Meteosat Third Generation Data: Users' Needs Come First

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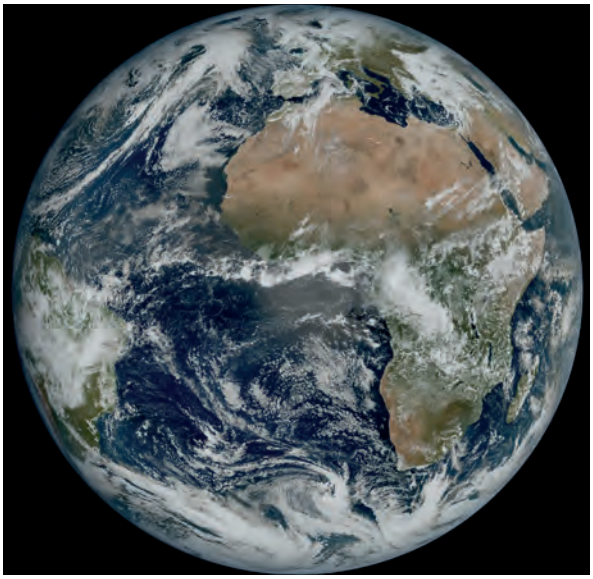
On the 24th of December 1963, the Météo France Meteorological Satellite Centre (CMS) received a Christmas present that forecasters had long been dreaming of: the first weather satellite image ever processed by a European centre **(figure 1)**. Sixty years after this first step, meteorologists were eagerly awaiting the next big moment in European weather forecasting history – the arrival of the first image of Meteosat Third Generation (MTG) on to their workstations **(figure 2)**. The launch of the first MTG satellite (13th December 2022) was another major step forward for European meteorology, as witnessed every couple of decades. MTG observations enrich the information available for forecasters and make numerical weather predictions more accurate. They will provide observations that can speed-up storm warnings, track lightning, pinpoint fire hotspots, and enhance emergency response.

The Meteosat Third Generation system is the most complex and innovative geostationary meteorological system ever built. The MTG space segment will eventually comprise a total of six satellites: four MTG-I (imaging spacecraft) and two MTG-S (sounding spacecraft) delivering 50 times more data than Meteosat Second Generation (MSG). This satellite complex will provide at least 20 years of operational service. By 2026 the first three satellites will be deployed, this fully operational constellation will include two MTG-I and one MTG-S satellites.

▲ *Figure 1: 24/12/1963 at 1229 UTC – Tiros-8 First image received in Europe at the Météo-France Meteorological Satellite Centre – Photo: Météo France*



▲ *Figure 2: 18/03/2023 at 1150 UTC – MTG-I1 First image from Meteosat Third Generation – Photo: Eumetsat/Esa*

		MTG	MSG
+	Better temporal resolution	10 min (full disk) 2 min 30 s (Europe)	15 min (full disk) 5 min (Europe)
+	Better spatial resolution	500 m to 2 km	1 to 3 km
+	Better spectral resolution	16 channels	12 channels
+	More instruments	FCI – LI IRS – Sentinel-4	SEVIRI – GERB

MTG-I

The priority of the MTG programme with the Flexible Combined Imager (FCI) will be to continue to support nowcasting and very short-term forecasting. Made possible by major enhancements to the Meteosat imagery mission, with images available much more frequently, every 10 minutes

for full disk imagery (vs 15 min for MSG) and every 2.5 minutes (vs 5 minutes for MSG) for the rapid scanning service over Europe and adjacent seas. The number of spectral channels increases from 12 to 16, to deliver additional information on semi-transparent cirrus clouds, cloud microphysics, aerosols, volcanic ash, fog, air mass characteristics and wildfires. The spatial resolution varies from 500 m to 2 km, depending on the channels **(figure 3)**. FCI data continues the 40-plus-years of data series from Meteosat satellites.

On the same platform (MTG-I), for the first time over Europe and Africa, the Lightning Imager (LI) provides real-time data on the location and intensity of lightning flashes. The imager detects all types of lightning: cloud-to-cloud, cloud-to-ground and intra-cloud flashes, day and night. Data from LI enables more precise forecasts of severe thunderstorms and allow meteorologists to monitor, track and extrapolate where lightning strikes. Better knowledge of the state of electrification improves air navigation services and gives pilots more opportunity to avoid electrically active thunderstorms.

MTG-S

The new geostationary sounding service is based upon requests from the numerical weather prediction (NWP) community to frequently deliver spectral information and/or retrieved products. It will also support nowcasting applications, such as early detection of areas prone to convective initiation, and improved warnings on location and intensity of convective storms.

The infrared sounder (IRS) on-board MTG-S is set to revolutionise weather forecasting by tracking the four-dimensional (over time and space) structure of atmospheric water vapour and temperature, for the first time on an operational basis. In addition, IRS is expected to provide information on ozone, carbon monoxide and volcanic ash composition.

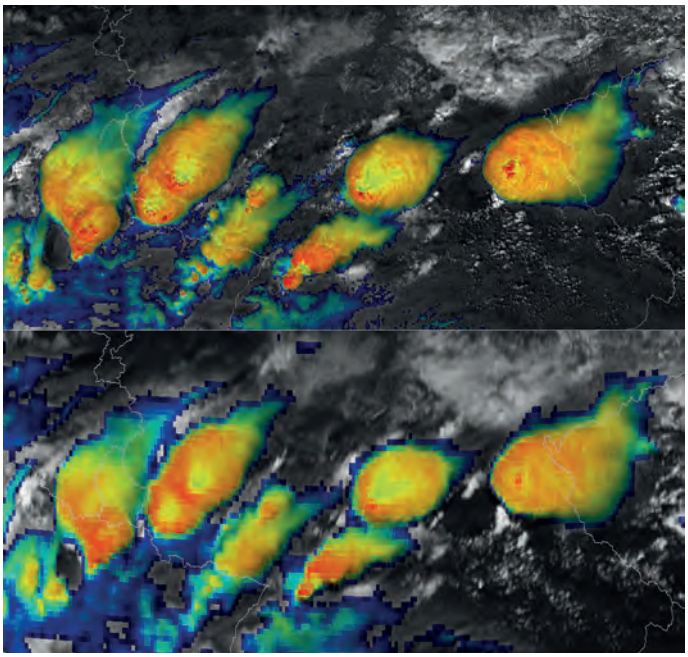
Copernicus Sentinel-4 instrumentation will monitor air quality, trace gases and aerosols over Europe on an hourly basis and with high spatial resolution. Sentinel-4 covers the need for continuous monitoring of atmospheric composition. The mission will focus on air quality, with the main data products being ozone (O_3), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), formaldehyde (HCHO) and aerosol optical depth.

At Météo-France

It's been a long time in the making, to provide data that has never been available over Europe before. Alongside other member states, Météo-France takes part in the MTG user preparedness group (MTGUP!) and in a wide range of initiatives and workshops that has allowed it to account for the needs of users such as forecasters, researchers and, more generally, all the customers of satellite data **(figure 4)**.

Météo-France already has experience in processing data for French overseas territories from next-generation satellites currently in operation, such as Japan's Himawari-8 and -9 and United States' Goes-16, -17 and -18. They have given a tantalizing taste of what is to come.

Inside Météo-France, users' needs come first, so a new working group lead by the end users has been created to discuss their requirements with the specialists of the Meteorological Satellite Centre and so the GUSAT was born (in French: "Groupe des utilisateurs des données satellitaires"). At the same time, the CMS has been delivering specialist training courses in collaboration with the French National School of Meteorology.



◄ *Figure 3: Spatial resolution of the sandwich product using VIS and IR channels to characterise thunderstorms – MTG vs MSG – Photos: Eumetsat*

To broadcast these new products in real time and to be sure that end users are ready to hit the ground running as soon as MTG goes operational, all the elements of the operational chain, the processes and the hardware required improvements and testing. Additionally, telecommunications lines, antennas, EumetCast systems and algorithms were set up and checked under the guidance of the Météo France MTG-I1 project.

▲ *Figure 4: Meteorological Satellite Centre – Photo: Météo France*