencia Estatal de Meteorología,  
Spain



**OSI SAF**  
Ocean and Sea Ice  
Led by Météo France



**CM SAF**  
Climate Monitoring  
Led by Deutscher Wetterdienst, Germany



**NWP SAF**  
Numerical Weather Prediction  
Led by Met Office (UK)





# Cooperation with other operators

- 
- Operators of satellites in the geostationary ring other than EUMETSAT are CMA, the Japan Meteorological Agency (JMA), ROSHYDROMET, Korea Meteorological Administration (KMA), Indian Space Research Organisation (ISRO), as well as NOAA, all of which have launches scheduled in 2015-2018 timeframe, for example:
    - JMA launched Himawari-8 in summer 2014 and plans to launch the Himawari-9 in 2016.
    - NASA/NOAA plans launch of first GOES-R geostationary satellite with Geostationary Lightning Mapper in 2015
    - CMA is developing next generation FY-4 including Advanced Geo Radiation Imager, Geo Interferometric Infrared Sounder and Lightning Mapping Imager.

# EUMETSAT-ROSHYDROMET Cooperation

- Data exchange agreement in place for GEO (Meteosat/Electro) and LEO (Metop/Meteor) – pending operational availability of data
- EUMETSAT ATOVS Retransmission Service – EARS project
- Data validation, algorithm development, EUMETSAT Satellite Application Facilities, Data Collection System Programmes
- Training
- Collaboration in the fields of data validation, algorithm development, EUMETSAT Satellite Application Facilities, International Data Collection System Programmes

## **International collaboration:**

- EUMETSAT and ROSHYDROMET are Members of CGMS (as well as ROSCOSMOS)
- Cooperation activities within the framework of WMO and CGMS (GSICS, SCOPE-CM, Virtual Laboratory, International Charter, Space and major disasters...)



# EUMETSAT Advanced Retransmission Service

## EARS project

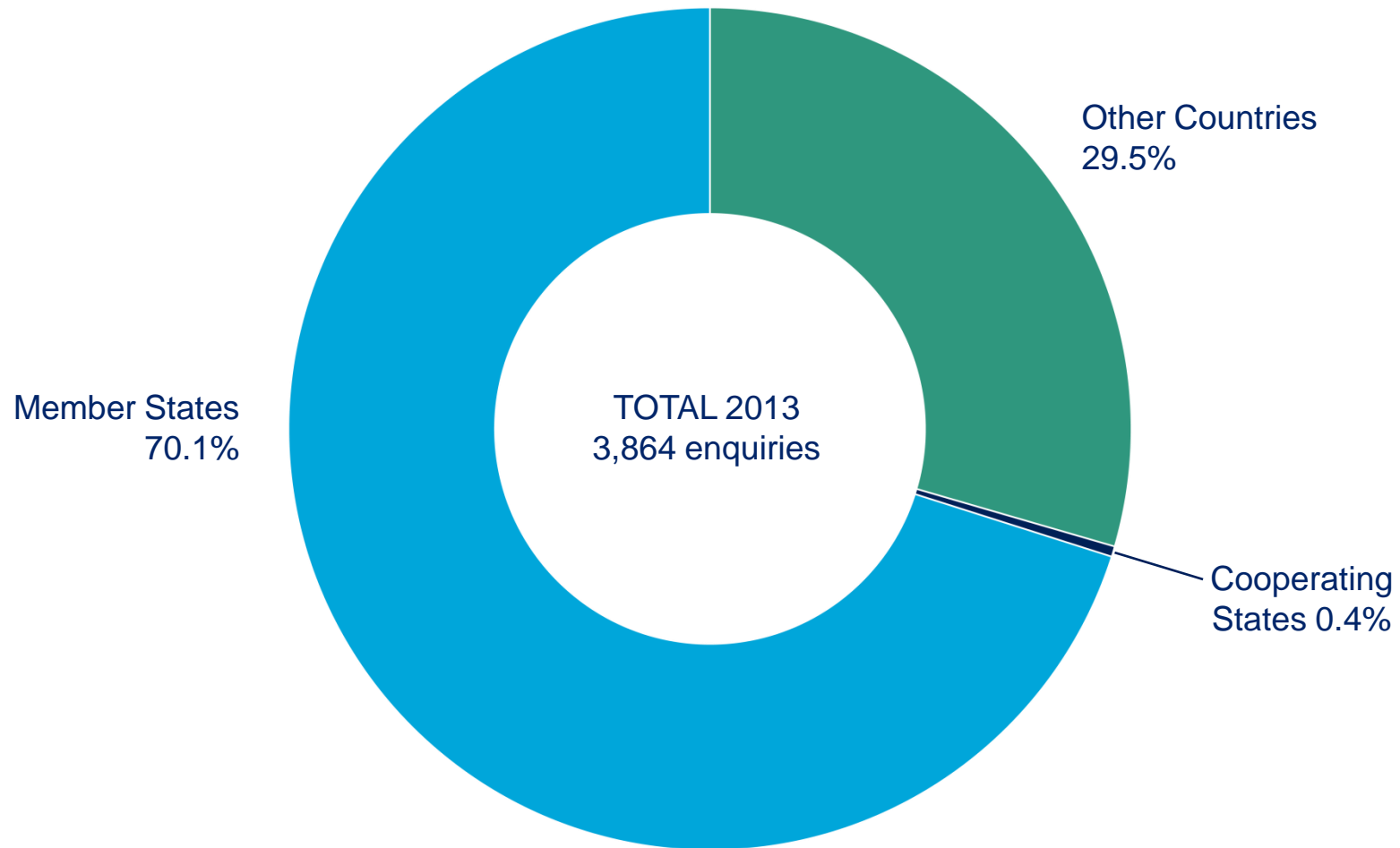
- Data received by SRC Planeta in Moscow and Dolgoprudny continues to be highly valuable to the operational EARS services.
- Metop-B will have full HRPT capability and will provide better coverage over Russia.
- Investigations ongoing to indentify data distribution capacity from Novosibirsk/Khabarovsk to Moscow for inclusion in EARS service.

# SUPPORTING THE USERS





# User support services



**Helpdesk: [ops@eumetsat.int](mailto:ops@eumetsat.int)**

# Supporting users – Training Courses





# Supporting users – Training Courses

## INTERNATIONAL SUMMER SCHOOL 2014

### INTERNATIONAL SCHOOL ON APPLICATIONS WITH THE NEWEST MULTI-SPECTRAL ENVIRONMENTAL SATELLITES.

10–18 JUNE 2014, BRACCIANO, ITALY

In June 2014, EUMETSAT and the Centro Nazionale di Meteorologia e Climatologia Aeronautica (CNMCA) of the Italian air force organised the 13th 'International Summer School on Applications with the Newest Multi-spectral Environmental Satellites'.

The course presented in depth explanation of methods and techniques used to extract information from environmental satellite data, with emphasis on the latest measuring technologies.

It was attended by 16 participants from Italy, Belgium, Czech Republic, Estonia, Germany, Hungary, Kenya, Latvia, Romania, Turkey and Ukraine. The lecturers and tutors were Ralf Bennartz and Mike Hiley, from the University of Wisconsin Cooperative Institute for Meteorological Satellite Studies; EUMETSAT trainer Jochen Kerkmann; Davide Melfi (CNMCA) and Zanita Avotniece, a EUMETSAT trainee from the Latvian Met Service.

The curriculum consisted of 13 lectures covering a number of subjects, including convective clouds and climate applications. Participants were also able to take part in 14 lab sessions and to access real-time MSG data to practice their new skills on actual weather situations.



# Supporting users– New Training Resources



## Conceptual Models for Southern Hemisphere

ARGENTINA

SALLJ & MCSs

ZONDA

AUSTRALIA

EXPLOSIVE

CYCLOGENESIS

SHALLOW COLD  
FRONTS

BRAZIL

ATLANTIC  
CONVERGENCE ZONE

MESOSCALE  
CONVECTIVE  
COMPLEXES

SOUTH AFRICA

COL

CONTINENTAL  
TROPICAL LOWS

VIEW BY CATEGORY

INVENTORY

QUICK LOOK CASES

LITERATURE

CONTRIBUTORS

Argentina > SALLJ and MCSs >

### Cloud Structure in Satellite Images

CLOUD STRUCTURE IN  
SATELLITE IMAGES

METEOROLOGICAL  
PHYSICAL BACKGROUND

NWP KEY  
PARAMETERS

In satellite images, there are two different features related to SALLJ

1. **Cloud streets:** these cumuliform clouds are usually found in lines parallel to the flow. Their presence indicates warm advection in the lower troposphere.
2. **Mesoscale convective systems (MCSs):** These systems are usually elongated or carrot-shaped. The shape usually depends on the orientation of the SALLJ.

### 1. Cloud streets

The figure depicts cumulus clouds organized into lines parallel to the flow.

16°S

18°S

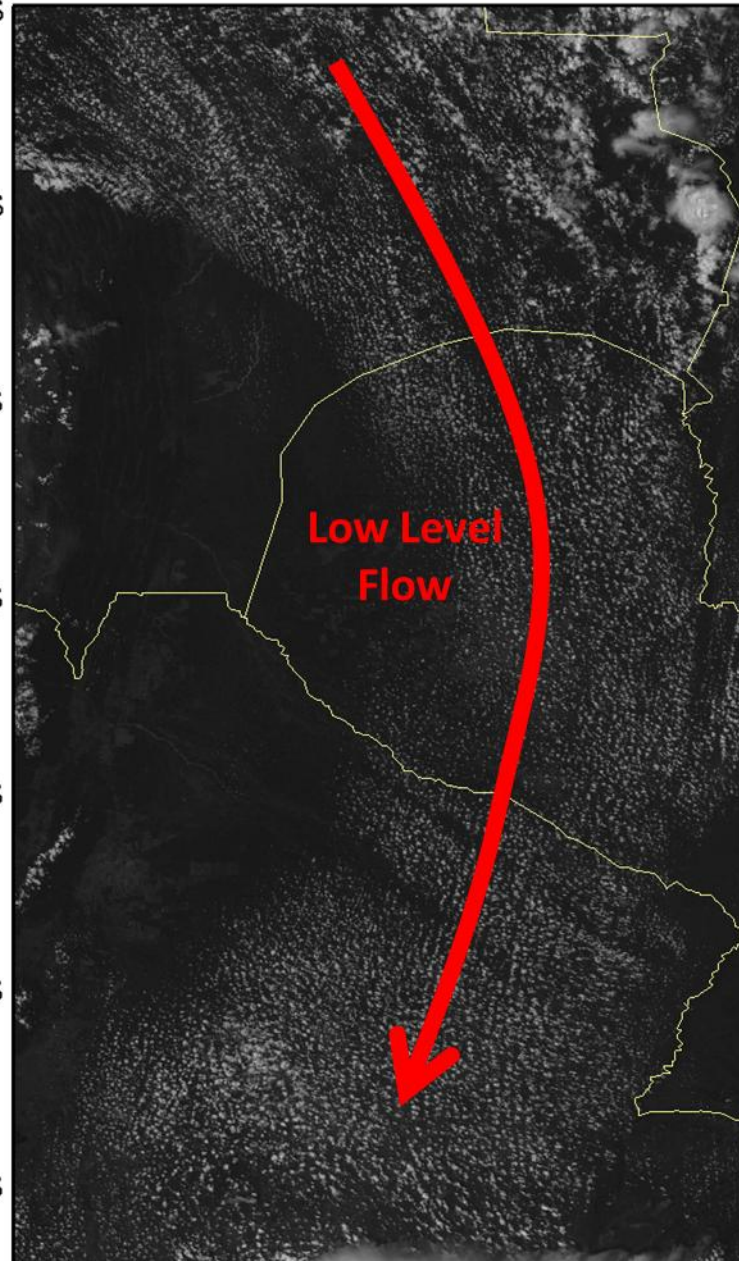
20°S

22°S

24°S

26°S

28°S





# Outlook to Future - Meteosat Third Generation



- Imagery mission implemented by a two-satellite MTG-I system:
  - Full disk imagery every 10 minutes in 16 spectral bands
  - Fast imaging of European weather every 2.5 minutes
  - new Lightning Imager (LI)
- Hyperspectral infrared (IRS) sounding mission:
  - 3D mapping of water vapour, temperature, O<sub>3</sub> every 1 hour
  - Air quality monitoring and atmospheric chemistry in synergy with GMES Sentinel-4 Ultraviolet Visible

# Outlook to Future - Meteosat Third Generation

- 4 imaging (MTG-I) and 2 sounding (MTG-S) satellites,
- start of operations in 2018 and 2019
- operational exploitation: 2018 – 2038
- Full MTG mission implemented by two MTG-I satellites and MTG-S satellite in orbit





# MTG to Secure Continuity and Evolution of EUMETSAT Services

1977



↓ MOP/MTP

Observation mission:  
MVIRI: 3 channels  
Spinning satellite  
Class 800 kg

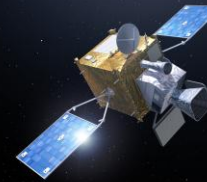
2002



↓ MSG

Observation missions:  
SEVIRI: 12 channels  
GERB  
Spinning satellite  
Class 2 tons

2018 and 2020



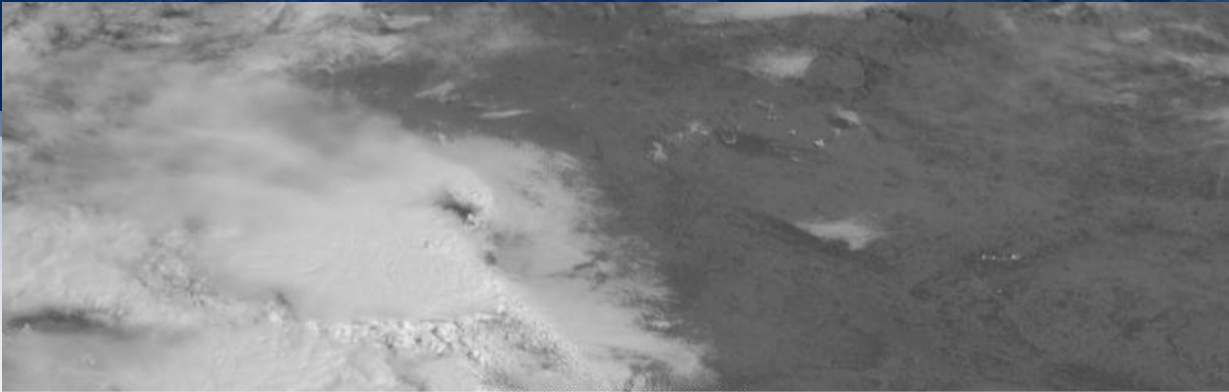
↓ MTG-I and MTG-S



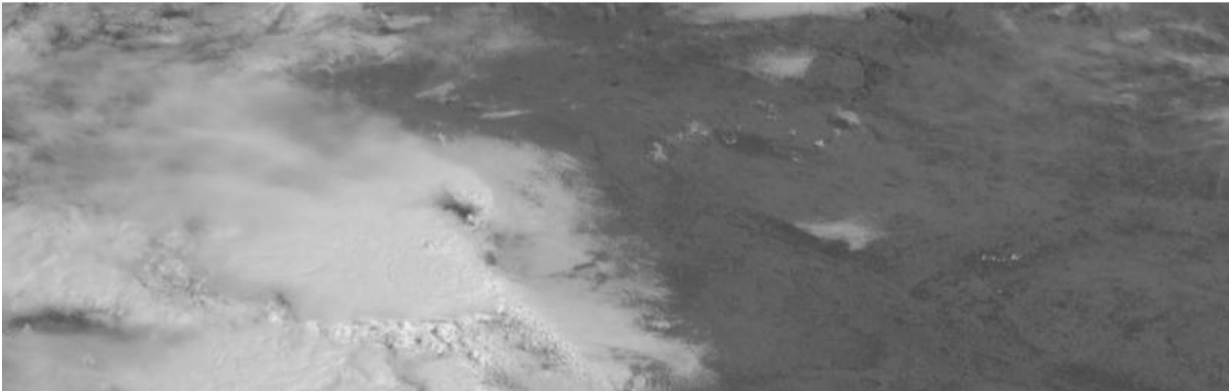
Observation missions:  
Flex.Comb. Imager:  
16 channels  
Infra-Red Sounder  
Lightning Imager  
UVN  
3-axis stabilised satellites  
Twin Sat configuration  
Class 3.6 – 3.7 tons



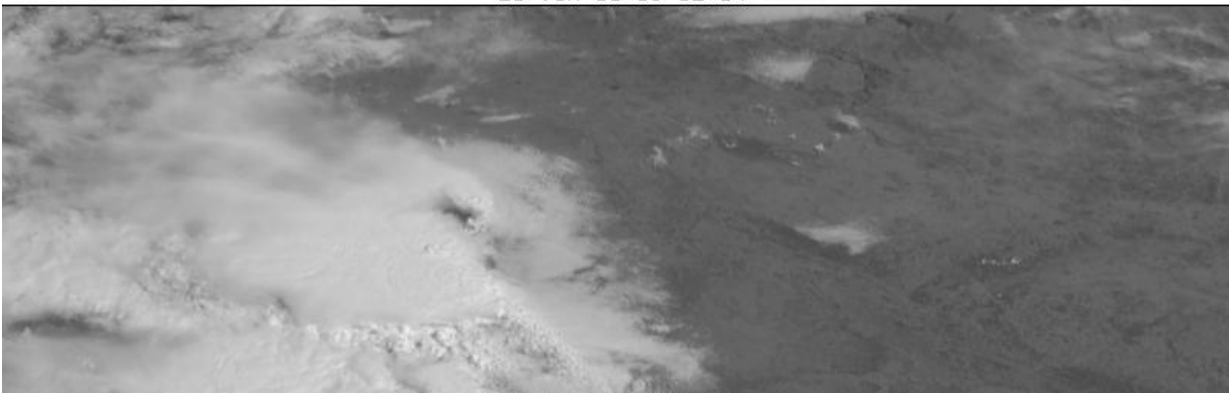
# 2.5 min Scans



20 JUN 13 09:02:14



20 JUN 13 09:02:14

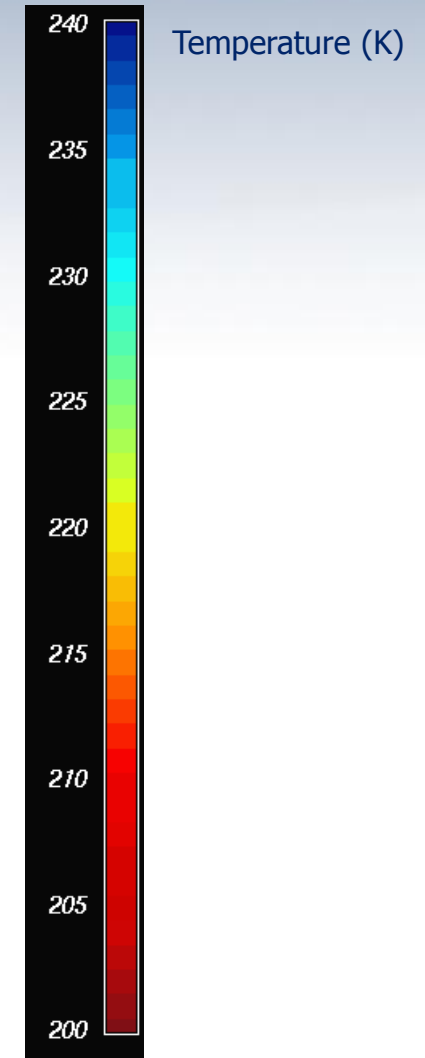
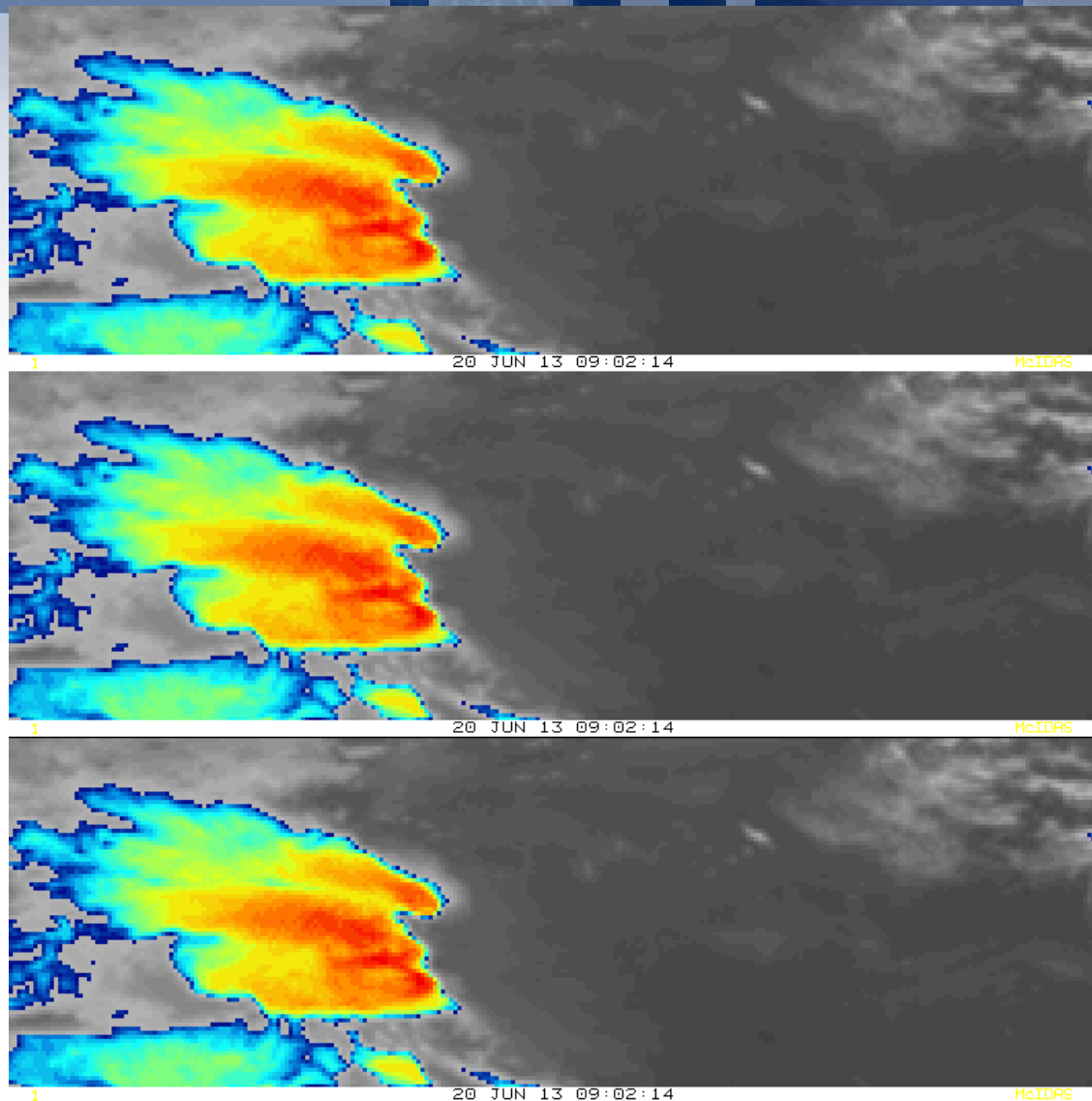


20 JUN 13 09:02:14



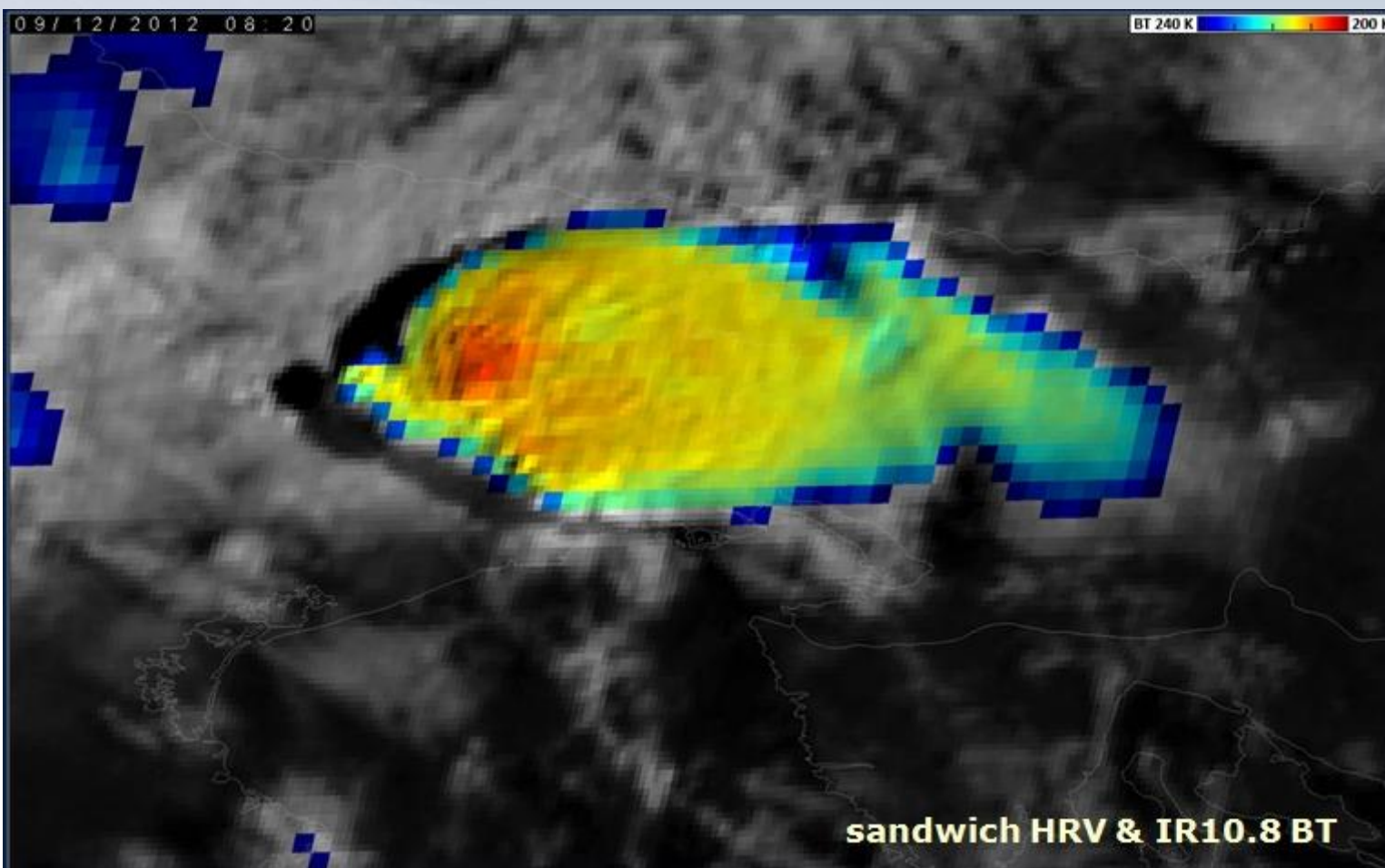


# Time Resolution - IR





# Spatial Resolution: Channel Overlays



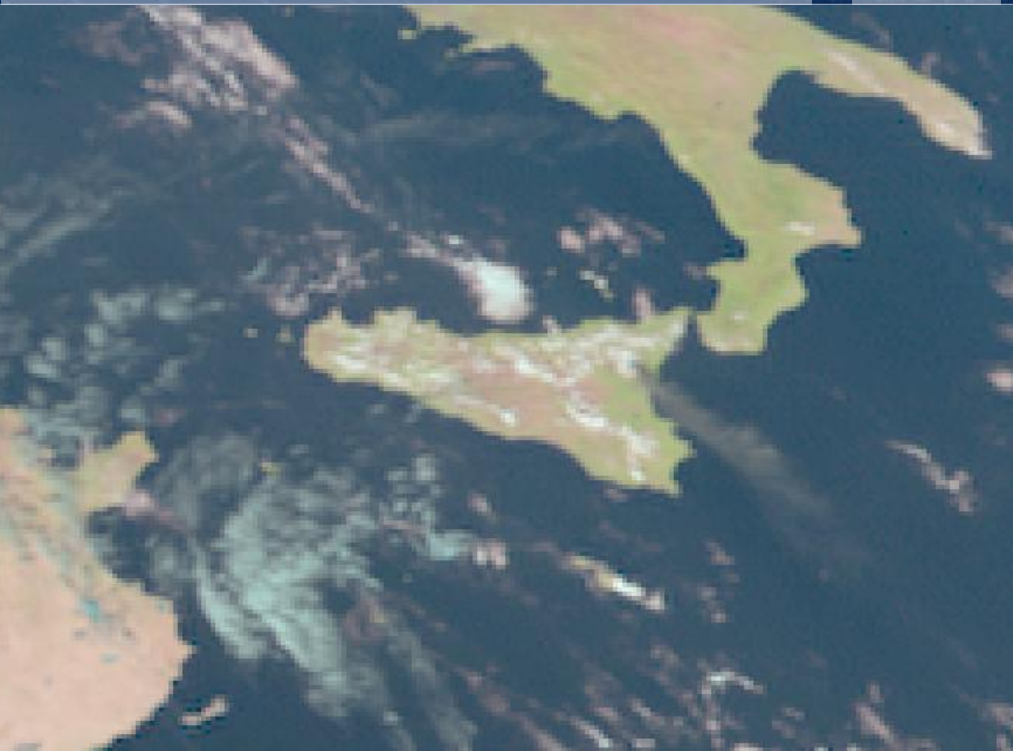
MTG Application:

Also useful  
because of  
channel resolution  
differences

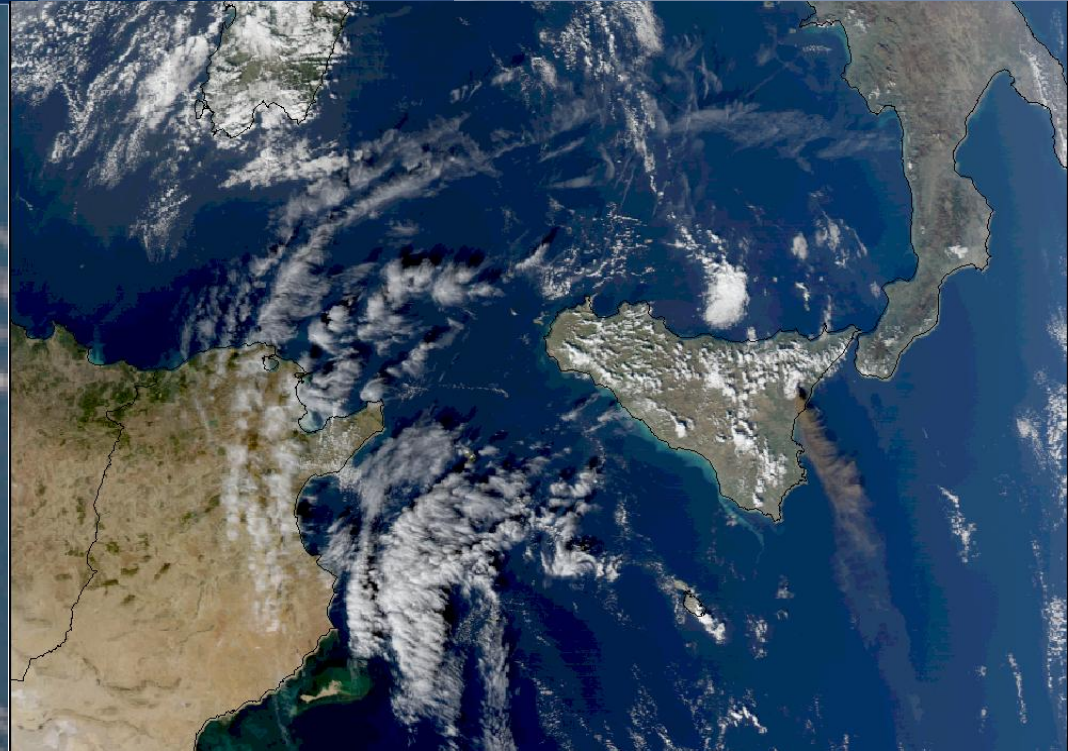




# Spectral Resolution: “True Colour” RGB Possible



“Day Natural Colour RGB” Today

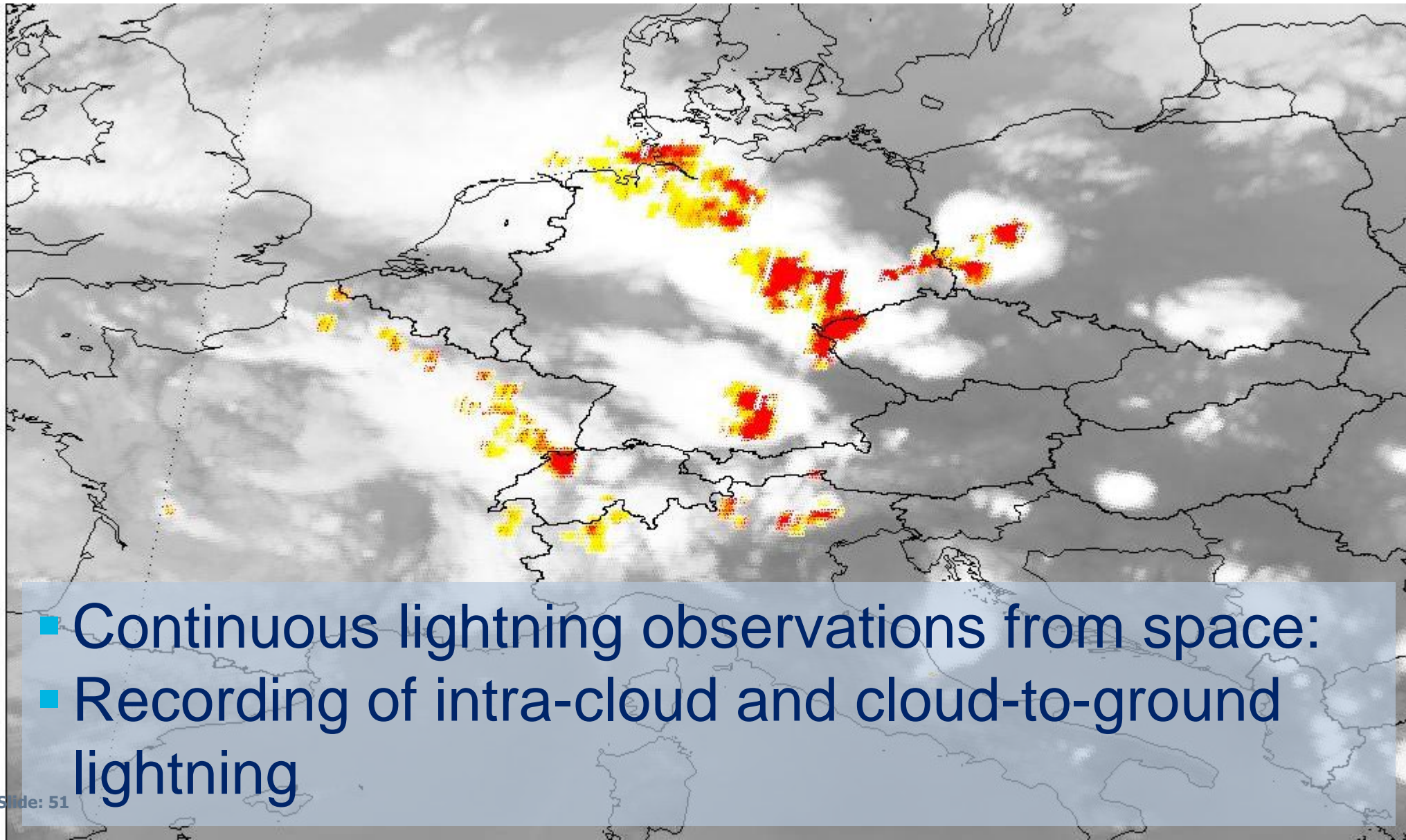


A true “Day Natural Colour RGB”

Applications:

- Weather forecasts for public
- Quicklooks for forecasters
- Aviation

# Lightning imager



- Continuous lightning observations from space:
- Recording of intra-cloud and cloud-to-ground lightning





# Thank you!

[vesa.nietosvaara@eumetsat.int](mailto:vesa.nietosvaara@eumetsat.int)