

Webinar :

Launch of MTG satellite: data journey from space to solar plants

January 26th 2023



Moderator:

Annalisa Donati
Secretary General



Speaker:

Jochen Grandell
MTG Programme Scientist



Speaker:

Pilar Rípodas
Project Manager Nowcasting SAF



Speaker:

Mathieu Turpin
Satellite Data Expert



MTG satellite systems: data journey from space to solar plants





Members



Approach



Facilitator → EXPLORE

Raise awareness of satellite applications to help professional communities in many sectors: from transport to risk management, from habitat protection to energy, from climate change to the IoT.



Matchmaker → CONNECT

Support potential end users of satellite applications by leveraging its vast network among space and non-space communities; understanding patterns and links and/or creating them for mutual benefits.



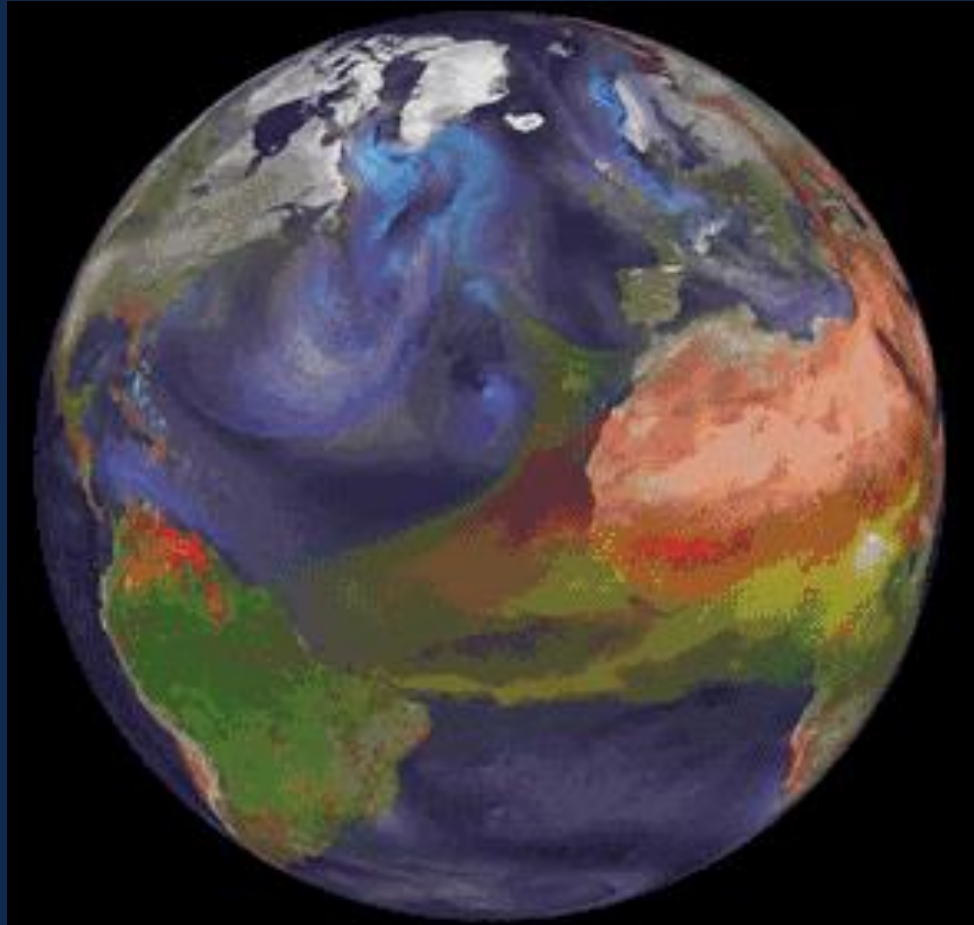
Adviser → INFORM

Provide feedback to decision-makers on possible measures to overcome obstacles in diffusing space-derived innovation in society.



Why Space Applications?

*Earth
Observation*



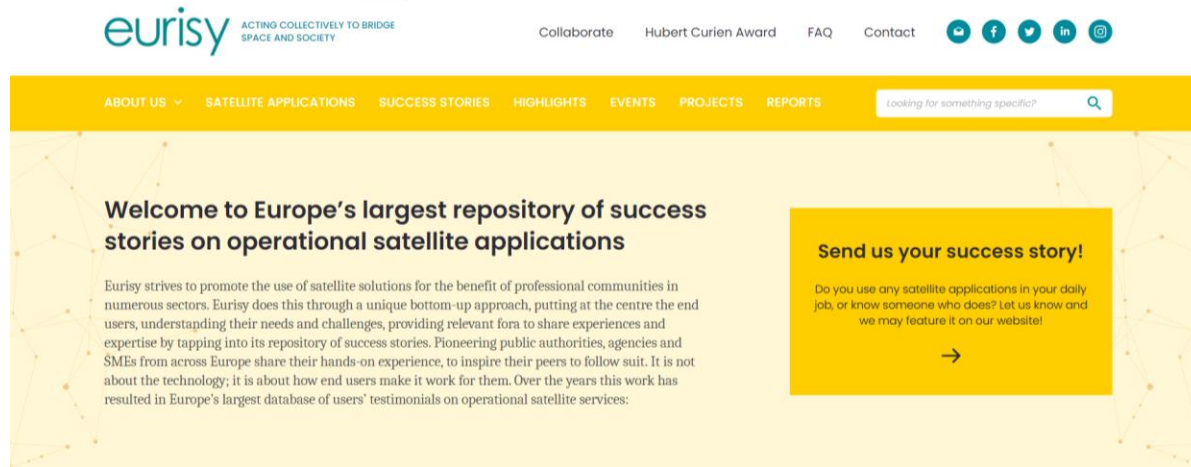
*Satellite
Communication*



*Satellite
Navigation*



Success stories database

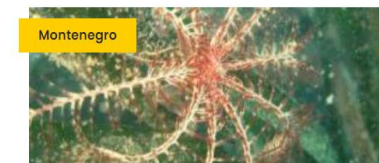


The Success Stories aim at addressing communities outside the space sector to express their needs and to present their challenges.

Objective is to favour the integration of satellite-based solutions in their workflow.

Success stories will favour the dissemination of case studies and help connecting service providers and end users.

Communication and digital society	>
Energy, infrastructure and utilities	>
Environment, climate and health	>
Maritime	>
Risk management and emergencies	>
Smart cities	>
Tourism, culture and leisure	>
Transport and logistics	>



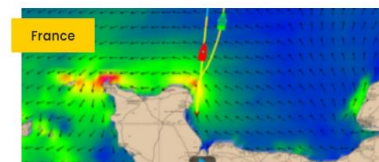
Montenegro
Montenegro: Protecting marine habitats thanks to a map based on satellite information



Italy
Lazio Region: supporting coastal zone management with geo-information services



Finland
Finland: All-year-round open ports due to efficient ice-breaking services



France
Weather4D: smooth seas and fair winds ahead with satellite technology





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Meteosat Third Generation (MTG) – A fully new Imaging Satellite

Jochen Grandell
MTG Programme Scientist

*MTG Webinar with Reuniwatt, AEMet and EUMETSAT
26 January 2023*

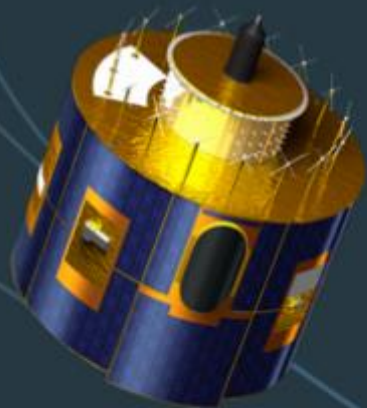


Geostationary and Polar orbit satellites have different objectives

www.eumetsat.int

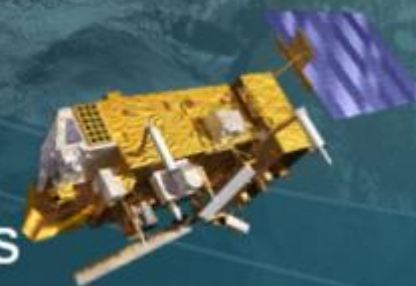
GEOSTATIONARY ORBIT

Vital for forecasts up to a few hours



POLAR ORBIT

Critical for forecasts up to 10 days





MTG mission objectives...

...achieved through Imaging and Sounding satellites MTG-I and MTG-S

Primary mission:

- **Support Nowcasting / Short Range Forecasting of high impact (severe) weather**
 - This is achieved through:
 - Continuity and enhancement of MSG imagery
 - Addition of a new lightning imaging capability
 - New infrared hyper-spectral sounding

Secondary mission:

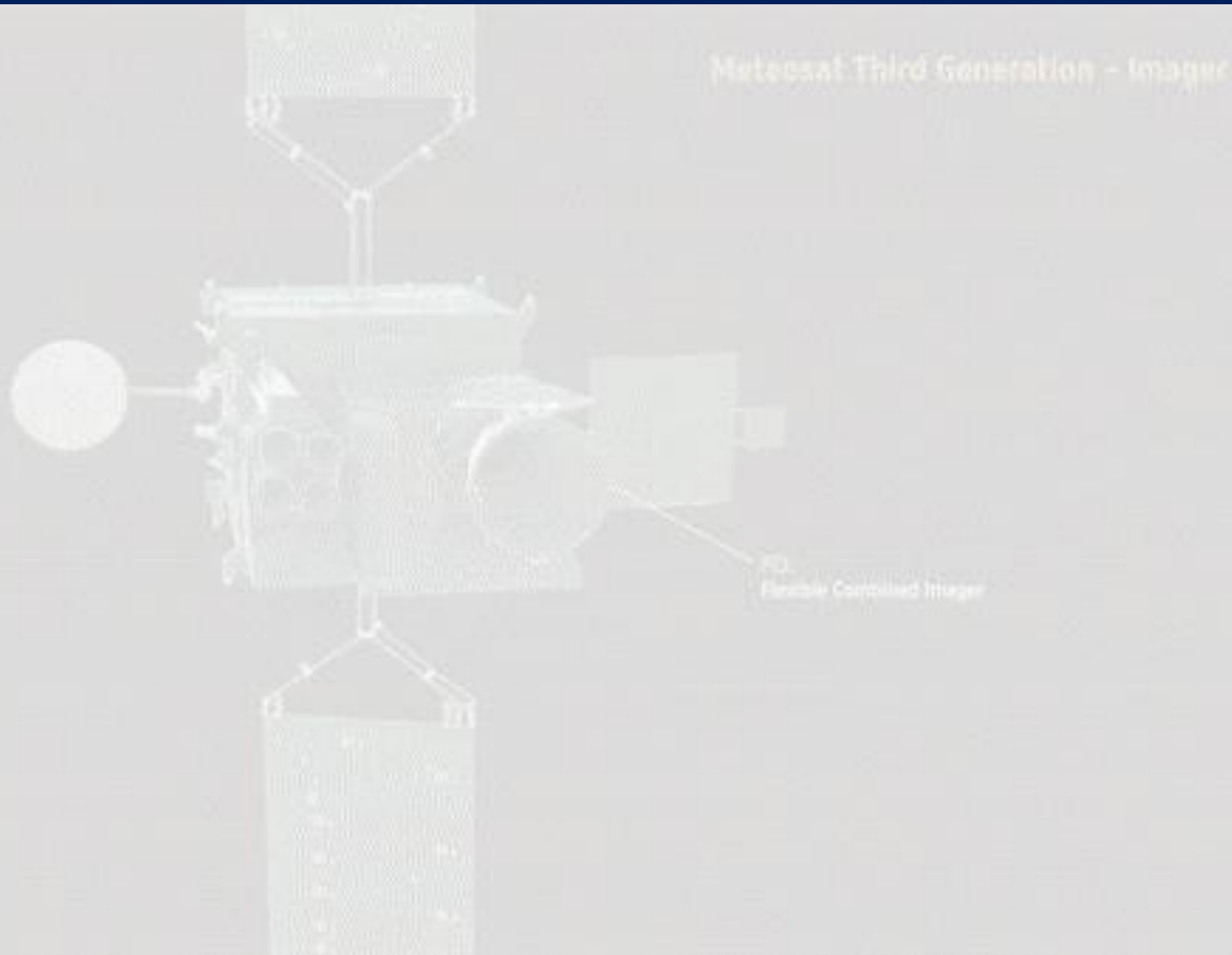
- **Air quality monitoring over Europe**
 - This is achieved through:
 - Synergy between Sentinel-4, Infrared Sounder and Imagery

MTG-I

MTG-S



MTG-I: Flexible Combined Imager (FCI) and Lightning Imager (LI)



...towards a
three-satellite
configuration

Combination of an
imaging mission (2x
MTG-I) and a
sounding mission
(1x MTG-S)

MTG-I

- First launch in 2022
- Operational exploitation: 2023-2044

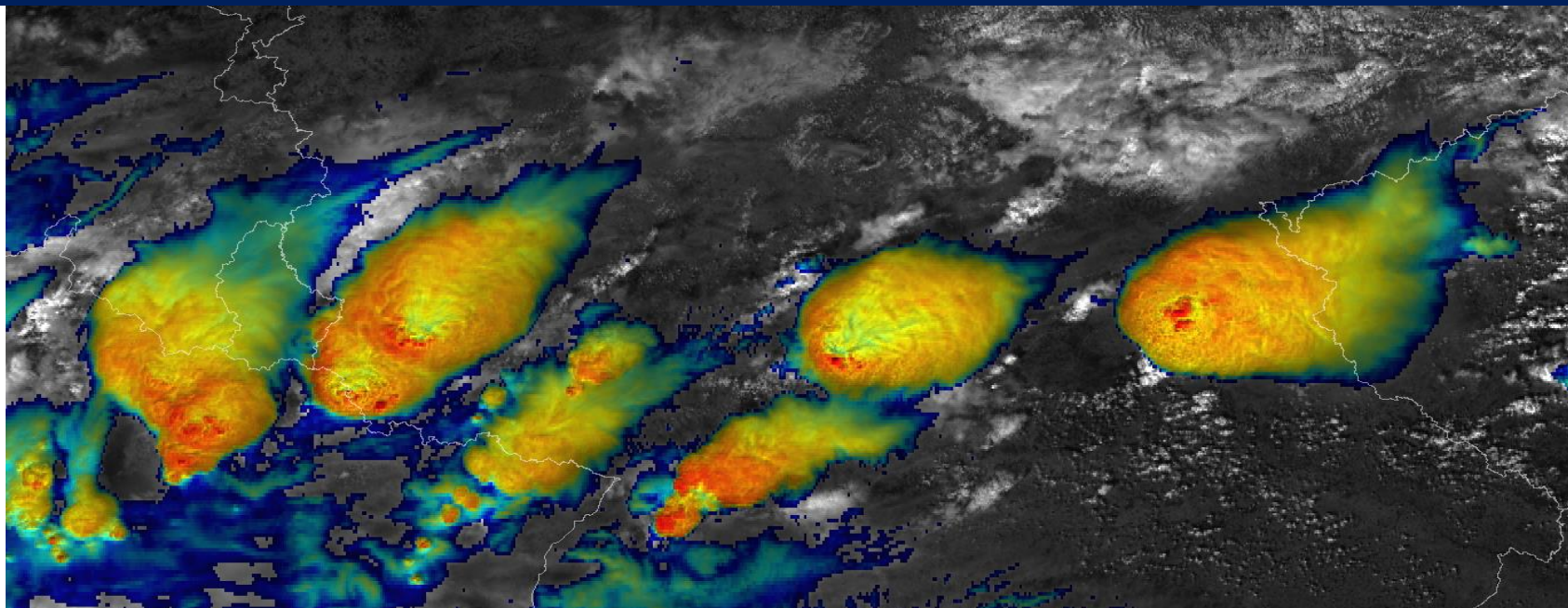
MTG-S

- First launch in 2024

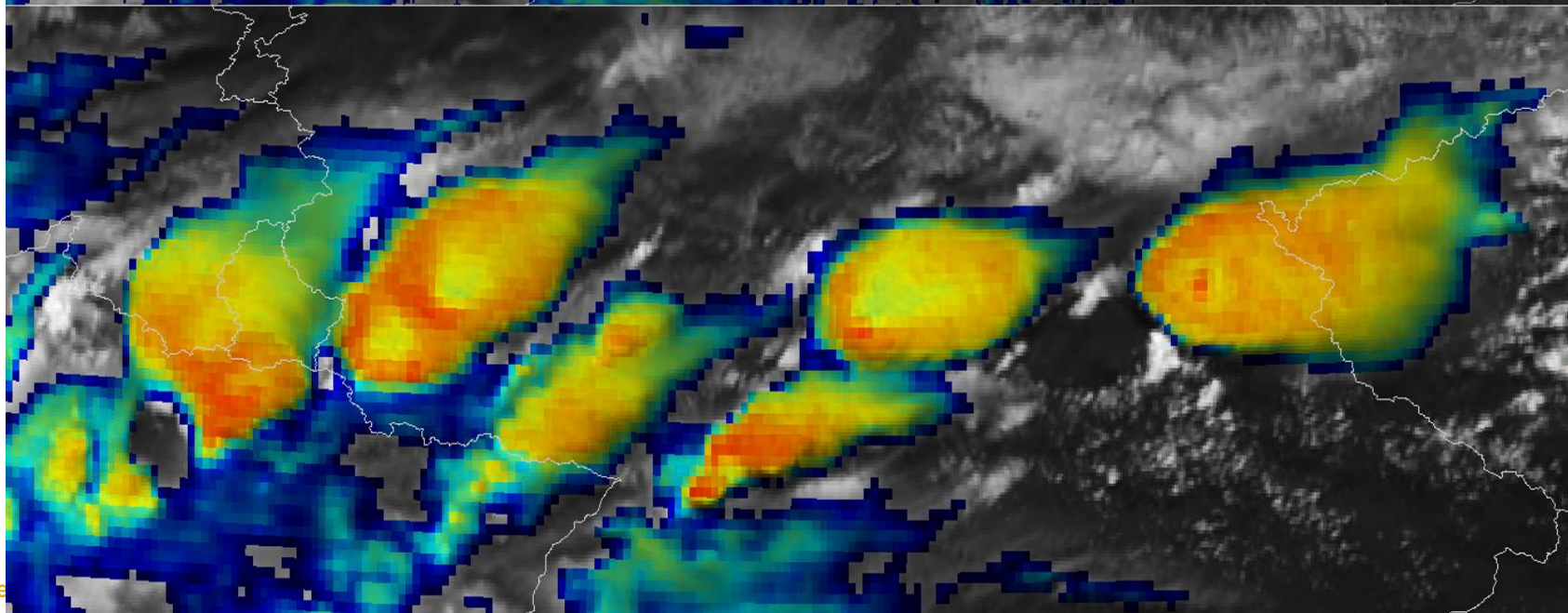


Improvements in spatial & temporal resolution of the FCI

Future



Current



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Full disk scan:

15 min



10 min

**Rapid scan
(Europe):**

5 min

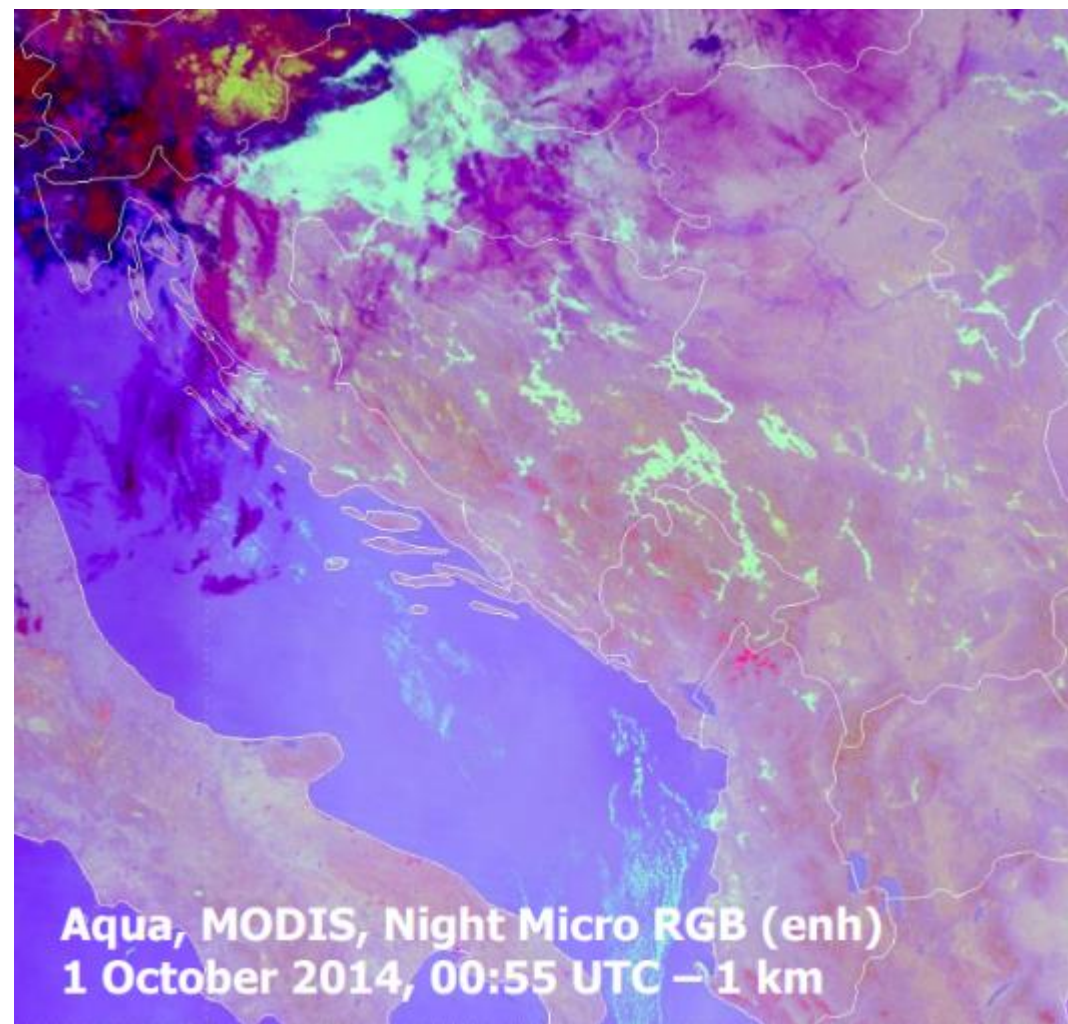
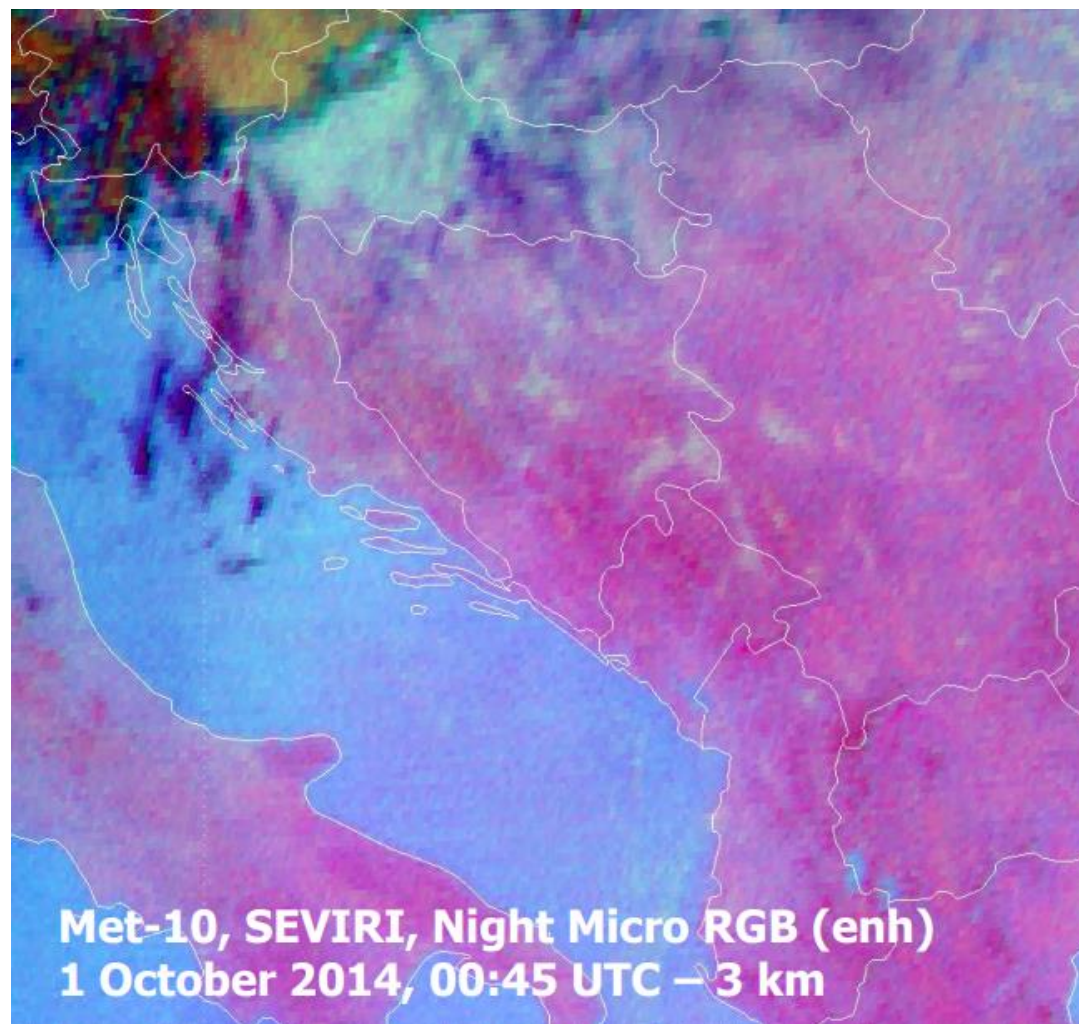


2.5 min



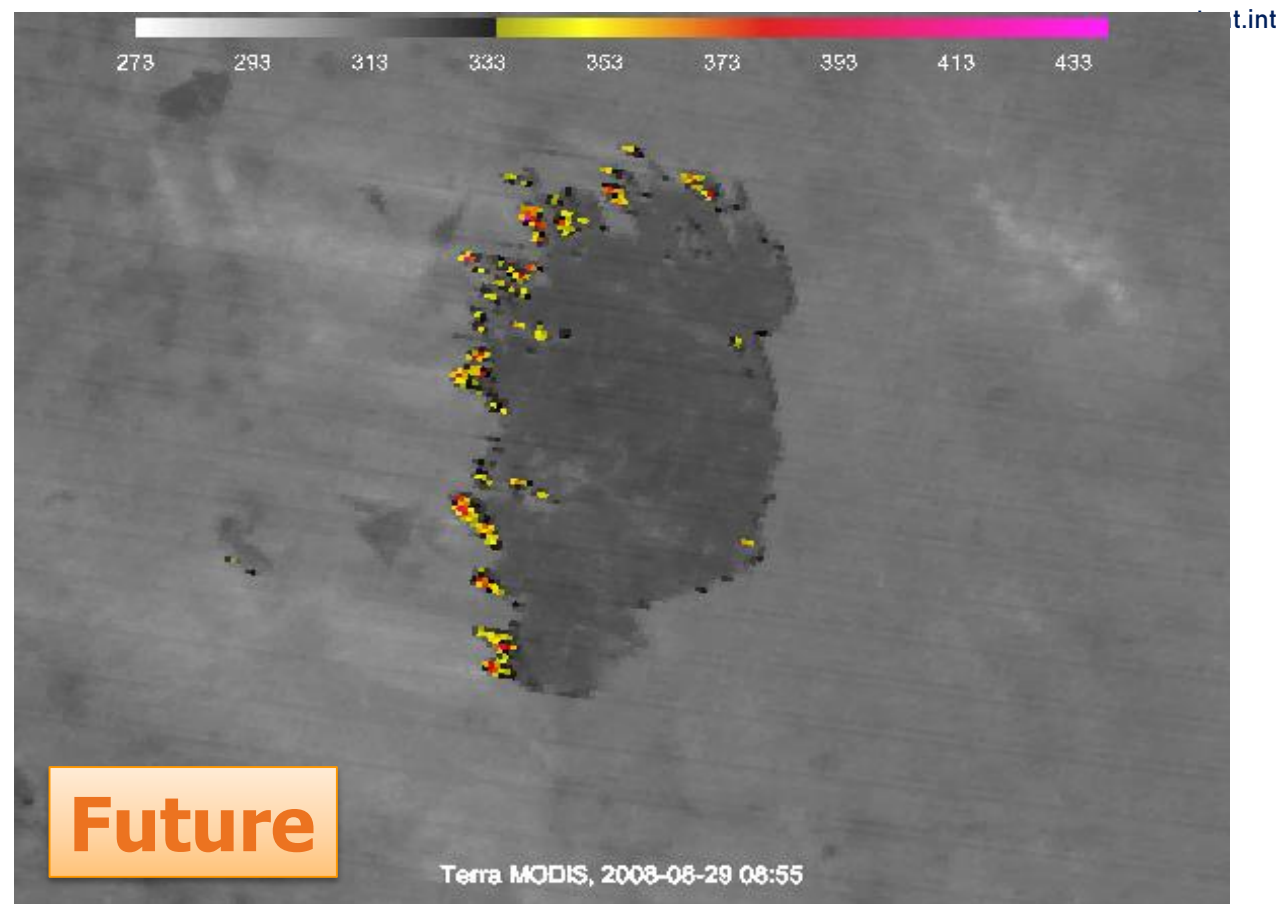
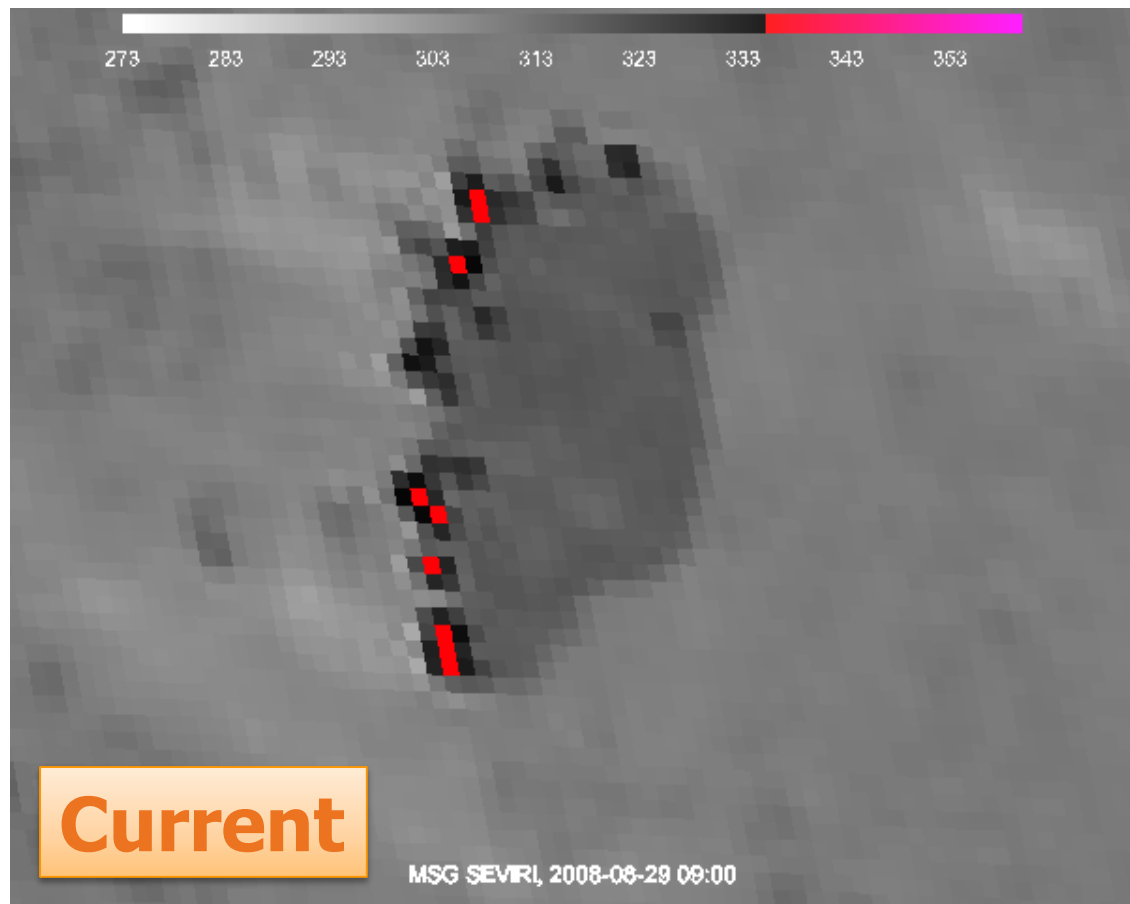
Expected improvements from the MTG-I mission: Spatial resolution

www.eumetsat.int





Expected improvements from the MTG-I mission: Fire detection

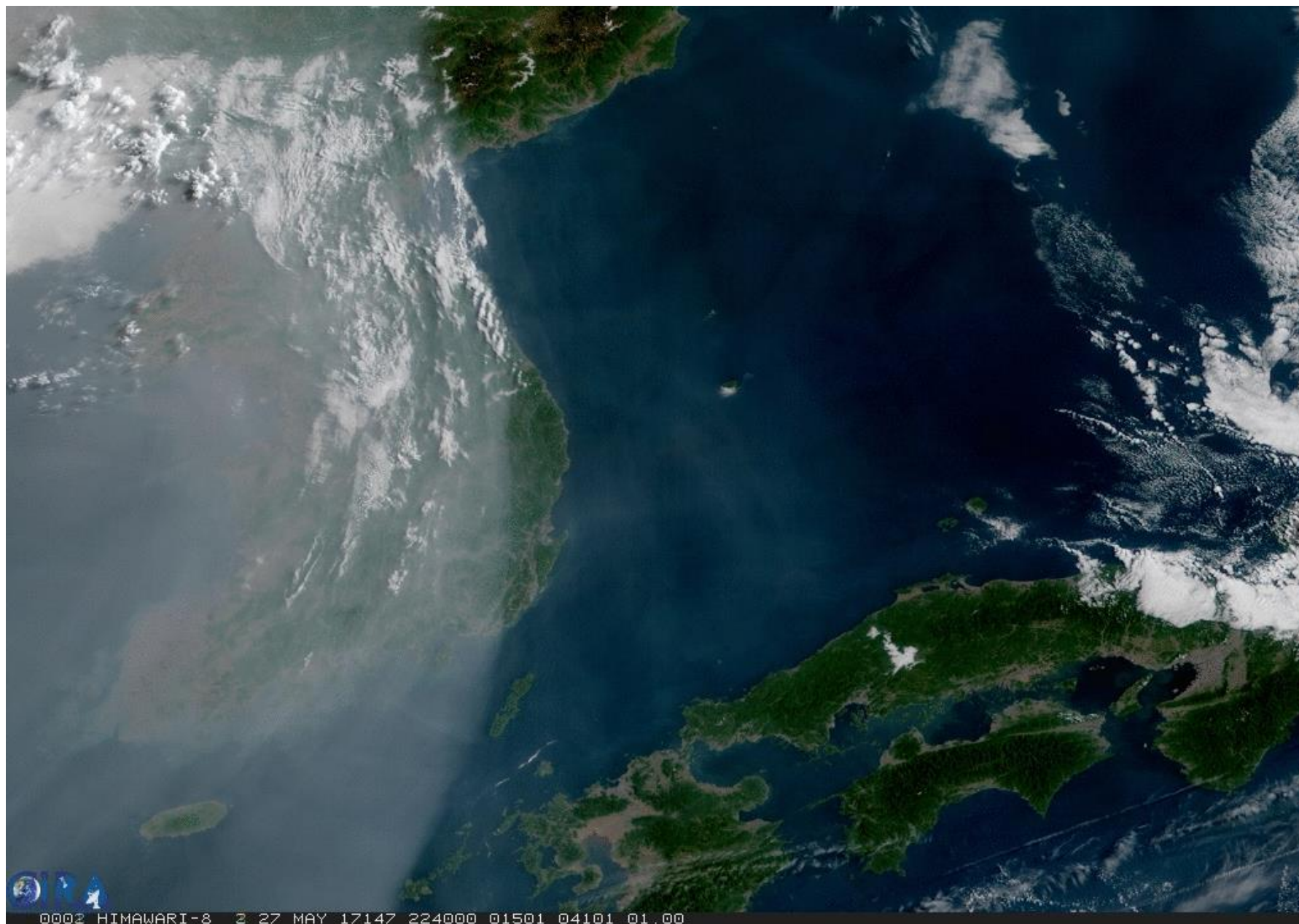


Bushfire line in Botswana as seen in imagery from current Meteosat (left panel) compared to future MTG imagery simulated by proxy data (right panel). MTG imagery will enable more precise detection of fire location and better fire intensity estimates.



Expected improvements from the MTG-I mission: True Colour

www.eumetsat.int



**A wall of pollution
crosses the Sea of
Japan**

**From Himawari-08 (Japan),
True Colour RGB**

27 May 2017



0002 HIMAWARI-8 2 27 MAY 17147 224000 01501 04101 01.00



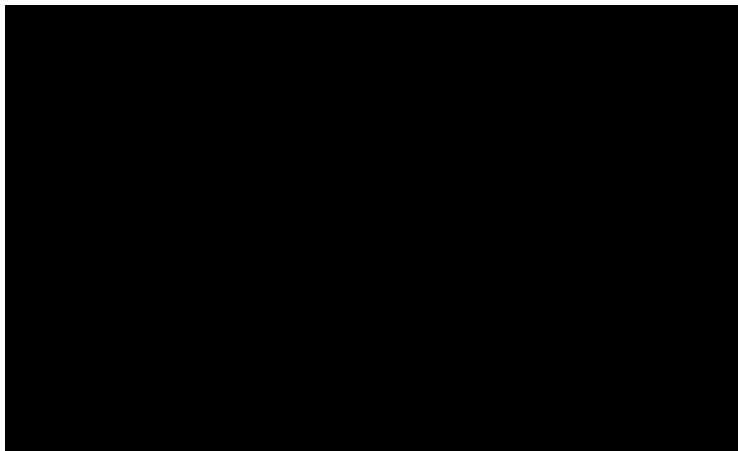
Foto: Daniel Pavlinovic

- Lightning is a precursor of severe weather
- Ground-based lightning location systems are typically sensitive to cloud-to-ground lightning (CG)
- Total lightning is the most important parameter to observe – and is well observed from space

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



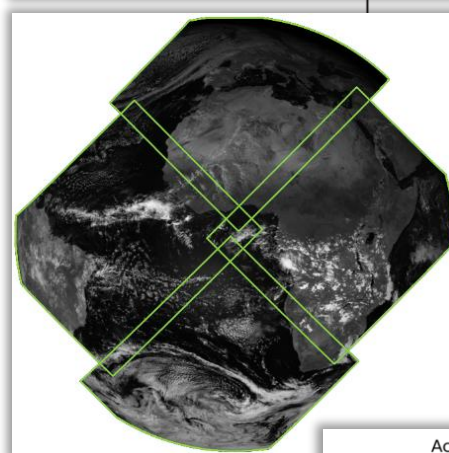
MTG Lightning Imager mission



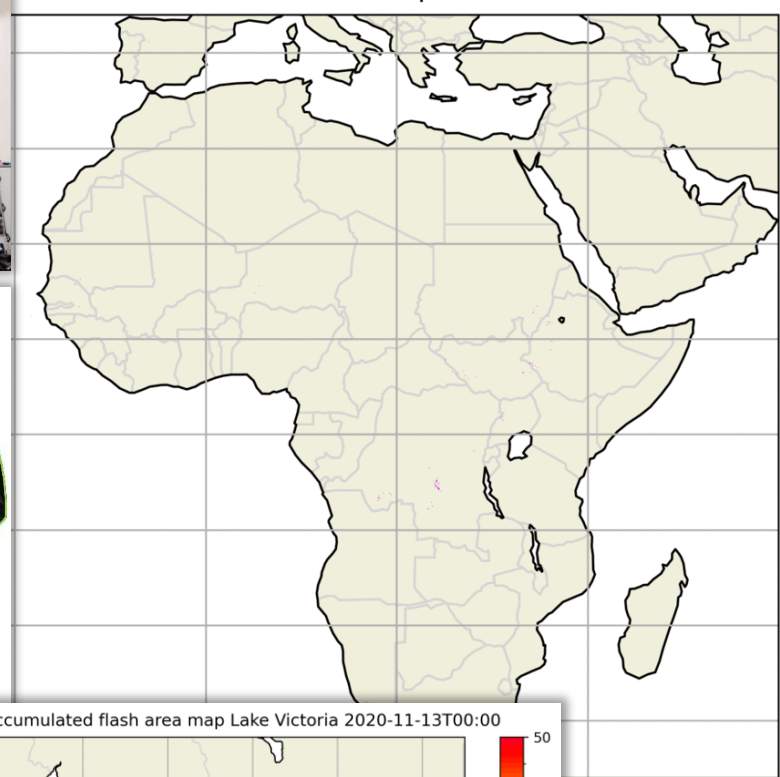
Lightning activity in correspondence of developing storms



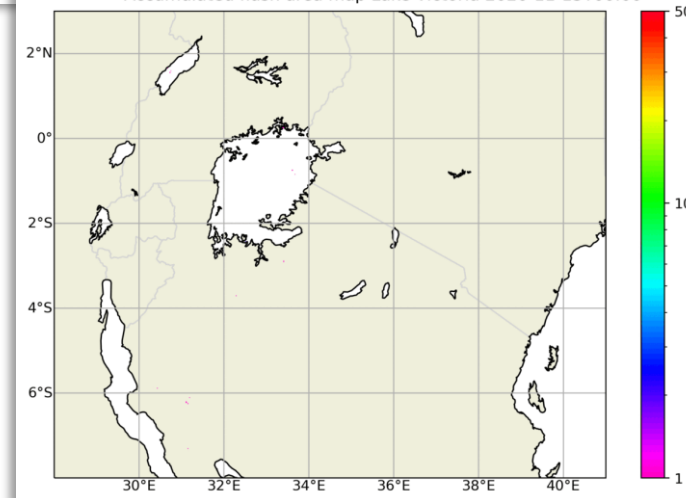
Lightning as visible from space



Accumulated flash area map Africa 2018-09-03T00:00



Accumulated flash area map Lake Victoria 2020-11-13T00:00



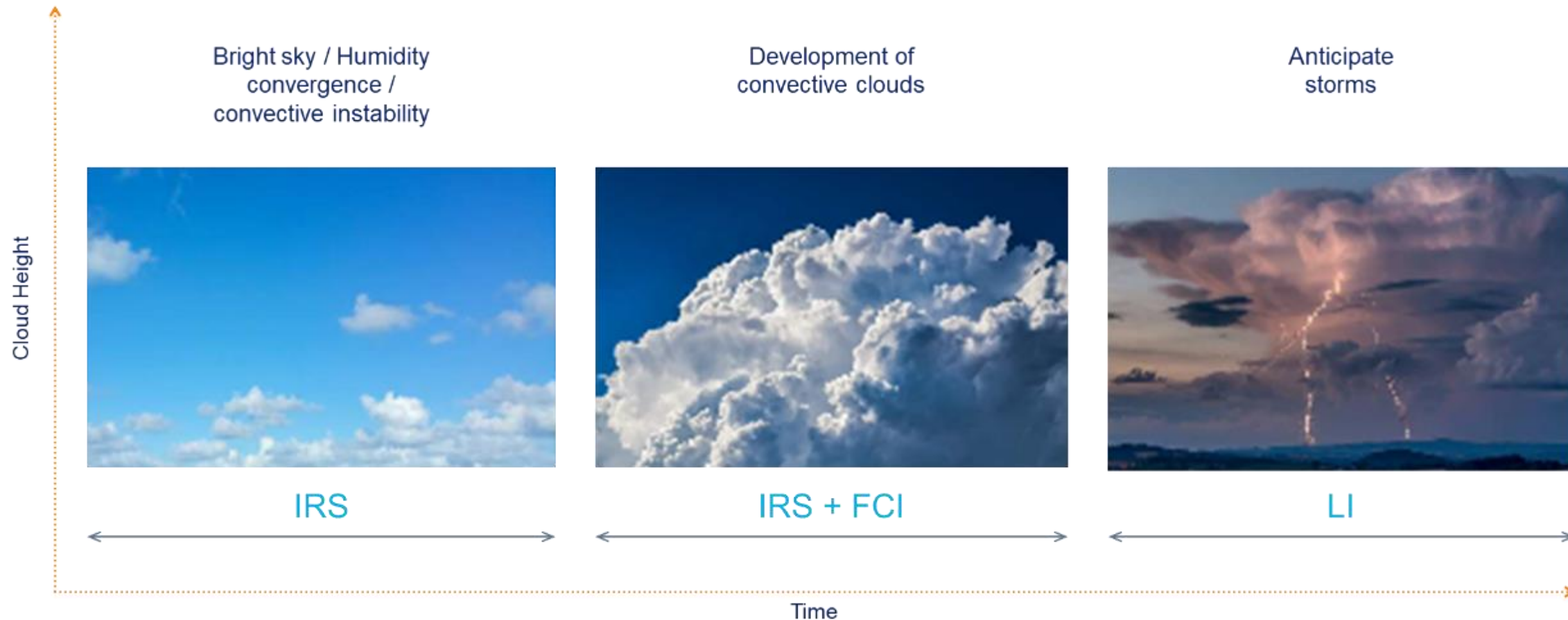
Example of simulated
LI Level 2 product:
24h of Accumulated
Flash Area (LI-2-
AFA) over Africa (top)
and over Lake
Victoria (bottom
zoom)

LI is the first lightning imager ever to be operated by EUMETSAT (and Europe) and the best lightning imager ever flown:

- ✓ detectors with the highest sensitivity,
- ✓ best overall spatial resolution (4.5 km at Nadir),
- ✓ largest disk coverage (84%),
- ✓ most advanced ground processing chain, and
- ✓ state-of-the-art user products.



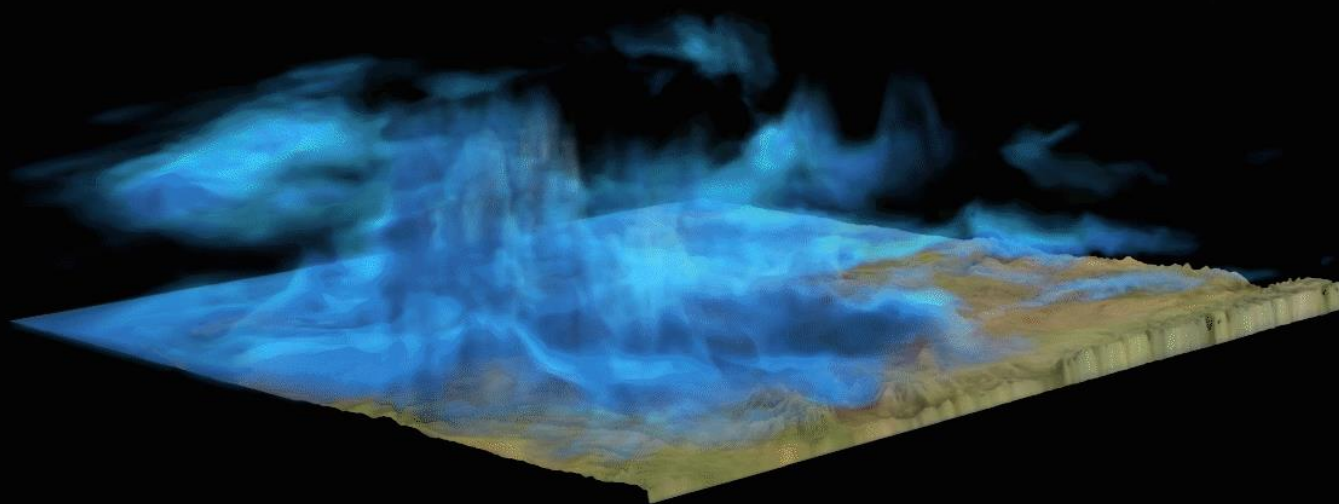
MTG – Strong contribution to predicting high-impact weather





...The 4D weather cube with MTG-I and MTG-S (from 2025...)

tsat.int



- **MTG resources, for example:**
 - Webinars for MTG user preparation for FCI, LI, IRS & UVN
 - End-user requirements
 - Algorithm Theoretical Basis Documents
 - User guides
 - <https://www.eumetsat.int/mtg-resources>
- **Data and products from EUMETSAT Central & Satellite Application Facilities (SAFs):**
 - The current status of data and products to be generated by EUMETSAT Central Facilities, and the products to be generated by the EUMETSAT Satellite Application Facilities (SAF) – at Day-1:
 - <https://www.eumetsat.int/mtg-data>
- **Test data:**
 - Test data is available for the user community to help with preparations for receiving and processing the MTG data
 - <https://www.eumetsat.int/mtg-test-data>
- **Mission Advisory Groups (MAG) for FCI, LI and IRS – meeting minutes and presentation material:**
 - <https://www.eumetsat.int/science-meetings>



Thank you!
Questions are welcome.

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The Nowcasting SAF: products and improvements with MTG satellites

Pilar Rípodas (AEMET)

with contributions from the NWC SAF team

“Launch of MTG satellite: data journey from space to solar plants”

Reuniwatt Webinar, 26 January 2023

Spain is a member state of EUMETSAT

AEMET is the State Meteorological Agency of Spain and holds the representation of Spain in EUMETSAT

AEMET uses the EUMETSAT satellite data for different purposes: nowcasting, watching and warning issue, assimilation in the NWP model Harmonie, study of meteorological events, etc

AEMET leads the Nowcasting SAF (NWC SAF) consortium

The NWC SAF is part of the EUMETSAT SAF Network

SAF Network objective: To optimize the use of the satellite data

The eight EUMETSAT SAFs are dedicated to processing satellite data for specific user groups or application areas on behalf of EUMETSAT.

EUMETSAT Secretariat supervises and coordinates the overall activities of the SAF network

<https://www.eumetsat.int/about-us/satellite-application-facilities-safs>

Meet the SAFs



AC SAF

Atmospheric Composition Monitoring

The AC SAF processes satellite data on ozone, other trace gases, aerosols and ultraviolet data.

[Learn more about AC SAF](#)

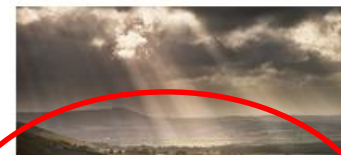


OSI SAF

Ocean and Sea Ice

The OSI SAF provides comprehensive information on the ocean-atmosphere interface.

[Learn more about OSI SAF](#)



NWC SAF

Nowcasting and Very Short Range Forecasting

Nowcasting is a weather forecast for the next few hours, based on current information.

[Learn more about NWC SAF](#)



CM SAF

Climate Monitoring

The CM SAF generates and archives high-quality climate datasets.

[Learn more about CM SAF](#)



NWP SAF

Numerical Weather Prediction

The NWP SAF supports the interface between satellite data and European activities in NWP.

[Learn more about NWP SAF](#)



H SAF

Operational Hydrology and Water Management

The H SAF generates and archives datasets and products for operational hydrological applications.

[Learn more about H SAF](#)



LSA SAF

Land Surface Analysis

The LSA SAF exploits remotely-sensed data on land, land-atmosphere interactions and biosphere applications.

[Learn more about LSA SAF](#)



ROM SAF

Radio Occultation Meteorology

The ROM SAF generates and archives high-quality GNSS Radio Occultation (RO) data for NWP.

[Learn more about ROM SAF](#)

NWC SAF



The **objective** of the NWC SAF is to contribute to the optimum use of the meteorological satellites on their application to Nowcasting

Nowcasting is a short-term weather forecast up to 3-6 hours.

The NWC SAF develops, maintains and distributes software packages

For geostationary (**NWC SAF GEO**) and polar satellites (**NWC SAF PPS**)

Freely distributed to registered users

The software packages allow the generation of satellite derived products with application on Nowcasting for the user area of interest.

Current NWC SAF software versions

NWC SAF GEO v2021.1.1

Supports

- EUMETSAT satellites (MSG 0 service, Rapid Scan service, IODC)
- Himawari 8/9
- GOES 16/17/18

Global coverage

NWC SAF PPS v2021.2

Supports

- Metop
- SNPP, NOAA
- Terra, Aqua
- Feng-Yun-3

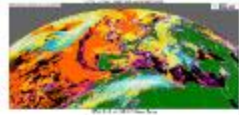
NWC SAF/GEO Products



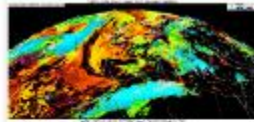
Cloud Products



CMA: Cloud Mask



CT: Cloud Type

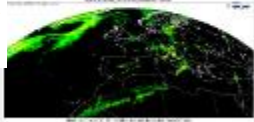


CTTH: Cloud Top Temperature and Height



CMIC: Cloud Microphysics

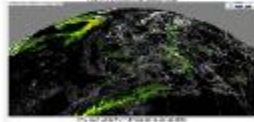
Precipitation Products



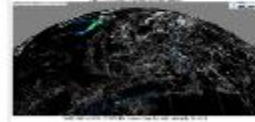
PC: Precipitating Clouds



CRR: Convective Rainfall Rate



PC-Ph: Precipitating Clouds based on Cloud Physical Properties



CRR-Ph: Convective Rainfall Rate based on Cloud Physical Properties

Convection Products

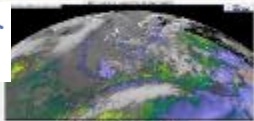


RDT: Rapid Developing Thunderstorms

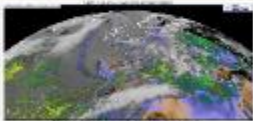


CI: Convection Initiation

Satellite Humidity and Instability Products



ISHAI: Total Precipitable Water



ISHAI: Layer Precipitable Water

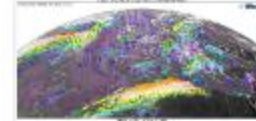


ISHAI: Stability Analysis Imagery

Winds Products



HRW: High Resolution Winds - AMV levels



HRW: High Resolution Winds - AMV speed

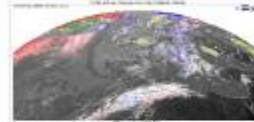


HRW: High Resolution Winds - Trajectories 1 hour

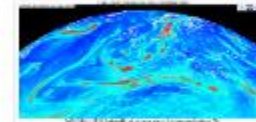


HRW: High Resolution Winds - Trajectories 3 hour

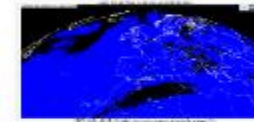
Conceptual Model Products



ASII: Automatic Satellite Image Interpretation

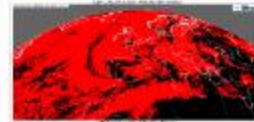


ASII-TF: Automatic Satellite Image Interpretation - Tropopause Folding detection

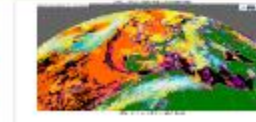


ASII-GW: Automatic Satellite Image Interpretation - Gravity Wave pattern detection

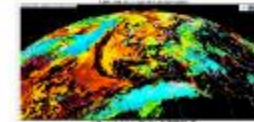
Extrapolated Imagery Products



EXIM: Cloud Mask



EXIM: Cloud Type



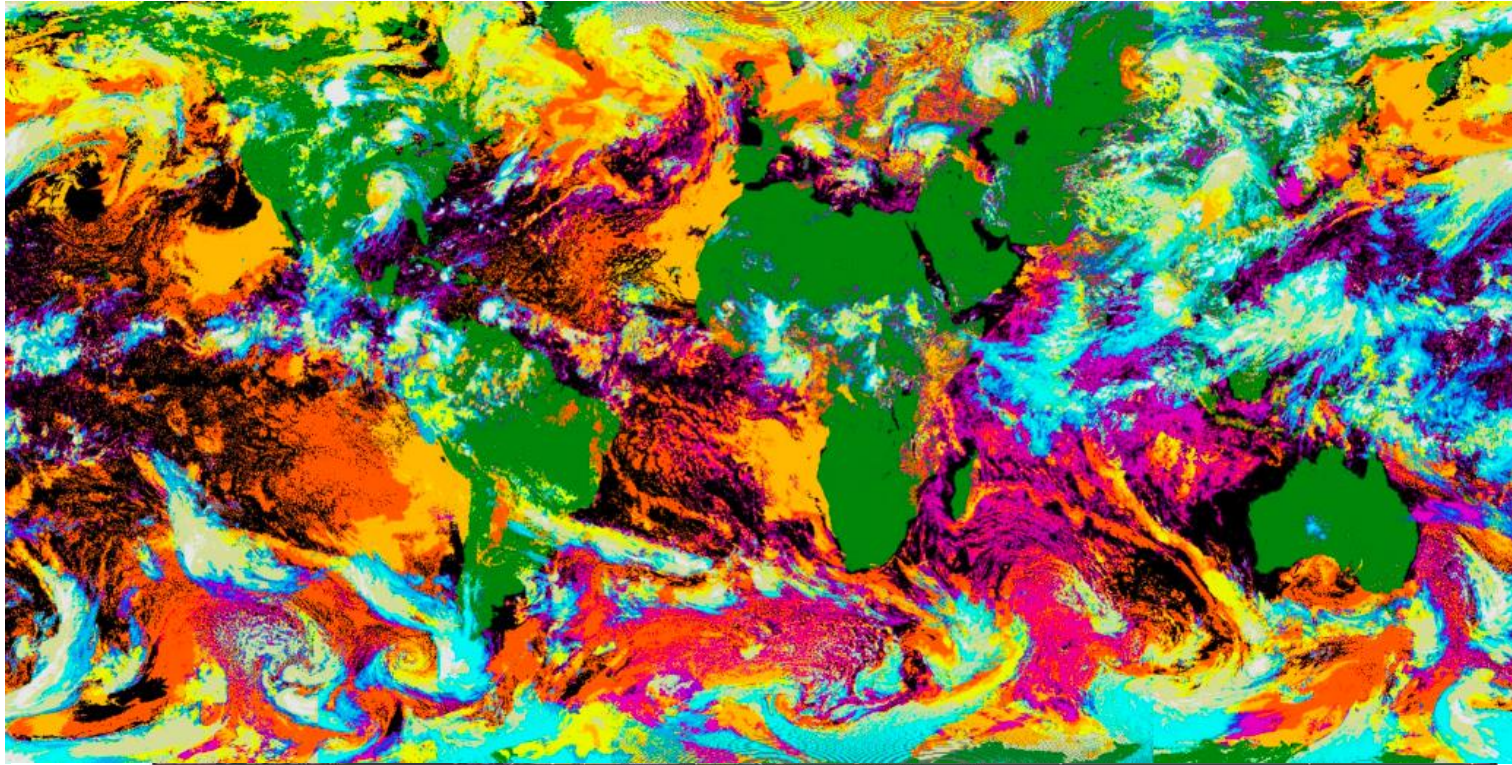
EXIM: Cloud Top Temperature and Height



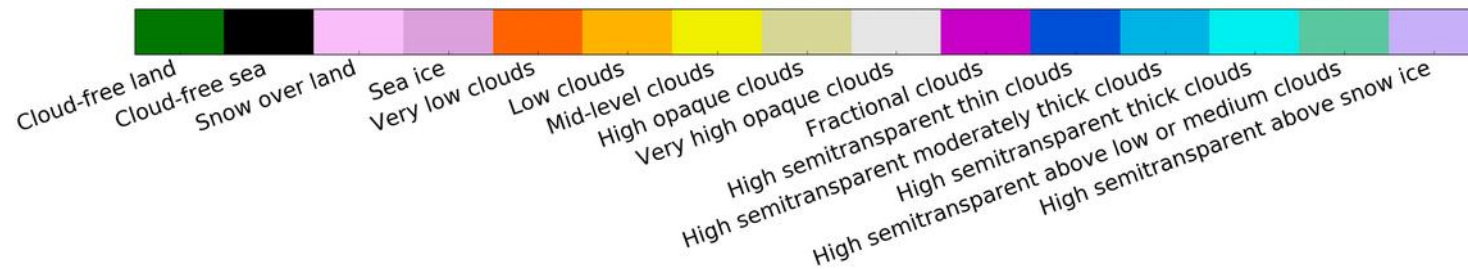
EXIM: Cloud Phase

Near real time outputs in nwc-saf.eumetsat.int

NWC SAF/GEO Cloud Type



NWC GEO v2021.1 CT Cloud Type



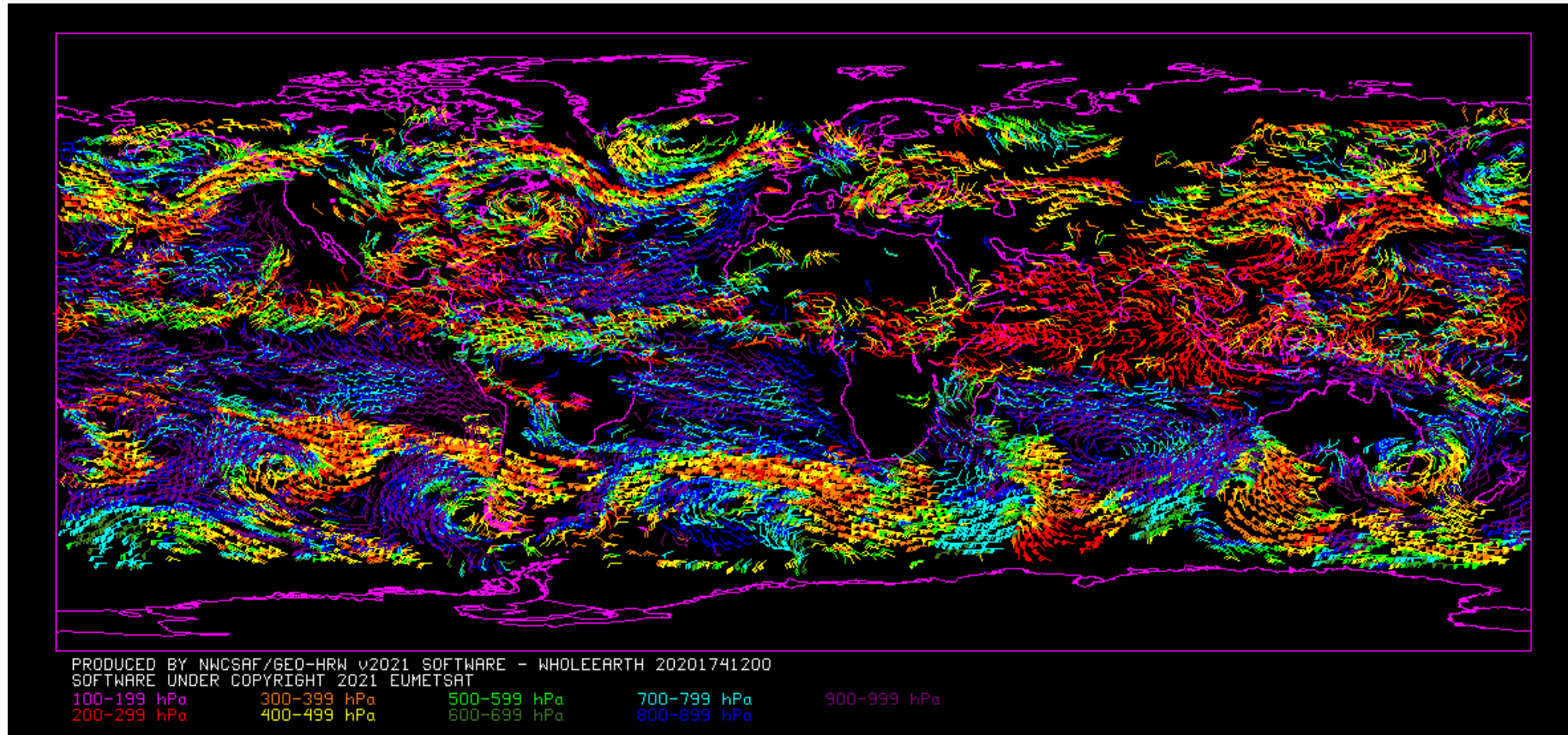
NWC SAF Team
at MF-Lannion

Example of NWC/GEO-CT Cloud Type

with GOES-17, GOES-16, MSG, MSG/IODC, Himawari-8 for 15 July 2019, 09:00Z

EUMETSAT

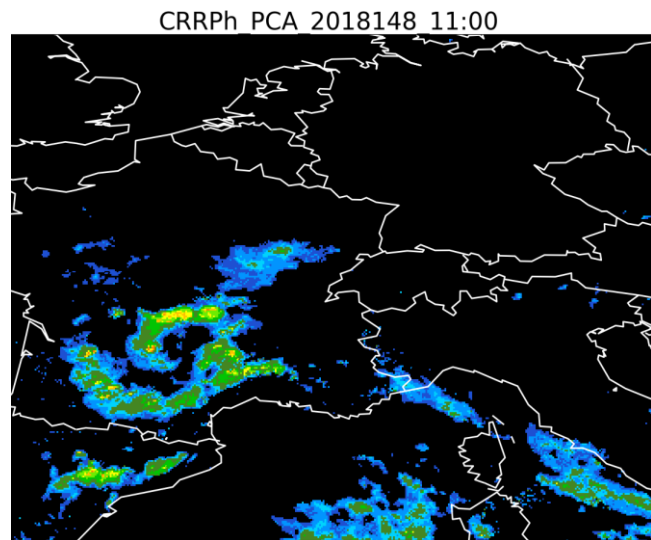
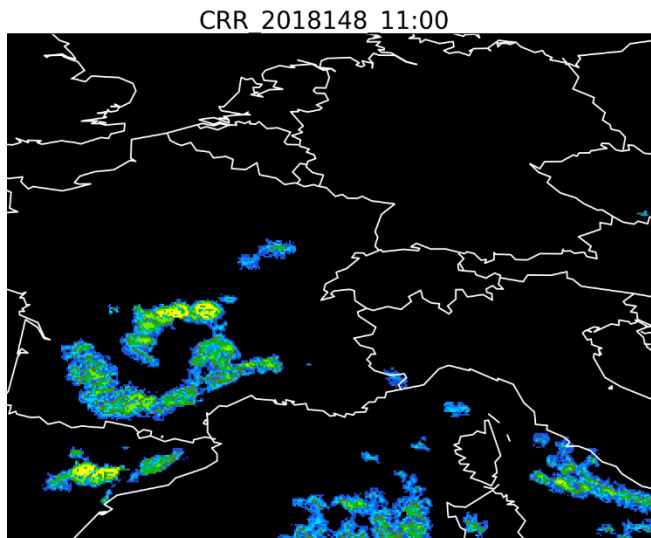
NWC SAF/GEO HRW (High Resolution winds) product



J. García-Pereda
AEMET

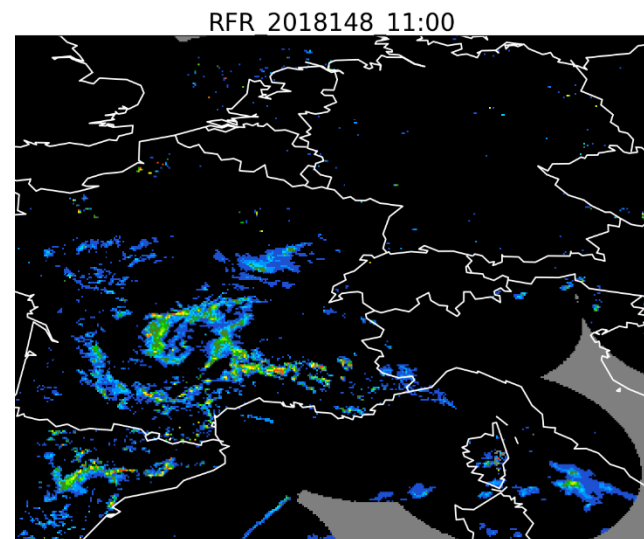
Example of NWC/GEO-HRW AMVs
with GOES-17, GOES-16, MSG, MSG/IODC, Himawari-8 for 22 June 2020, 12:00Z

NWC SAF/GEO v2021: New version of CRRPh



GEO v2021
CRR

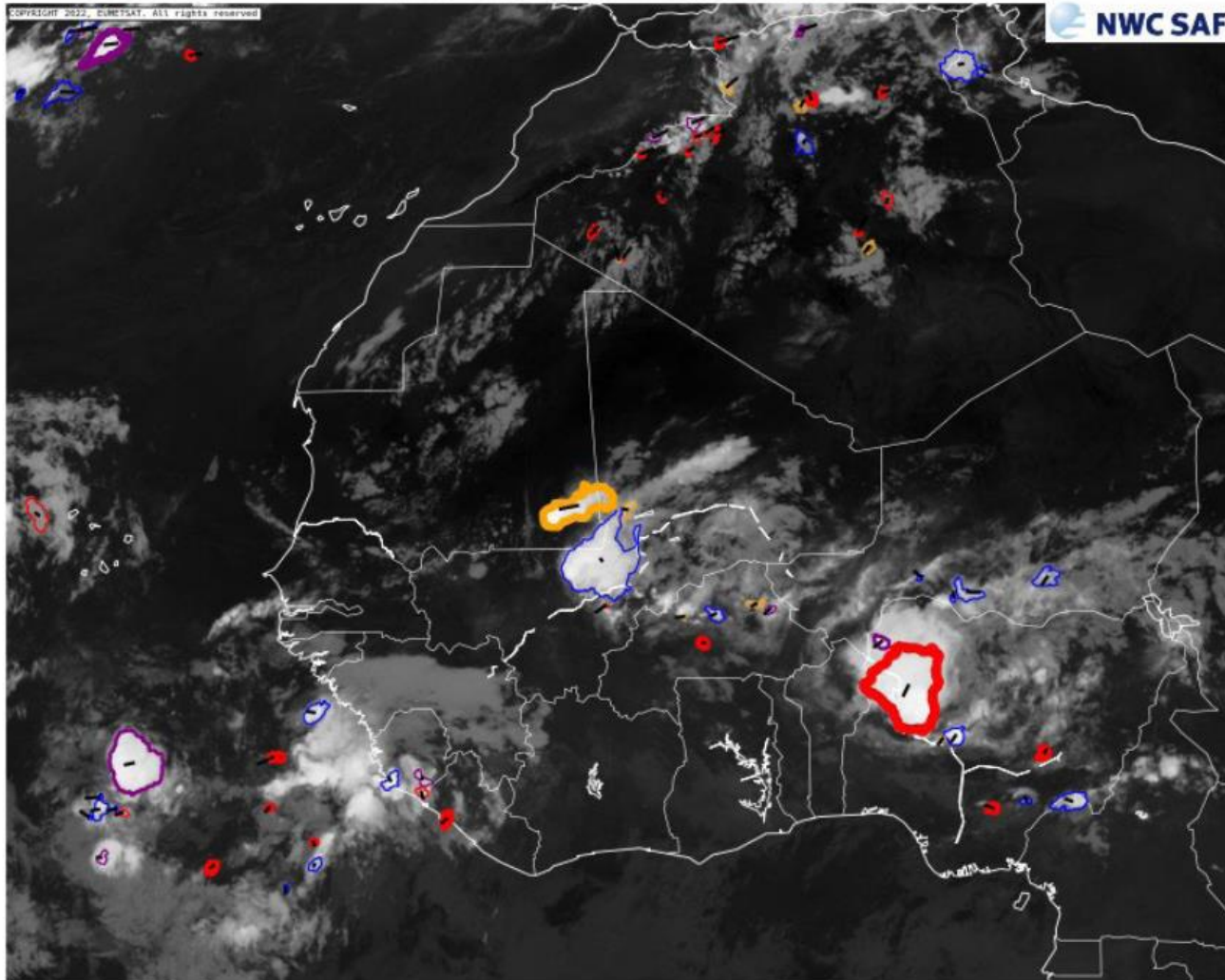
GEO v2021
CRRPh



OPERA radar composition
(EUMETNET)

Precipitation rate 28 May 2018 11:00.
J.A. Lahuerta, AEMET

S_NWC_RDT-CW_MSG4_WestAfrica-VISIR_20220907T051500Z



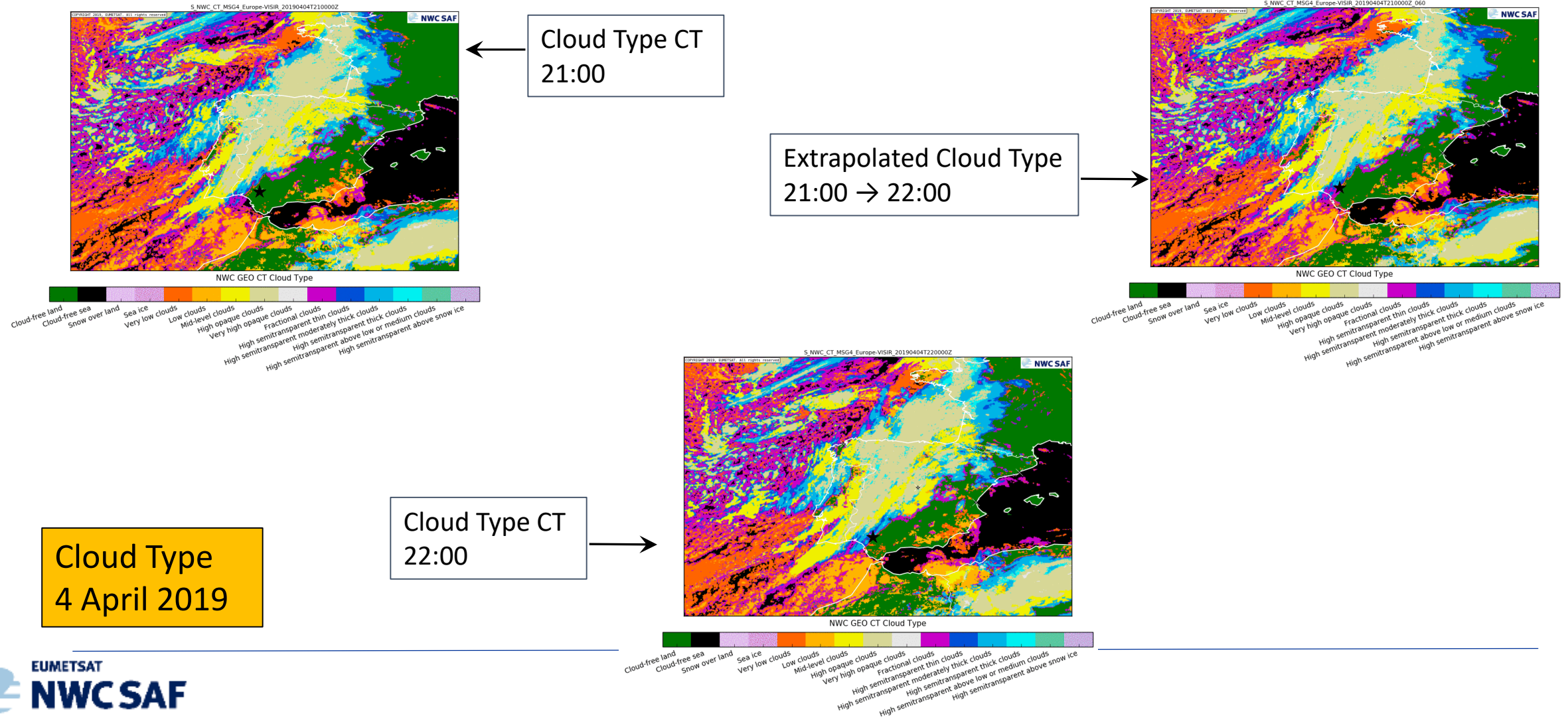
RDT-CW Product

Identifies, characterizes and tracks Convective Cells

Source: "Guidelines for Satellite-based Nowcasting in Africa" WMO-No. 1309
© World Meteorological Organization, 2023

Triggering Triggering from Split Growing Maturity Decaying

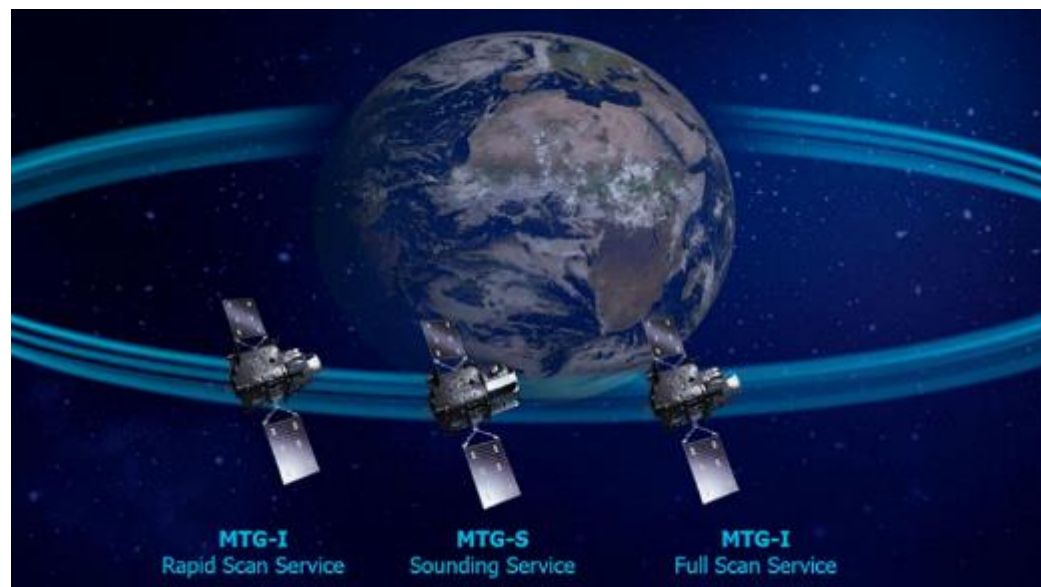
EXIM product. Extrapolation of the Cloud Type



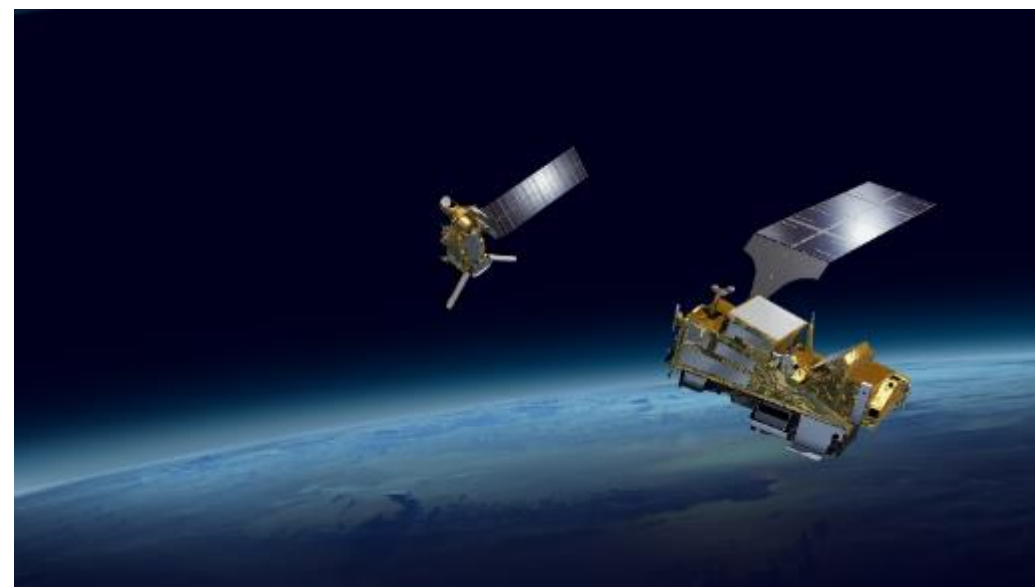
Future plans of the NWC SAF

Mainly driven by:

- New generation EUMETSAT Satellites, with launch starting in 2022 (MTG-I, MTG-S, EPS-SG A, EPS-SG B)
- New scientific developments, based on new satellite capabilities
- New user requirements.



MTG-I and MTG-S Satellites, EUMETSAT



EPS-SG A and EPS SG B Satellites, EUMETSAT

NWC SAF MTG day-1 software version:

First version of NWC SAF GEO software for MTG-I

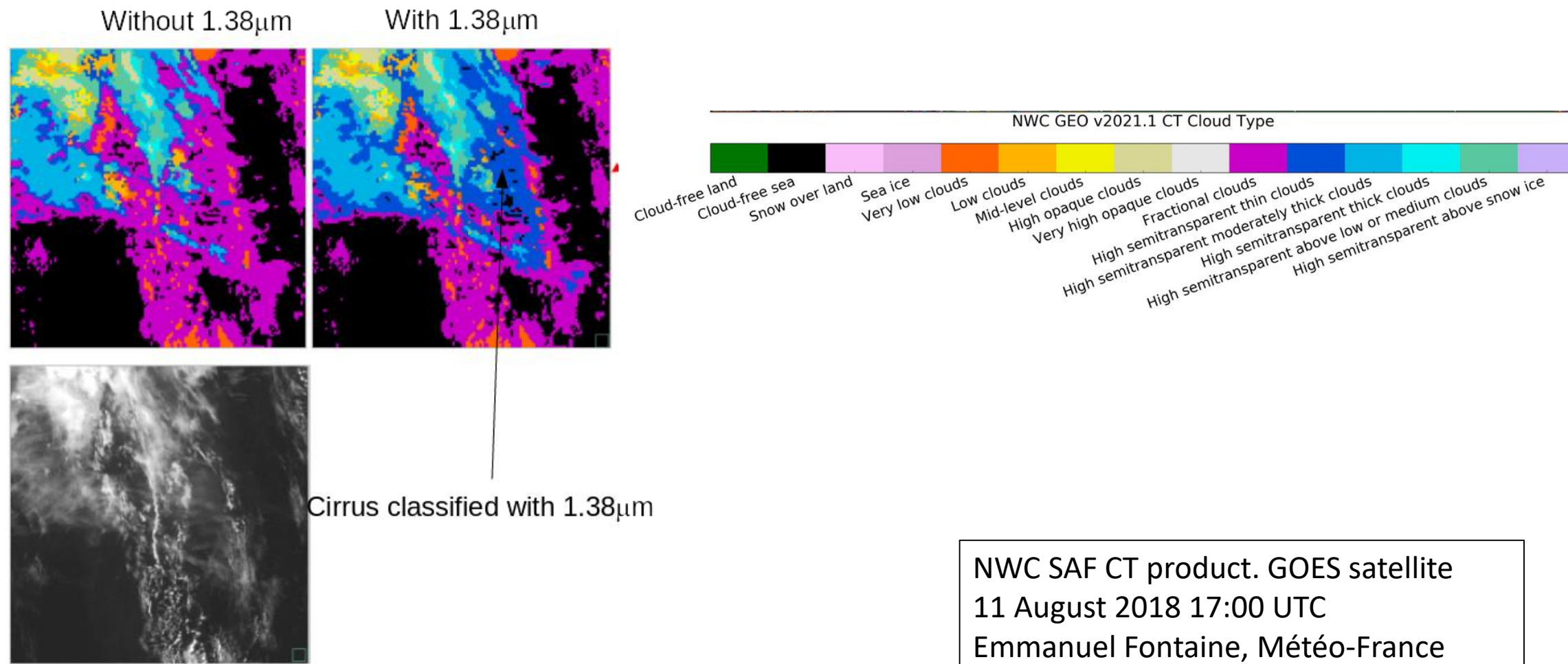
- Available from the first day that MTG-I is operational
- Ensures continuation of current services for MSG
- **Benefit from the higher spatial and temporal resolution of MTG-I/FCI**
- Use of some of the new channels thanks to the experience gained with GOES/ABI and Himawari/AHI
- Use of MTG-I/LI data as input for the RDT-CW product

NWC SAF MTG day-1 version:

First version of NWC SAF GEO software for MTG-I

- New product ASII-ICE for in-flight icing detection, as demonstrational product
- Updated NetCDF format to be 100% compliant with CF convention, for an easier processing by other tools
- Expected to be released end 2023/beginning 2024

NWC SAF/MTG: used of 1.38 μm to improve Cloud Type



Other improvements for MTG in the following software releases

Objective: Exploitation of the full capacities of the MTG satellites

- Cloud distinction stratiform/cumuliform clouds. Cloud products provided at visible channels resolution (1 km at nadir).
- **New Lightning products** (by NMA/Romania)
 - **LiStack**: Accumulation of EUMETSAT L2 LI gridded products in the user's defined time period and region (with option of parallax correction).
To monitor the lightning activity.
 - **LiJump**: Lightning jump detection.

Other improvements for MTG in the following software releases

- New software package with **new products for the IRS sensor in the MTG-S satellites**, between them:
 - **qIRS product/service**: new RGBs
 - **Vertical atmospheric profiles**: 4D representation of the atmosphere (Temperature and humidity) and stability indices without precedent over Europe and Africa.
- **Continuous improvements of all the products**

Thank you very much for your attention!

More information in nwc-saf.eumetsat.int

You can contact us at

pripodasa@aemet.es

safnwchd@aemet.es

Webinar : Launch of MTG satellite: data journey from space to solar plants

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Project Manager Nowcasting SAF



Speaker:
Mathieu Turpin
Satellite Data Expert



Using satellite data to forecast solar power

Mathieu Turpin

*MTG Webinar with Reuniwatt, AEMet and
EUMETSAT
26 January 2023*



Reuniwatt: a leader in renewables forecasting



Accompanying our clients towards a better management of the weather-sensitivity of their assets thanks to state-of-the-art weather forecasting techniques.

Founded
2010



Renewable energies



Atmospheric science



Defence & Space

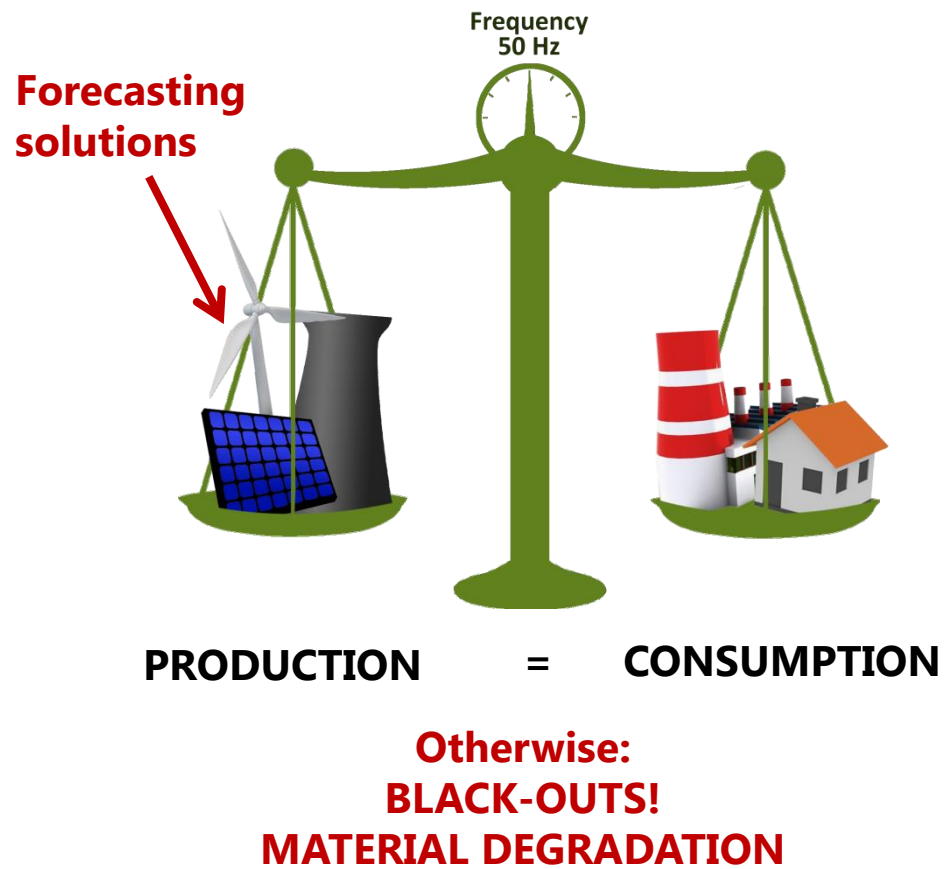
> 300 projects in
45
countries

Strong R&D investments
300,000
hours, > 100 publications,
5 patents

Capability as of January 2023



The need for solar forecasts: Grid stability



A cloud passing in front of the sun can instantly cause an **80% decrease** of the local ground irradiance

Solar forecasting products & services and their use

InstaCast™

*intra-hour solar
forecasts*



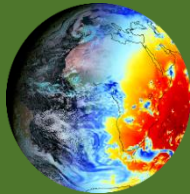
HourCast™

*intraday solar
forecasts*



DayCast™

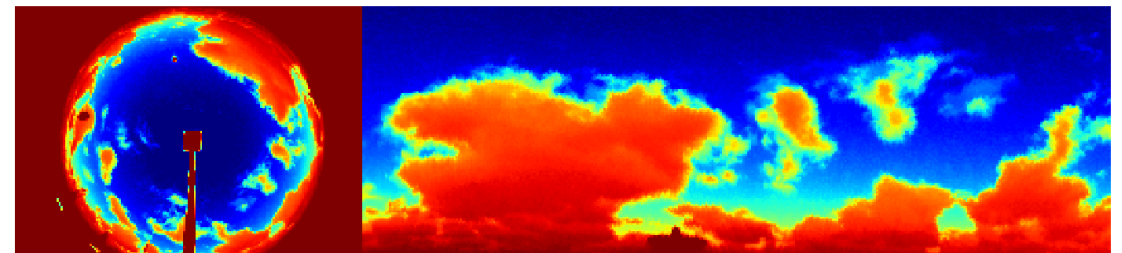
*day-ahead solar
forecasts*



Forecasting

SOLAR FORECASTING

Track clouds from the ground



Solar forecasting products & services and their use

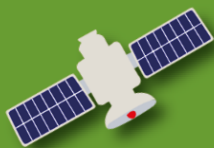
InstaCast™

*intrahour solar
forecasts*



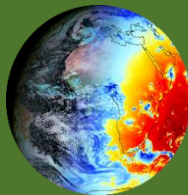
HourCast™

*intraday solar
forecasts*



DayCast™

*day-ahead solar
forecasts*

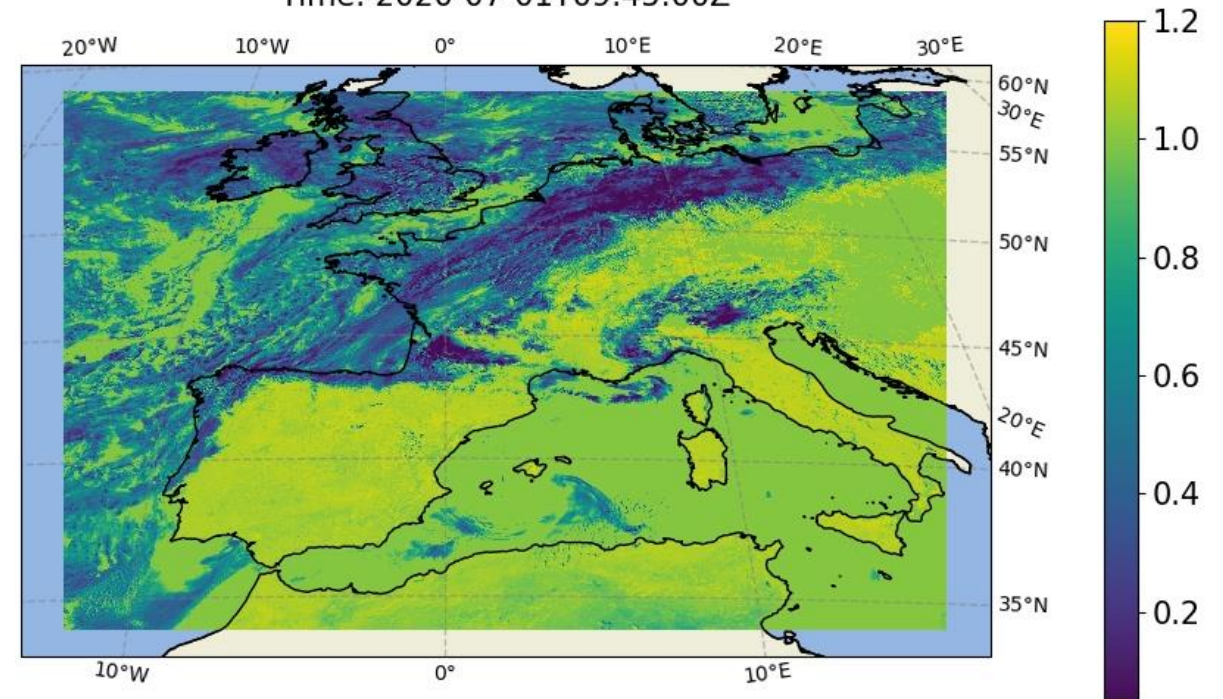


Forecasting

SOLAR FORECASTING

Track clouds from space

Time: 2020-07-01T09:45:00Z



Solar forecasting products & services and their use

InstaCast™

intrahour solar forecasts



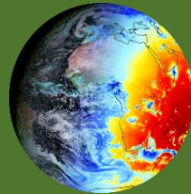
HourCast™

intraday solar forecasts



DayCast™

day-ahead solar forecasts



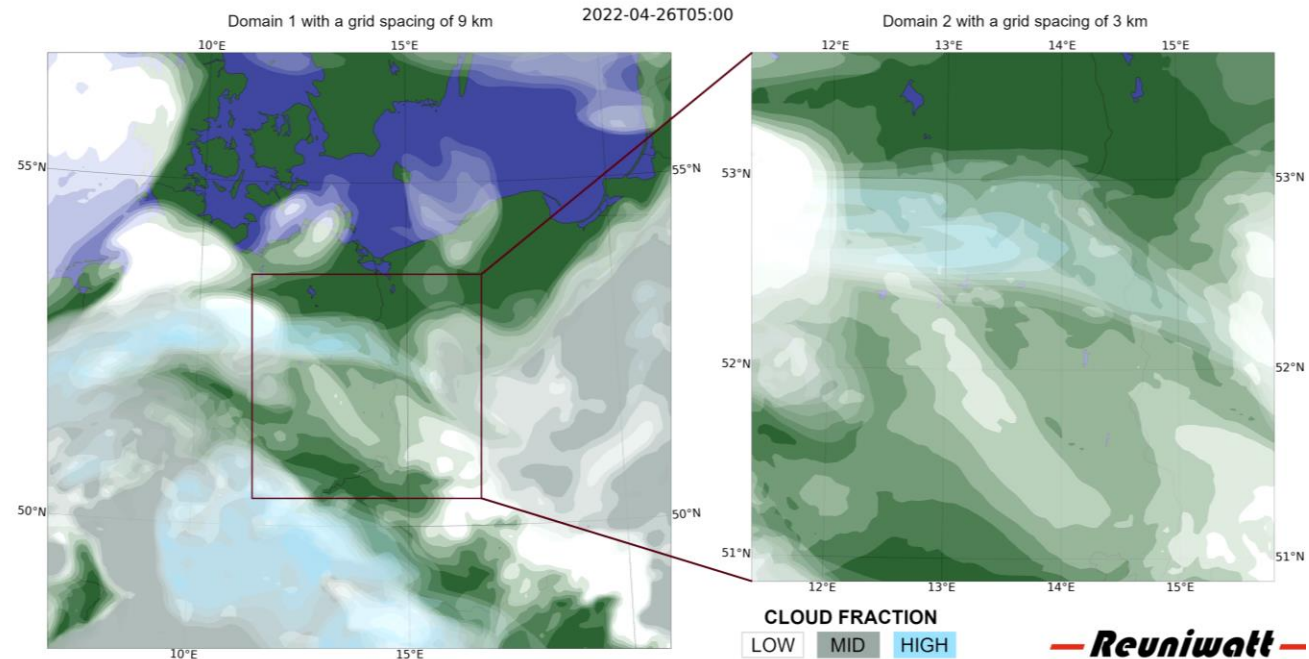
Forecasting

SOLAR FORECASTING

Track clouds using NWP

WRF-Solar forecast of cloud cover for Central Europe

WRF-Solar v4.4, initialised with GFS 0000 UTC



Surface Solar Irradiance Assessment Method

Cloud Index

$$CI = \frac{\rho - \rho_g}{\rho_c - \rho_g}$$

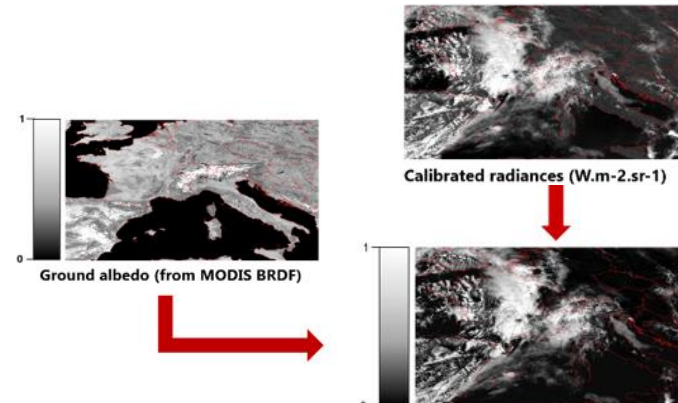
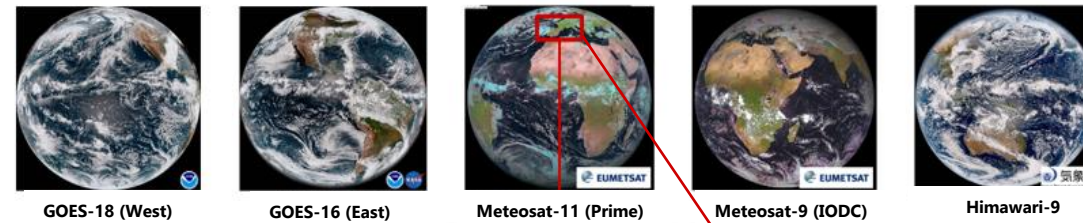
ρ : albedo measured by satellite

ρ_g : minimum albedo if there is no cloud

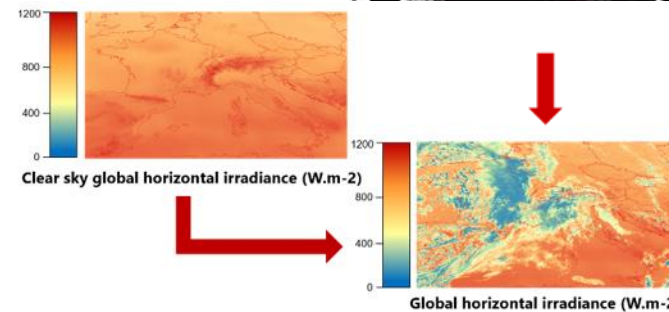
ρ_c : maximum albedo if there is a cloud

$$CI_{CT} = \begin{cases} 0 & \text{if cloudfree} \\ CI & \text{else} \end{cases}$$

$$GHI = (1 - CI_{CT}) \times GHI_{cc}$$



NWCSAF Cloud Type



Site adaptation

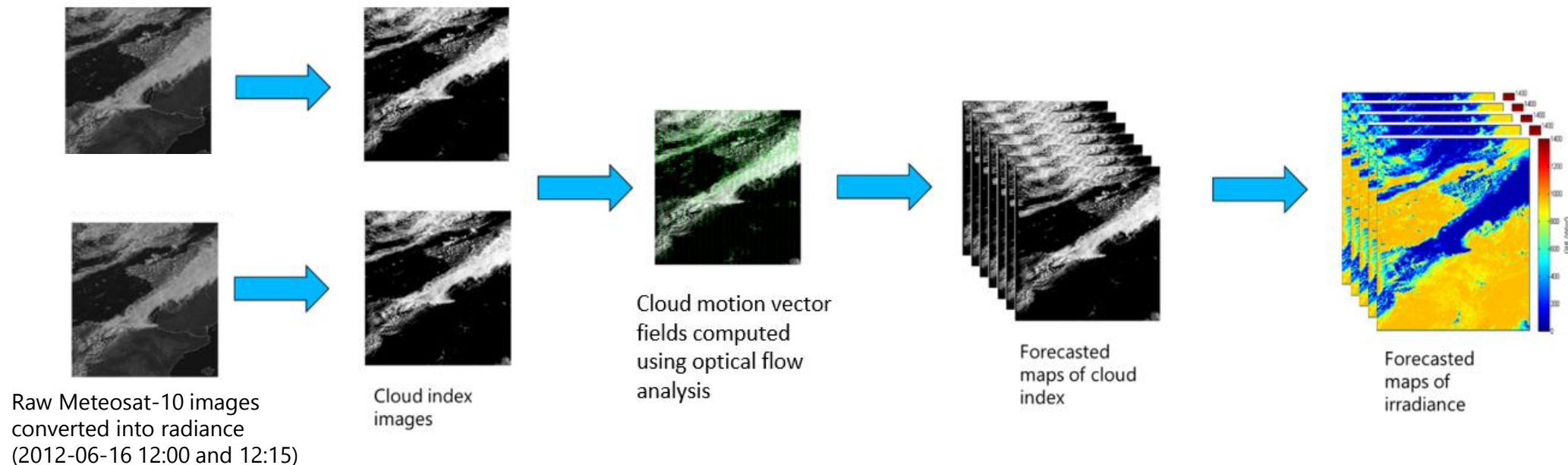


Real time estimations for PV monitoring/forecasting

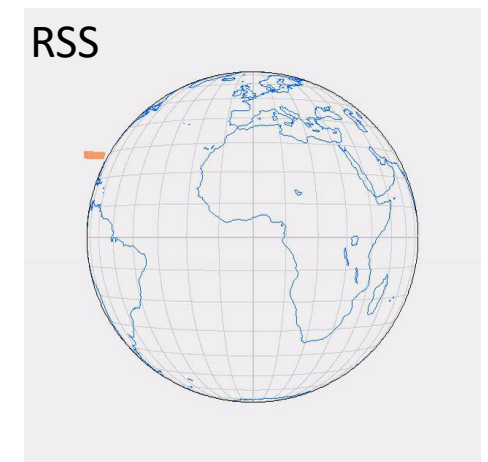
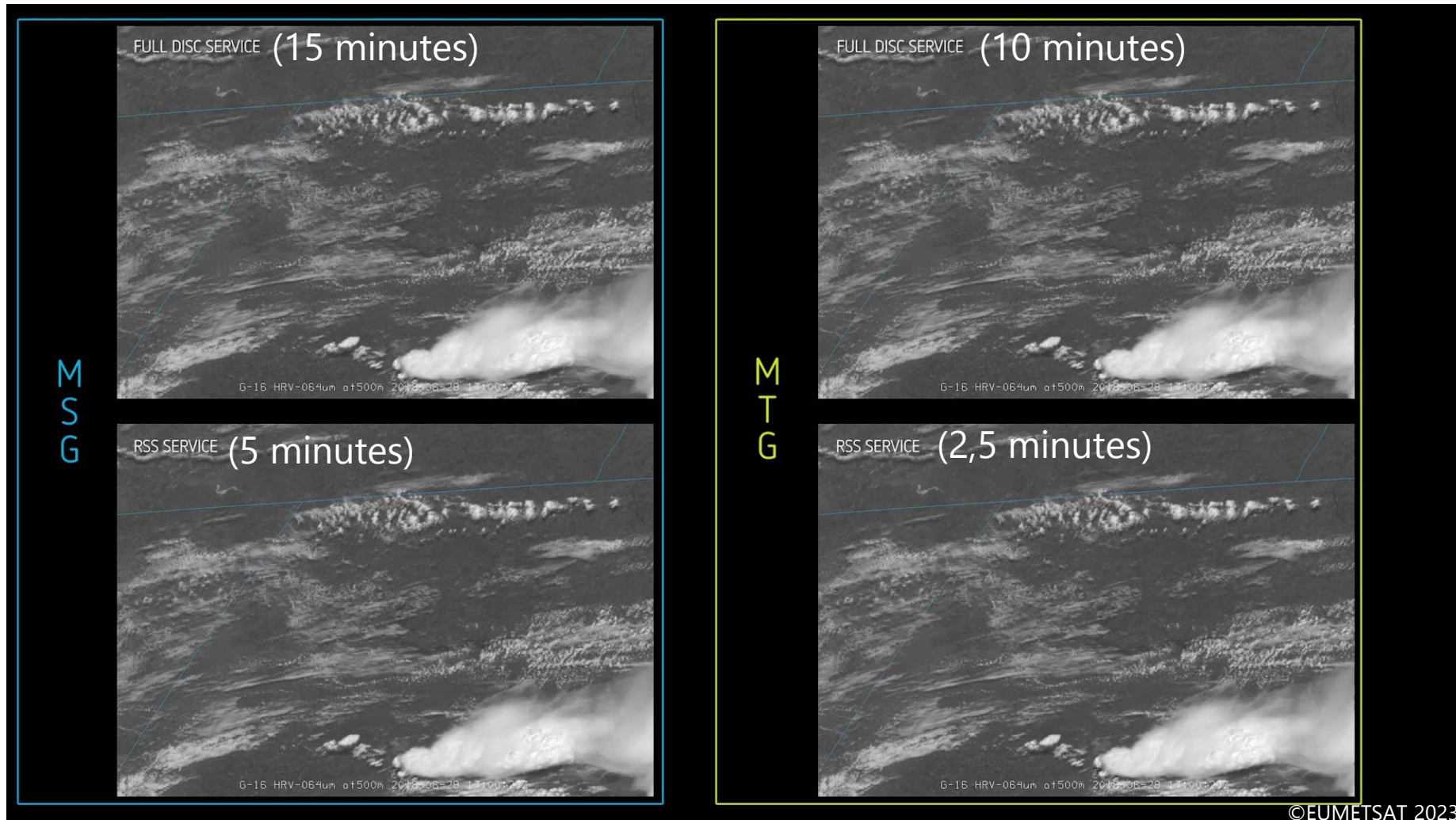
GHI = Global Horizontal Irradiance

HourCast™

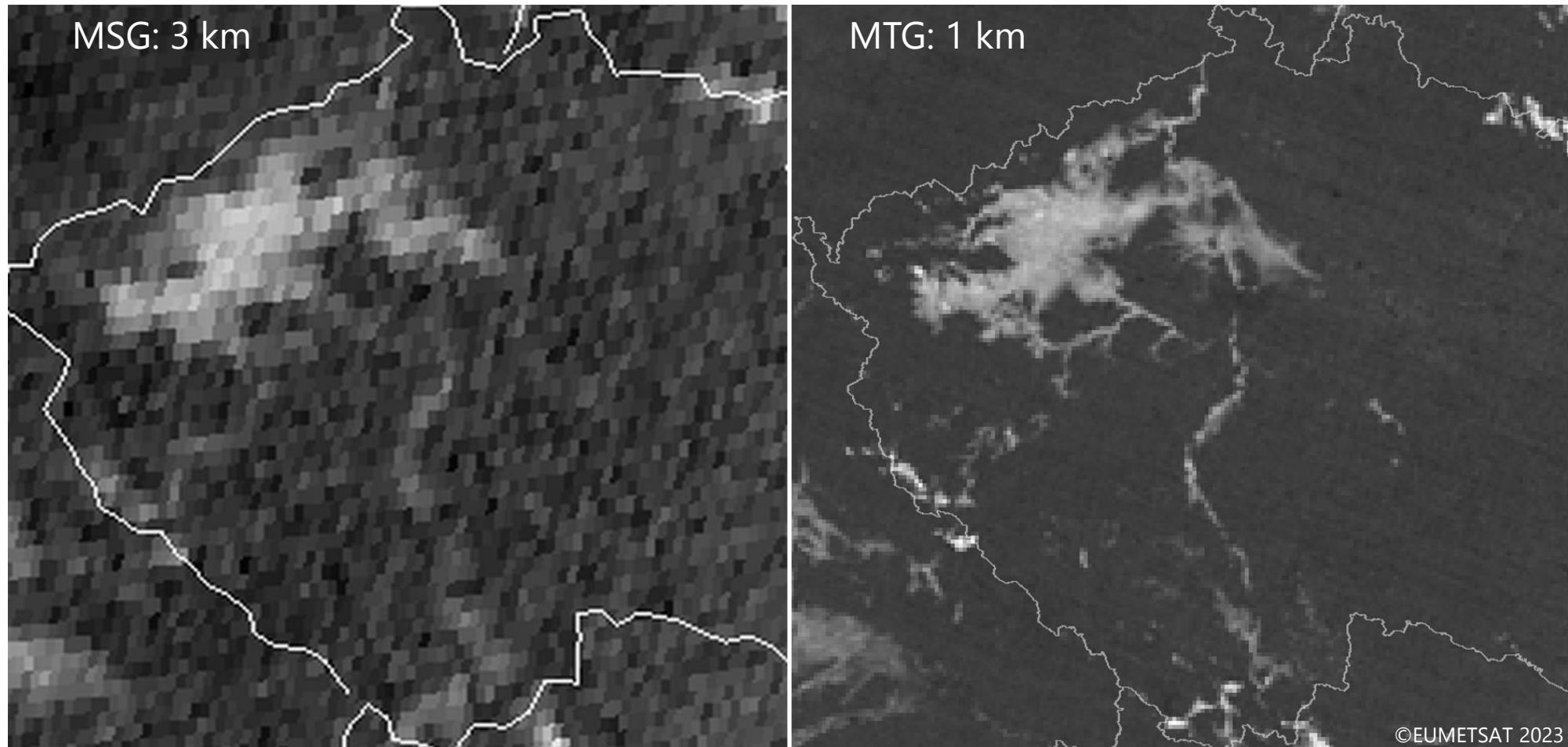
- Forecasts for single sites, portfolios of installations or entire regions
- From 10-15 min up to 6h in advance
- State of the art: Optical Flow
- Patented algorithms based on Machine Learning and Deep Learning



Benefit from the higher temporal resolution of MTG-I/FCI



Benefit from the higher spatial resolution of MTG-I/FCI



Example of fog detection, 16 Nov 2018, 01.37 UTC; simulated FCI imagery at 2km spatial resolution based on data from the VIIRS instrument on the NOAA Suomi-NPP satellite (right panel), and SEVIRI imagery at approximately 5km spatial resolution over Czech Republic (3km spatial resolution at sub-satellite point, left panel; Brightness Temperature differences (VIIRS I4 (3.7 μ m)–I5 (10.8 μ m); SEVIRI 3.9 μ m–10.8 μ m)

Better monitoring and forecasting of solar plants with MTG-I/FCI

- Take advantage of new NWCSAF products
- Feed our models with higher-resolution
- Update our forecasts more frequently



With EUMETSAT and NWCSAF services, Reuniwatt builds a high-quality product!



— Reuniwatt —

Excellence in forecasting

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Webinar : Launch of MTG satellite: data journey from space to solar plants

January 26th 2023



Moderator:
Annalisa Donati
Secretary General




Speaker:
Jochen Grandell
MTG Programme Scientist



Speaker:
Pilar Rípodas
Project Manager Nowcasting SAF



Speaker:
Mathieu Turpin
Satellite Data Expert

A large satellite with two large rectangular solar panel arrays is shown in space. The satellite is oriented diagonally, with one panel pointing towards the top left and the other towards the bottom left. The background is a deep blue space with a bright, glowing arc of light on the right side, suggesting the Earth's horizon or a celestial body.

Thank you for joining our discussion

Launch of MTG satellite:
data journey from space to solar plants

Please participate in our short survey.
We'd greatly appreciate your feedback!