# EUMETSAT Next-Generation Satellite Programmes

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EWGLAM SRNWP Meeting 2020
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# Current EUMETSAT satellites – 10 Satellites

**METOP-A, -B & -C (Local Equator Crossing Time - 9:30 AM)**

LOW EARTH, SUN-SYNCHRONOUS ORBIT

EUMETSAT POLAR SYSTEM (EPS) / INITIAL JOINT POLAR SYSTEM

**SENTINEL-3A & -3B (98.65° incl.)**

LOW EARTH, SUN-SYNCHRONOUS ORBIT

COPERNICUS SATELLITES DELIVERING MARINE AND LAND OBSERVATIONS

**JASON-3 (63° incl.)**

LOW EARTH, NON-SYNCHRONOUS ORBIT

OCEAN SURFACE TOPOGRAPHY MISSION, SHARED WITH CNES/NOAA/EU

**METEOSAT-9, -10, -11**

| | |
|---|---|
| GEOSTATIONARY ORBIT | TWO-SATELLITE SYSTEM |
| METEOSAT 2ND GENERATION | FULL DISC IMAGERY MISSION (15 MINS) (METEOSAT-11 (0°)) RAPID SCAN SERVICE OVER EUROPE (5 MINS) (METEOSAT-10 (9.5° E)) *METEOSAT-9 STORED IN ORBIT (BACKUP)* |

**METEOSAT-8 (41.5° E)**

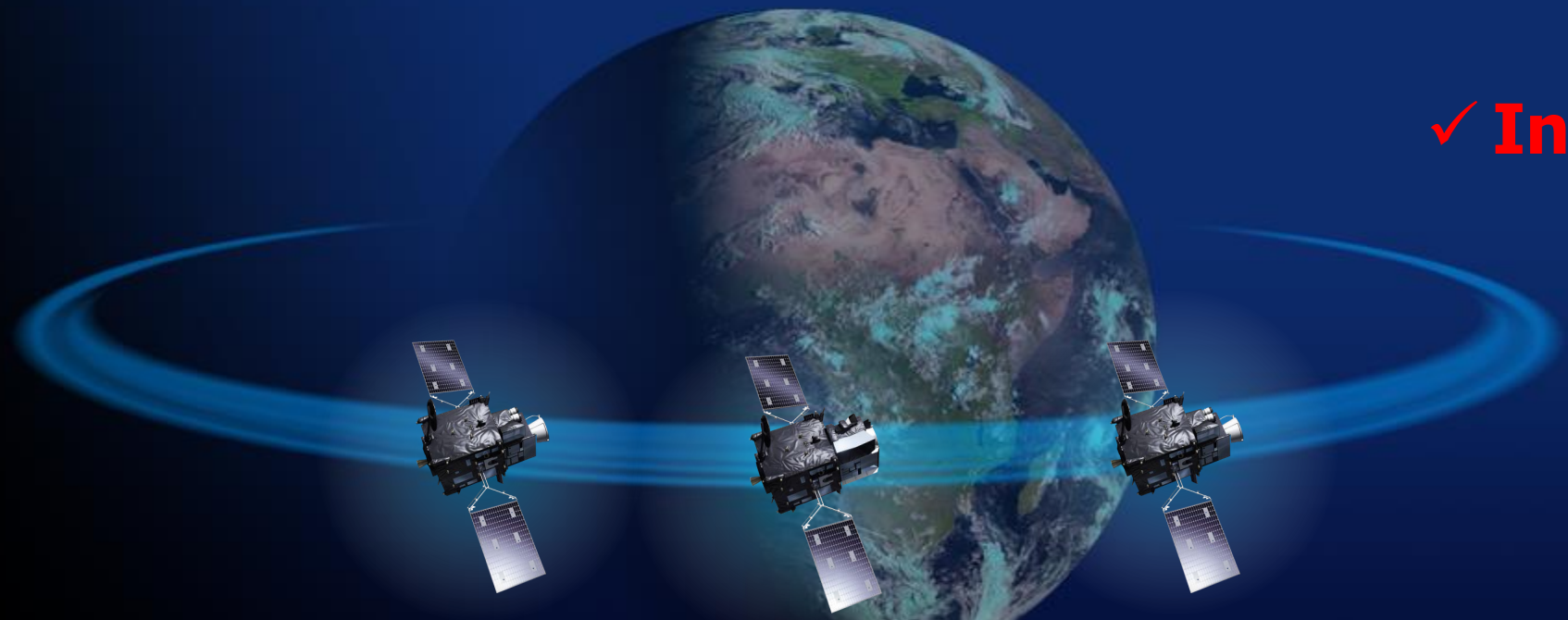
GEOSTATIONARY ORBIT

METEOSAT 2ND GENERATION PROVIDING INDIAN OCEAN DATA COVERAGE SERVICE (IODC)

# Meteosat Third Generation (MTG): Full operational configuration

✓ **Continuity**

✓ **Innovation**



**MTG-I**
Rapid Scan Service

**MTG-S**
Sounding Service

**MTG-I**
Full Scan Service

# 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 2023**
- **Operational exploitation: 2023-2042**

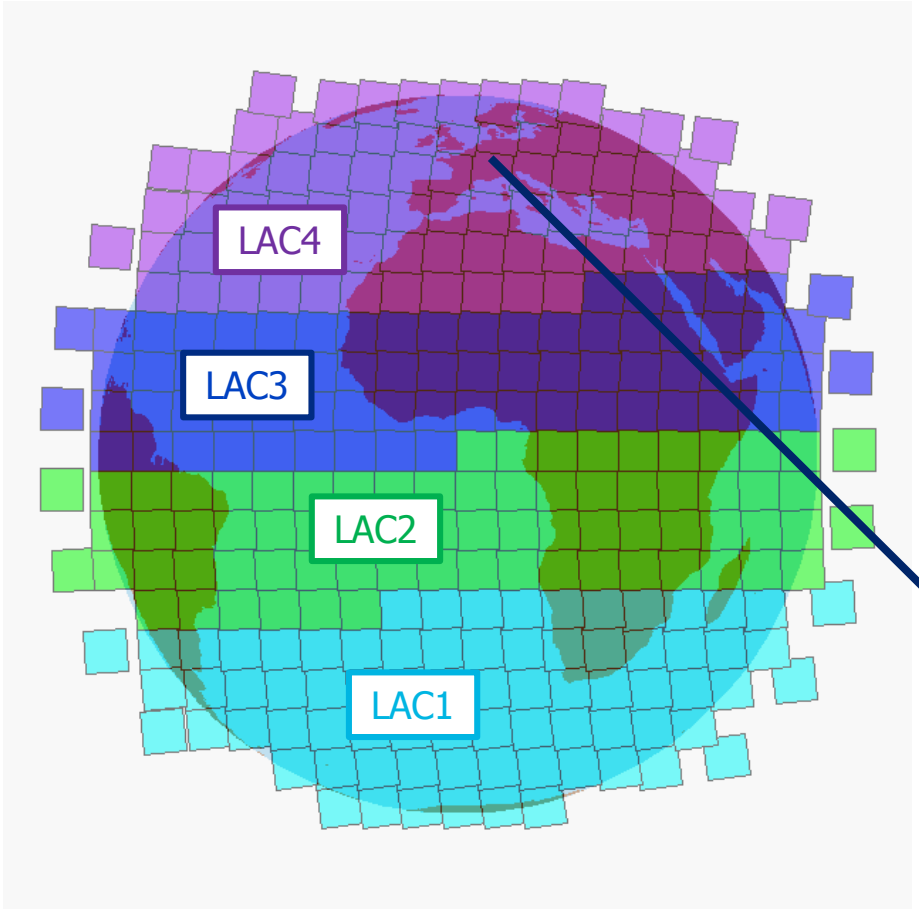
# Meteosat Third Generation: Sounding mission (MTG-S)

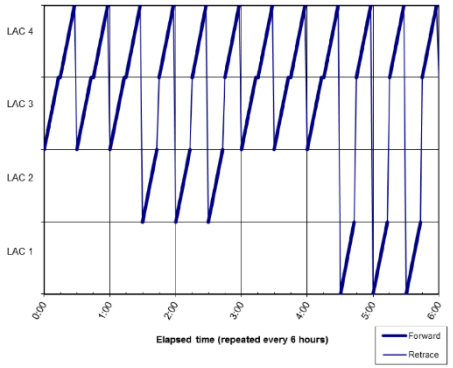
- Hyperspectral infrared sounding mission
- 4D weather cube: temperature, water vapour, O3, every 30 minutes over Europe
- Air quality monitoring and atmospheric chemistry in synergy with Copernicus Sentinel-4 instrument

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

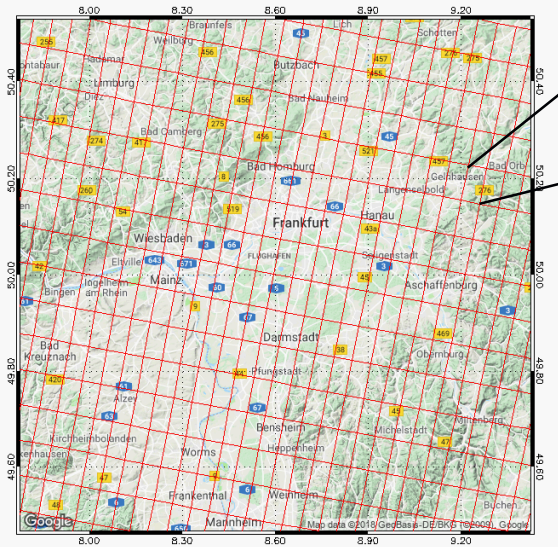
# MTG InfraRed Sounder (IRS) scanning sequence

- ✓ The Earth disk is split in 4 Local Area Coverage (LAC) zones, each of them covered in 15 min by a succession of “steps and stares” called dwells
- ✓ LAC4 (northern mid-latitudes) will be covered every 30 minutes
- ✓ LAC1, 2, 3 will be alternatively viewed in-between



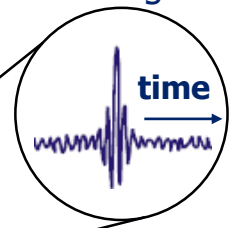




Each dwell consists of 160x160 pixels yielding a high spatial sampling



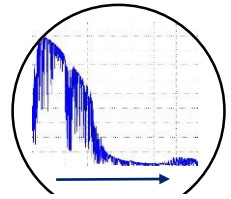

Interferogram

Single spatial sample




L0

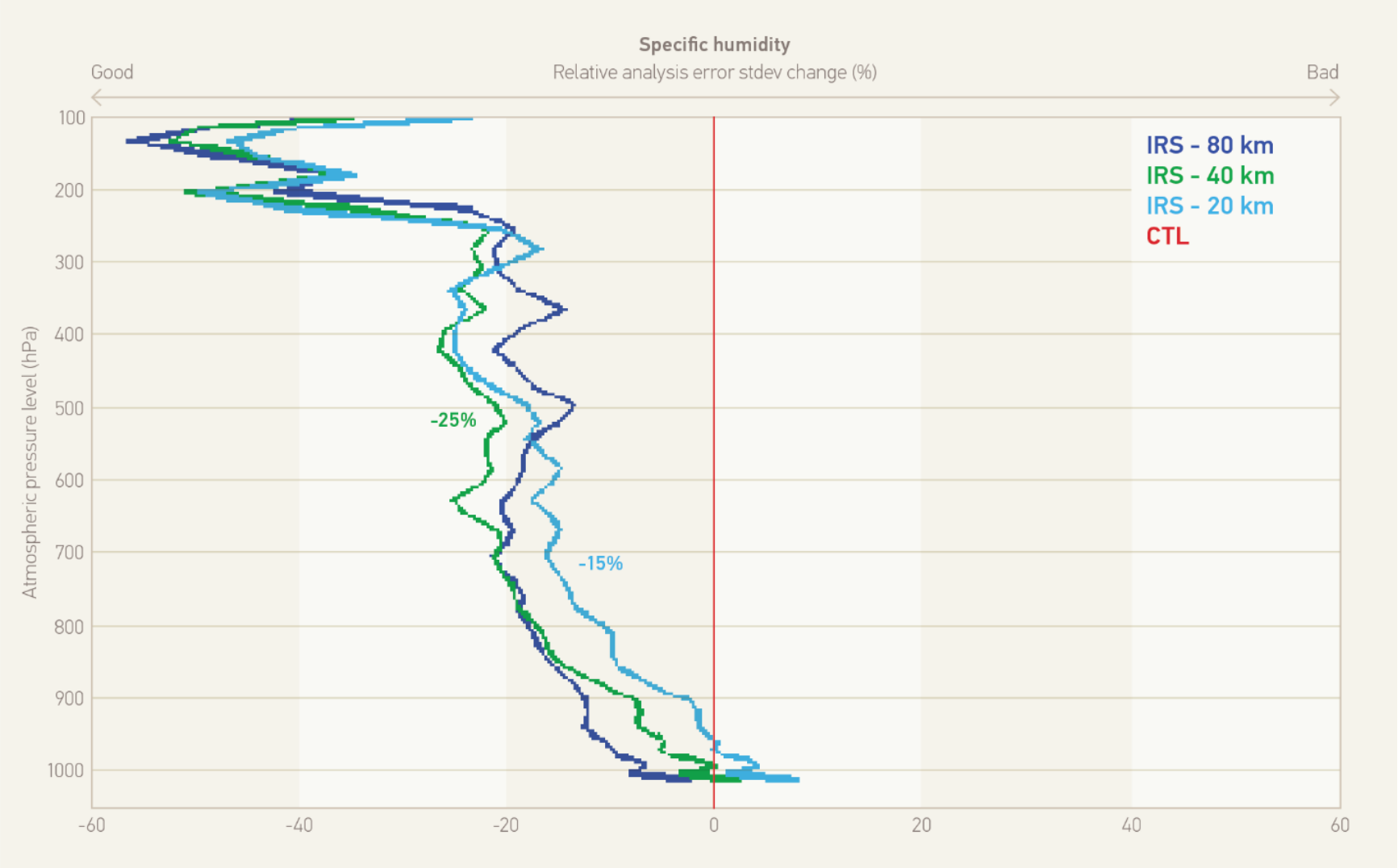
Spectrum



L1

wavenumber

# 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

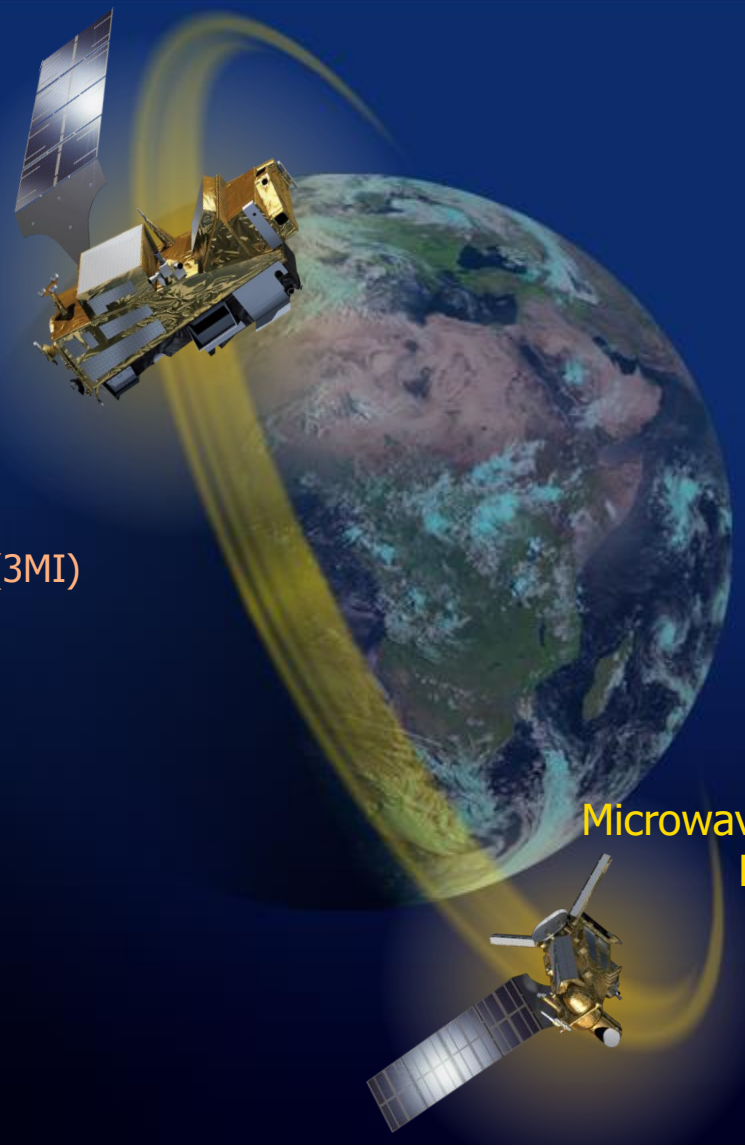
Source: Guedj et al., 2014

# EUMETSAT Polar System – Second Generation (EPS-SG)

**Metop-SG A**
Sounding & Optical Imaging
Launch: Q4 2023

High Resolution Infrared  Sounding (IASI – NG)
Micrwave Sounding (MWS)
Radio Occultation Sounding (RO)
Nadir viewing UV/VIS/NIR/SWIR Sounding (Sentinel-5)

VIS/IR Imaging (METimage)
Mulit-viewing Multi-channel Multi-polarisation Imaging (3MI)



**Metop-SG B**
Microwave Imaging and Sounding
Launch: Q4 2024

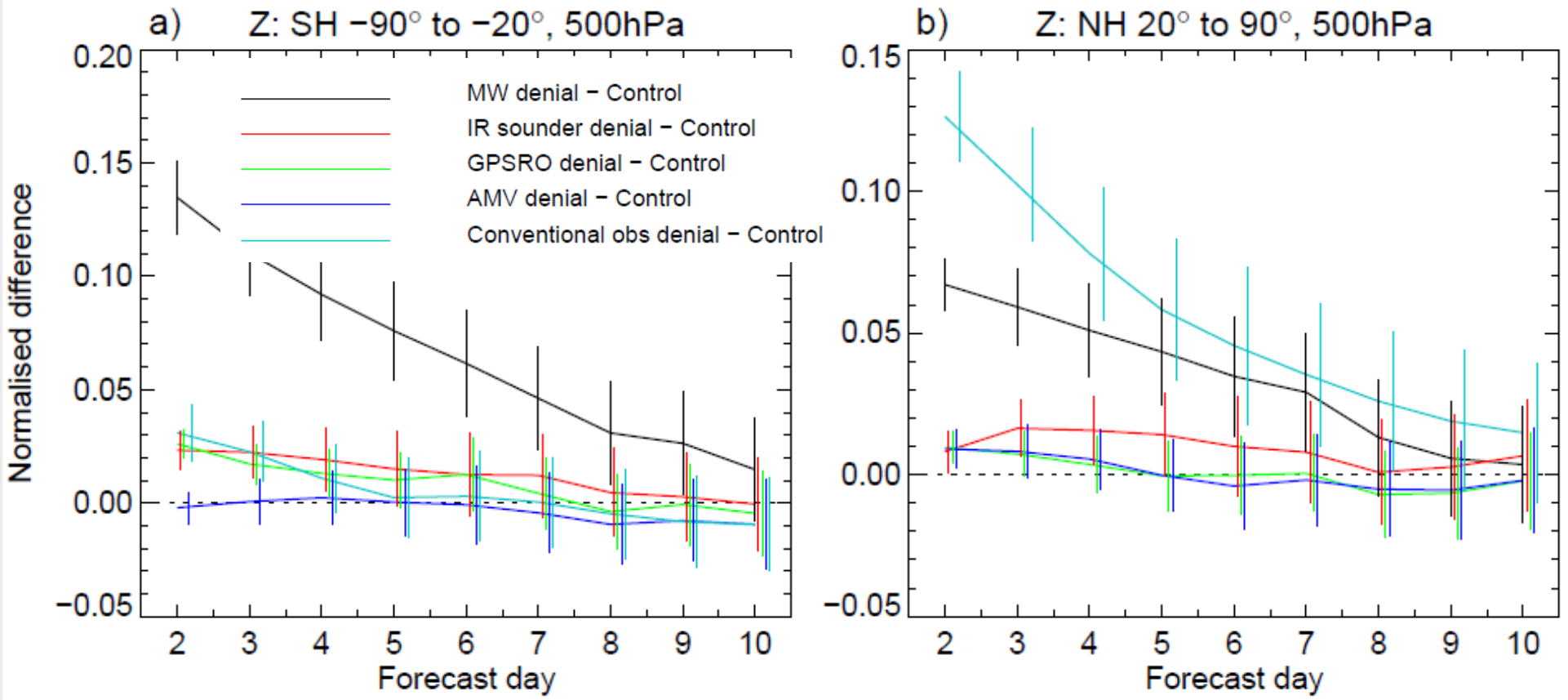
Scatterometer (SCA)
Micrwave Imaging (MWI)
Ice Cloud Imaging (ICI)

Radio Occultation Sounding (RO)

# EPS-SG benefits

| Main Payload | Enhanced Capabilities | Innovative Capabilities |
|---|---|---|
| High-Resolution Infrared Sounding **(IASI-NG)** | +75% information in temperature profiles<br>+30% in humidity-profiles | More trace gases and their vertical profiles |
| Microwave Sounding **(MWS)** | Enhanced spatial over-sampling | Ice-cloud info in support of water-vapour profiling |
| Radio Occultation Sounding **(RO)** | Large increase of number of radio-occultations | Tracking of Galileo, Beidou and QZSS signals |
| Nadir viewing UV/VIS/NIR/SWIR Sounding **(Sentinel-5)** | Drastic increase of spatial resolution | Additional trace gas measurements; $CO_2$ being studied |
| VIS/IR Imaging **(METimage)** | Better radiometric and spatial resolution | Far more variables measured with higher accuracy |
| Scatterometry **(SCA)** | Higher spatial resolution and coverage | Cross polarisation for higher wind speeds |
| Multi-viewing, -channel, -polarisation Imaging **(3MI)** | New mission | Aerosol parameters |
| Microwave Imaging **(MWI)** | New mission | Precipitation observations |
| Ice Cloud Imaging **(ICI)** | New mission | Cloud microphysics parameters |

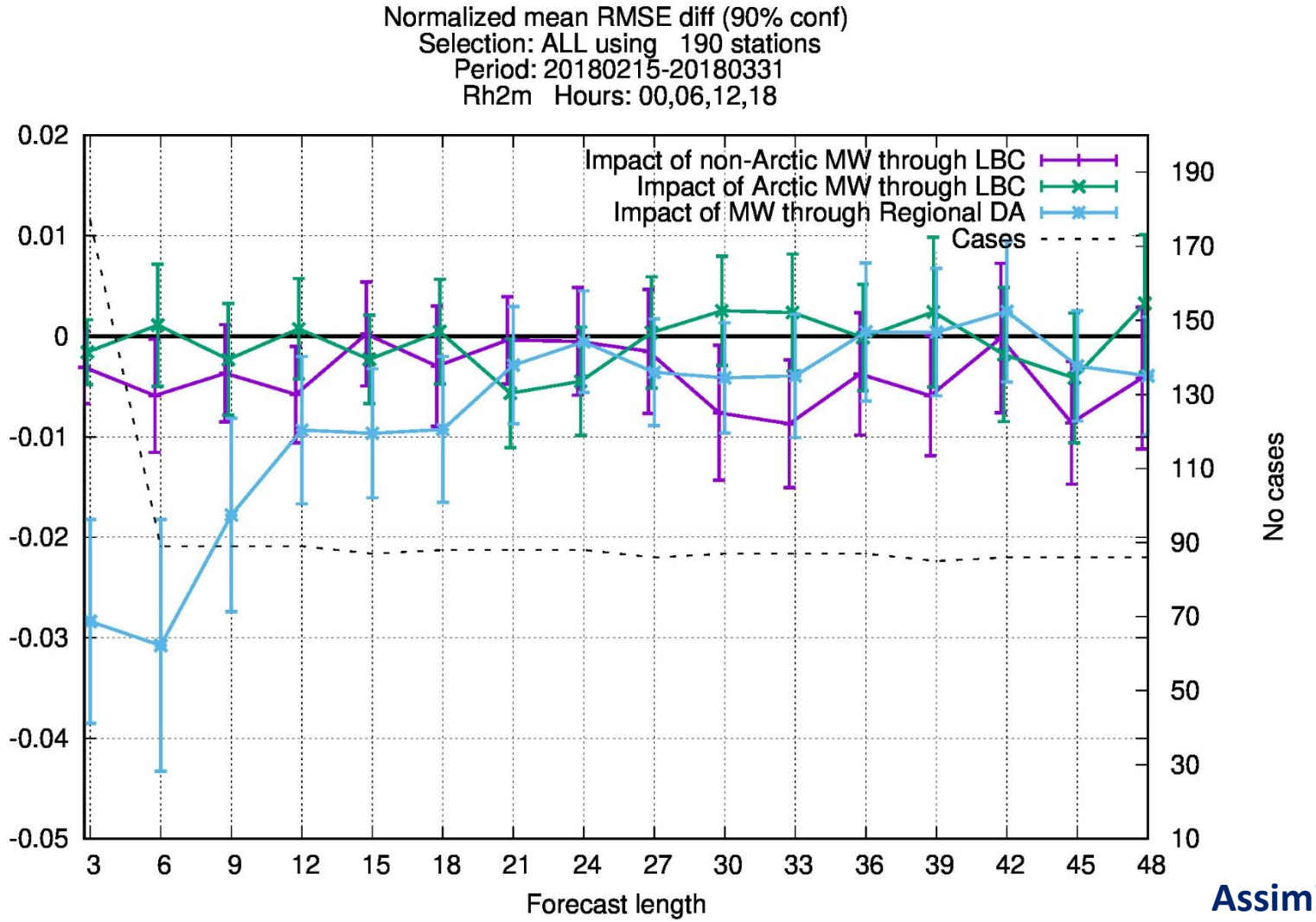
# Impact of Sounding data on Global NWP




- Microwave Temperature and Humidity Sounders on board ten Polar orbiting satellites
- Hyperspectral Infrared Sounders on board four Polar orbiting satellites
- GPS Radio Occultation sounders on board nine polar orbiting satellites
- Atmospheric Motion Vectors from five Geostationary and four Polar orbiting satellites

**ECMWF Tech memo 2019**

# Impact of assimilating Microwave data in Regional NWP Model




**Assimilation Study done at Met Norway by Roger Randriamampianina, 2020**

# Getting ready for next-generation EUMETSAT data

- **MTG and EPS-SG User preparation projects:**
  - **Support the EUMETSAT user community in**
    - Achieving a smooth transition and continuity of operations from the current to the next-generation satellites.
    - Exploit the innovation potential from the new missions

- **MTG UP and EPS-SG UP fostering preparation among NMHS**
  - User Days – 31 May 2 June 2022, Darmstadt, Germany
  - Technical Webinars
  - Science Conferences (EGU, EMS, EMSC)
  - Test data
  - Training
  - Engagement with private sector, SW/HW manufacturers

- EUMETSAT Website
  - MTG
  - EPS-SG


MTG & EPS-SG User Days 2019

# Regional NWP Workshop January 2020 – Next Generation satellite programmes

- Representation from SRNWP Consortia in Europe – Assimilation and Verification experts

- Objective:
  - to initiate a user engagement with the SRNWP community
  - Ensure *preparedness for MTG and EPS-SG programmes*

- Outcome:
  - Eumetsat to inform the group on test data releases and other activities related to user preparation.
  - Joining the efforts with Global NWP will be beneficial for knowledge sharing - Future events to include Global NWP centres.

→ Formation of NWP Core User Group

# Core NWP User Group

- Representation
  - Global NWP centres in Europe
  - Short Range NWP consortia in Europe
  - NWP SAF (Satellite Application Facility)
- Role of the NWP User Group
  - Offer guidance and feedback to User Preparation projects in areas of test data, training and data access.
  - Participate and take active roles during the events.
  - Foster knowledge transfer between Global and Regional NWP and to wider user community in Europe.

# Training

- Building on years of experience in training operational meteorologists, the EUMETSAT training programme has started to focus on MTG applications. There will be a range of opportunities for and staff of NMHS to engage.
- Online learning
- Short-term Skills Development Award : short-term placements of individuals
- EUMETSAT NWPSAF ECMWF Data Assimilation Training
  - Satellite Sounding retrieval training in a European Weather Cloud
    - Radiative Transfer model, retrieval algorithms to be accessed through a web interface
- Testbeds:
  - simulation of an operational meteorological forecasting environment; new products will be introduced to operational forecasters
    - Themes: Severe convective storms, Fires, Aviation
    - Train about 300+ forecasters during 2021-2024

# Welcome to the EUMETSAT User Preparation Webinar!

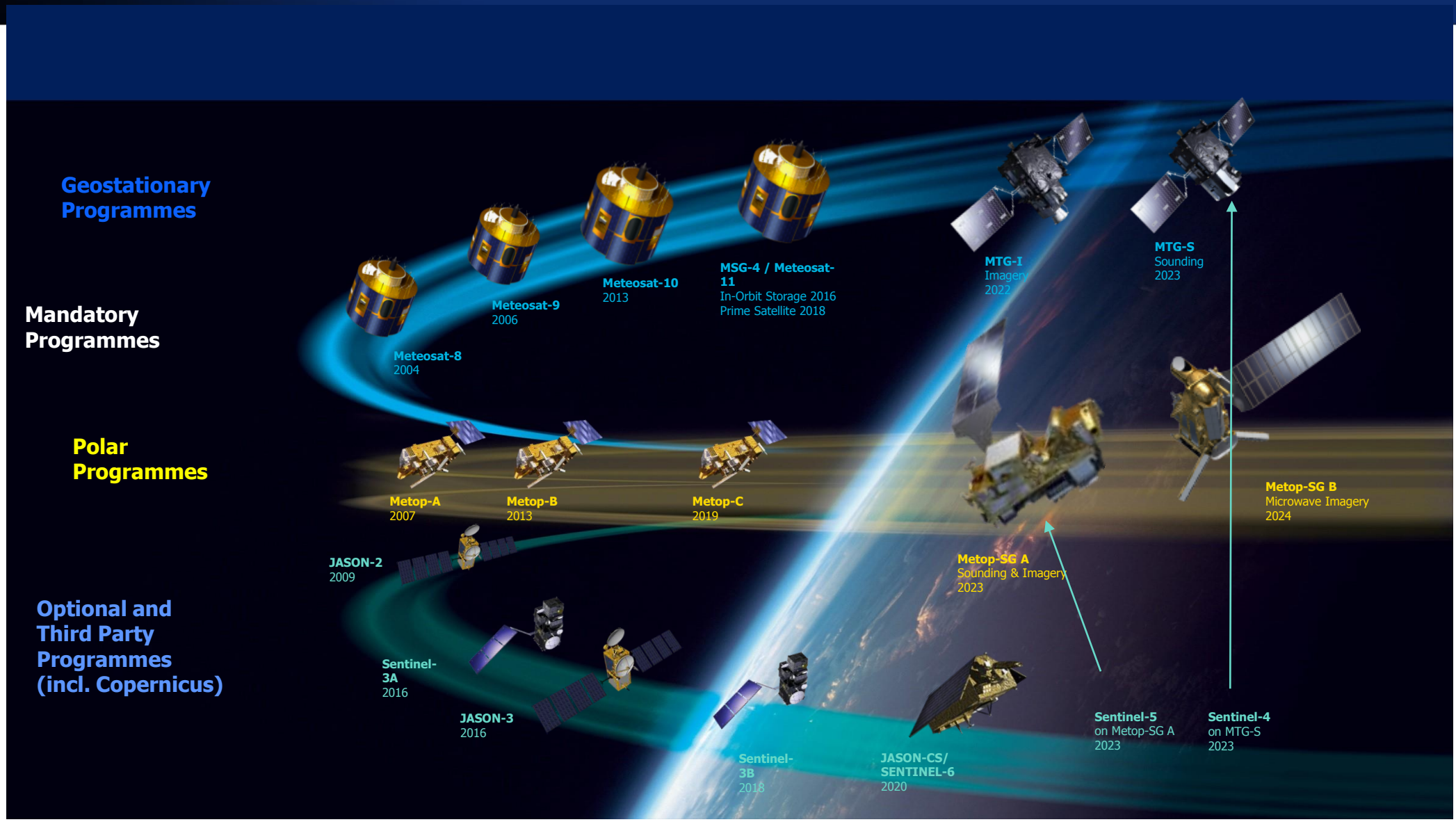
Topic: Next-generation Hyperspectral Infrared Sounders:

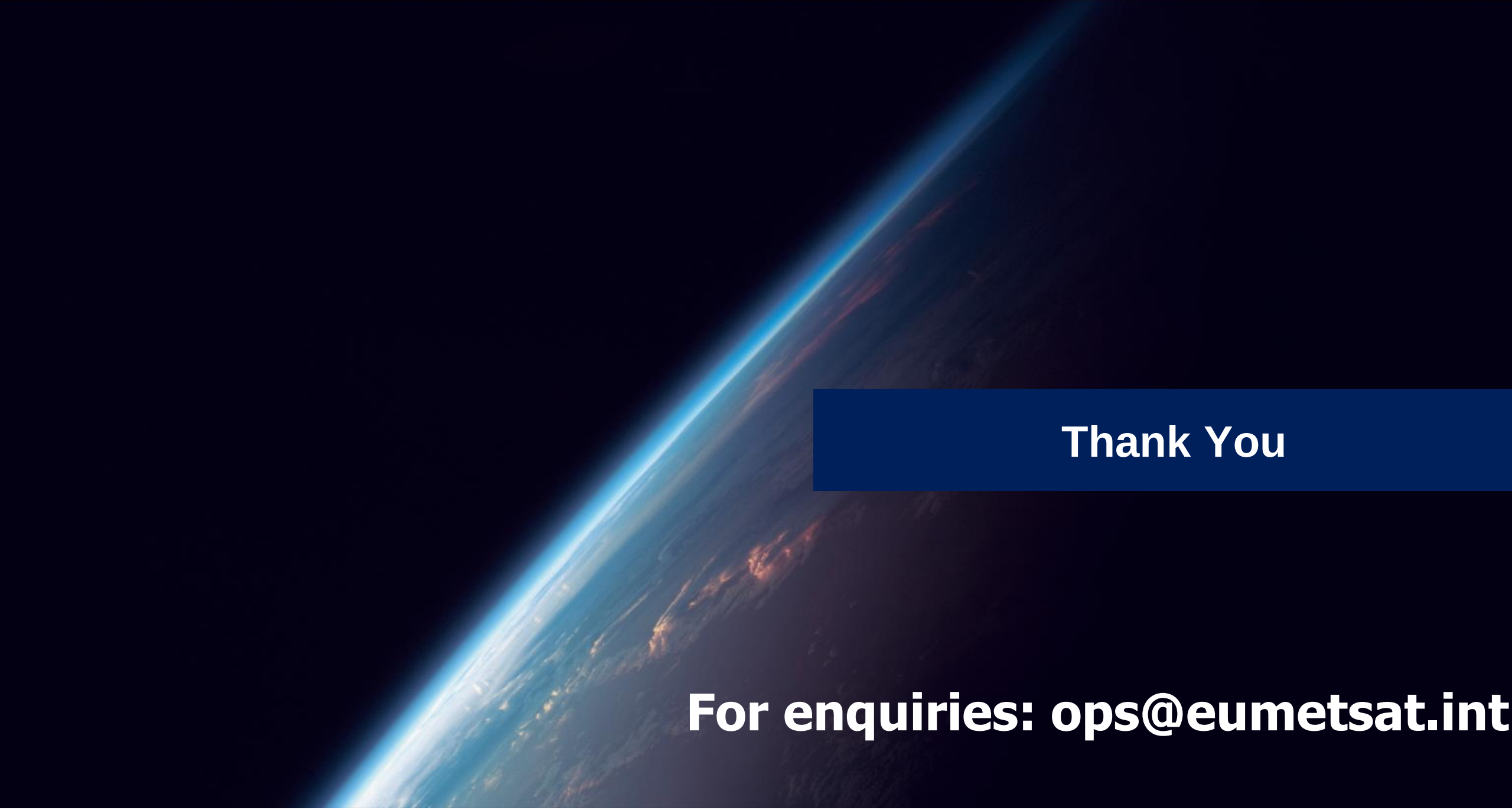
- InfraRed Sounder (IRS)
- Infrared Atmospheric Sounder Interferometer (IASI-NG)

13 October 2020 14.00-16.00 CEST (12.00-14.00 UTC) Registration
14 October 2020 14.00-16.00 CEST (12.00-14.00 UTC) Registration

*Ask your questions on www.slido.com: event code #NG-HSIR*

# EUMETSAT current and next-generation satellites





# Thank You

**For enquiries: ops@eumetsat.int**