Preparation of MTG era: developing of imager and sounder nowcasting tools
First scientifically realistic synthetic MTG-I/FCI and MTG-S/IRS data generated with RTTOV-13.0

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AEMET PGE00s programs upgraded to RTTOV-13.0

NWC SAF vMTG version with support MTG-I/FCI projection migrated to RTTOV13.0

GEO-PGE00-VISIR: high quality simulation of MTG-I/FCI (same for other imager instruments) clear and cloudy BTs or radiances

GEO-PGE00-hyper: high quality simulation of MTG-S/IRS or IASI clear and cloudy BTs.

PGE00 can be used at same time as an NWP 4D (presure, time, longitude, latitude) interpolator of NWP GRIB files to satellite positions.

First version that allows simultaneous generation of synthetic MTG-I/FCI, MTG-S/IRS and IASI radiance on MTG-I/FCI grid.

- Output files are binary files with Nx * Ny records for each position on boxes 1x1 for FCI and 2x2 for IRS on IR FCI grid (2x2 km at nadir).
- Each record contains: clear and cloudy radiances, profiles (T, q, ozone, cc, clwc, cwic, wind) from NWP at the 54 RTTOV levels, surface fields from NWP and NWCSAF ancillary fields.

Synthetic MTG-I/FCI and MTG-S/IRS data generation for case study 2019-05-01

synthetic MTG-I/FCI dataset
- ✓ FCI 16 channels
- ✓ VIS and IR clear and cloudy radiances.
- ✓ every 10 minutes.
- ✓ 144 slots from 00:00Z to 23:50Z
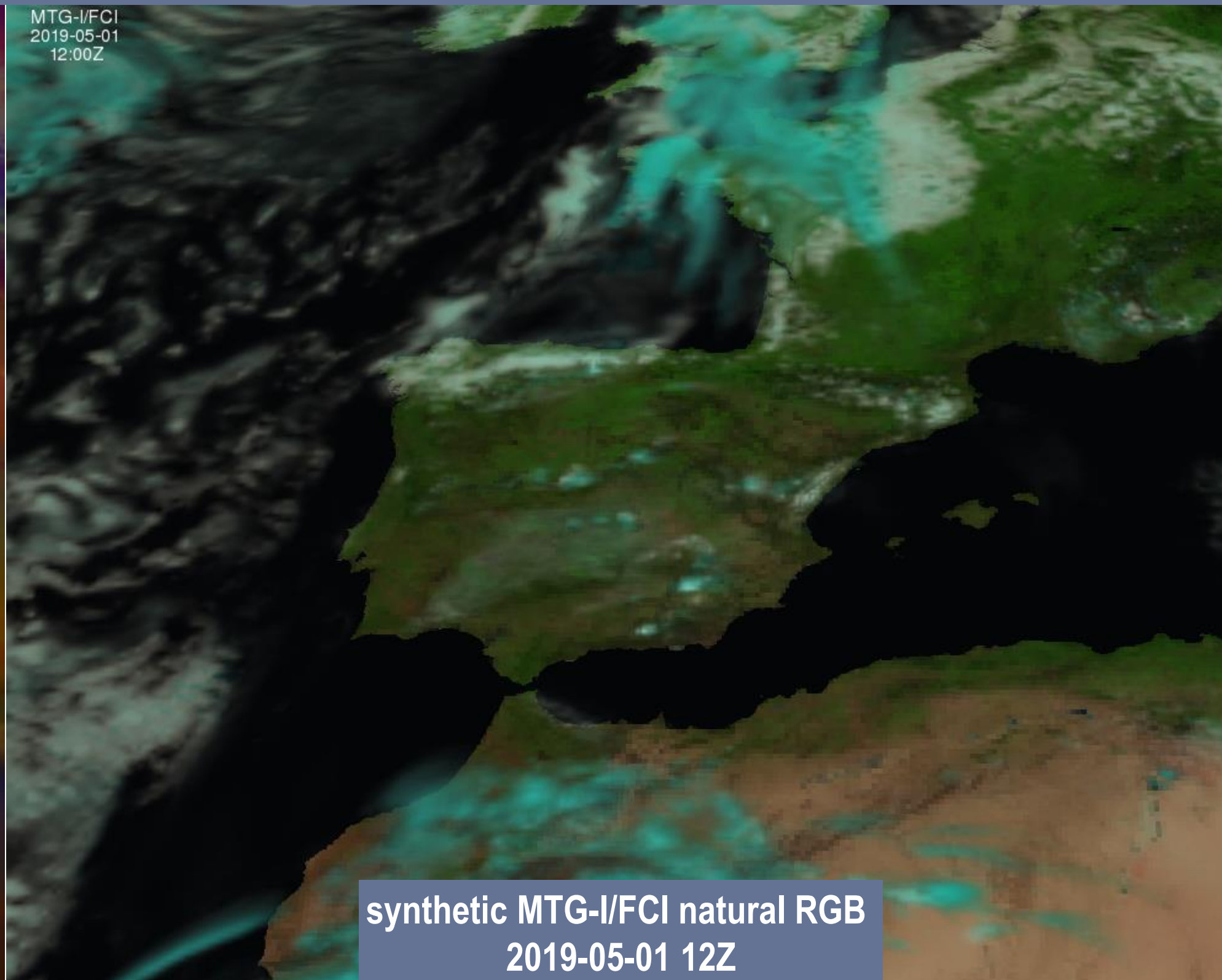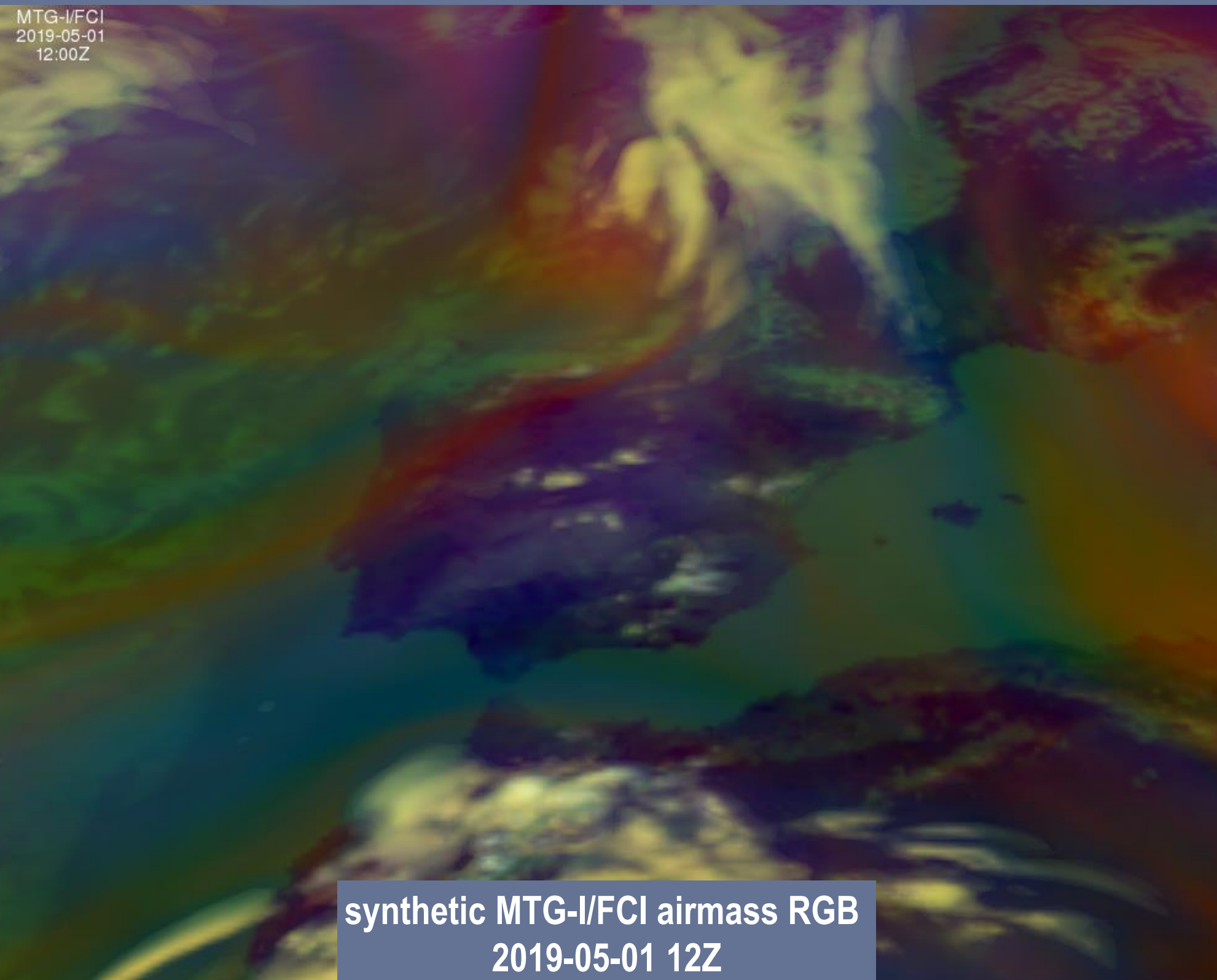- ✓ at IR FCI resolution (2x2 km nadir)
- ✓ Region: 1000 x 800 pixels

synthetic MTG-S IRS dataset
- ✓ MTG-S/IRS 1960 channels
- ✓ every 30 minutes.
- ✓ 48 slots from 00:00Z to 23:30Z
- ✓ at boxes 2x2 pixels IR FCI resolution => similar to theoretical IRS spatial resolution (4x4 km nadir)
- ✓ Region: 500 x 400 pixels

Synthetic datasets generated using operational ECMWF hybrid GRIB files between t+00 to t+24 hours range forecast (every 1 hour) with 0.1º x 0.1º from 2019-05-01 00Z run.
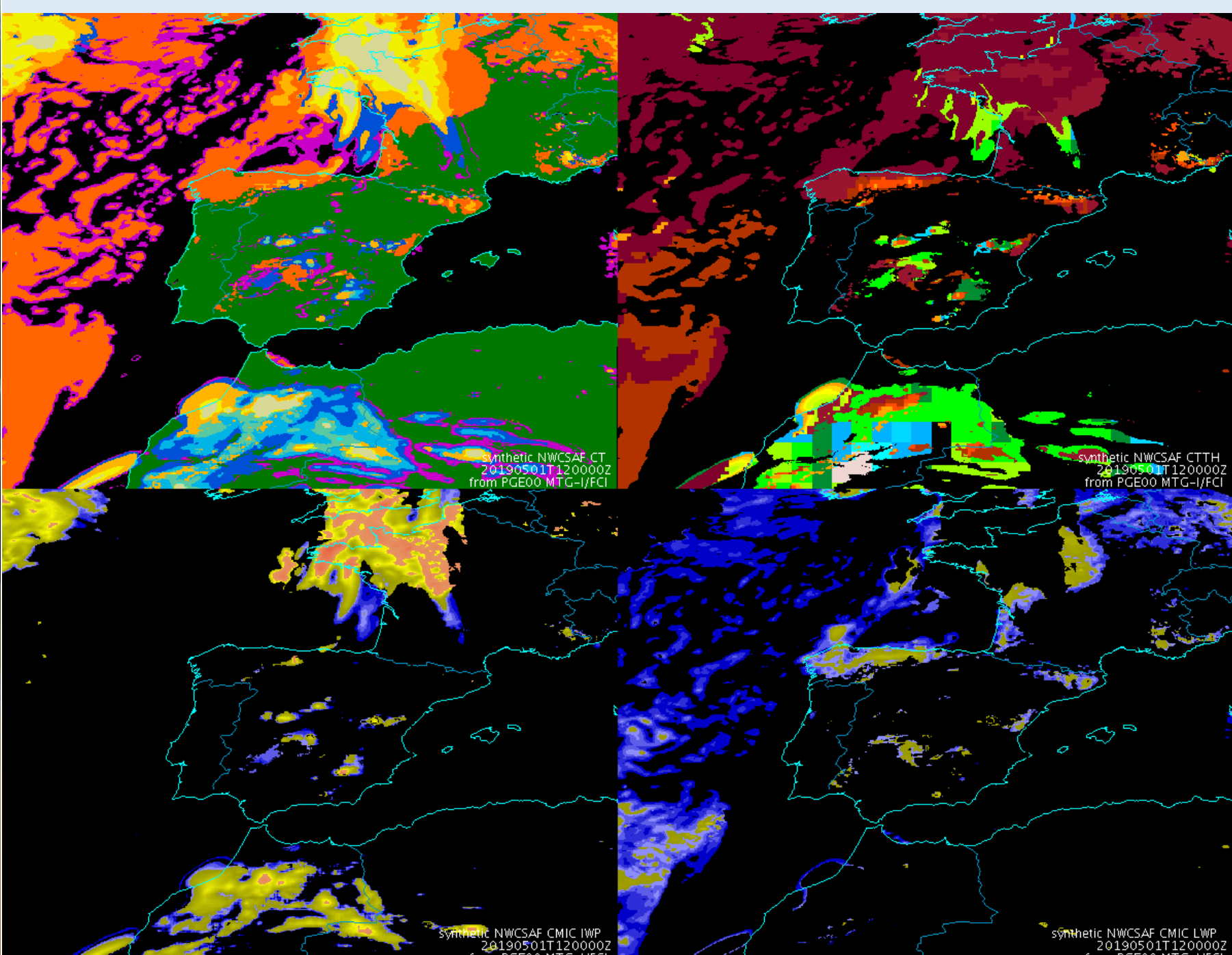
Loops availables; see Reference

Synthetic MTG-I/FCI data for case study 2019-05-01

NWC SAF CT, CTTH, LWP and IWP generated using as inputs the synthetic MTG-I/ FCI data

synthetic MTG-I/FCI airmass RGB 2019-05-01 12Z

synthetic MTG-I/FCI natural RGB 2019-05-01 12Z

In order to have data on VIS channels the 24 hours it is used 75° solar zenith angle during night

synthetic MTG-S/IRS on MTG-I/FCI projection for case study 2019-05-01

Using synthetic MSG and IRS data from same dataset, it has been searched the IRS channels with statistical properties closest to MSG channels. These IRS channels are used to build an air mass RGB similar to MSG air mass RGB.
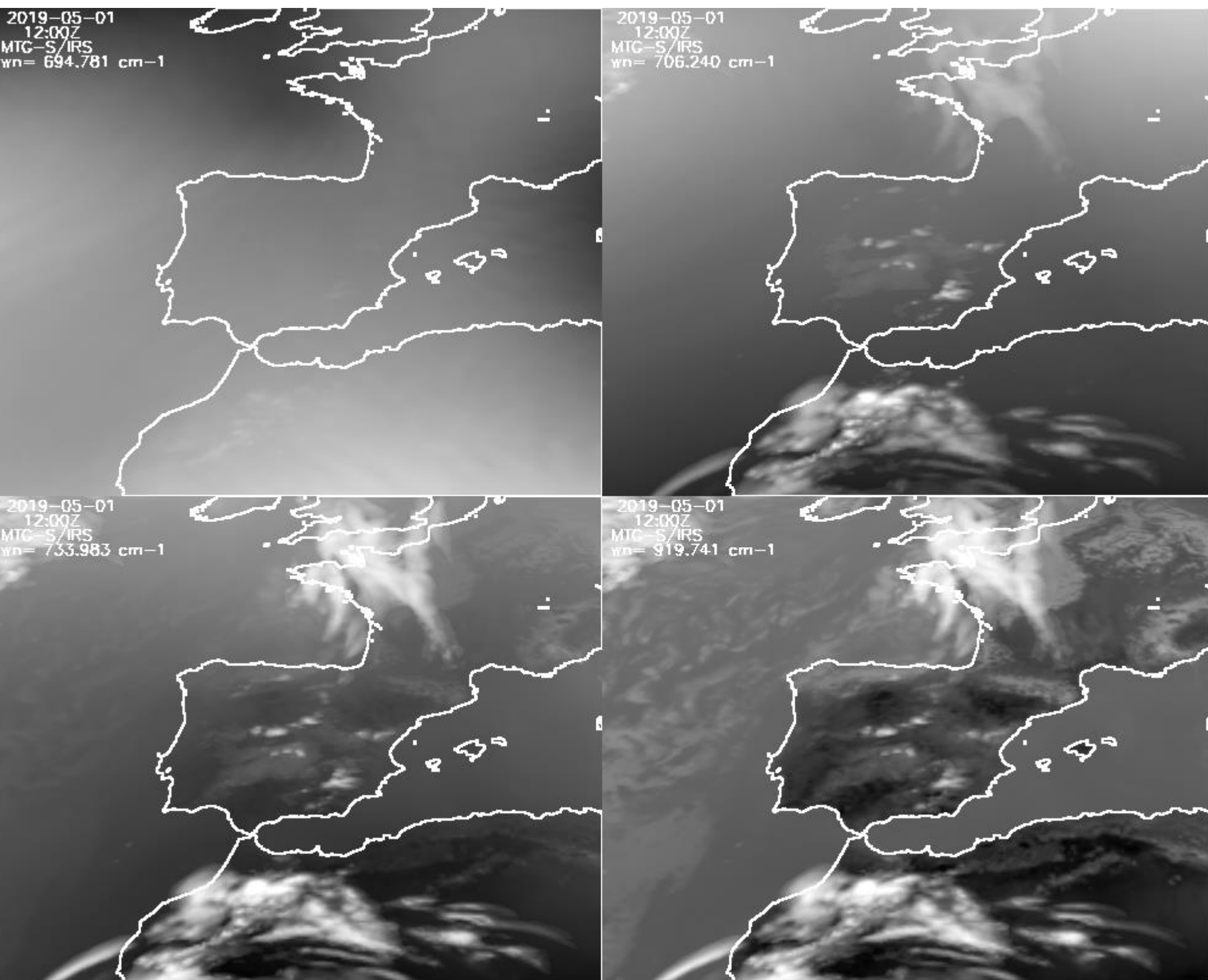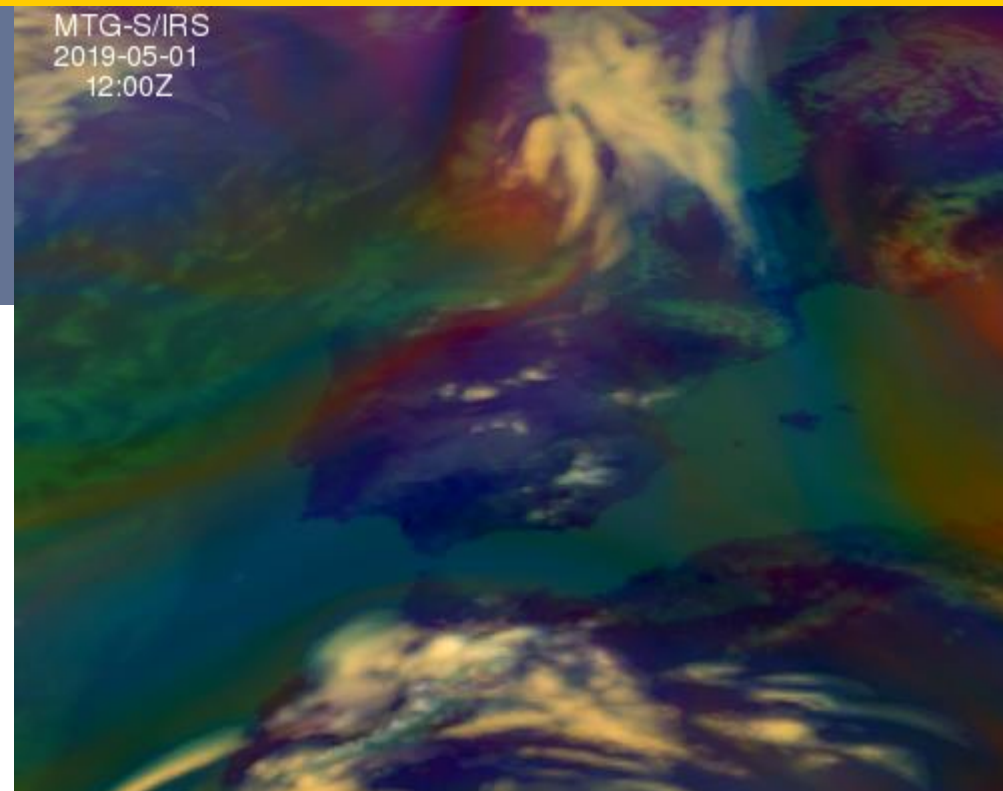
MTG-S/IRS channels nearest to IASI channels at 695, 706, 734 and 919.5 cm^{-1}. The wavenumbers has been selected in CO_2 branch to provide top to down view in the atmosphere.

- ► NWC SAF provides software for use of satellite data in Nowcasting. The products are generated locally by users => No bandwidth constraints on local generated products.
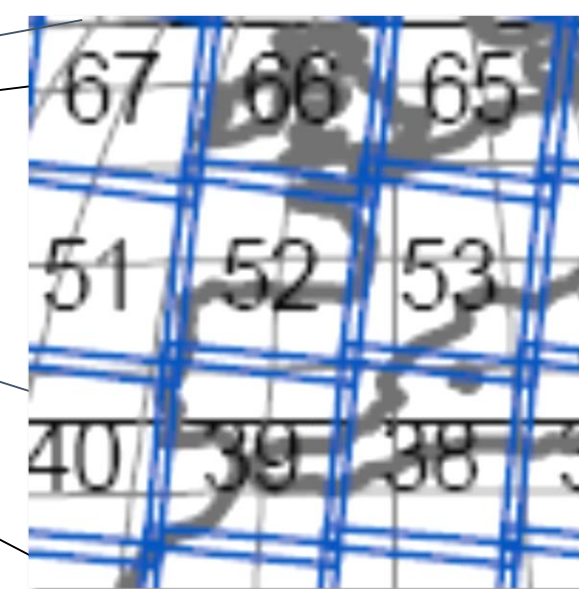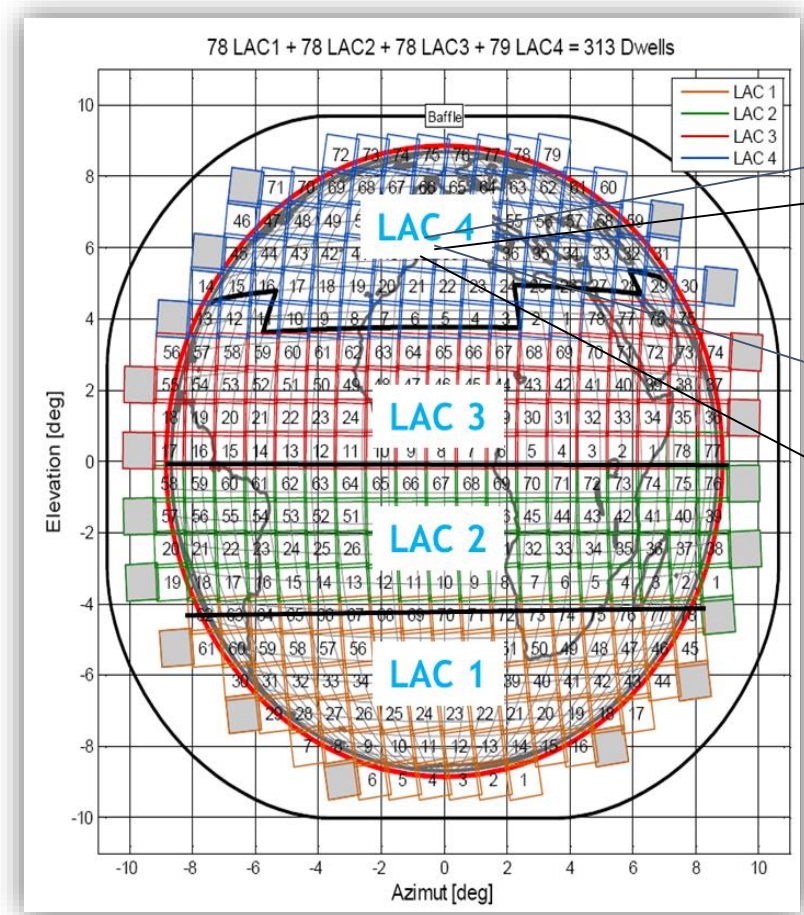- ► NWC-SAF is the SAF nearest to users. It works in the users side of the EUMETCast

Key point: NWCSAF as integration and reprojection tool:

MTG-IRS will have the half of spatial resolution of MTG-FCI.

MTG-IRS will explore in "dwells" of 160x160 pixels at 4x4 km resolution with no reprojection on a common GEO grid.

Thus, to cover a region *it is needed of one re-projection and joining of dwell files tool to get one user interest region.* The default projection will be regions on MTG-I/FCI projection with FCI IR or half of FCI IR resolution.

Plan for MTG: to offer a user friendly software to manage the FCI, LI and IRS L1 data and to generate L2 Nowcasting products. **The main objective is to explore the synergies and differences of MTG-FCI and MTG-IRS products and the background NWP.**
**They will be prepared during CDOP-4 and they will be available at IRS Day-2.**

NWC SAF products and services for MTG-IRS

qIRS *Quick IRS product*	Conversion from Principal Components to BTs and IRS L1 images generation on NWC SAF regions: - PC to BTs at dwells - Combination and reprojection of MTG-S L1 BTs selected by users from dwells coordinates to user NWC SAF defined regions on FCI grid projection. - Generation of IRS L1 imagery related products; IRS RGB images as example.
sSHAI_ES *sounder Satellite Humidity And Instability from Eumetsat Secretariat*	- combination and reprojection of 2D and 3D fields from dwells to user NWC SAF defined regions - calculation of nowcasting parameters (TPW, LPW and instability indices) at dwells. - Add fields as IR images on cloudy pixels.
sSHAI *sounder Satellite Humidity And Instability from NWC SAF*	- Local NWCSAF MTG-IRS L2 product generation. Locally executed light CPU algorithms for retrieval of T, q profiles using as input local NWP models. - Calculation of nowcasting parameters (TPW, LPW and Instability indices) at dwells. - Combination and reprojection of dwells to user NWC SAF defined regions

Next developments

- ✓ iSHAI (imager Satellite Humidity And Instability) is the clear air product of the NWC SAF GEO software package.
- ✓ iSHAI provides the TPW, LPW (precipitable water in three layers) and several instability indices. Also provides the difference with the ones calculated from the background NWP input.
- ✓ PGE00 is a complementary AEMET tool. Together with synthetic data generation, it can get the same fields that from iSHAI for all pixels.
- ✓ iSHAI from MTG-I/FCI will be improved with combination of MTG-S/IRS L1 or MSG-S/IRS L2 inputs.
- ✓ The availability of synthetic dataset will be used to develop and validate before launch of MTG-S/IRS.
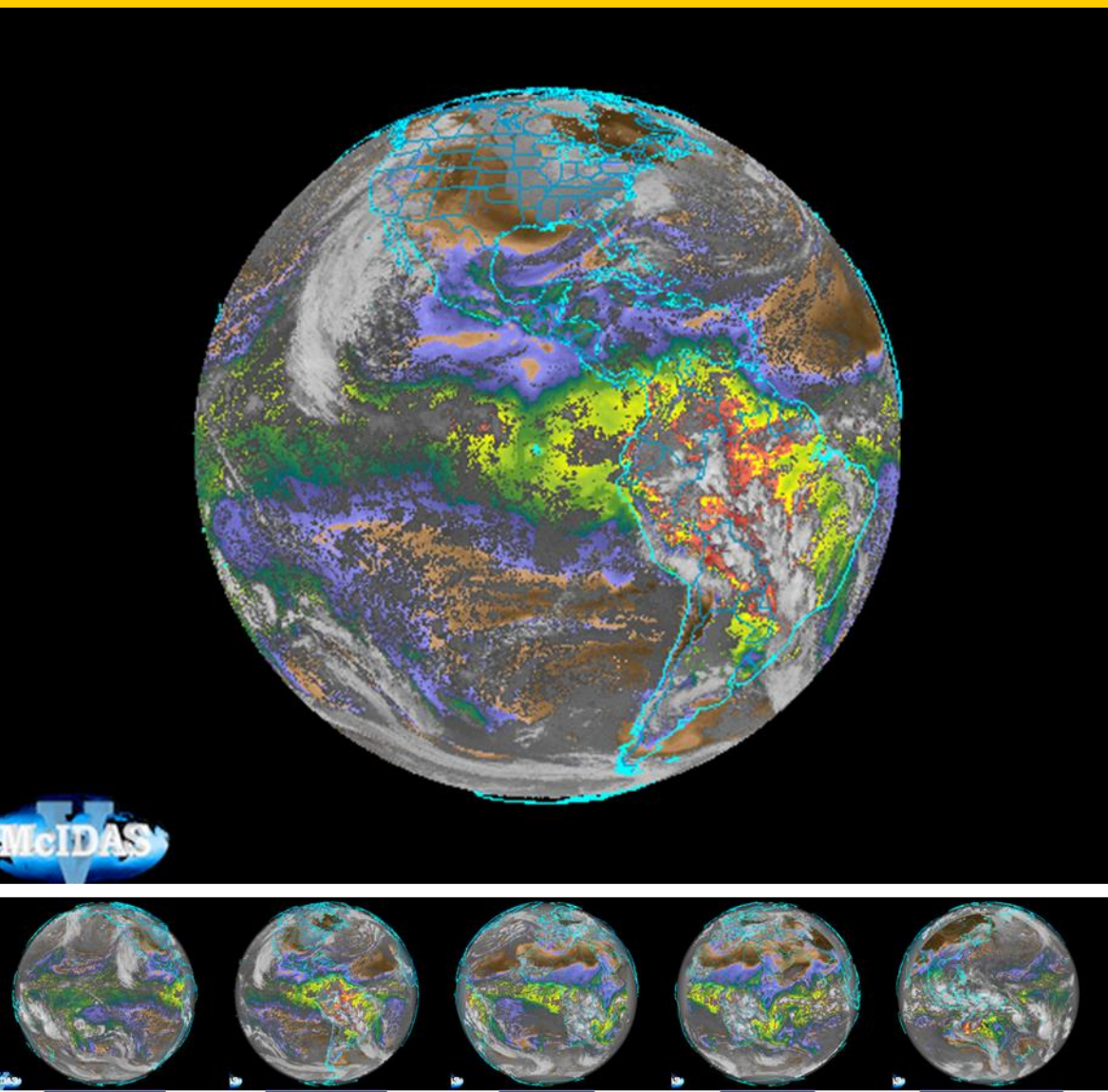
iSHAI on GEO ring. Version 2021 of NWC SAF GEO package will support also the execution with GOES-17. Thus, NWC SAF products could be generated from GEO imager satellites covering geostationary ring.

GOES-17   GOES-16   MSG-4   MSG-1   Himawari-8

First FCI synthetic image with Harmone 2021-04-25 12Z
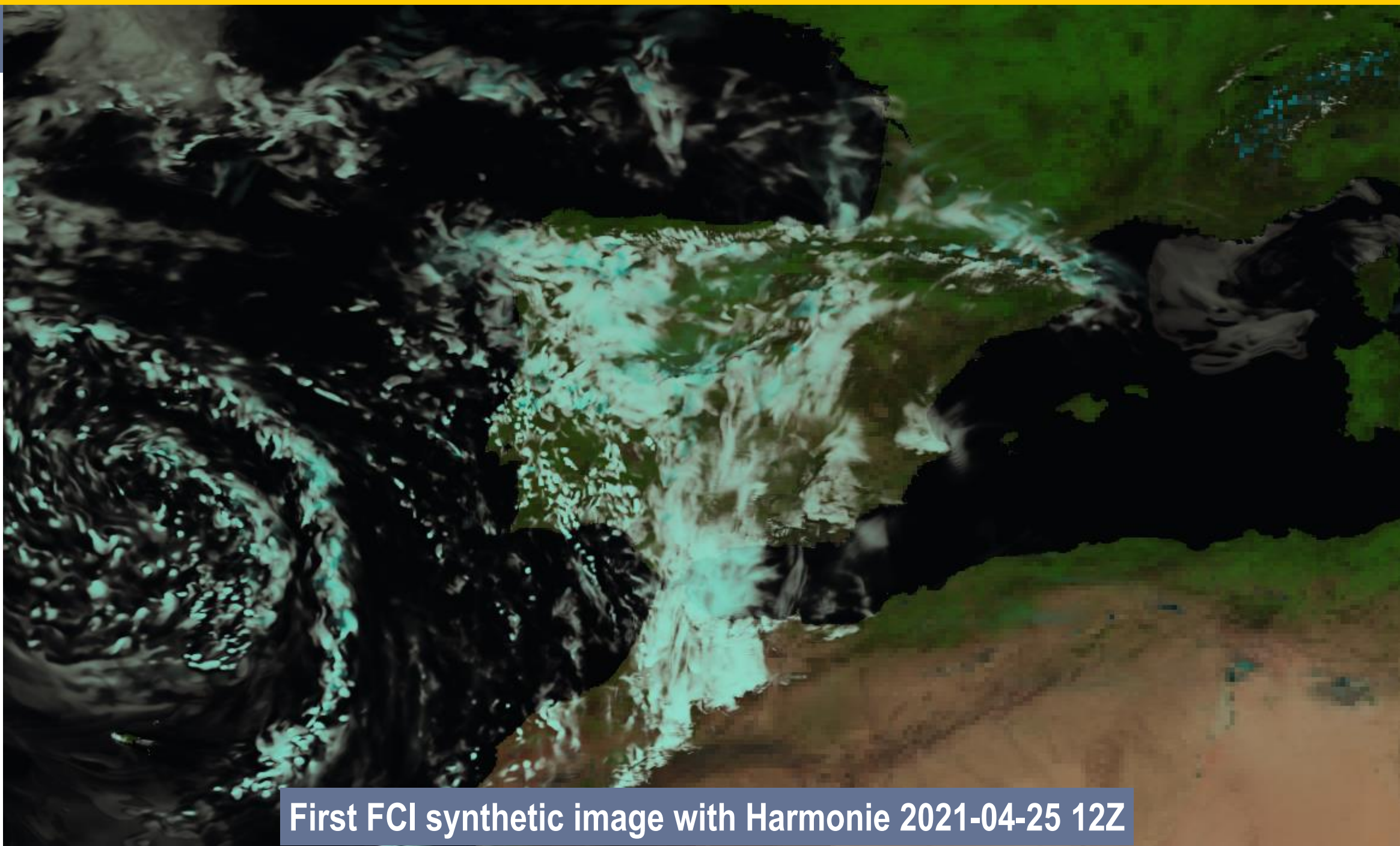
Need of improvement of synthetic data generation. To get better spatial and temporal resolutions, it has been initiated the adaption of PGE00 to use combination of Harmonie model with ECMWF (ozone profiles and levels above 10 hPa).

References

In the NWC SAF web, there is an iSHAI dedicated web information page with all the documentation (ATBD, User Manual and Validation Reports).

It is also included a web page with iSHAI and PGE00 developments for MTG. *The loops corresponding to the cases studies included in this poster are available as AVI files.*

There is also an iSHAI Reference web page where publications and latest presentations on pptx format are available with the cases studies shown in this poster.