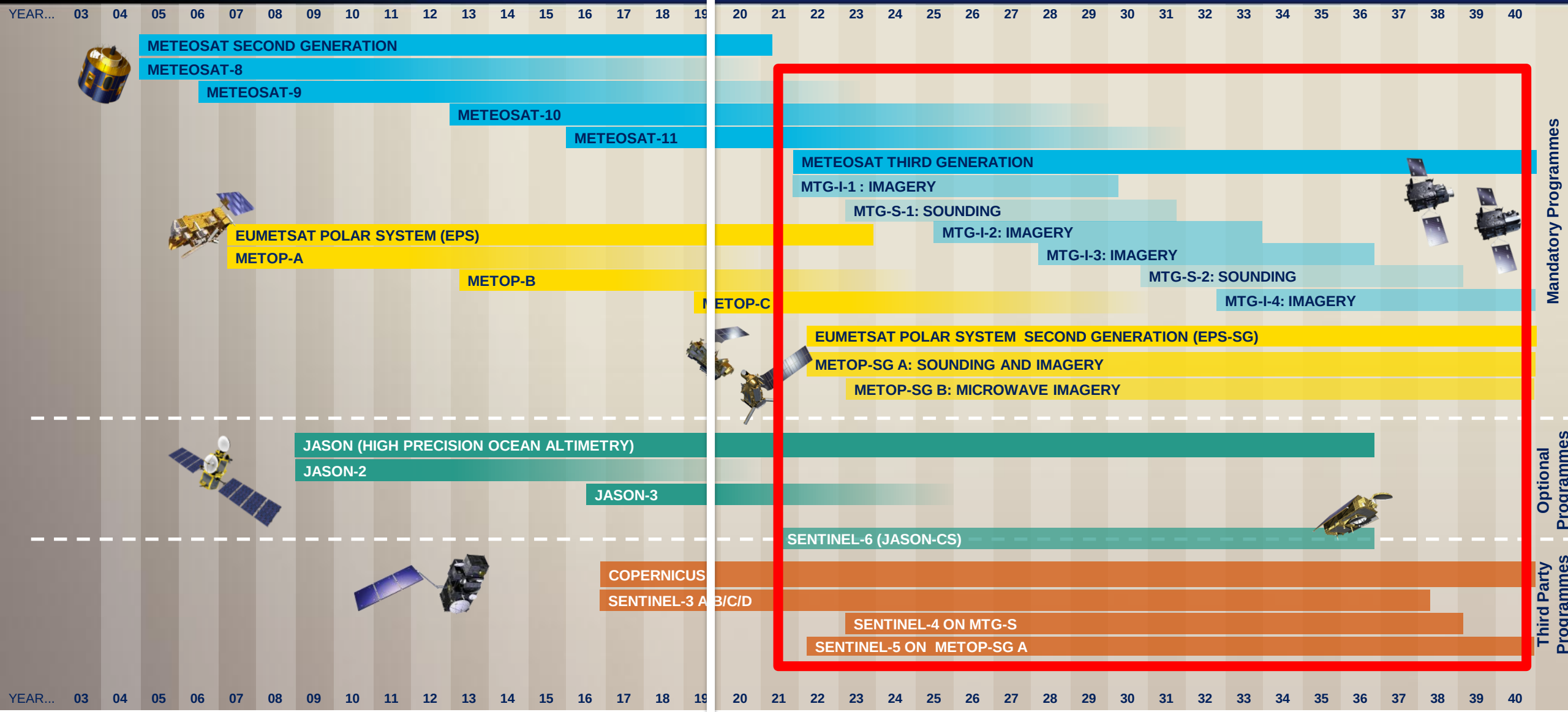
User preparation for next-generation EUMETSAT meteorological satellites (MTG, EPS-SG)

EUMETSAT Next-generation Missions: European multi-satellite programmes for long-term commitments - until early 2040s



EUMETSAT

Meteosat Third Generation: Mission

- Primary mission: support nowcasting/ Short Range Forecasting of high impact weather
  - Continuity and enhancement of MSG imagery
  - Addition of a new lightning imaging capability
  - New, innovative infrared hyper-spectral sounding
- Secondary mission: air quality monitoring over Europe
  - Synergy between Sentinel-4, IRS and imagery

Meteosat Third Generation: Imaging mission (MTG-I)

- Imagery mission implemented by two MTG-I satellites
- Full disc imagery every 10 minutes in 16 bands (→MTG-I1)
- Fast imagery of Europe every 2.5 minutes (MTG-I2)
- New Lightning Imager (LI)

- **Start of operations in 2022**
- **Operational exploitation: 2022-2042**

Meteosat Third Generation: Sounding mission (MTG-S)

- Hyperspectral infrared sounding mission
- 4D weather cube: temperature, water vapour, O3, every 30 minutes over Europe
- Air quality monitoring and atmospheric chemistry in synergy with Copernicus Sentinel-4 instrument

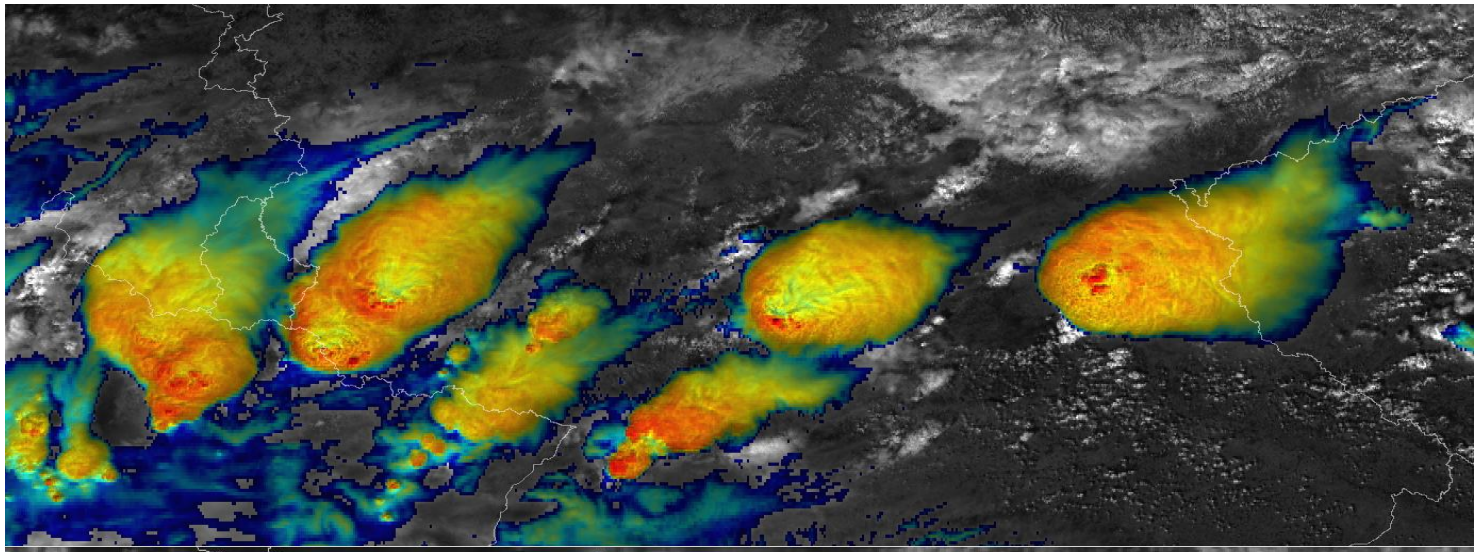
- **Start of operations in 2024**
- **Operational exploitation: 2024-2043**

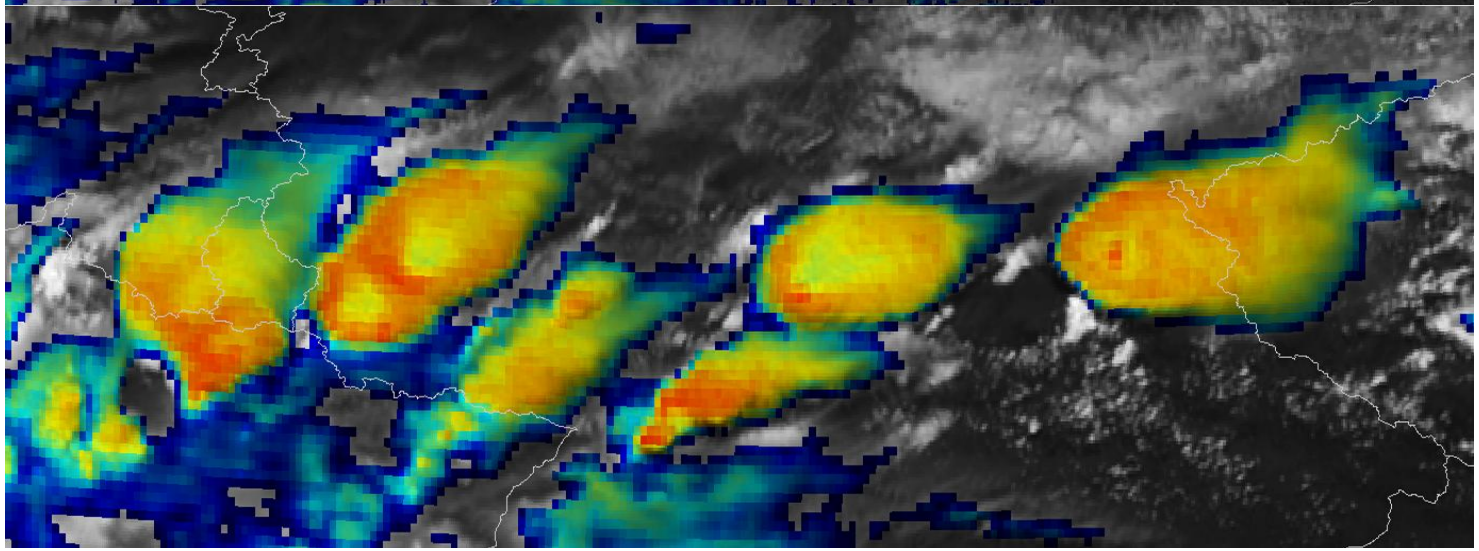
Expected improvements from

Meteosat Third Generation (MTG) missions

MTG Imager (FCI): New insights into convective storms through higher spatial resolution

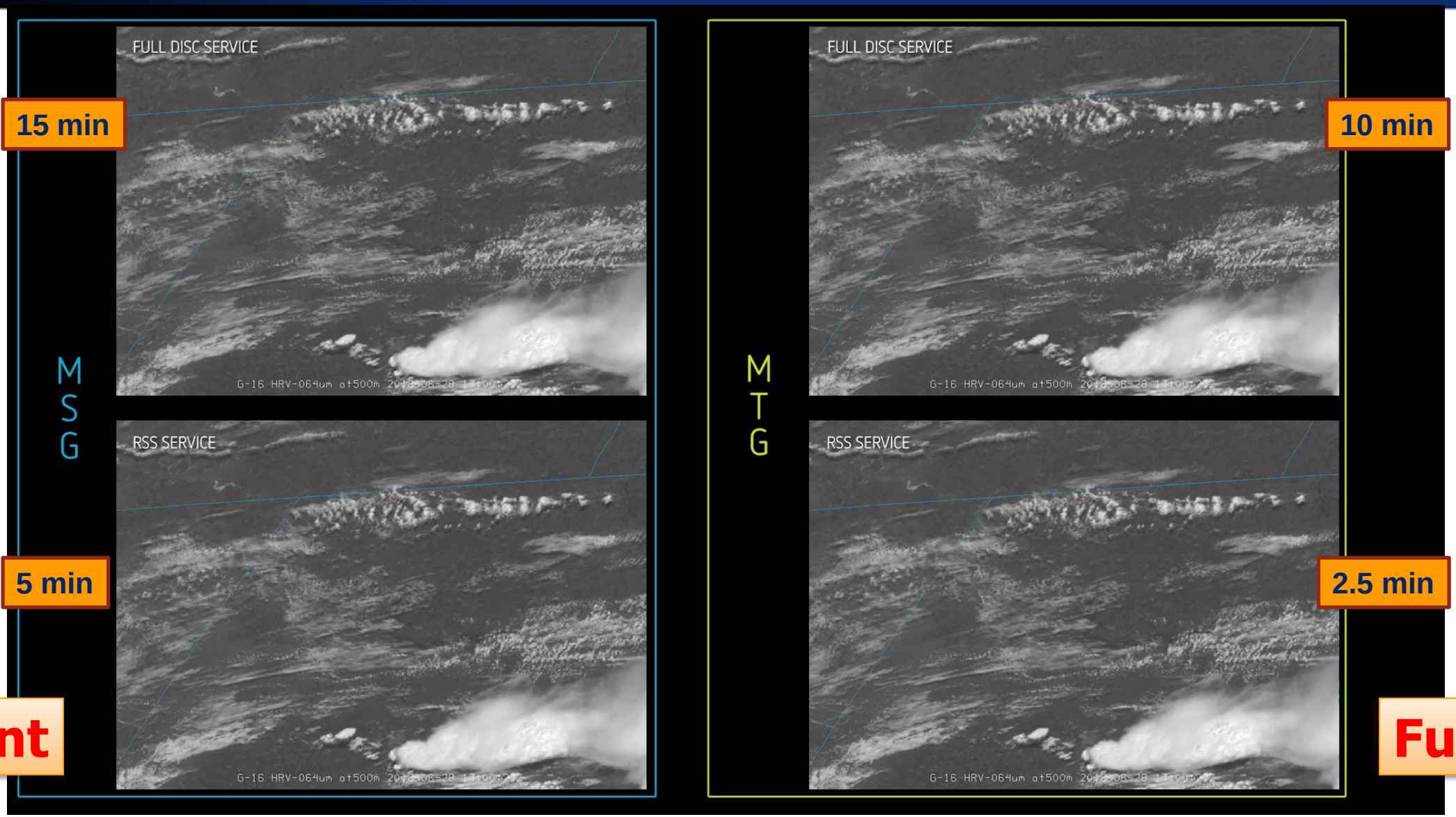
Future



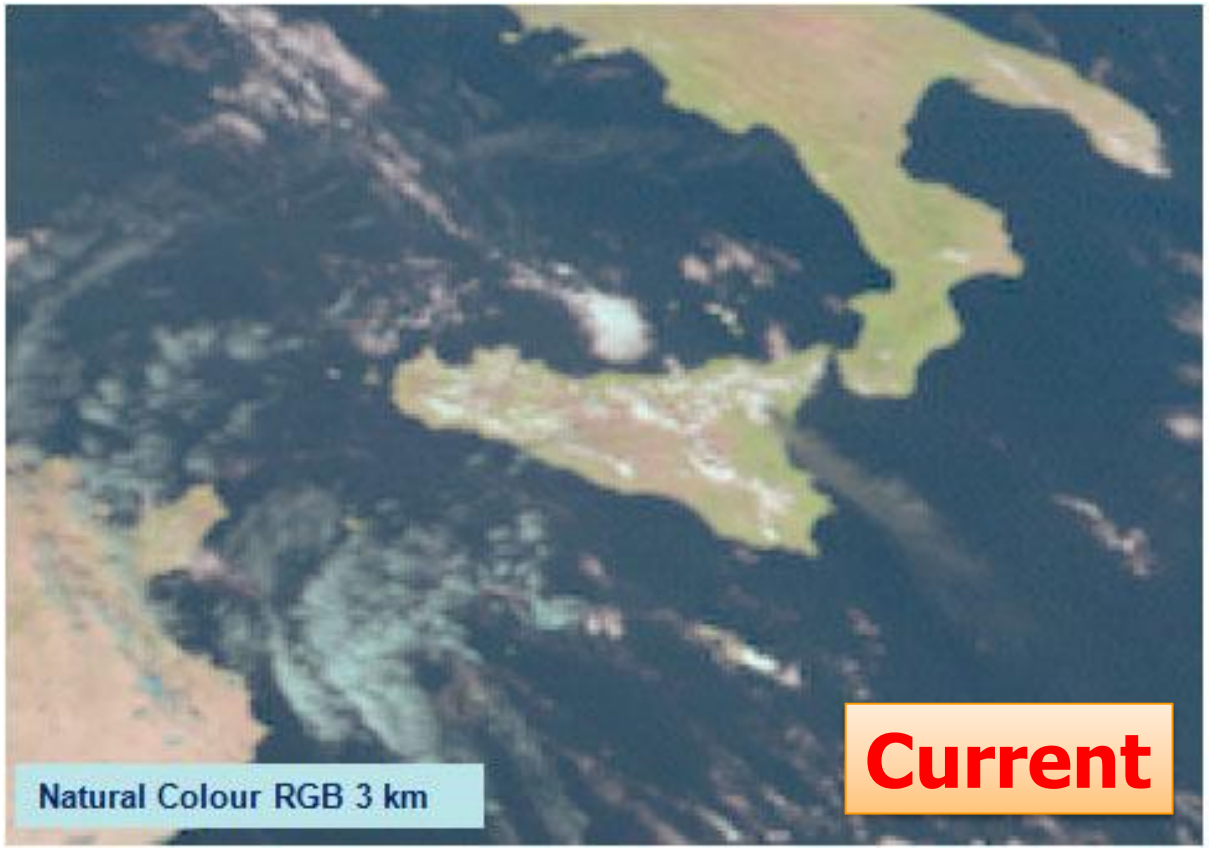


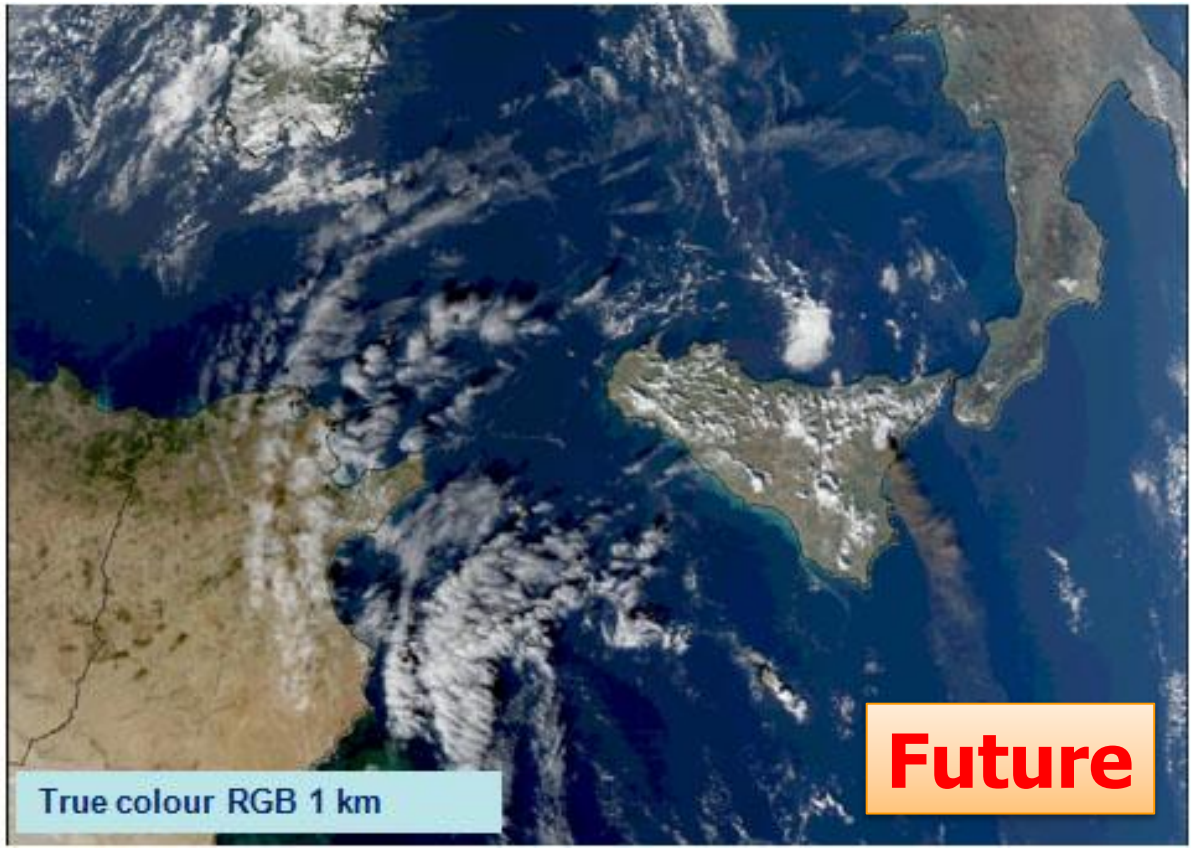
Current

MTG Imager (FCI): New insights through higher temporal resolution



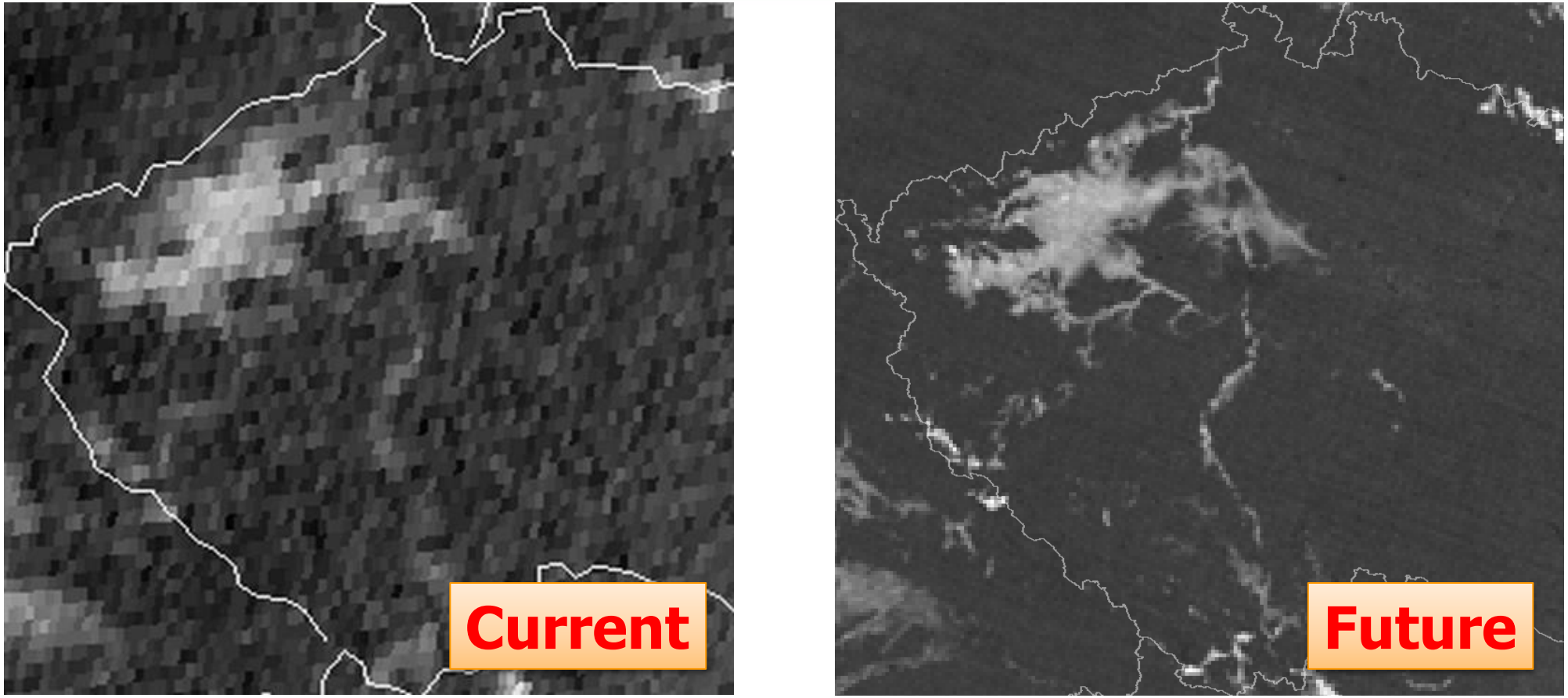
MTG Imager (FCI): higher spatial resolution imagery





Example of ash detection, SEVIRI Natural Colour RGB, 12:15 UTC, 26 November 2006 (left), MODIS True Colour RGB, 12:20 UTC, 26 November 2006

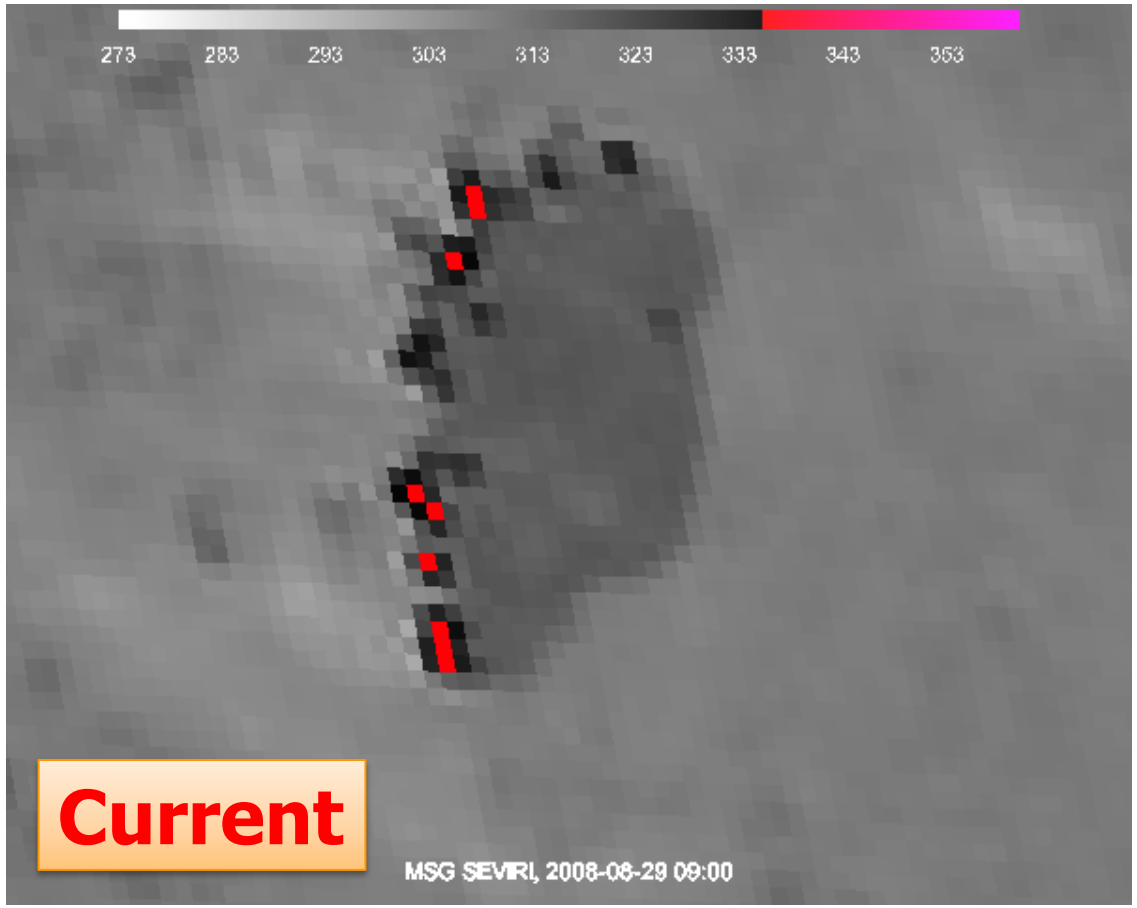
MTG Imager (FCI): higher spatial resolution imagery

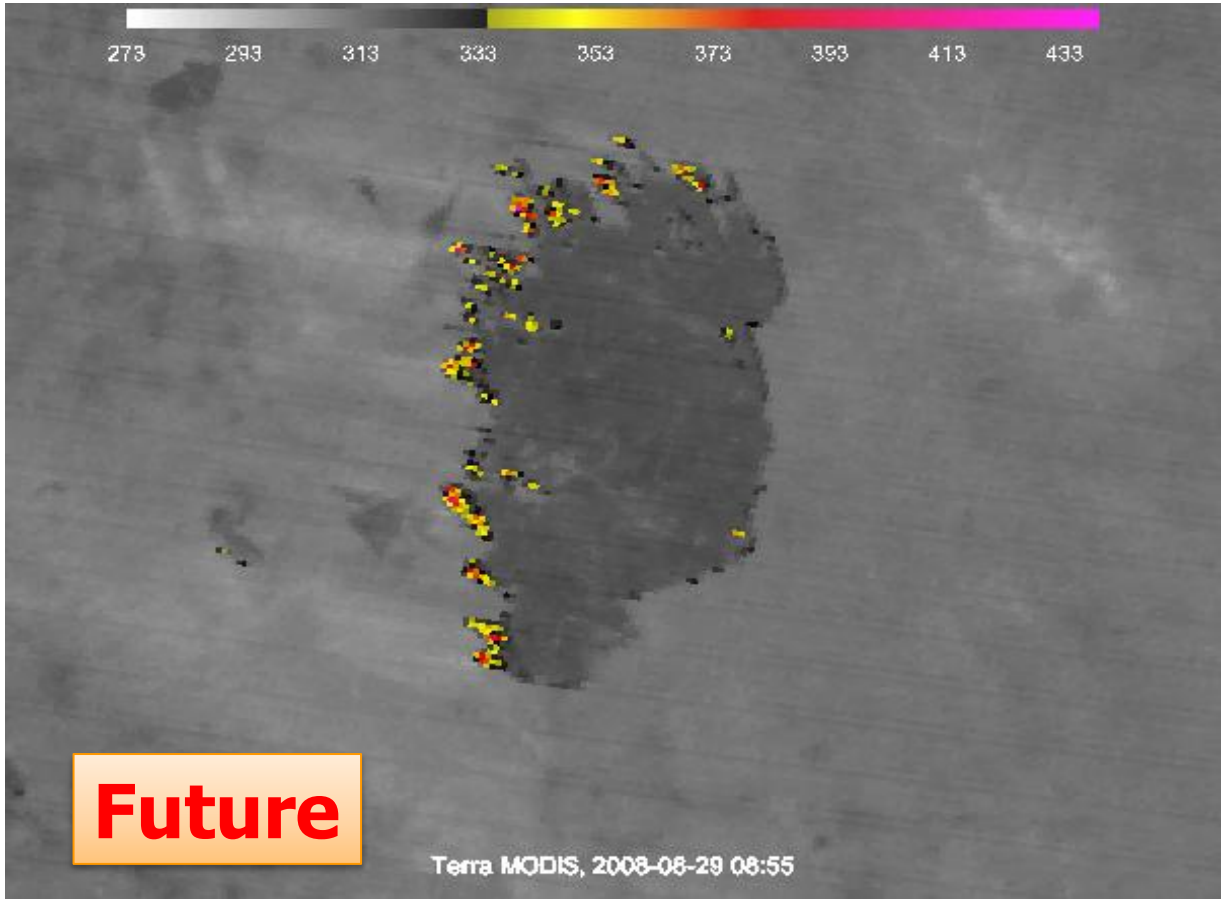


Example of fog detection over Czech Republic

Source: M. Setvak, J. Kerkmann; 16 Nov 2018, 01.37 UTC
Right panel: simulated FCI imagery at ~2 km horizontal resolution (1 km at nadir), based on NOAA Suomi-NPP VIIRS data
Left panel: MSG SEVIRI imagery at 5 km horizontal resolution (3 km at nadir)

MTG Imager (FCI): New prospects for fire detection and monitoring



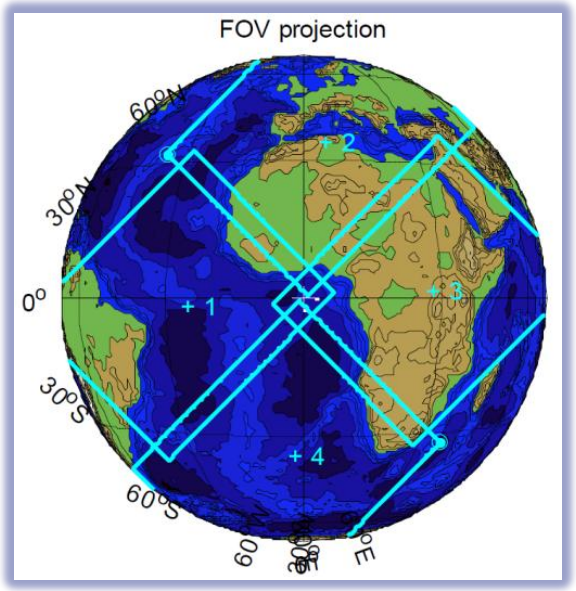


Bushfire line in Botswana as seen in imagery from current Meteosat (left panel) compared to future MTG imagery simulated by proxy data (right panel). MTG imagery will enable more precise detection of fire location and better fire intensity estimates.

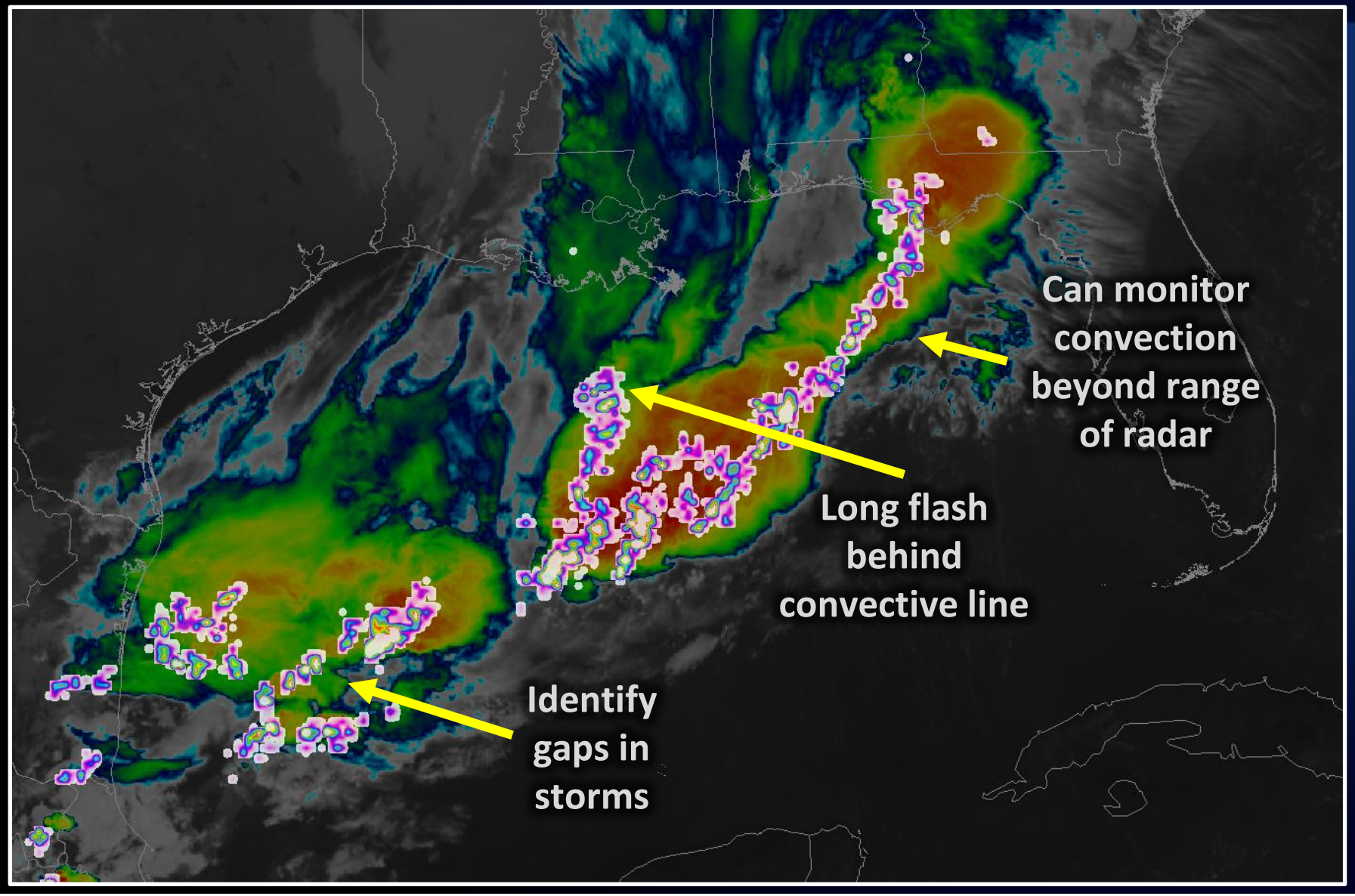
MTG lightning imager mission: *Why do we care?*

- Lightning is a precursor of severe weather, with a lead time of tens of minutes
- Most ground-based lightning location systems are mainly sensitive to cloud-to-ground lightning (CG)
- Often, no increase in CG due to “weather intensification” observable → Total lightning is the parameter of interest

Total lightning = cloud-to-ground + cloud-to-cloud lightning

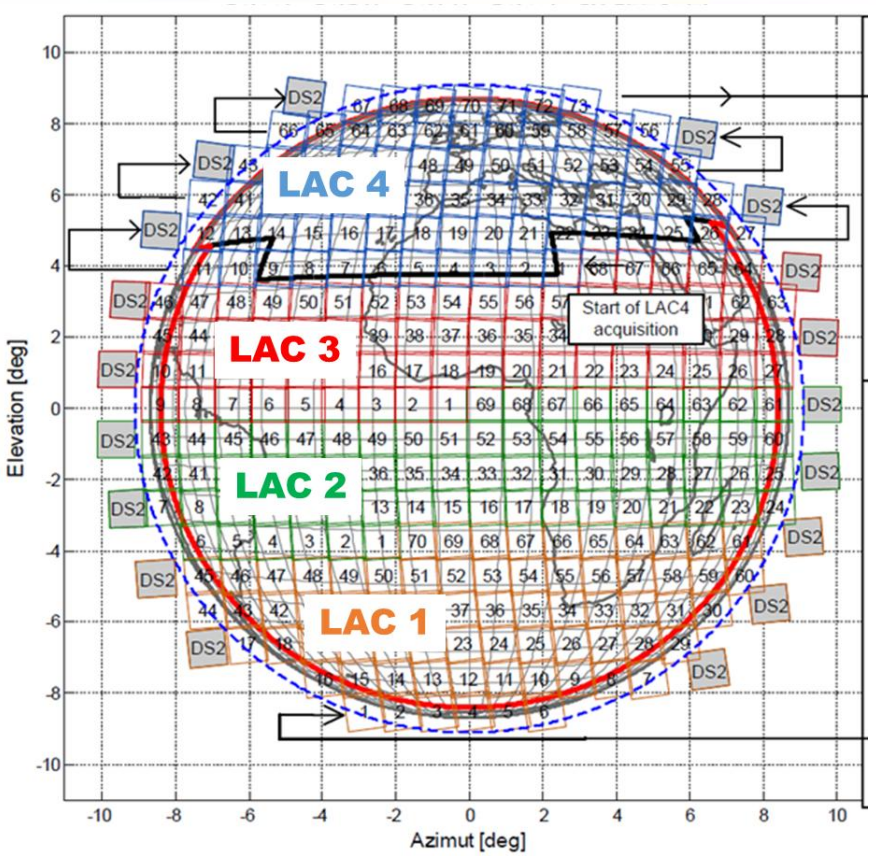


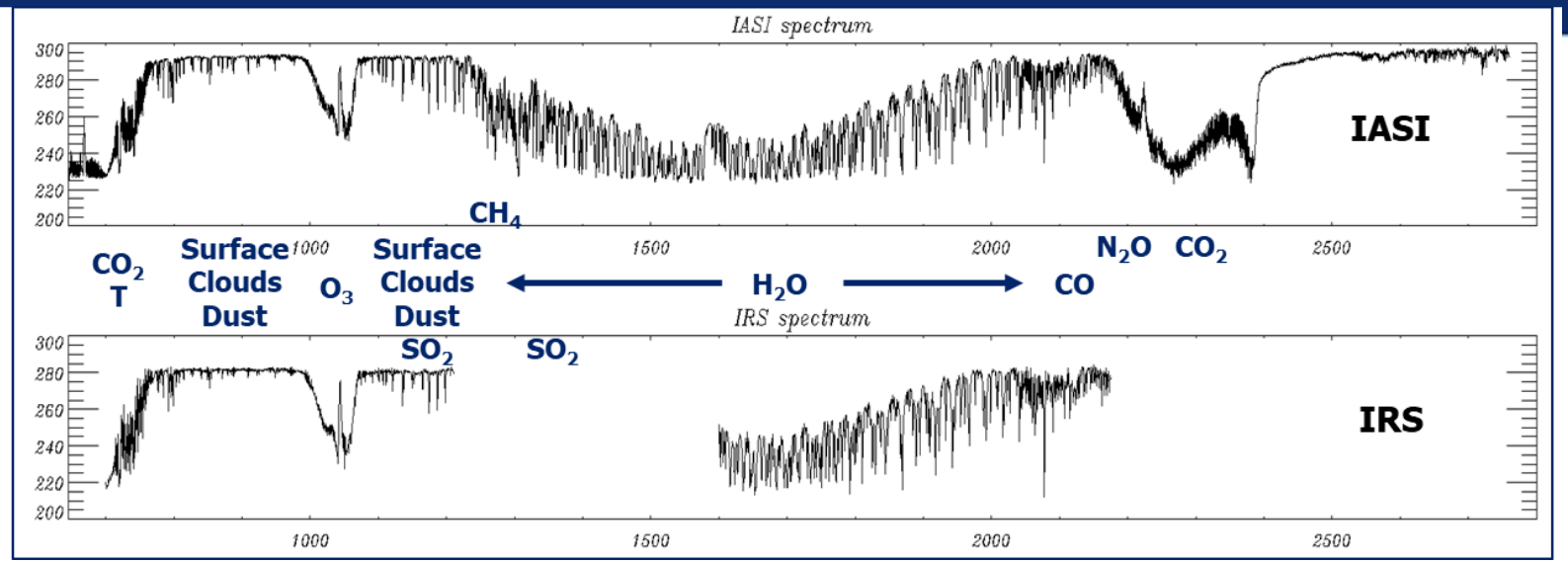
MTG Lightning Imager (LI): U.S. Proxy Data



- Lightning activity monitored from space (white-blue-magenta in colours) along a convective storm line (yellow-orange-red shades in background infrared imagery) over the Gulf of Mexico.
- Weather forecasters have additional information to more precisely monitor convective development, especially in areas where detection efficiency of ground-based lightning detection networks is lower

MTG InfraRed Sounder (IRS)

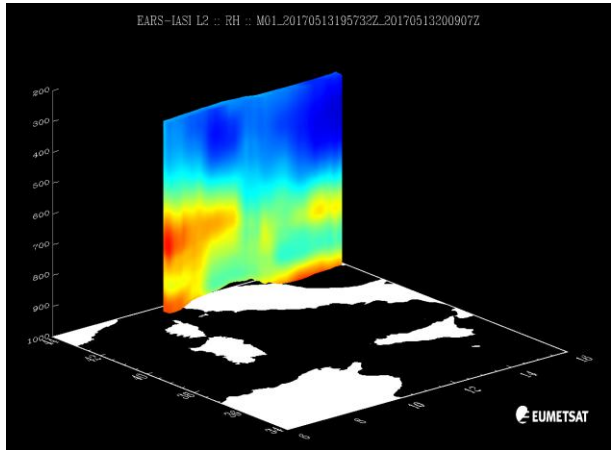




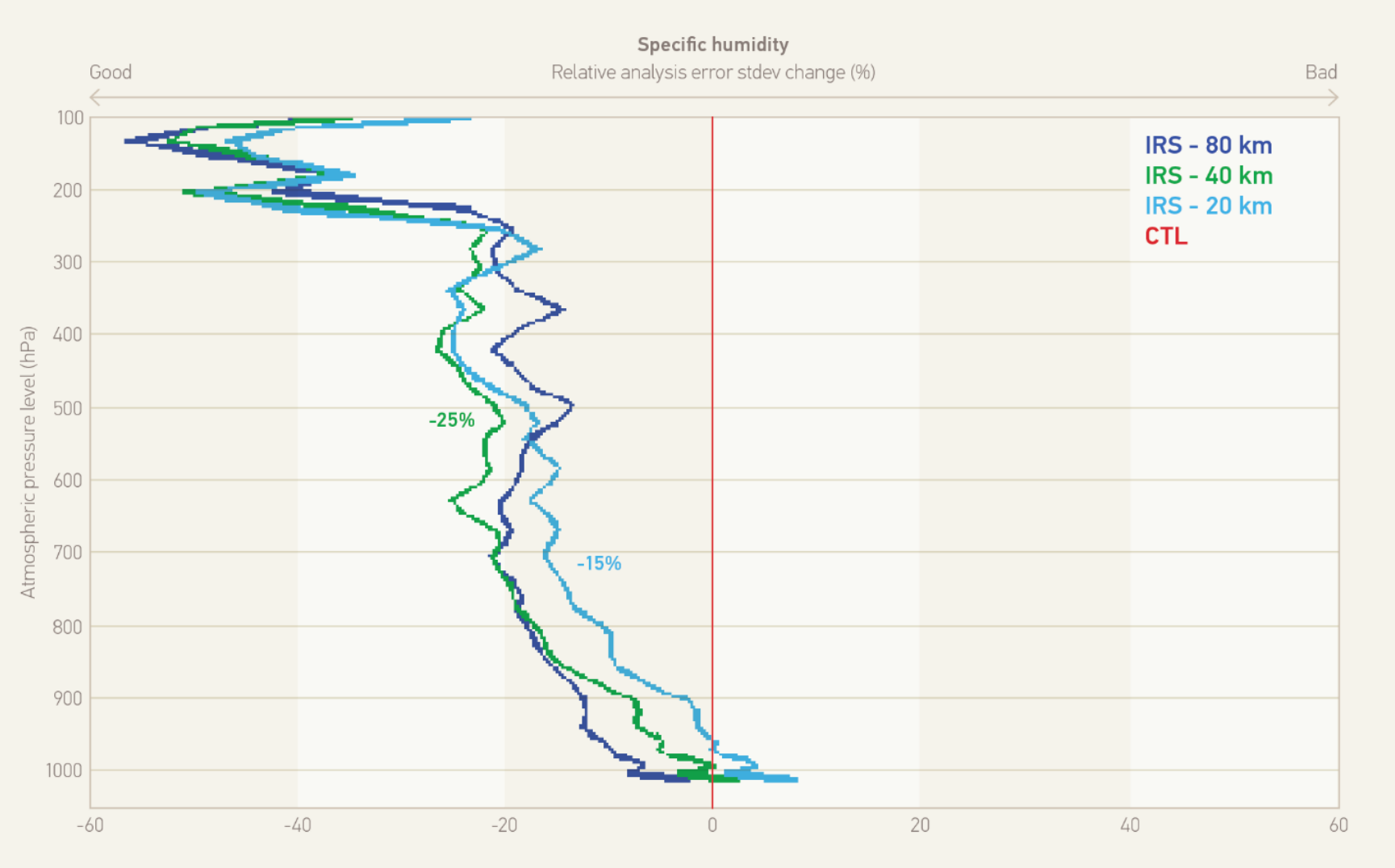
4 Local Area Coverage (LAC):

- One LAC acquired within 15'
- Overlapping step & stare dwells
- 160x160 pixels, ~4km at Nadir
- Europe (LAC 4) observed every 30'

Major innovation: Operational spectro-imagery at high spectral, spatial & temporal resolution



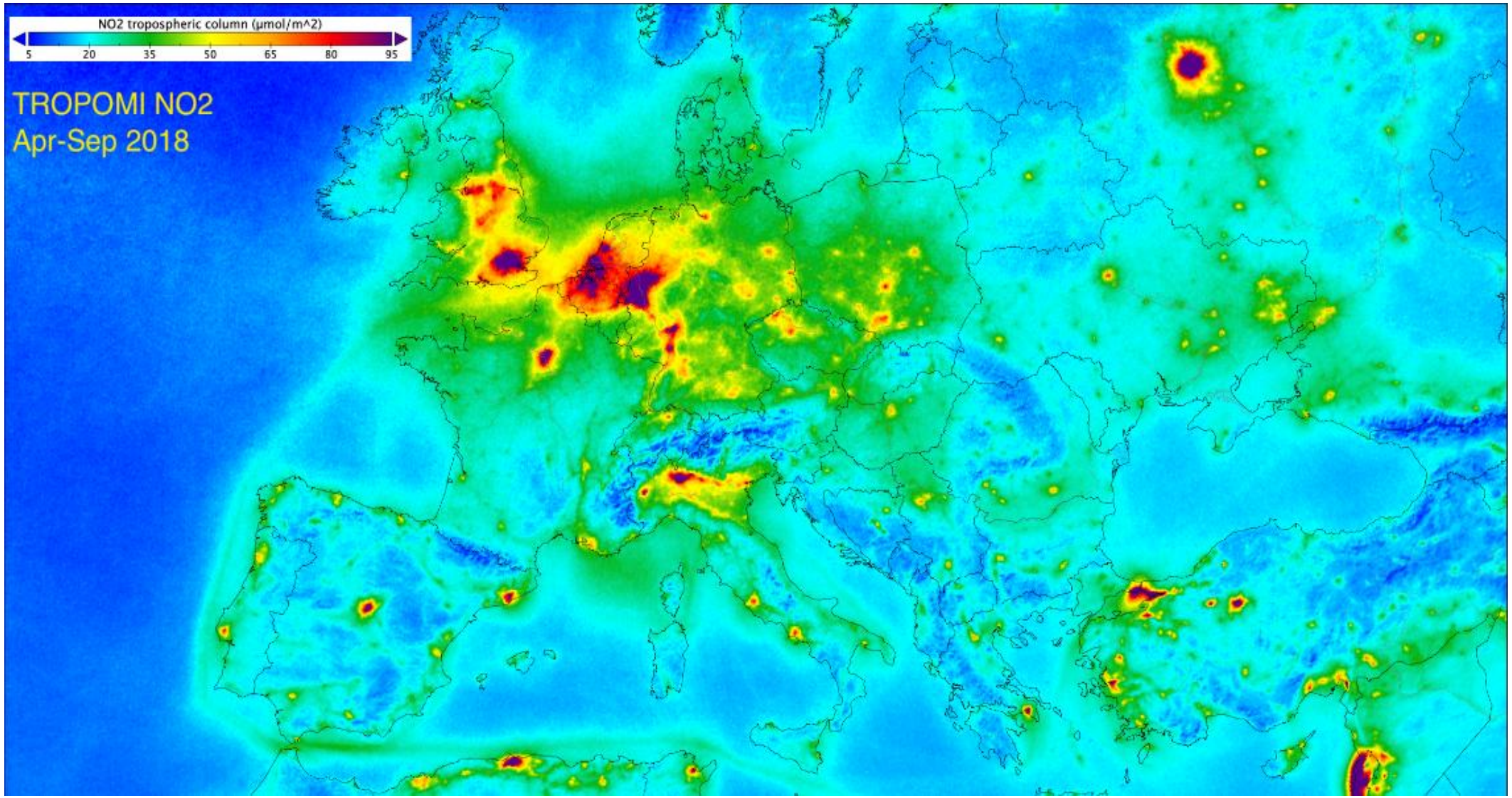
MTG InfraRed Sounder (IRS): Enhancing numerical weather prediction



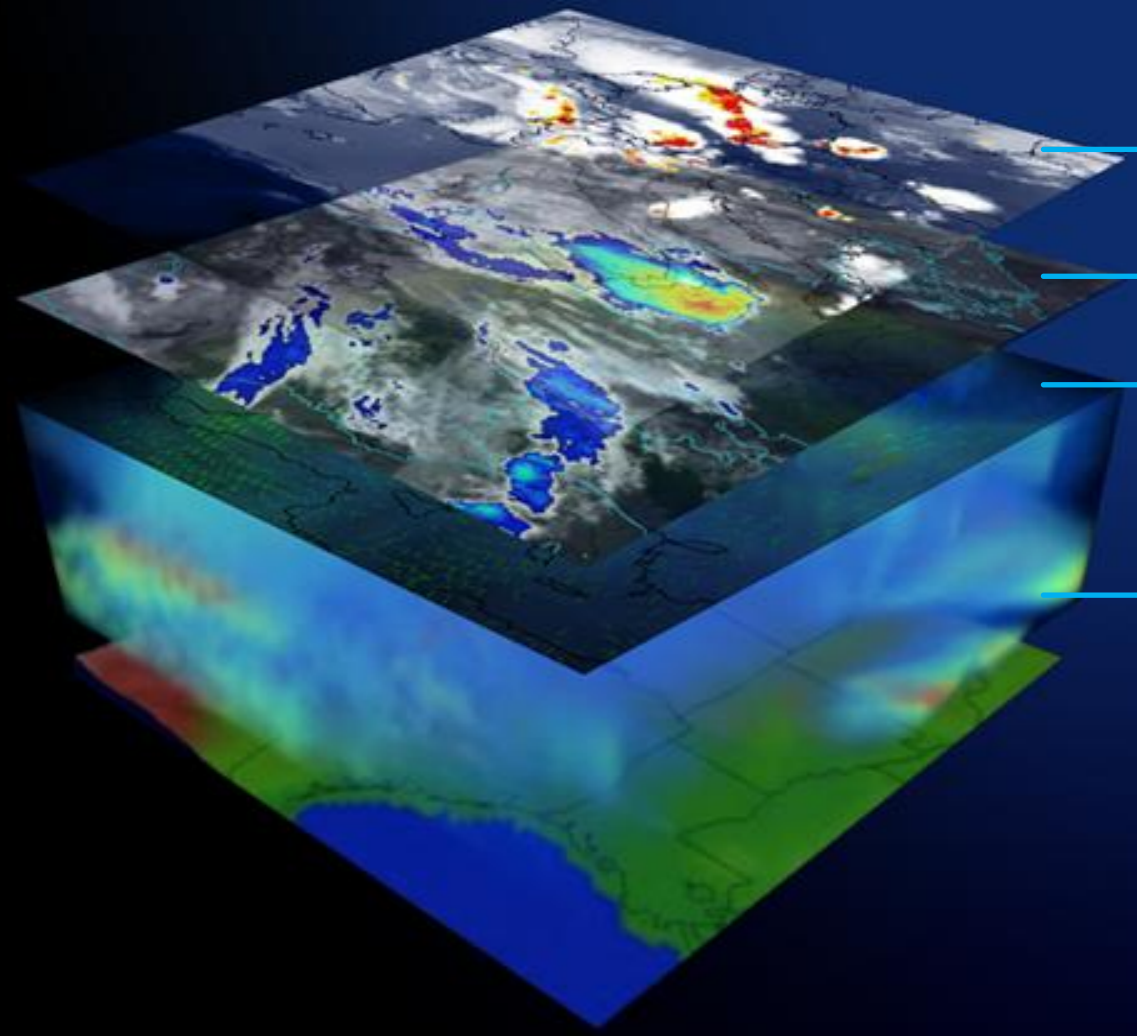
Simulated MTG infrared sounding data have a demonstrated positive impact on regional weather modelling, by reducing the error of forecasting specific humidity and other meteorological parameters

Source: Guedj et al., 2014

Copernicus Sentinel-4 on MTG: Monitoring atmospheric composition



MTG Summary: 4D Weather Cube



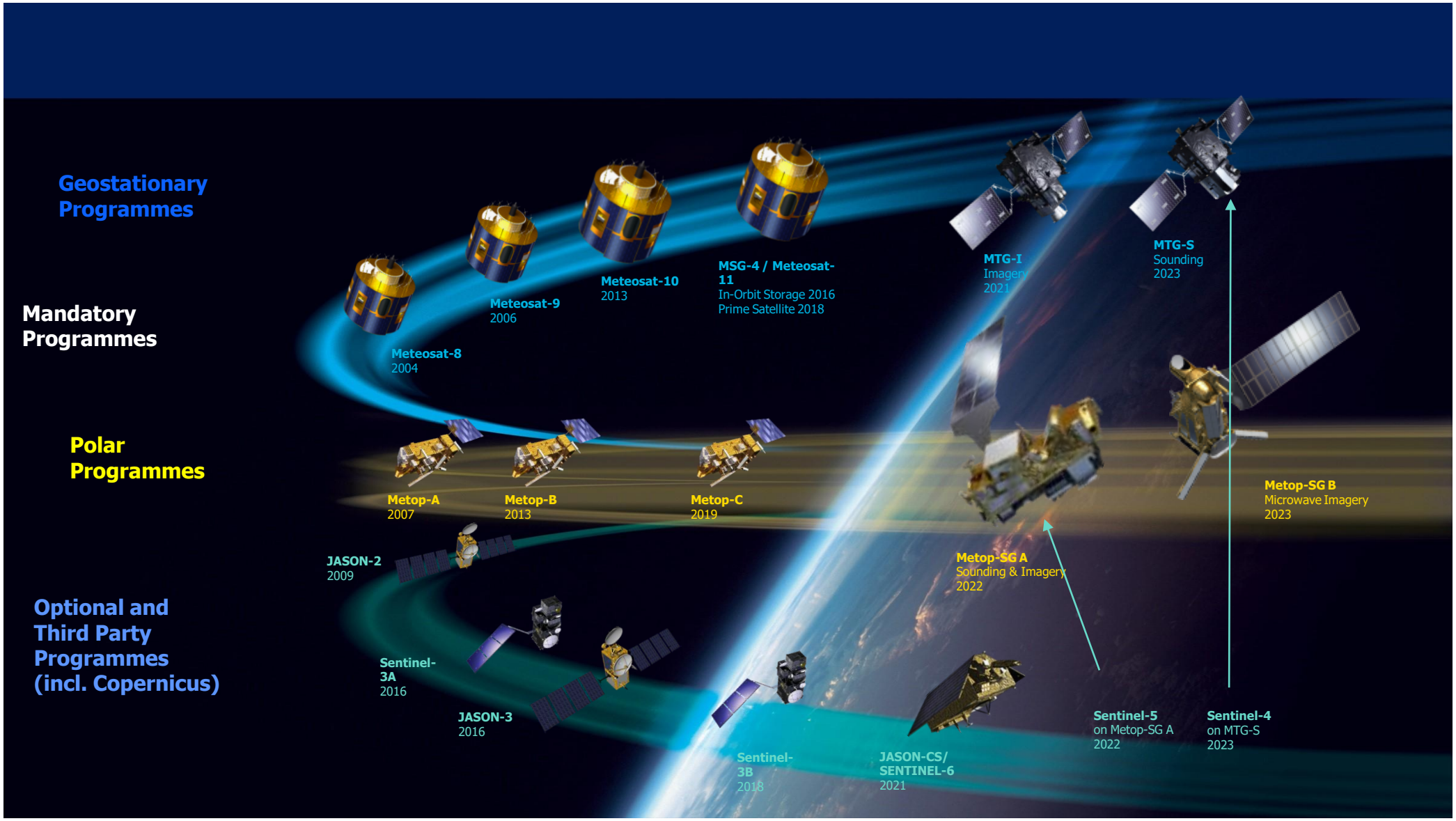
- Lightning
- Convection
- Winds
- Atmosphere

Every 30 min over Europe

In Summary: Application scenarios for MTG data

- Monitoring and nowcasting severe convective storms
- Detecting convective initiation, a precursor of potentially severe storms
- Fog detection for transport safety
- Lightning monitoring for storm tracking over oceans
- Air quality monitoring
- Fire detection and monitoring
- Enhancing numerical weather prediction

EUMETSAT Polar System – Second Generation



EUMETSAT

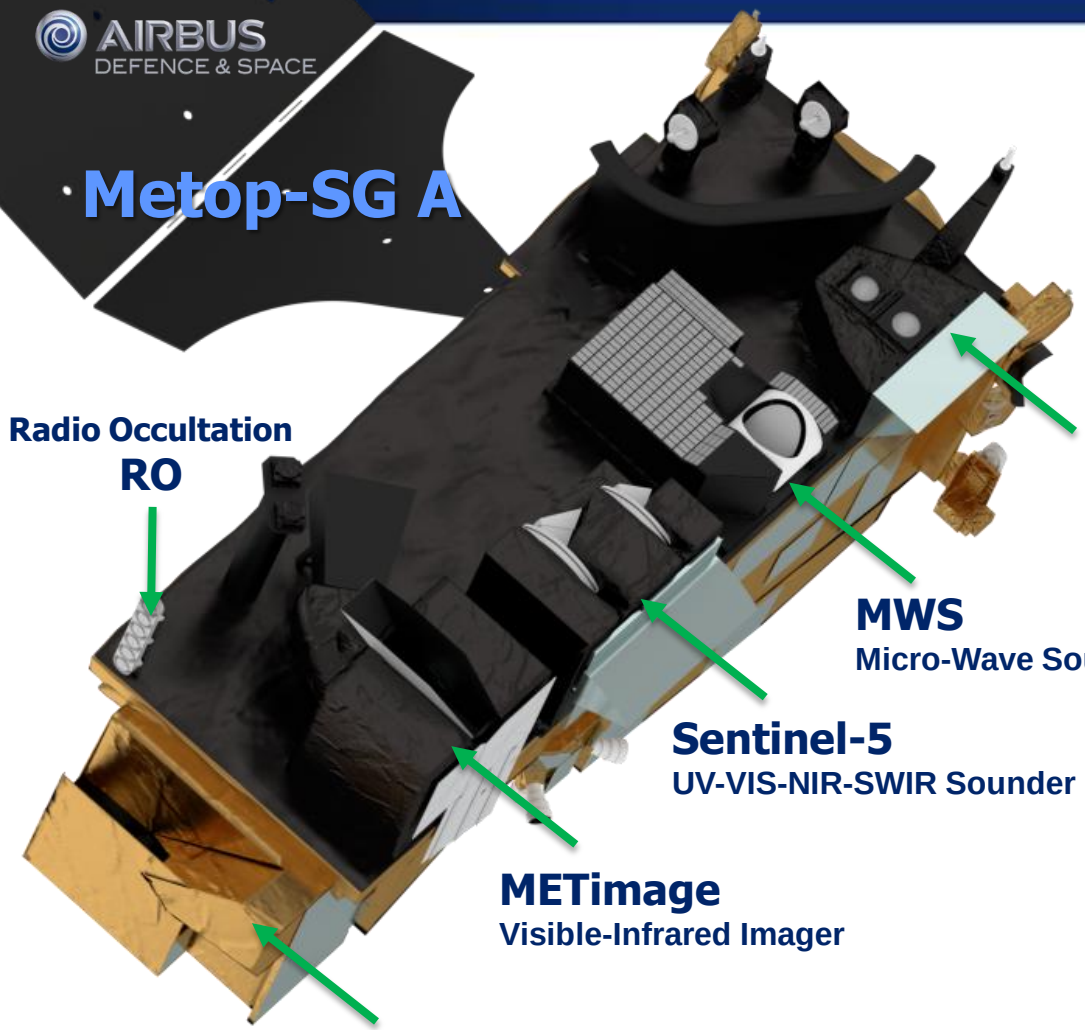
EUMETSAT Polar System – Second Generation Programme Objectives

- **Primary mission: further improve observational inputs to Numerical Weather Prediction models.**
- **Continuation and enhancement of service from mid morning polar orbit in 2022 – 2042.**
- **Significant contributions to other real time applications:**
  - **Nowcasting at high latitudes**
  - **Marine meteorology and operational oceanography**
  - **Operational hydrology**
  - **Air quality monitoring**
- **Climate monitoring: expand by 20+ years the climate data records initiated in 2006 with EPS (first generation).**

EPS-SG: Metop-SG satellites

AIRBUS DEFENCE & SPACE

Metop-SG A



Radio Occultation
RO

3MI
Multi-viewing, -channel, -polarisation Imager

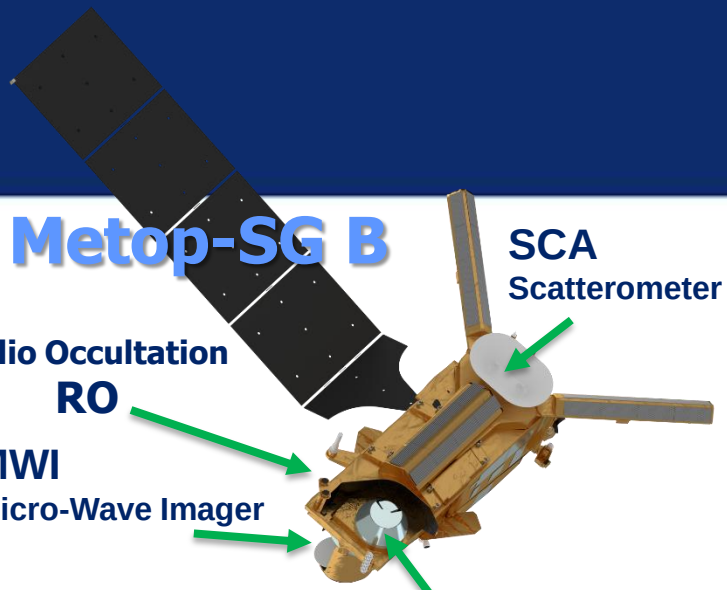
MWS
Micro-Wave Sounder

Sentinel-5
UV-VIS-NIR-SWIR Sounder

METimage
Visible-Infrared Imager

IASI-NG
Infrared Atmospheric Sounding Interferometer – New Generation

Metop-SG B



SCA
Scatterometer

Radio Occultation
RO

MWI
Micro-Wave Imager

ICI
sub-mm wave Ice Cloud Imager

Two-satellite configuration Metop-SG-A and –B on the same orbit, separated by 90°

Metop-like orbit:
- → Sun synchronous
- → low earth orbit at 835 km mean altitude
- → 09:30 local time of the descending node

First launches:
11/2022 Metop-SG A1 11/2023 Metop-SG B1

Expected improvements from

EUMETSAT Polar System Second Generation (EPS-SG) missions

EPS-SG Sounding Missions

Main Payload	Heritage	Applications Benefiting
High-Resolution Infrared Sounding **(IASI-NG)**	IASI	NWP, NWC, AC, CM, Oceanography
Microwave Sounding **(MWS)**	AMSU-A and MHS	NWP, NWC, CM, Hydrology
Radio Occultation Sounding **(RO)**	GRAS	NWP, CM
Nadir viewing UV/VIS/NIR/SWIR Sounding **(UVNS - Sentinel-5)**	GOME-2	Air Quality, CM, AC

- All missions on SAT-A, RO on both satellites

NWP: Numerical Weather Prediction; NWC: Nowcasting; CM: Climate Monitoring; AC: Atm. Composition

EPS-SG Imaging Missions

Main Payload	Heritage	Applications Benefiting
VIS/IR Imaging **(METimage)**	AVHRR	NWC, NWP, CM, Land-surface analysis, oceanography, hydrology
Scatterometry **(SCA)**	ASCAT	NWP, NWC, CM, hydrology, oceanography
Multi-viewing, -channel, -polarisation Imaging **(3MI)**	New mission	Air quality, CM, NWC, Land surface analysis
Microwave Imaging **(MWI)**	New mission	NWP, NWC, Hydrology, CM, Oceanography
Ice Cloud Imaging **(ICI)**	New mission	NWP, NWC, Hydrology, CM

- MetImage and 3MI on board Sat-A
- SCA, MWI, ICI on board Sat-B

NWP: Numerical Weather Prediction; NWC: Nowcasting; CM: Climate Monitoring; AC: Atm. Composition

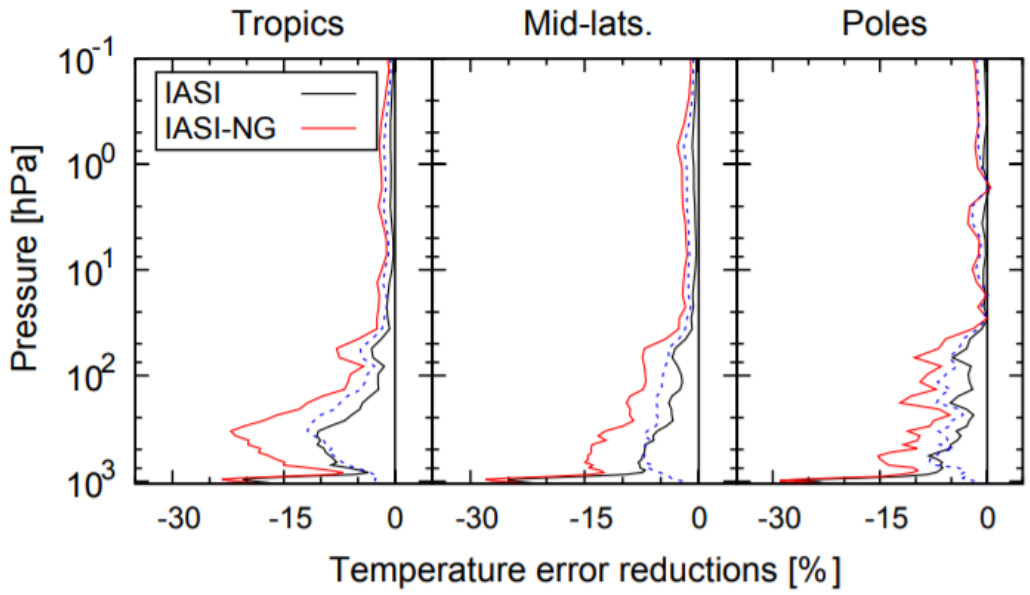
Hyper-spectral infrared sounding (IASI – NG)

Objectives / products

- Temperature/humidity profile at highvertical resolution in clear air
- Clouds, trace gases (O_3, CO, CH_4, CO_2,...)
- Sea/land/ice surface temperature
- Aerosols, Volcanic Ash

Applications benefitting

- Numerical weather prediction
- Nowcasting
- Climate monitoring
- Oceanography
- Atmospheric composition



Andrey-Andrés, et. al, Atmos. Meas. Techniques, 2018

Heritate on EPS: IASI

Doubling of radiometric and spectral resolution benefits weather forecast and atmospheric composition

- 75% more information in temperature profiling, particularly PBL (Planetary Boundary Layer)
- 30 % more information in water vapour profiling
- Quantification of trace gases which are currently only detected
- Vertical profile of trace gases instead of columnar amounts only

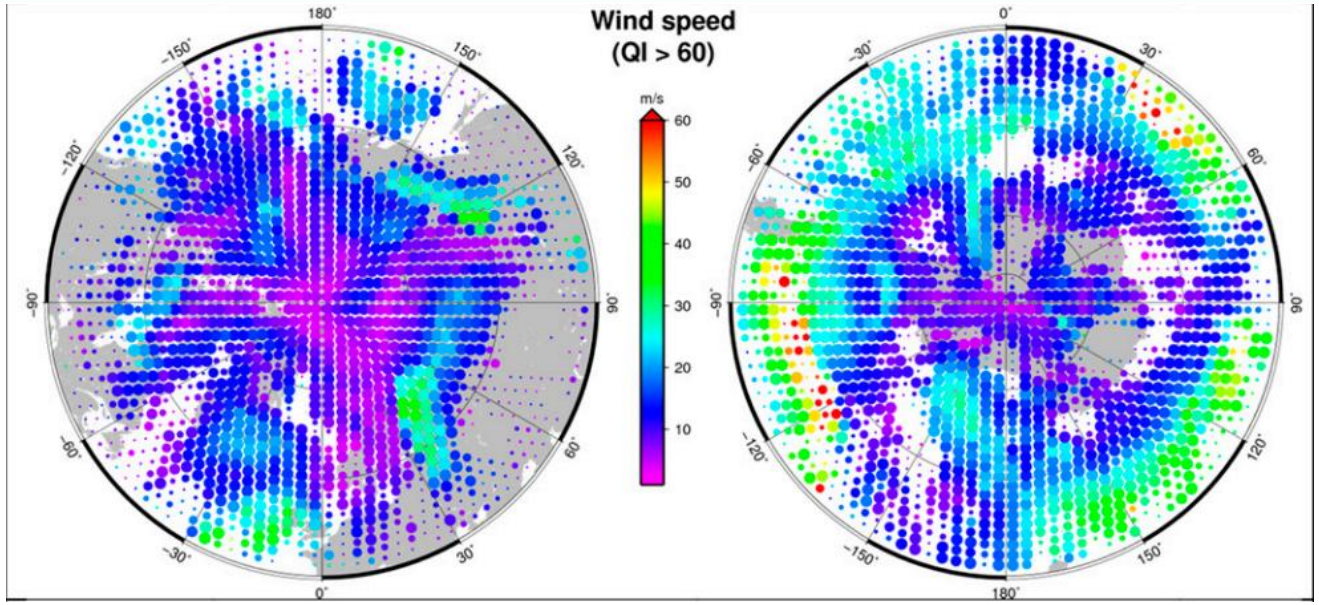
Optical imaging (METimage)

Objectives / products

- Hi-res cloud products, incl. microphysics
- Aerosols
- Polar AMVs
- Vegetation, snow, fire
- Sea/ice/land surface temperature
- Support to sounding missions

Applications benefitting

- Nowcasting
- Numerical weather prediction
- Oceanography
- Hydrology
- Climate monitoring



Average wind speed extracted on 27 Jun 2015 over NH (left) and SH (right).
Figure: O. Hautecoeur and R. Borde, 2017

Heritage on EPS: AVHRR

- **Far more spectral channels than AVHRR for the benefit of measuring more variables**
- **Higher spatial sampling (500 m):**
  - more complete coverage through greater likelihood to measure surface variables in partly cloud conditions
- **Better radiometric resolution for more accurate quantification of many variables**

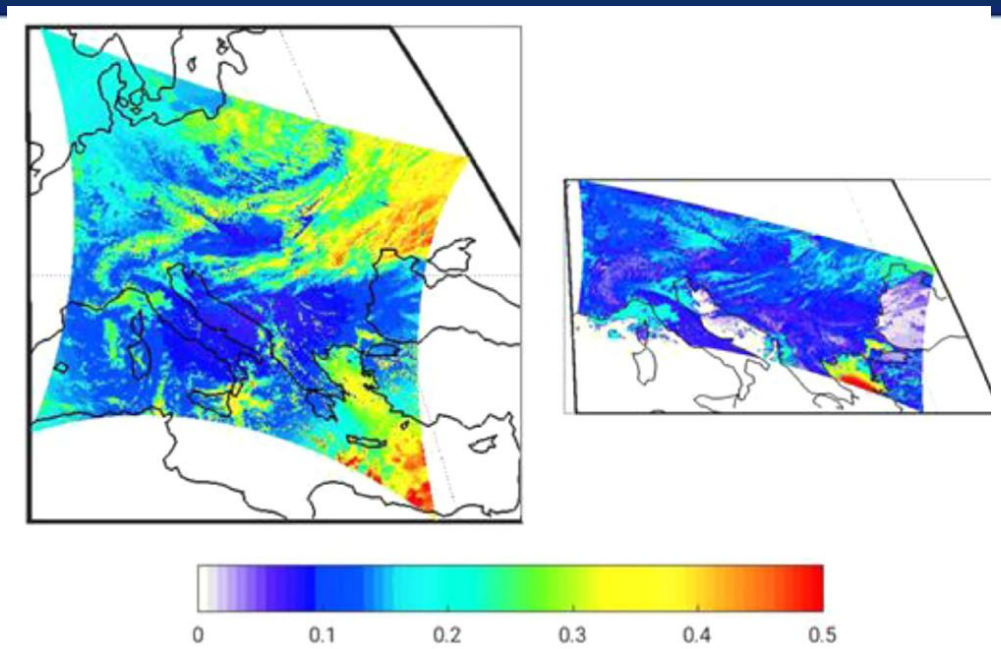
Multi-viewing multi-channel multi-polarisation Imaging (3MI)

Objectives / products

- Aerosol – optical thickness, particle size,
  type, height, absorption
- Volcanic Ash
- Cloud phase, height, optical depth
- Surface albedo

Applications benefitting

- Climate monitoring
- Nowcasting
- Air quality



Lang et. Al, JQSRT, 2019

- **Enhanced spatial sampling (4 km)**
  - Improves separation of cloudy areas
- **12 spectral channels (9 polarised), extending into the SWIR**
  - Better aerosol characterisation
- **Higher angular resolution (14 views)**
  - Better phase function characterisation

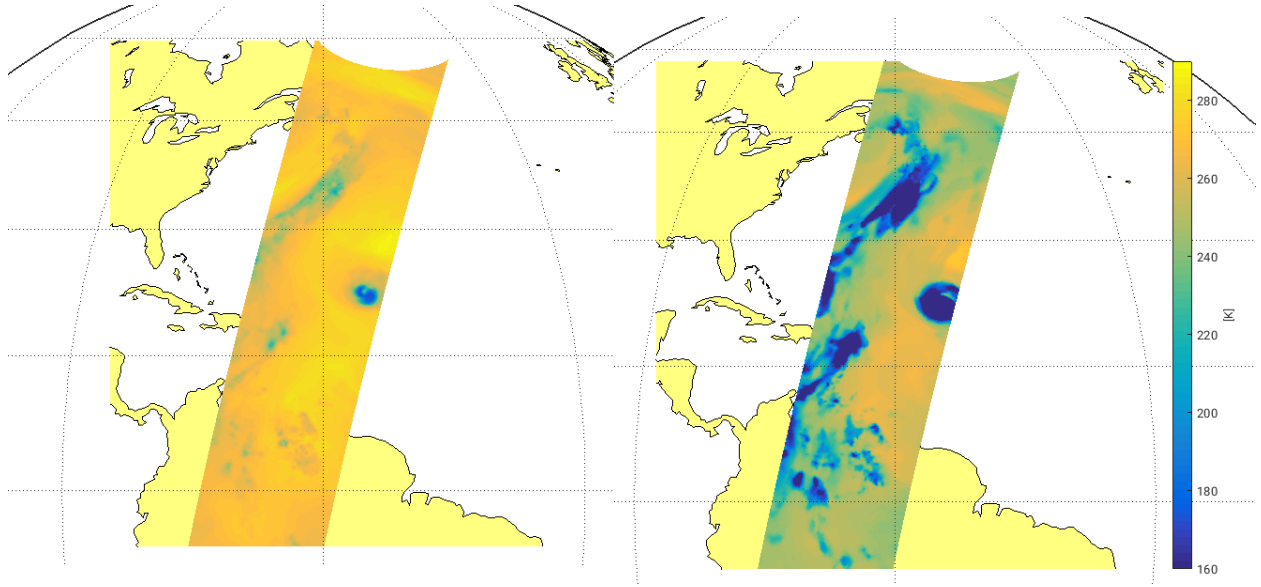
Ice cloud imaging (ICI)

Objectives / products

- Cloud products, in particular ice clouds
- Snowfall detection and quantification
- Water-vapour profiles and imagery

Applications benefitting

- Numerical weather prediction
- Nowcasting
- Hydrology
- Climate monitoring



Simulations of hurricane “IKE” , sept 2008
Left: ICI CH 01 at 183.3 +/-7 GHz (currently the most sensitive channel to ice clouds in Metop)
Right: ICI CH 11 at 664 GHz

- **Establishes operational ice-cloud imaging mission**
- **Support of weather forecast, hydrology, and climate monitoring**

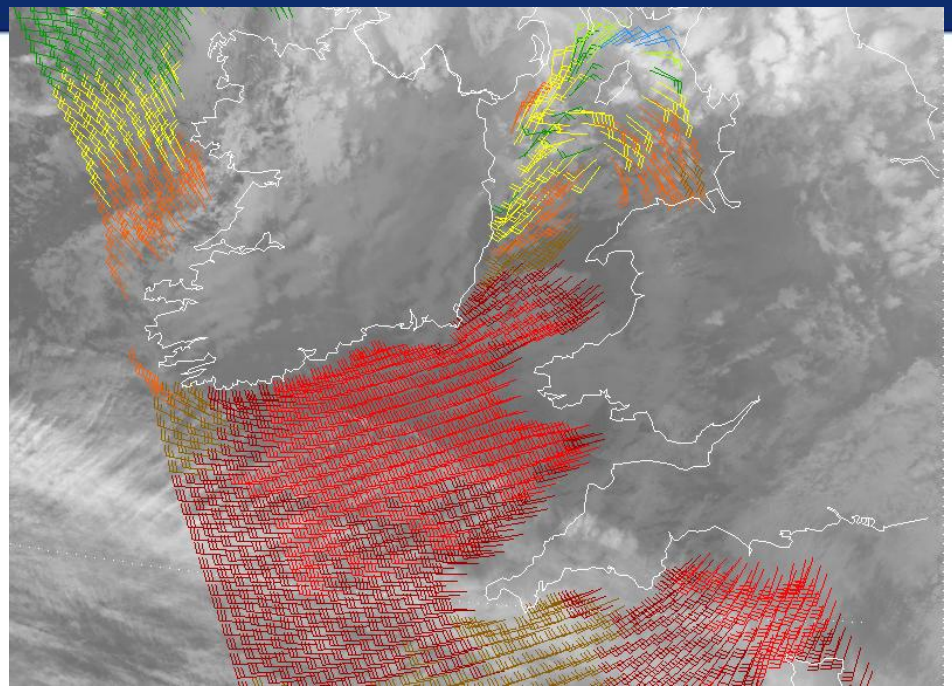
Scatterometry (SCA)

Objectives / products

- Ocean surface wind vectors
- Soil moisture
- Snow equivalent water
- Sea-ice type

Applications benefitting

- Numerical weather prediction
- Nowcasting
- Oceanography
- Hydrology
- Climate monitoring



ASCAT winds; Hurricane Aileen, 12 Sept 2017 (EUMETSAT Image Library)

Heritage on EPS: ASCAT

- **Increase of spatial resolution to 25 km**
  - Better approach of coast lines
- **Increase of swath width to ~1200 km**
  - Enhanced coverage
- **Addition of VH polarisation**
  - Covers higher wind speeds, will benefit observation of tropical and extra-tropical storms
  - Better surface characterisation

EPS-SG Level 1 Products

Mission	Product and Product Level	Coverage	NRT	Eumetsat Data Centre
IASI-NG	Radiances (L1B) Principal Comp Scores (L1D)	Global and Regional	Yes	Yes
MWS	Radiances (L1B)	Global and Regional	Yes	Yes
RO	Bending Angle (L1B)	Global and Regional	Yes	Yes
MetImage	Radiances (L1B)	Global and Regional	Configurable set of channels	Yes
3MI	Radiances (L1B) Stokes Vectors (L1C)	Global and Regional	Yes	Yes
UVNS	Radiances (L1B) Irradiances (L1B)	Global	Yes	Yes
MWI	Radiances (L1B)	Global and Regional	Yes	Yes
ICI	Radiances (L1B)	Global and Regional	Yes	Yes
SCA	Spatially averaged normalised backscatter radar cross section (L1B)	Global and Regional	Yes	Yes

Key Meteorological Information from EPS-SG Mission

- Vertical profiles of temperature and humidity, even in cloudy cases
- Wind vectors of the troposphere in polar regions
- Optical and physical properties of clouds and aerosols including volcanic ash
- Vertical profiles of many atmospheric gases
- Sea surface temperature, ocean surface wind vectors and sea-ice
- Precipitation, soil moisture and snow cover
- Land surface parameters, fire
- Ionospheric electron content

User preparation for MTG and EPS-SG

(MTGUP and EPS-SG UP)

MTGUP: Key User Groups

- Member State National Meteorological and Hydrological Services (NMHS) (core users)
- Other NMHS in RA-VI (Europe), through EUMETSAT Information Days
- NMHS from RA-I (Africa),
  - through WMO RA-I Dissemination Expert Group (RAIDEG)
  - separate track for North Africa NMHS, due to EUMETCast Europe coverage
- Wider user community (R&D, academia, etc.)
- Manufacturers of SW/HW for data acquisition, processing and visualisation
- Atmospheric Composition user community

EPS-SG UP Key User Groups

- Member State National Meteorological and Hydrological Services (NMHS) (core users)
- NWP Core group: Representatives from Global NWP centres in Europe, Regional NWP consortia, and NWP-SAF
- Thematic user groups
  - Nordic Nowcasting
  - Atmospheric composition
  - …
- Global NWP: GODEX-NWP Global Data Exchange for NWP

Core Themes of the UP projects

- User information and communication
- User familiarization (test) data and format support
- User training
- Data access support
- Science support

- We believe there will be more effective and efficient user preparation of Member States by collaboration/coordination of MTGUP and EPS-SG UP with SAFs.

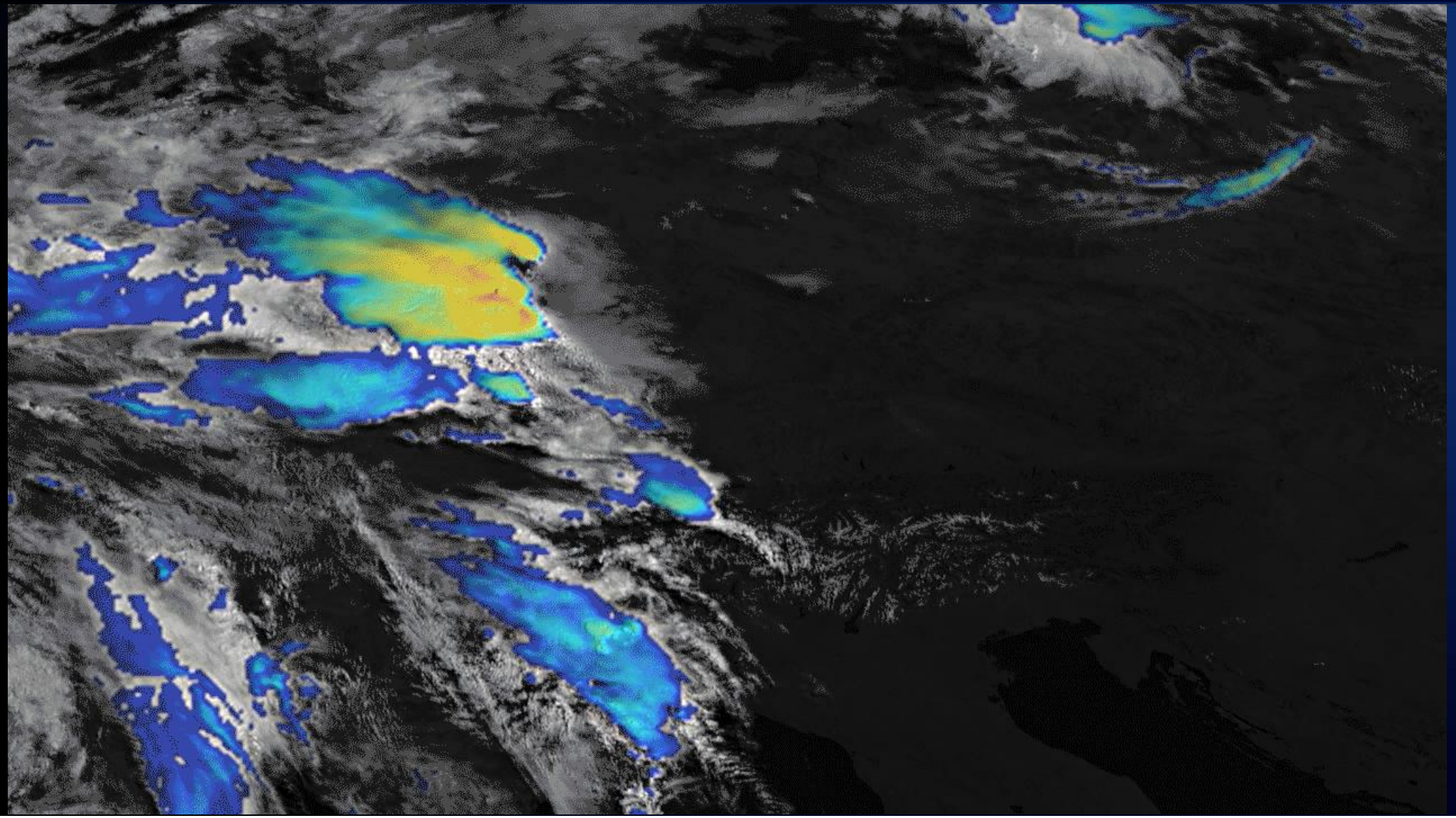

Thank you
Questions?
EPS-SG
USER DAYS
FUTURE
Weather
and climate
data
like never
EPS-SG

Information on Next-Generation Programmes

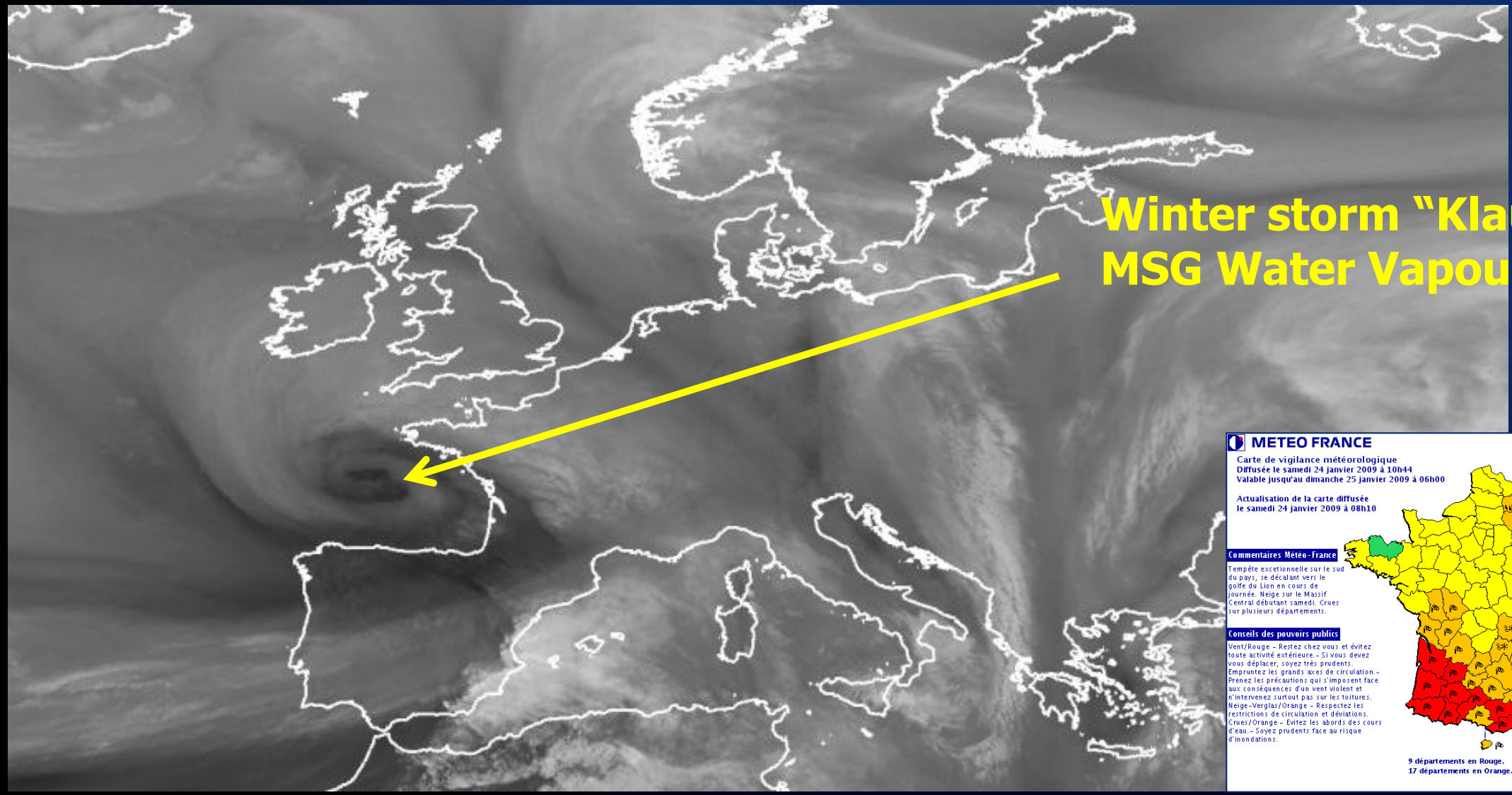
- www.eumetsat.int : Satellites : Future Satellites
- User Helpdesk: ops@eumetsat.int
- Last week‘s user days: presentations online at https://tinyurl.com/rc7gcdv

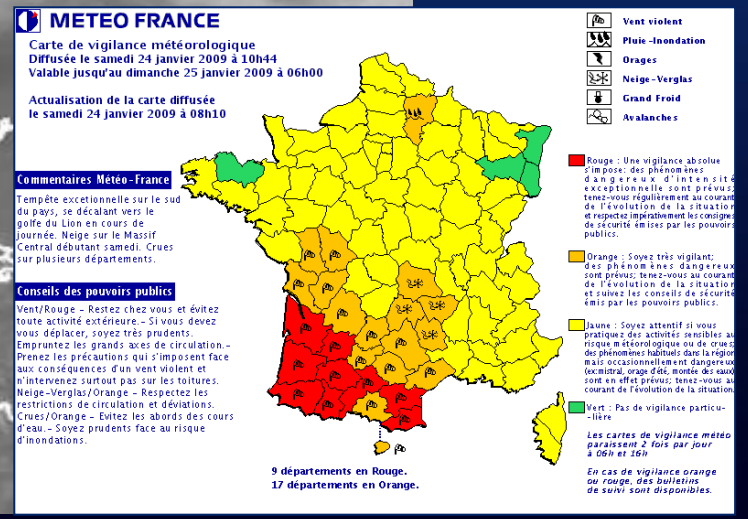
BACKUP

MSG for nowcasting of severe weather: thunderstorms

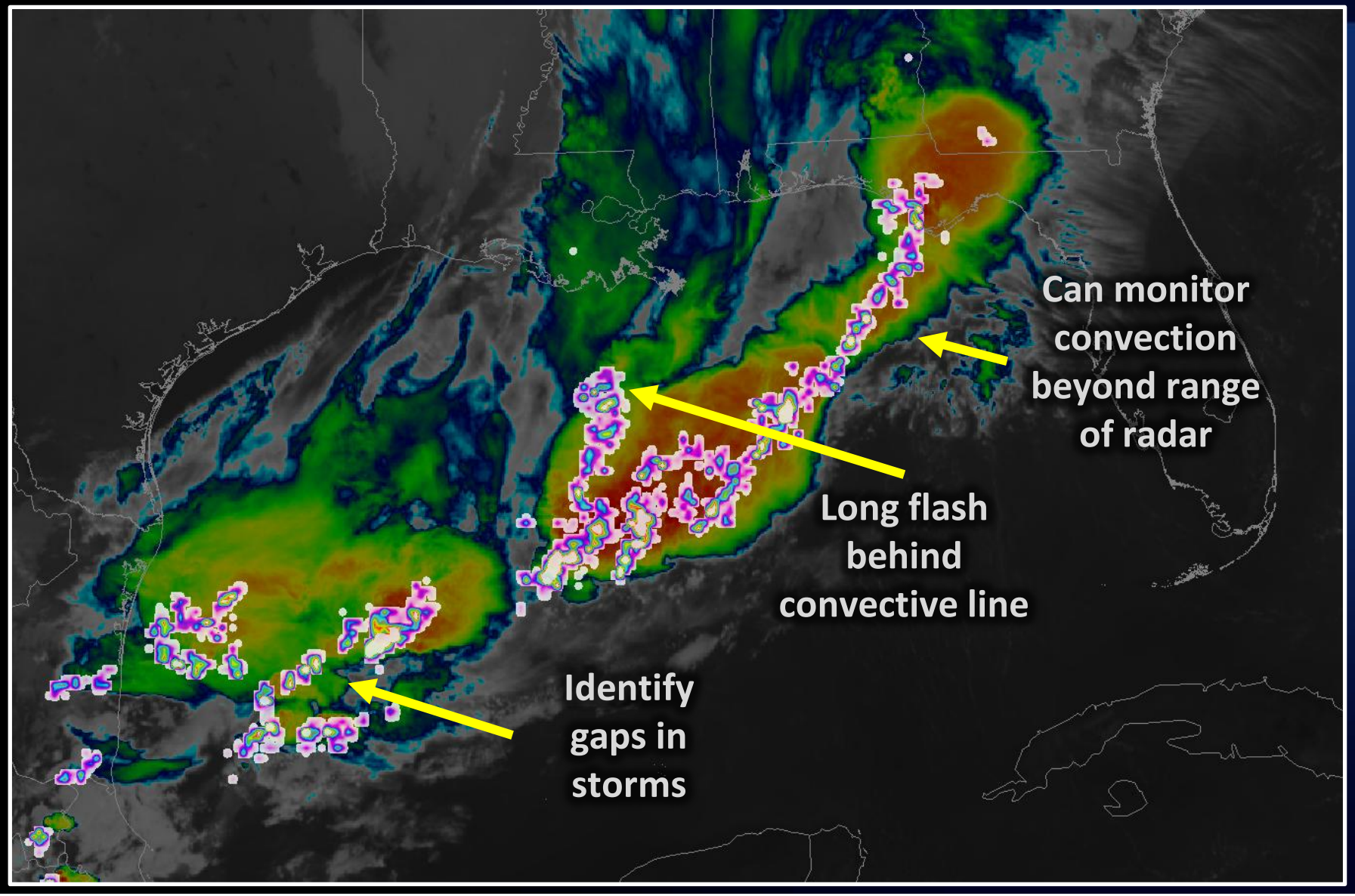


Meteosat Second Generation for confirmation of forecasts





MTG Lightning Imager (LI): US Proxy Data



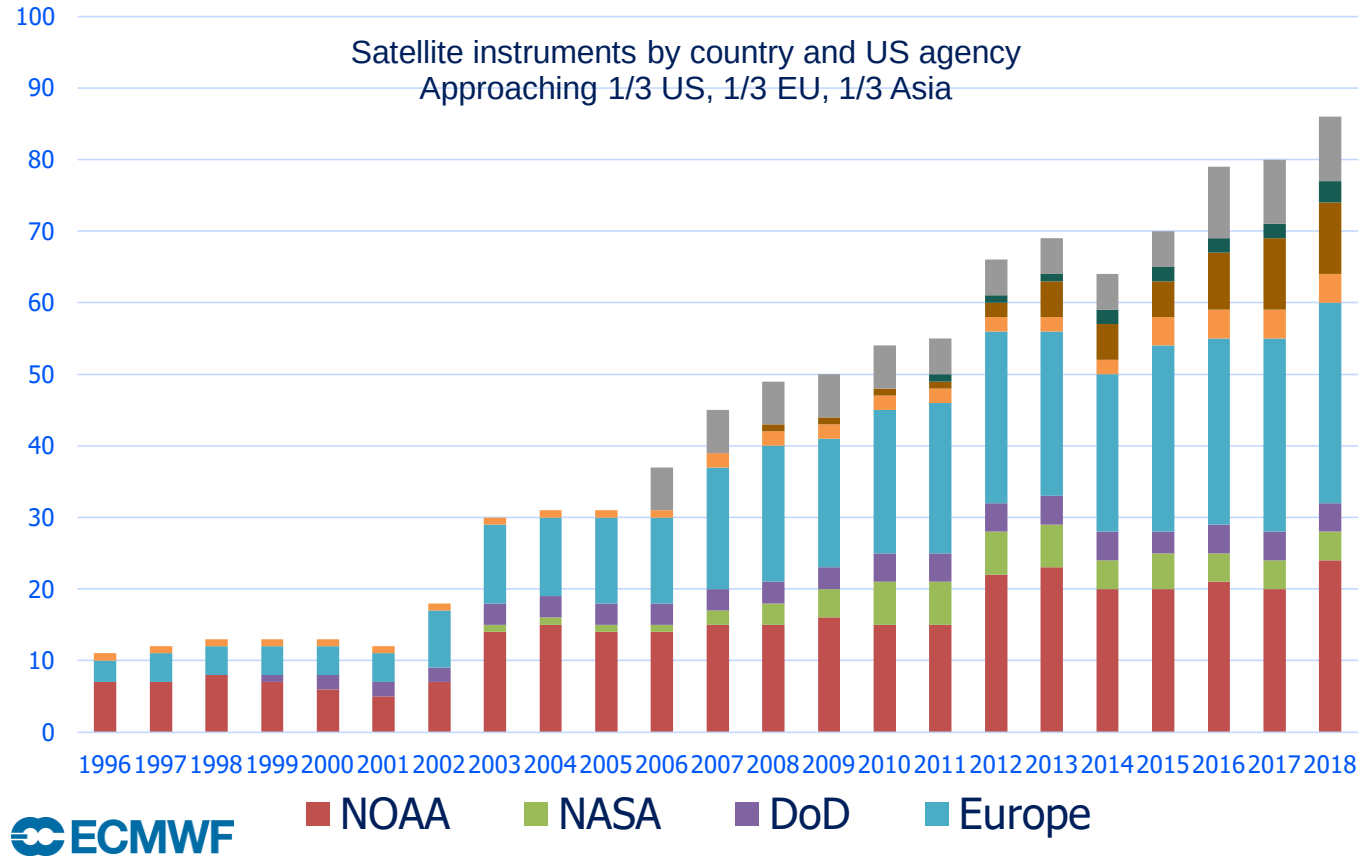
- GOES Lightning Mapper (GLM) Group Density
- Repeat cycle: 1 min
- Horizontal resolution: 8 km

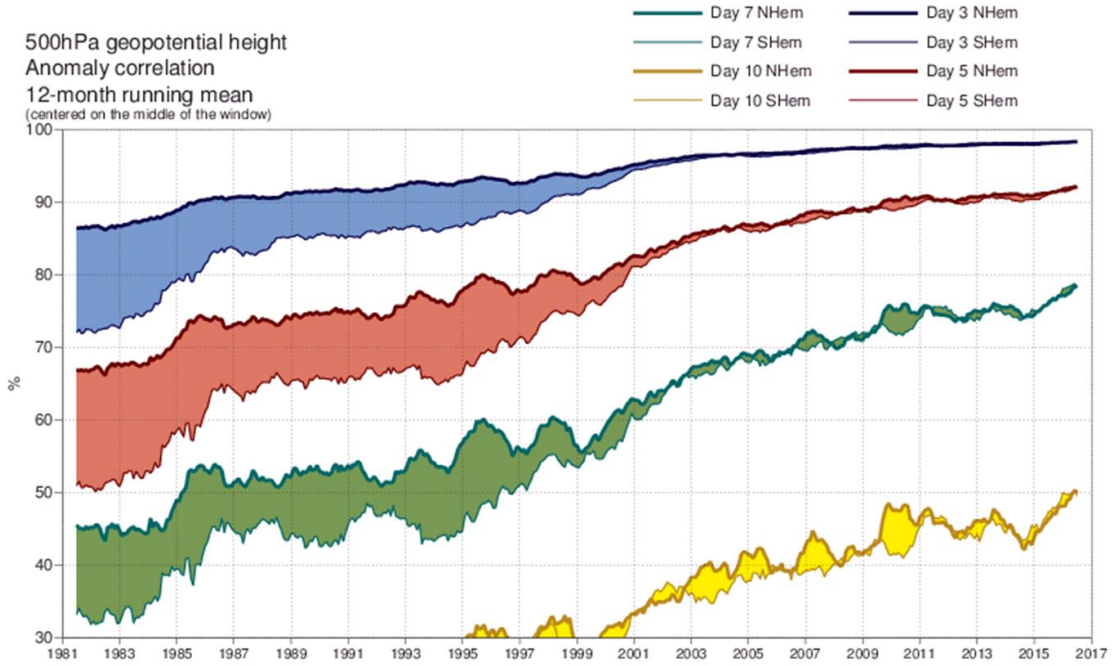
- GOES ABI 11.2 IR
- 4 May 2017

- Source: G. Stano, NASA SPoRT

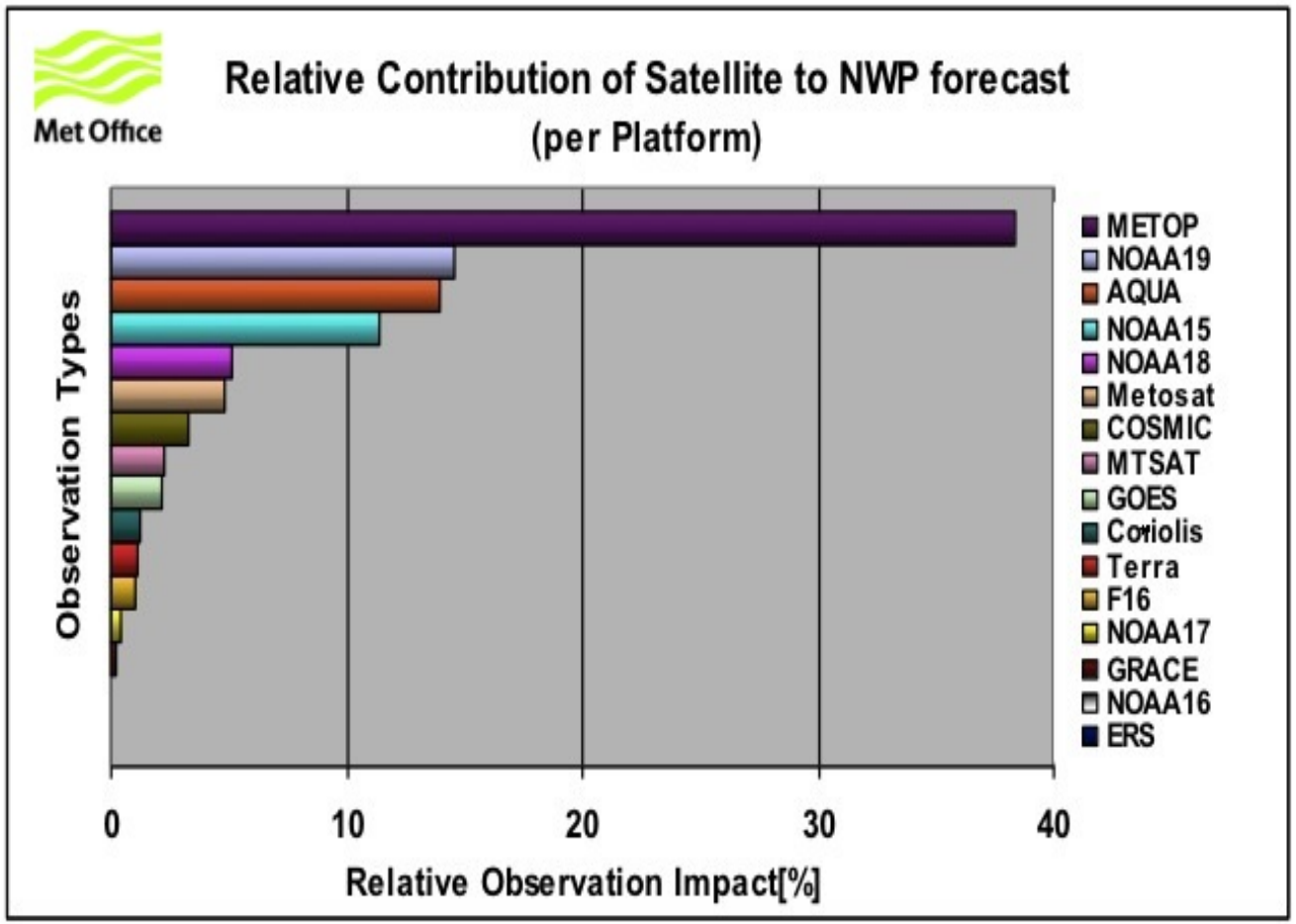
- MTG LI features:
  Spatial resolution:
  ~ 4.5 km at SSP
  Update cycle: 30s

Application in global numerical weather prediction: EUMETSAT contributes to 1/3 of all Satellite Data Assimilated at ECMWF



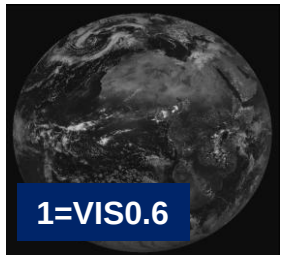


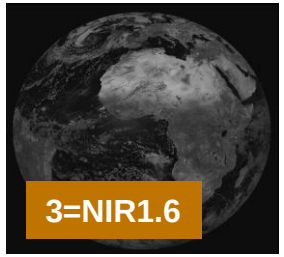
Some figures from cost benefit analysis

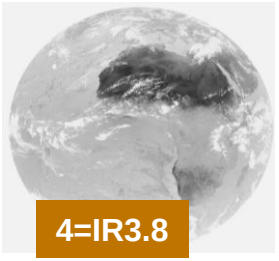


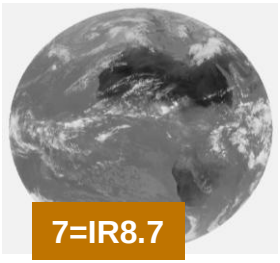
- Operational EUMETSAT and NOAA polar satellites account for 45% of the impact of all observations on NWP forecasts
- Metop itself has the highest contribution at around 25% of all assimilated observations, and close to 40% of all satellite contributions
- Innovation pays off: Metop-A has 2.5 times the positive impact of one satellite from the previous generation (NOAA 19)
- Based on conservative assumptions, the benefits to cost ratio of the EPS-SG programme is certainly over 5 and likely to exceed 20

Current and future imagers channels: MSG SEVIRI and MTG FCI



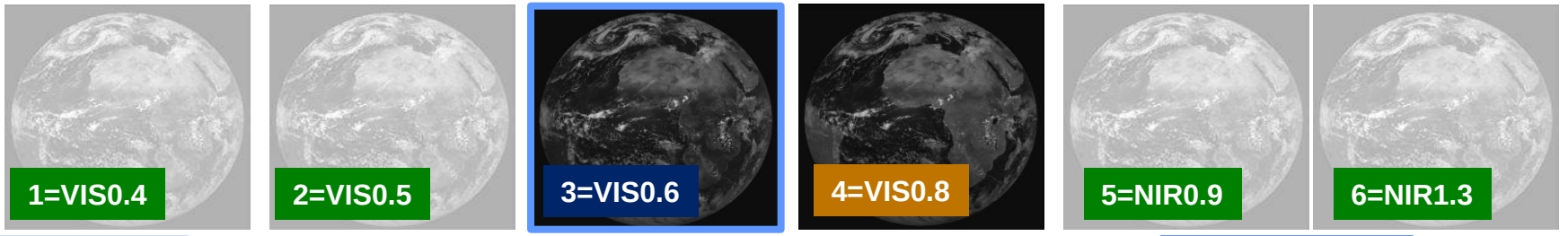




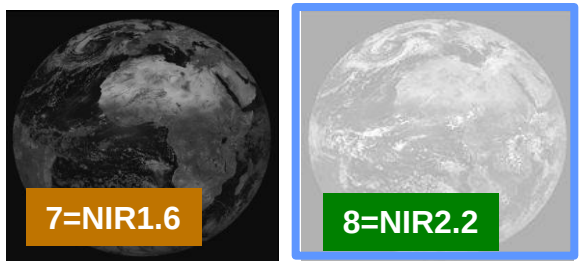


Current SEVIRI

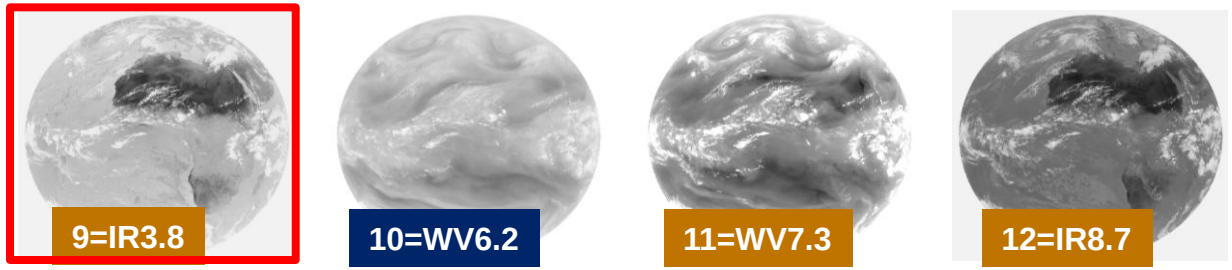
Current and future imagers channels: MSG SEVIRI and MTG FCI

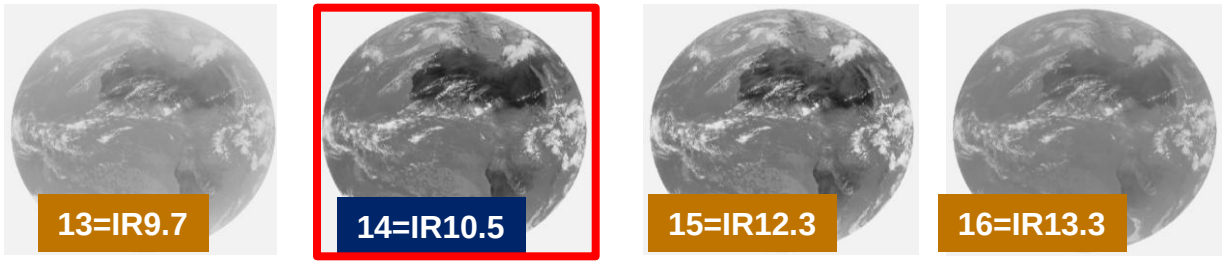


solar channels provided in 0.5 km / 1.0 km resolution



thermal channels provided in 1 km / 2 km resolution





✓ **Continuity**

✓ **Innovation**

Future FCI

Application benefits from the MTG Imager (FCI)

- New channels (0.444 µm and 0.51 µm) will support **true colour images** and permit surpassing current **aerosol retrievals** especially over land – also an important contribution to air quality monitoring.
- The 0.91 µm channel will provide during **daytime total column precipitable water** especially over land surfaces.
- The 1.375 µm channel will improve detection of **very thin cirrus clouds** not seen by the current system. If not detected, errors are introduced in all clear sky products.
- The 2.26 µm channel will provide the capability for an **improved retrieval of cloud microphysics.**
- The higher spatial resolution (1 km and 2 km) of the 3.8 µm channel will **improve fire detection** and, via its extended dynamical range (from 350 K to 450 K), the quality of products.
- To **improve the convection detection** through the shorter repeat cycle and better spatial resolution.

Application benefits from the MTG Lightning Imager (LI)

- **Main benefit from GEO lightning observations**:
  - homogeneous and continuous observations delivering information on location and strength of lightning flashes to the users with a timeliness of up to 30 seconds

- **Main objectives are to detect, monitor, track and extrapolate in time:**
  - Development of active convective areas and storm lifecycle
  - Lightning climatology
  - Chemistry (NOx production)

- **Furthermore:**
  - Good coverage in developed countries and around major airports
  - Most areas of the earth are without any good-quality lightning data from ground, but with significant severe weather and lightning causing risks for aviation (e.g. Africa)
  - This situation on the availability of ground-based data is not expected to change in the near future (technical/physical limitations)

Hyper-spectral infrared sounding (IASI-NG)

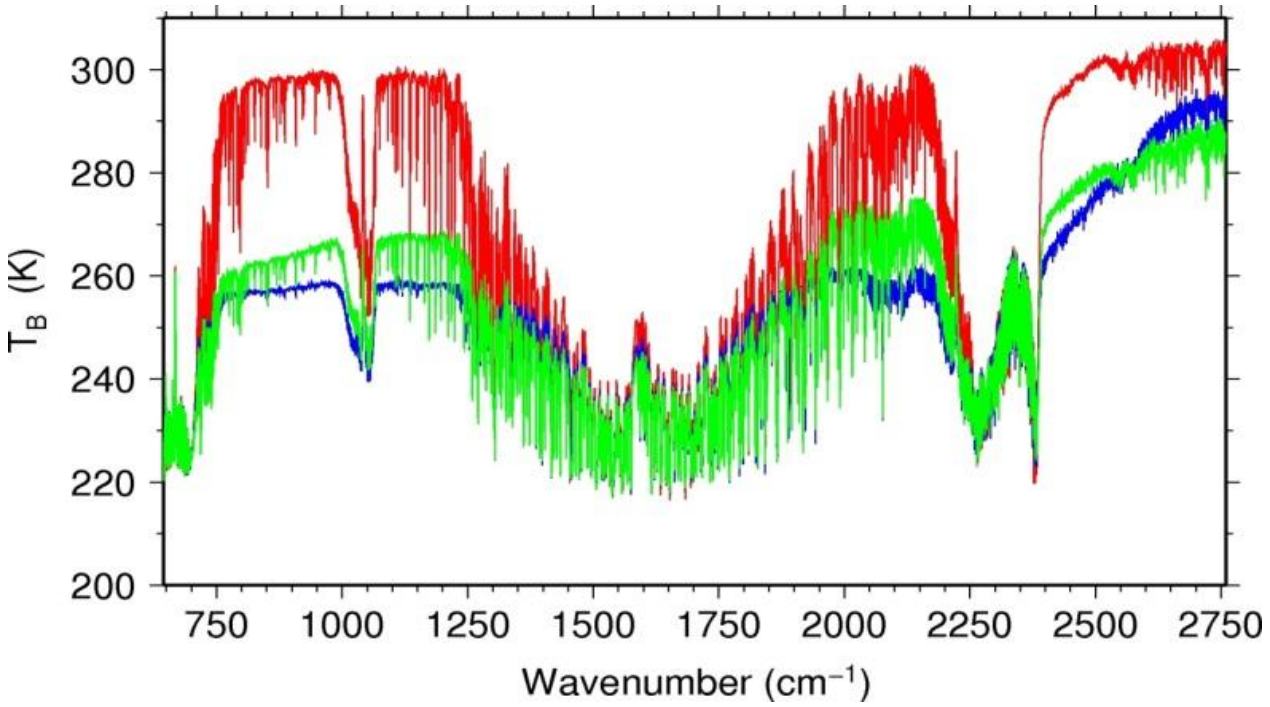
EPS Heritage: IASI

Objectives / products

- Temperature/humidity profile at high vertical resolution in clear air
- Clouds, trace gases (O_3, CO, CH_4, CO_2,...)
- Sea/land/ice surface temperature
- Aerosols, Volcanic Ash

Applications Benefitting

- Numerical Weather Prediction
- Nowcasting
- Atmospheric Composition
- Climate Monitoring
- Oceanography



Breakthrough

- **Doubling of radiometric and spectral resolution of IASI for the benefit of weather forecast and atmospheric composition**
  - Enhanced information in temperature profiling and water vapour profiling
  - Quantification of trace gases which are currently only detected
  - Vertical resolution of trace gases instead of columnar amounts only

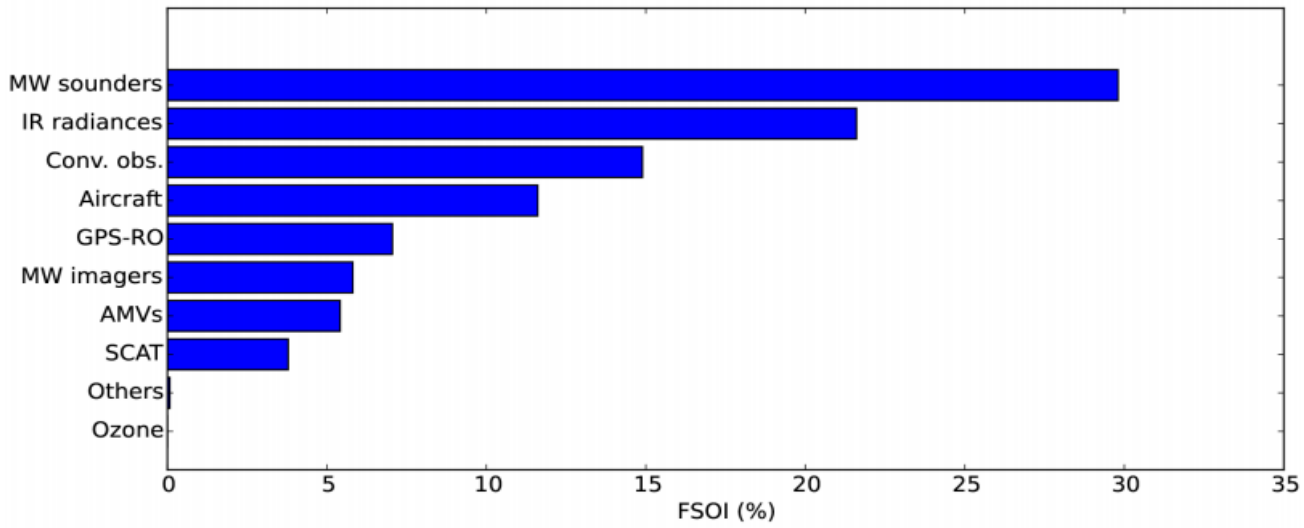
Micro-wave sounding (MWS)

Objectives / products

- Temperature/humidity profiles in clear and cloudy air
- Cloud liquid water total column
- Imagery: precipitation

Applications benefitting

- Numerical weather prediction
- Nowcasting
- Climate monitoring
- Hydrology



Forecast Sensitivity Observation Impact (FSOI) diagnostics, for ECMWF's operational 4DVAR system, taken from MWS Science plan

Heritage on EPS: AMSU-A, MHS

- **Addition of a quasi-window channel at a higher frequency - 229 GHz**
  - Cirrus cloud information giving a better humidity retrieval performance
- **Addition of sounding channels**
  - **+ 2 channels at 53-54 GHz**
  - **+ 3 channels at 183.31 GHz**
  - More information on temperature and water vapour profiles

EUMETSAT

Micro-wave sounding (MWS)

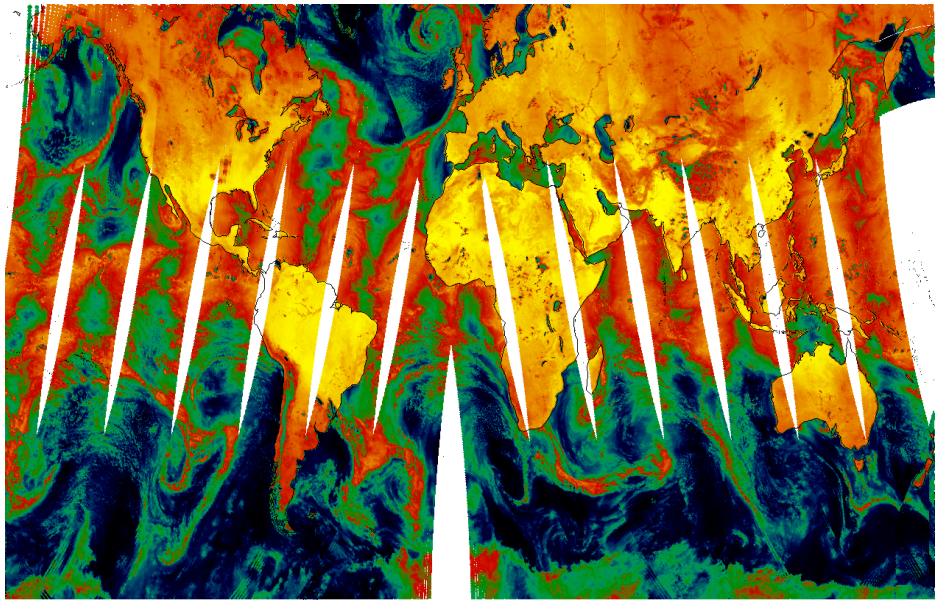
EPS Heritage: AMSU and MHS

Objectives / products

- Temperature/humidity profiles in clear and cloudy air
- Cloud liquid water total column
- Imagery: precipitation

Applications Benefitting

- Numerical Weather Prediction
- Nowcasting
- Climate Monitoring



Breakthrough

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  - **+ 3 channels at 183.31 GHz**
  - More information on temperature and water vapour profiles

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Radio occultation sounding (RO)

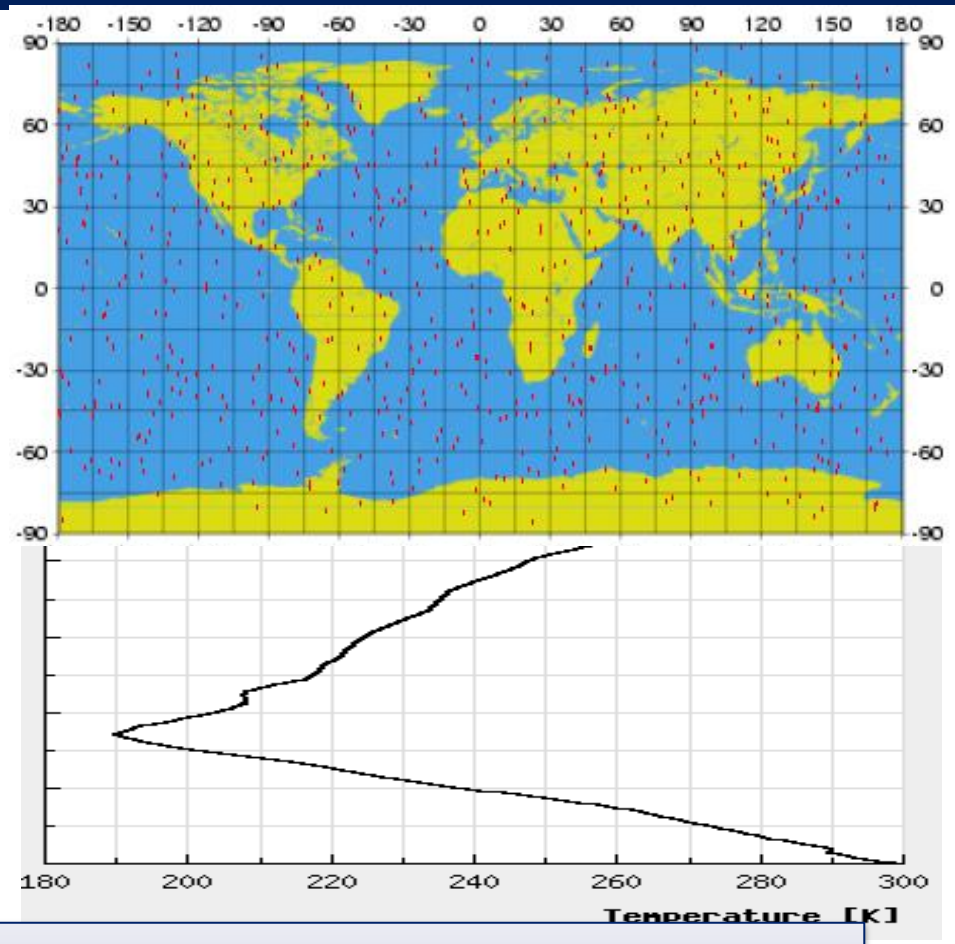
EPS Heritage: GRAS

Objectives / products

- Refractivity profiles at high vert. resolution
- Temperature / humidity profiles
- PBL top and tropopause height
- Ionospheric electron content

Applications benefitting

- Numerical weather prediction
- Climate monitoring
- Space weather



Breakthrough

- **Tracking of GPS and Galileo satellites to double the number of occultation measurements**
- **RO mission on board Metop-SG A and B satellites.**

EUMETSAT

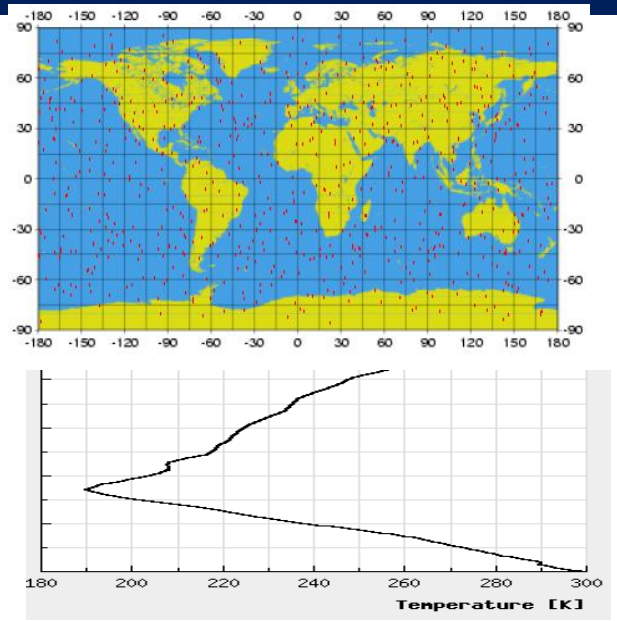
Radio occultation sounding (RO)

Objectives / products

- Refractivity profiles at high vert. resolution
- Temperature / humidity profiles
- PBL top and tropopause height
- Ionospheric electron content

Applications benefitting

- Numerical weather prediction
- Climate monitoring
- Space weather



Heritage on EPS: GRAS

- **Tracking of GPS and Galileo satellites to double the number of occultation measurements**
- **Equipment of both Metop-SG satellites with RO**
- **Support to space weather monitoring by measuring ionospheric electron content**

Slide: 56

Optical imaging (METimage)

EPS Heritage: AVHRR

Objectives / products

- Hi-res cloud products, incl. microphysics
- Aerosols
- Polar AMVs
- Vegetation, snow, fire
- Sea/ice/land surface temperature
- Support to sounding missions

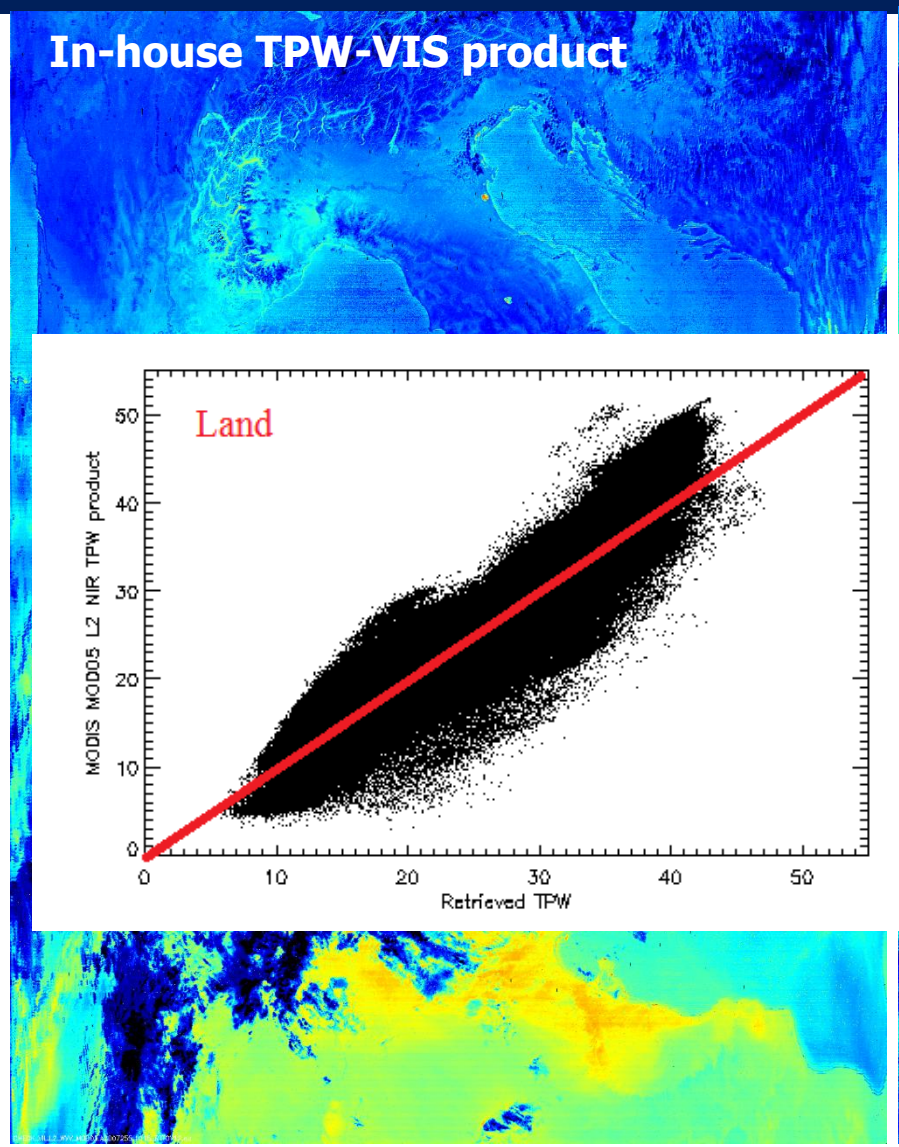
Applications benefitting

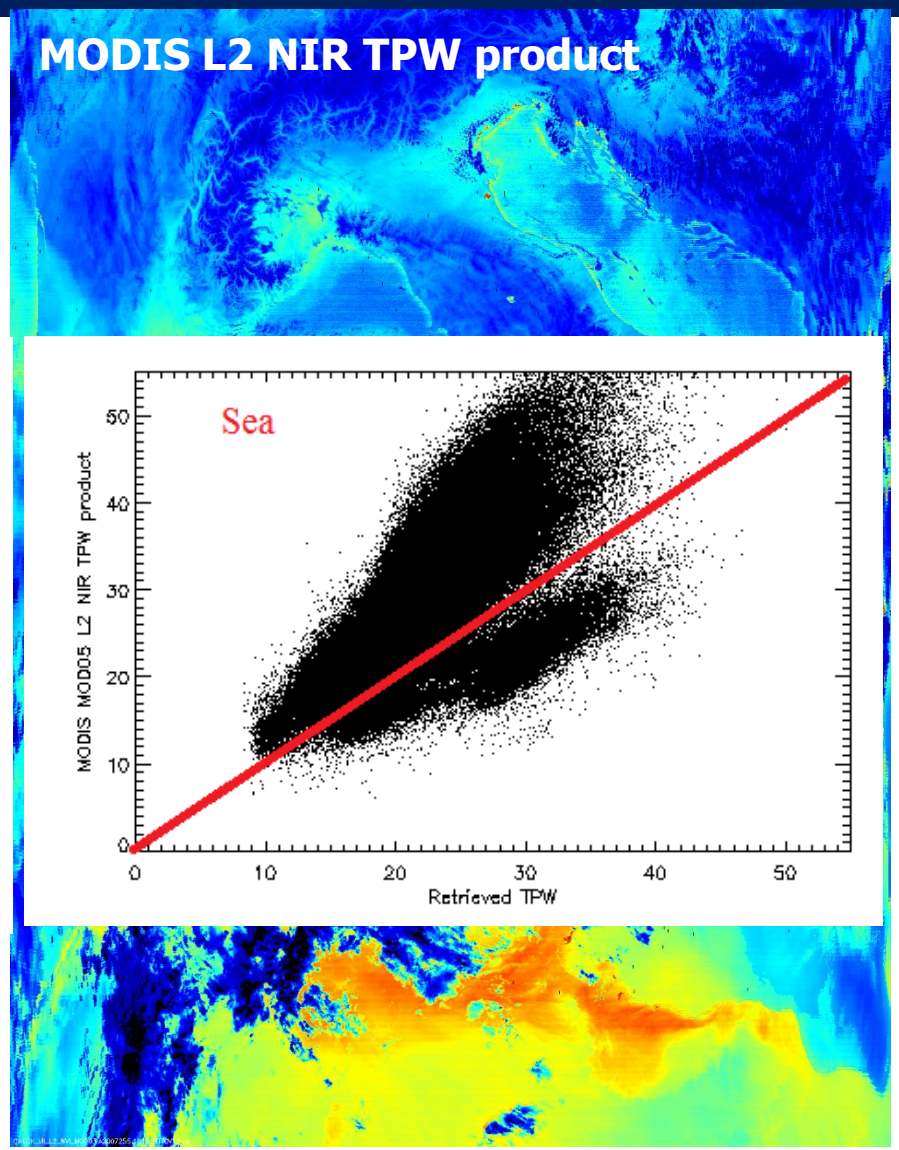
- Nowcasting
- Numerical weather prediction
- Oceanography
- Hydrology
- Climate monitoring

Breakthrough

- **Far more spectral channels than AVHRR for the benefit of measuring more variables**
- **Higher spatial sampling (500 m):**
  - more complete coverage through greater likelihood to measure surface variables in partly cloud conditions
- **Better radiometric resolution for more accurate quantification of many variables**

Performance of the METimage visible Water Vapour algorithm (TPW-VIS) on MODIS proxy data and comparison with operational MODIS L2 TPW NIR product





TPW in kg/m²

- >45
- ≤45
- <40
- <35
- <30
- <10
- Not Conv.

L. Spezzi, EUMETSAT

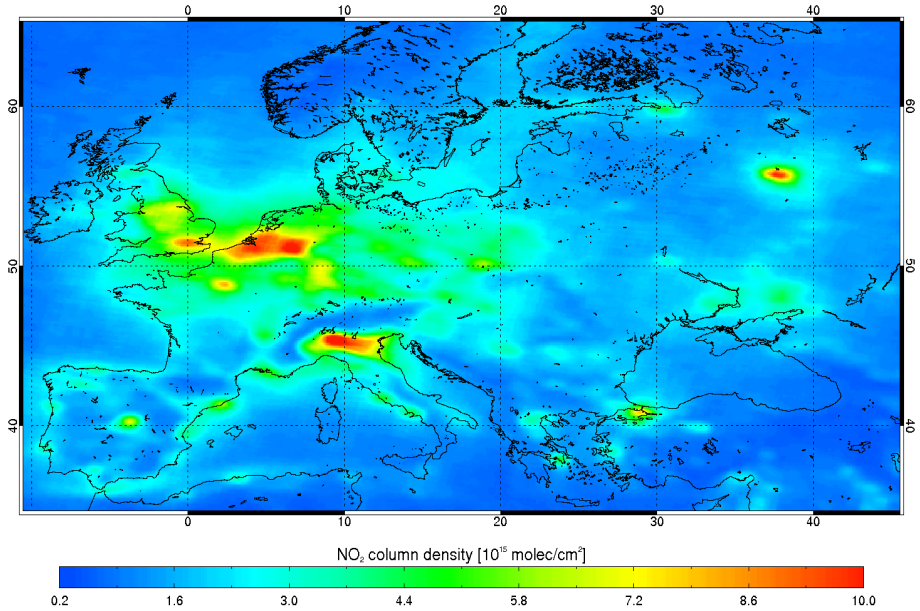
Nadir viewing UV/VIS/NIR/SWIR sounding (Sentinel-5)

Objectives / products

- Ozone profile and column
- Columns of CO_2,SO_2, NO_2, H_2O, CO, CH_4
- Aerosol optical depth
- Columns of BrO, HCHO, OCHCHO
- Volcanic Plumes

Applications benefitting

- Air quality forecasting
- Ozone-UV
- Atmospheric Composition
- Climate monitoring



GOME-2 tropospheric NO_2 in Europe 2007-2010 (AC SAF)

Heritage on EPS: GOME-2

- **Increased spatial sampling (7.5 km)**
  - for the benefit of air quality monitoring
- **Extended spectral range into the near and shortwave infrared regions**
  - to measure aerosols as well as methane and carbon monoxide in the PBL

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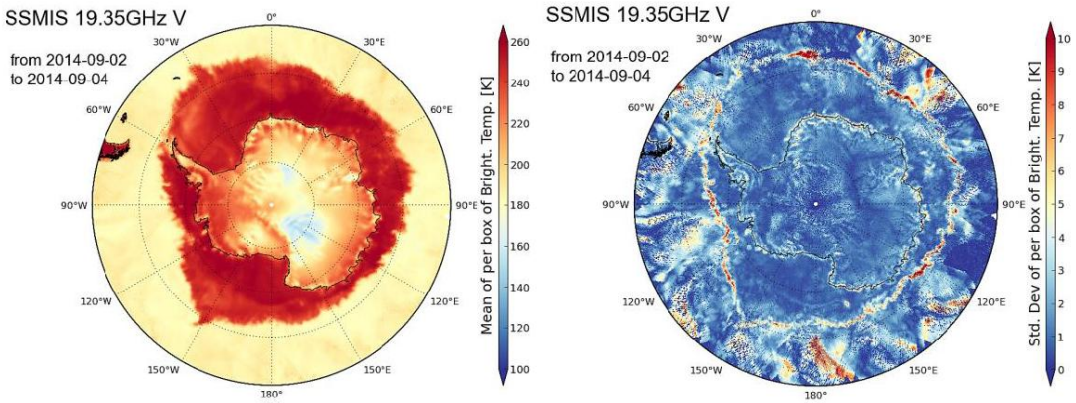
Micro-wave imaging (MWI)

Objectives / products

- Precipitation and cloud products
- Water vapour imagery
- Sea-ice, snow, sea surface wind

Applications benefitting

- Numerical weather prediction
- Nowcasting
- Oceanography
- Hydrology
- Climate monitoring

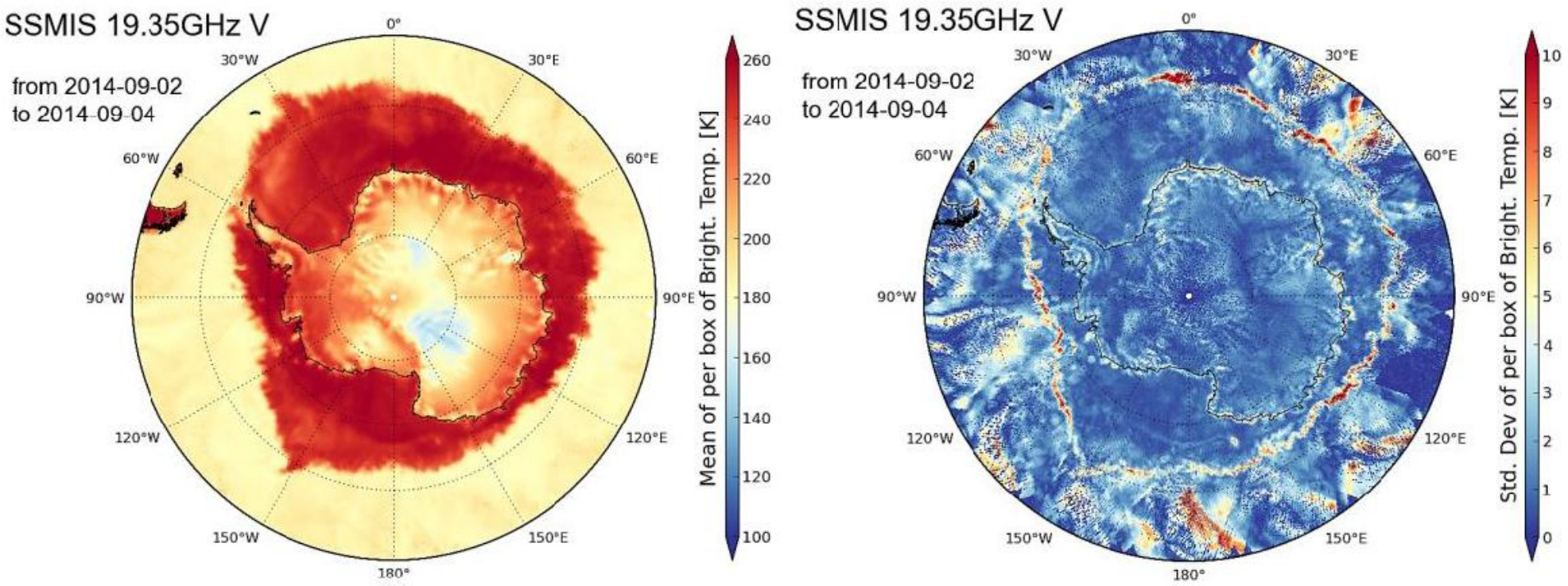


Mean value and standard deviation of 19 GHz SSMI/S brightness temperatures over Antarctica for a two-day averaging window (2. to 4. Sept. 2014).

ANPAC study

- **Continuity of key microwave imager channels for weather forecast**
- **Inclusion of dedicated sounding channels (118.75 GHz)**
  - Enhanced precipitation measurements through inclusion of dedicated sounding channels
- **Extended suite of 183.31 GHz channels**
  - water-vapour and cloud profiling

Sea Ice – SSMIS 19.35 GHz channel



Mean value and standard deviation of 19 GHz SSMI/S brightness temperatures over Antarctica for a two-day averaging window (2. to 4. Sept. 2014).

ANPAC study

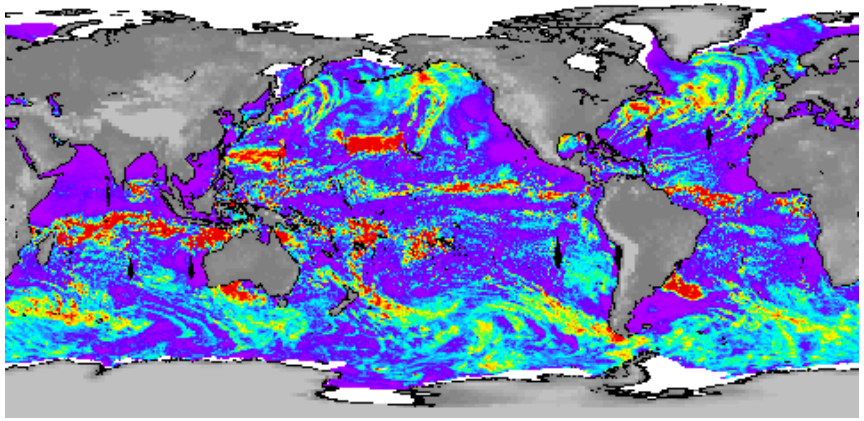
- Continuation of Sea Ice Data record
- Edges of Sea Ice clearly seen

Micro-wave imaging (MWI)

Novel mission on EPS-SG

Objectives / products

- Precipitation and cloud products
- Water vapour imagery
- Sea-ice, snow, sea surface wind



Applications benefitting

- Numerical weather prediction
- Nowcasting
- Oceanography
- Hydrology
- Climate monitoring

Breakthrough: 18 channels

- **Continuity of key microwave imager channels for weather forecast**
- **Inclusion of dedicated sounding channels (118.75 GHz)**
  - Enhanced precipitation measurements through inclusion of dedicated sounding channels
- **Extended suite of 183.31 GHz channels**
  - water-vapour and cloud profiling

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Scatterometry (SCA)

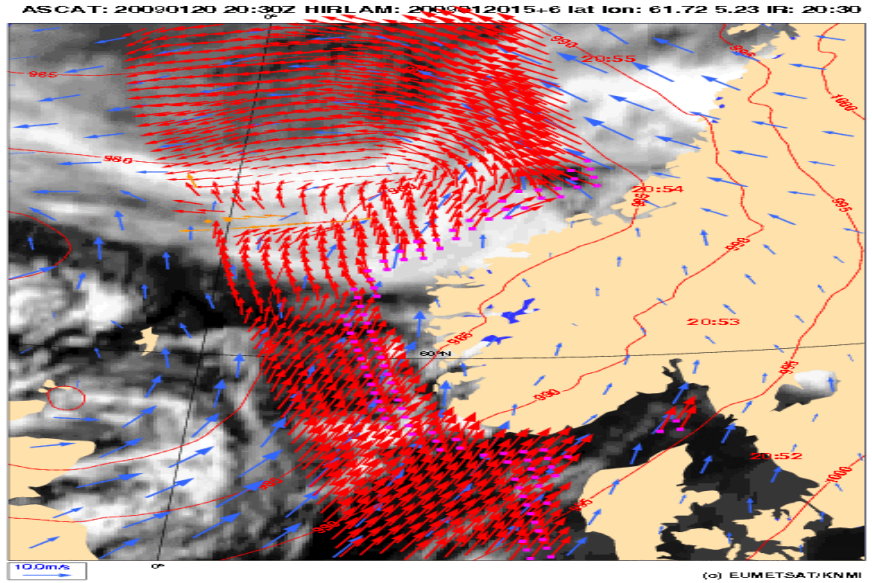
EPS Heritage: ASCAT

Objectives / products

- Ocean surface wind vectors
- Soil moisture
- Snow equivalent water
- Sea-ice type

Applications benefitting

- Numerical weather prediction
- Nowcasting
- Oceanography
- Hydrology
- Climate monitoring



Breakthrough

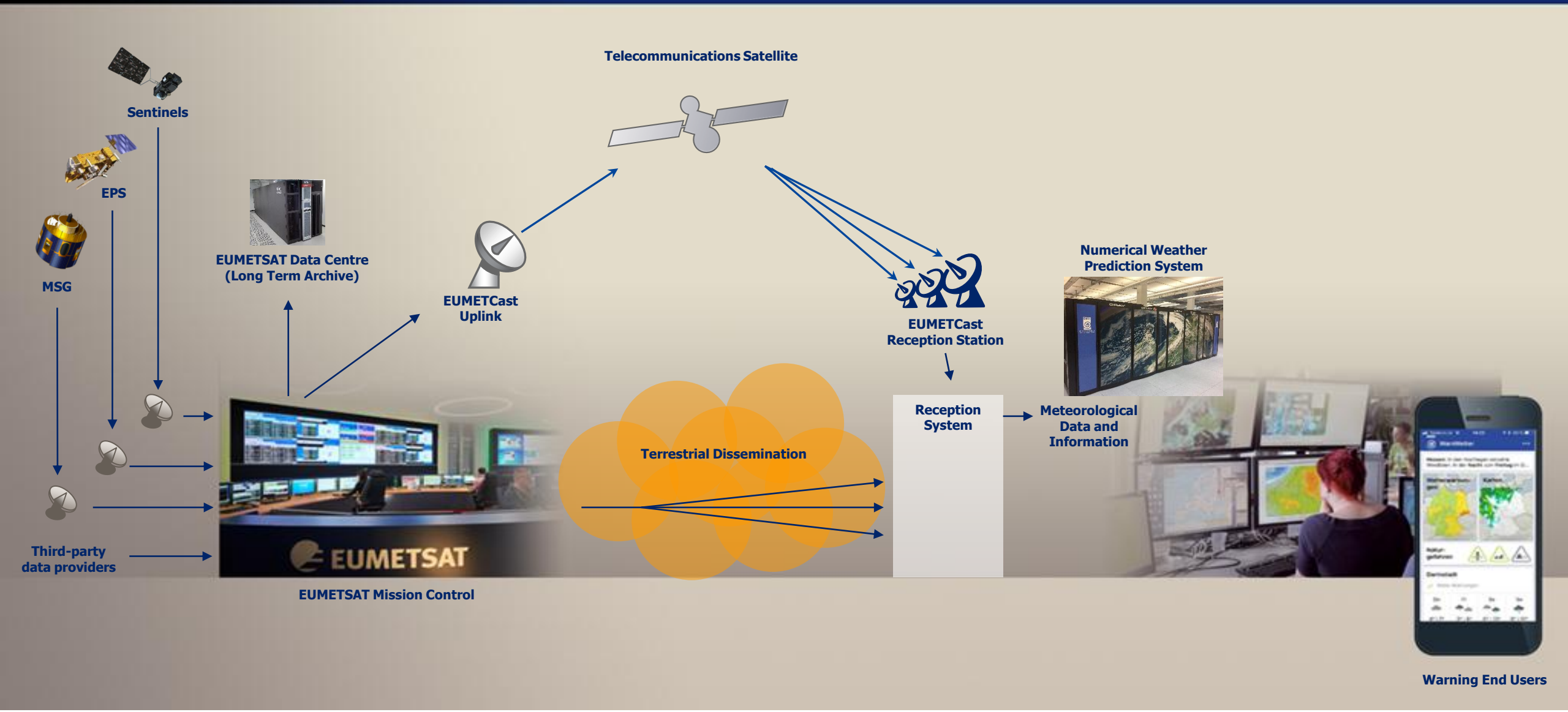
- **Increase of spatial resolution to 25 km**
  - Better approach of coast lines
- **Increase of swath width to ~1200 km**
  - Enhanced coverage
- **Addition of VH polarisation**
  - Covers higher wind speeds without saturation, will benefit observation of tropical and extra-tropical storms

EUMETSAT ground segment

EUMETSAT Data Services

- EUMETSAT Data Services (near real-time & archive)
  - EUMETCast, EUMETView, EUMETSAT Data Centre
  - New, additional pilot services underway, including online data access

Delivering critical data in near-real time to users



Online access to data

	eoportal.eumetsat.int	Create and manage your user account, subscribe to our services
	navigator.eumetsat.int	Explore our catalogue, what and where, supporting documentation
	eumetcast.com	Learn more about our push delivery service
	coda.eumetsat.int	Download Sentinel-3 marine and atmosphere data
	archive.eumetsat.int	Order past data
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