GeoSphere
Austria

NWC/GEO products ASII-NG ICE and EXIM

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Remote Sensing and Nowcasting

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ASII-NG ICE

- **supercooled water droplets**

- **high altitude ice crystals**

- algorithm

- MTG / Outlook

Extrapolated Imagery (EXIM)

- algorithm

- Portfolio

- MTG / Outlook

Three of the **products** developed at GeoSphere Austria as part of the NWCSAF **concern aviation safety**.

- ASII-NG GW (gravity waves)   – potential cause for **turbulence**
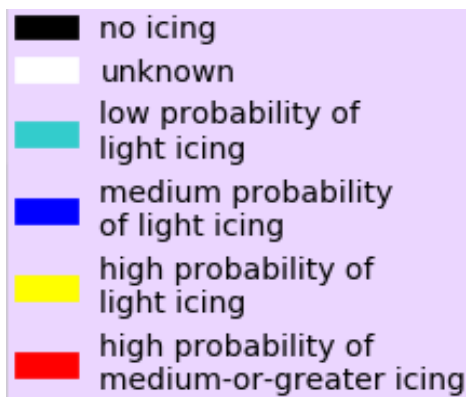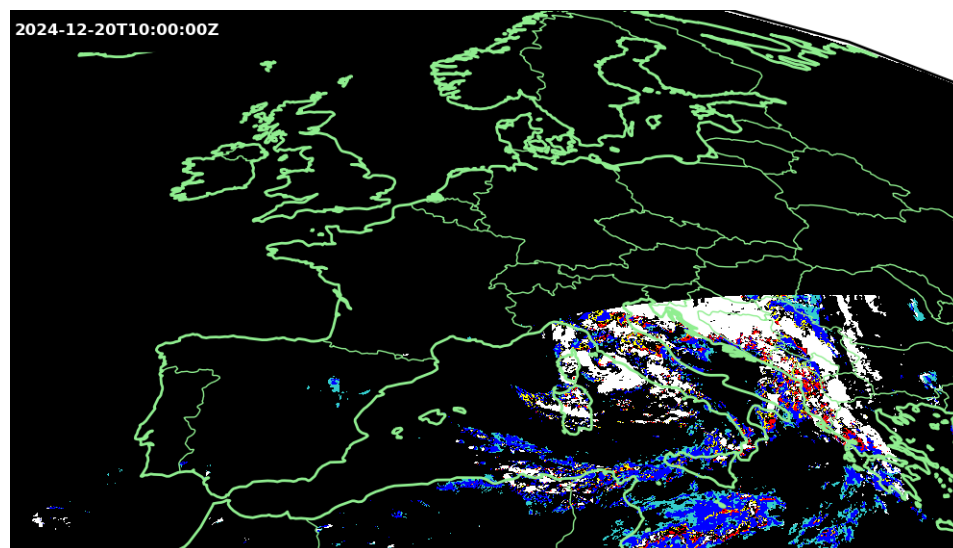
  → talk of Andreas Wirth

- ASII-NG TF (tropopause folding) – potential cause for **turbulence**
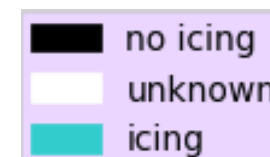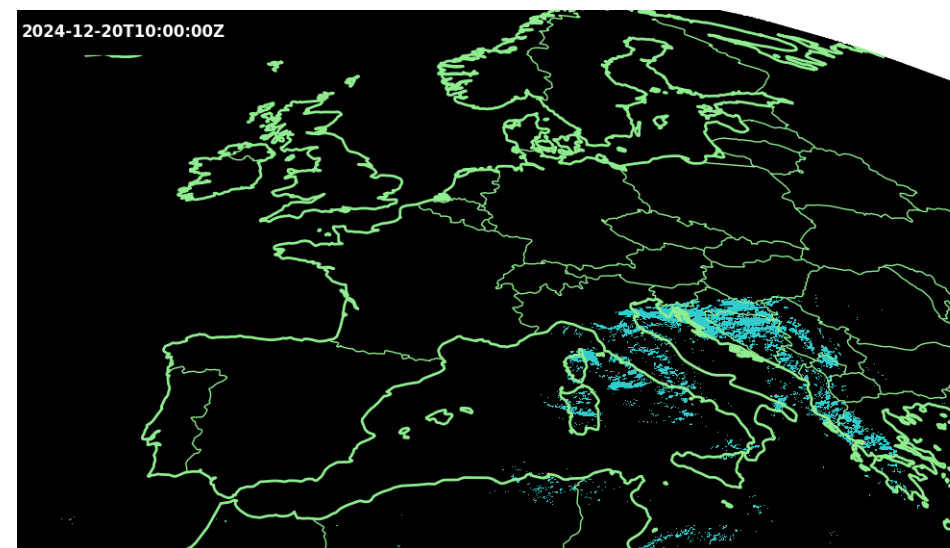
  → talk of Andreas Wirth

- **ASII-NG ICE**   – identify areas of high **icing risk**

  - supercooled water droplets
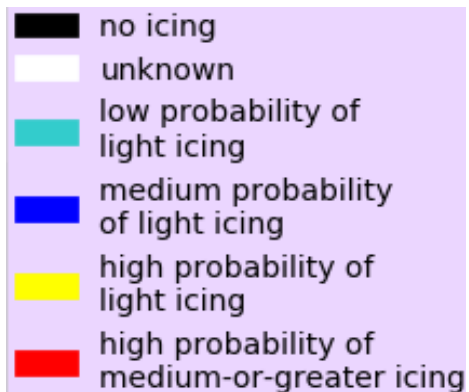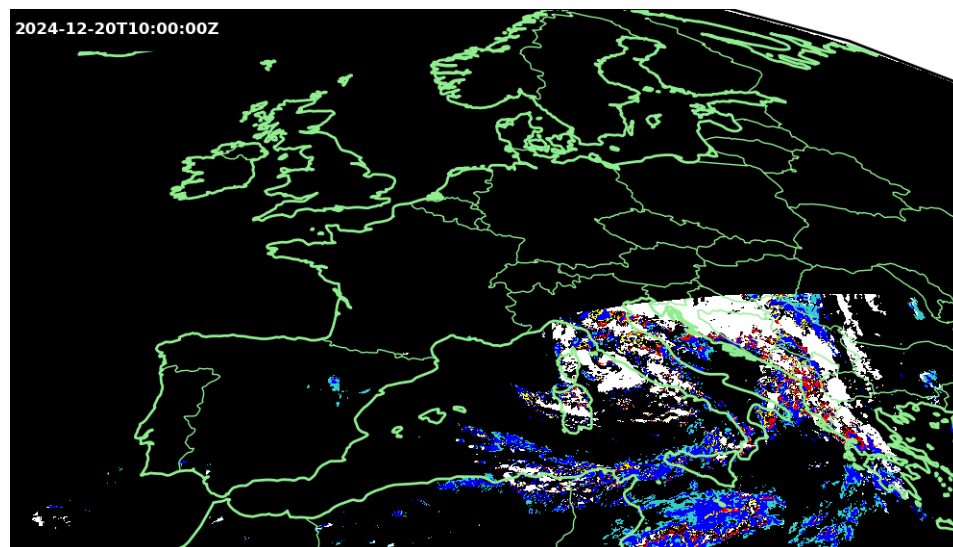
  - high altitude ice crystals
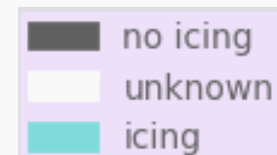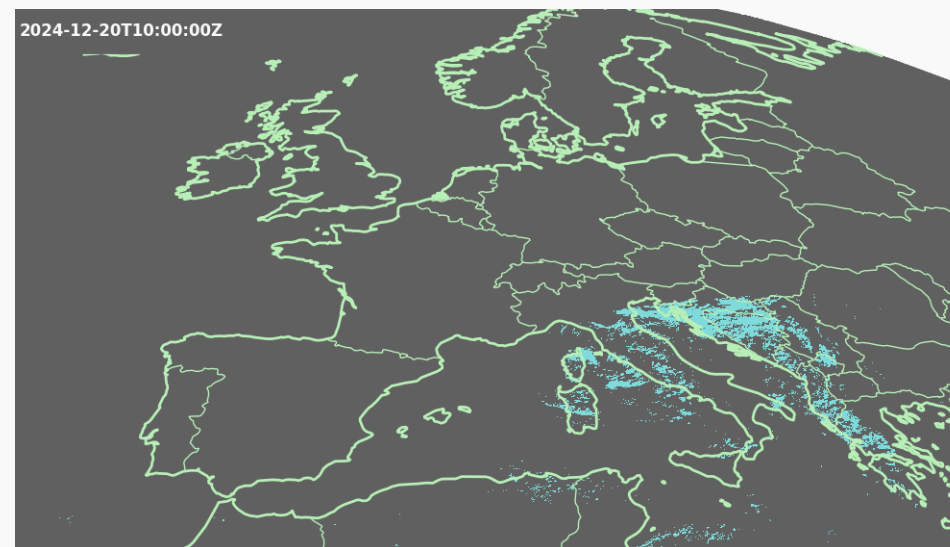
supercooled water droplets

high altitude ice crystals

supercooled water droplets

high altitude ice crystals

ASII-ICE uses **input** from other NWCSAF products:

- **Cloud microphysics**

  cloud phase   (**cmic phase**)   icing Y/N

  cloud optical thickness   (**cmic cot**)   icing Y/N

  Liquid water path   (**LWP**)   fraction of cloud above freezing level

- **Cloud top temperature and height**

  temperature   (**CTTH temp**)   icing Y/N

  height   (**CTTH height**)   fraction of cloud above freezing level

- Cloud top particle **effective radius**   (**Reff**)   icing probability (IP)

CTTH temp

cmic phase

cmic cot

>= 272 K → ⬛ no icing

< 272 K

ice

undefined

liquid/ mixed

< 6 → ⬛ no icing

> 6 → ⬜ unknown

<= 1 → ⬛ no icing

Post-Processing

Freezing level (**CTTH height & LWP**) → Cloud geometrical thickness → **Reff** to calculated IR

IP < 0.4

IP < 0.7

IP> 0.7

LWP < 0.397

LWP > 0.397

low probability of light icing

medium probability of light icing

high probability of light icing

high probability of medium-or-greater icing

ASII-NG ICE – supercooled water droplets – MTG/MSG

MSG-4

MTG-FCI

Legend:
- no icing (black)
- unknown (white)
- low probability of light icing (teal)
- medium probability of light icing (blue)
- high probability of light icing (yellow)
- high probability of medium-or-greater icing (red)

2024-12-20T10:00:00Z

20 December 2024 10:00 UTC
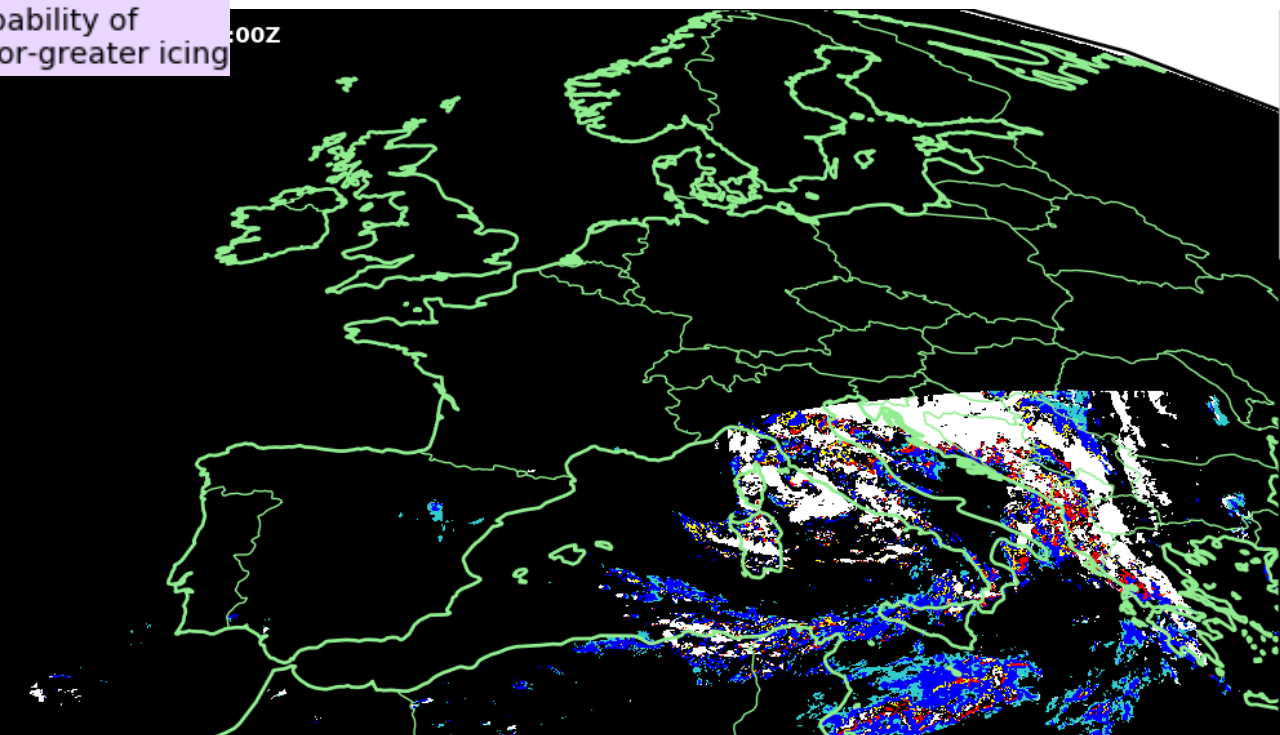
20 December 2024 10:00 UTC

supercooled water droplets
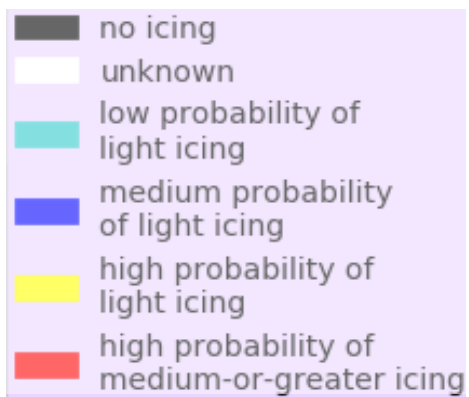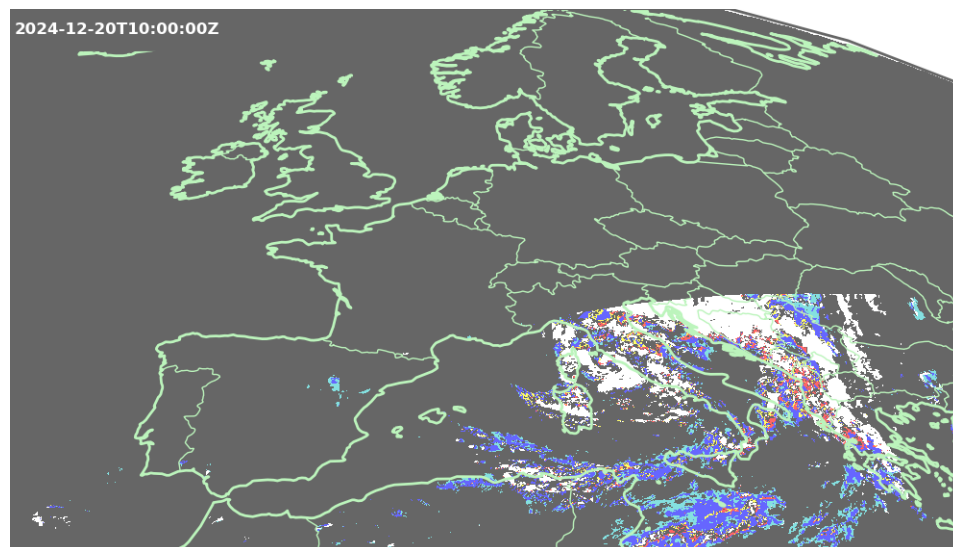
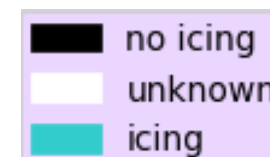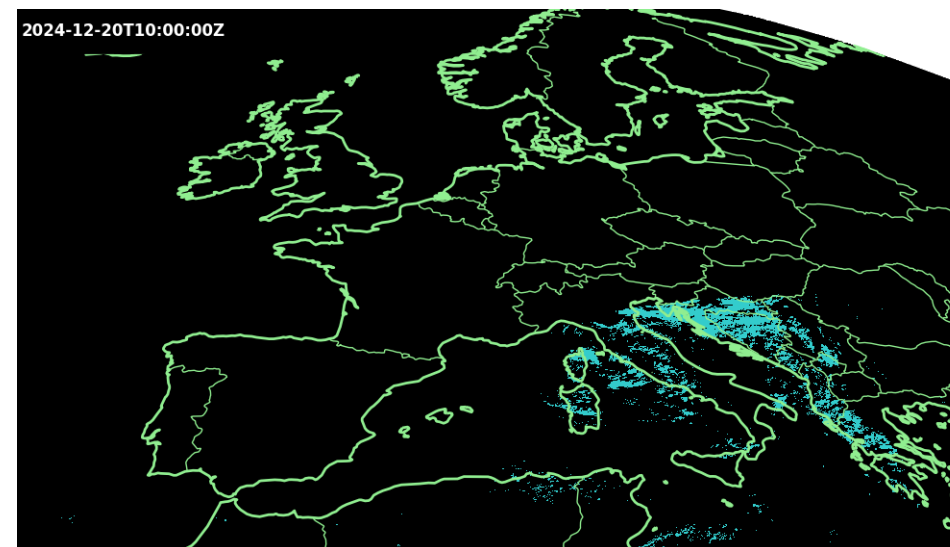high altitude ice crystals

ASII-ICE uses **input** from other NWCSAF products:

- Cloud microphysics   cloud phase   (**cmic phase**)

                            cloud optical thickness   (**cmic cot**)

                            Liquid water path   (**LWP**)

                            Ice water path   (**IWP**)

- Cloud top temperature and height

                            temperature   (**CTTH temp**)

ASII-NG ICE – high altitude ice crystals – flowchart

ASII-NG ICE – high altitude ice crystals
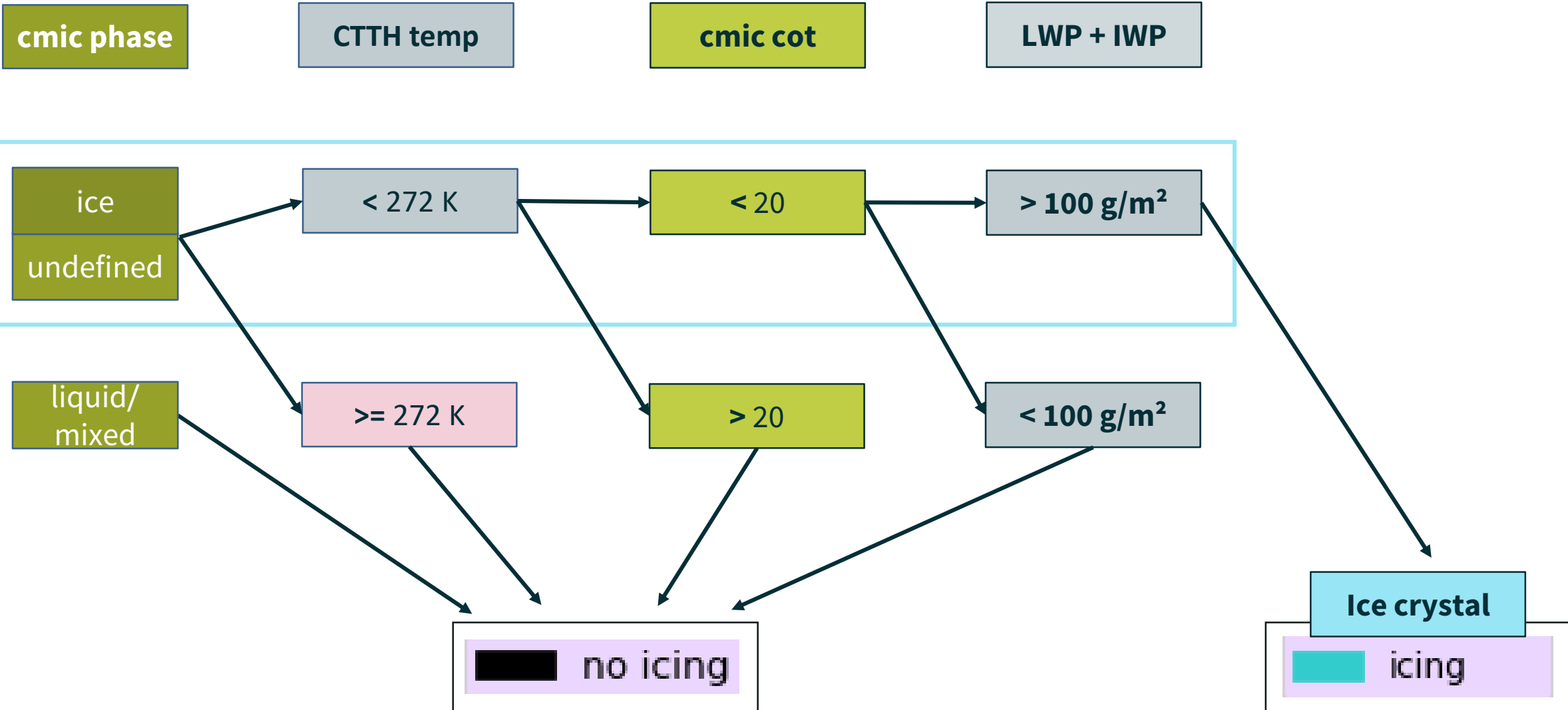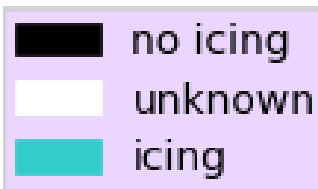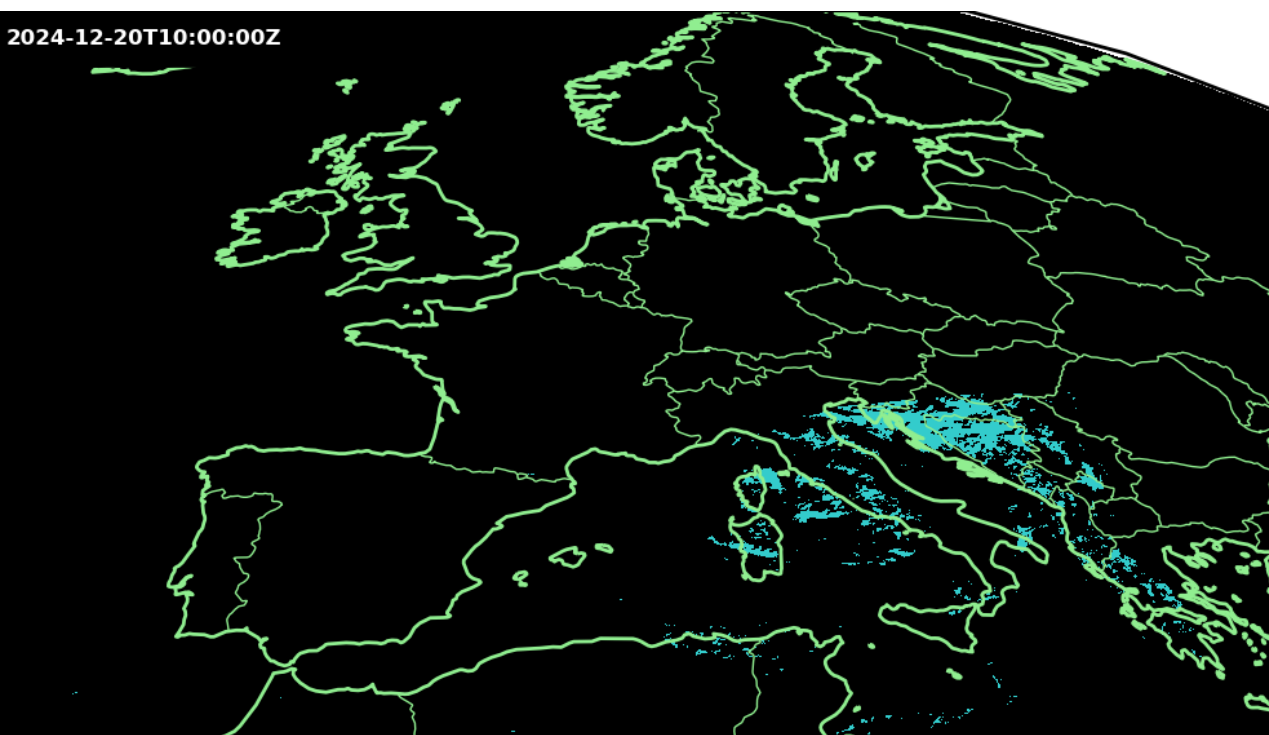
20 December 2024 10:00 UTC
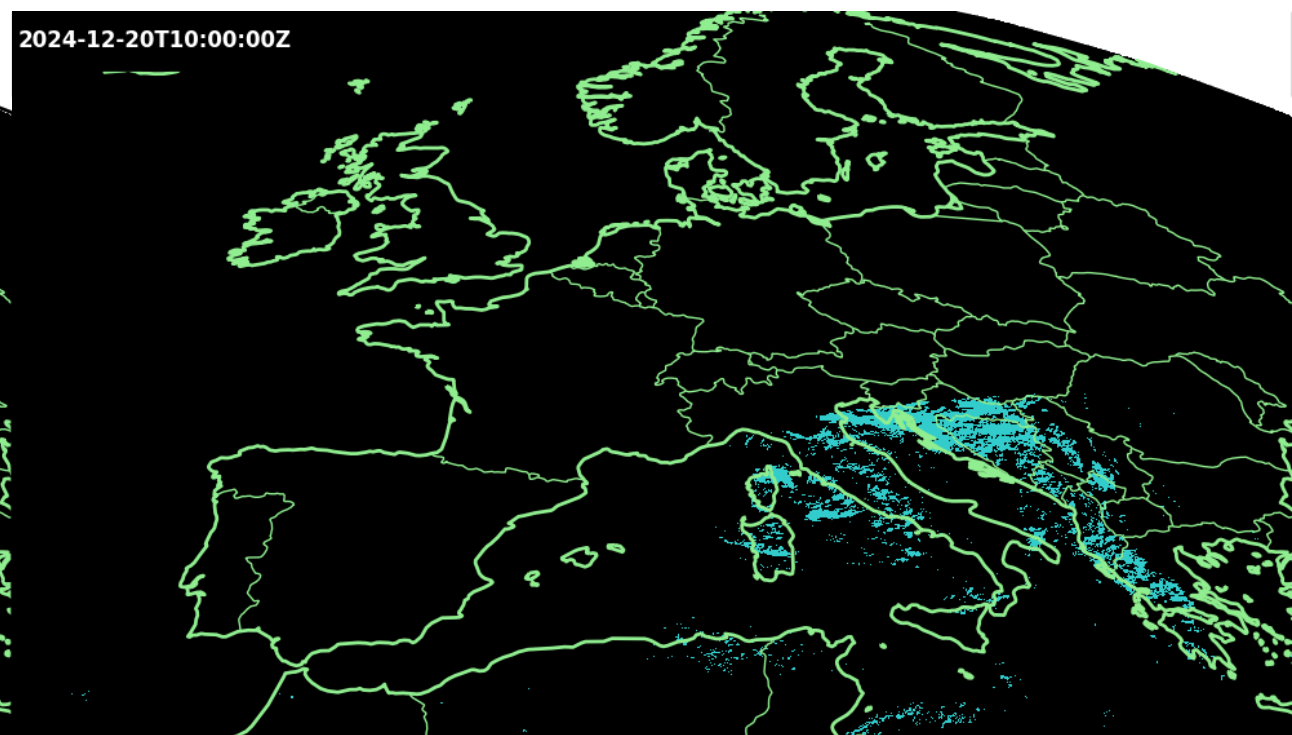
20 December 2024 10:00 UTC

With <u>new software releases </u>the following feature will come:

- ASII-NG ICE for **MTG** (next)

- **Night-time analysis** (later)

With a new satellite, the following features might be of advantage for ASII-NG ICE:

- MTG-I:

  - New **channel sensitive to particle size**: 2.25 µm

  - Greater spatial **resolution**

- MTG-S

  - Humidity and temperature profiles for a better location of supercooled water droplets

<u>Future plans</u>:

  - Going from fixed thresholds to machine learning algorithm

ASII-NG ICE

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Extrapolated Imagery (EXIM)

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- Portfolio

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EXIM (Extrapolated Imagery) **actually provides forecasts in the nowcasting time** range (for **up to 1 hour** the quality is guaranteed).
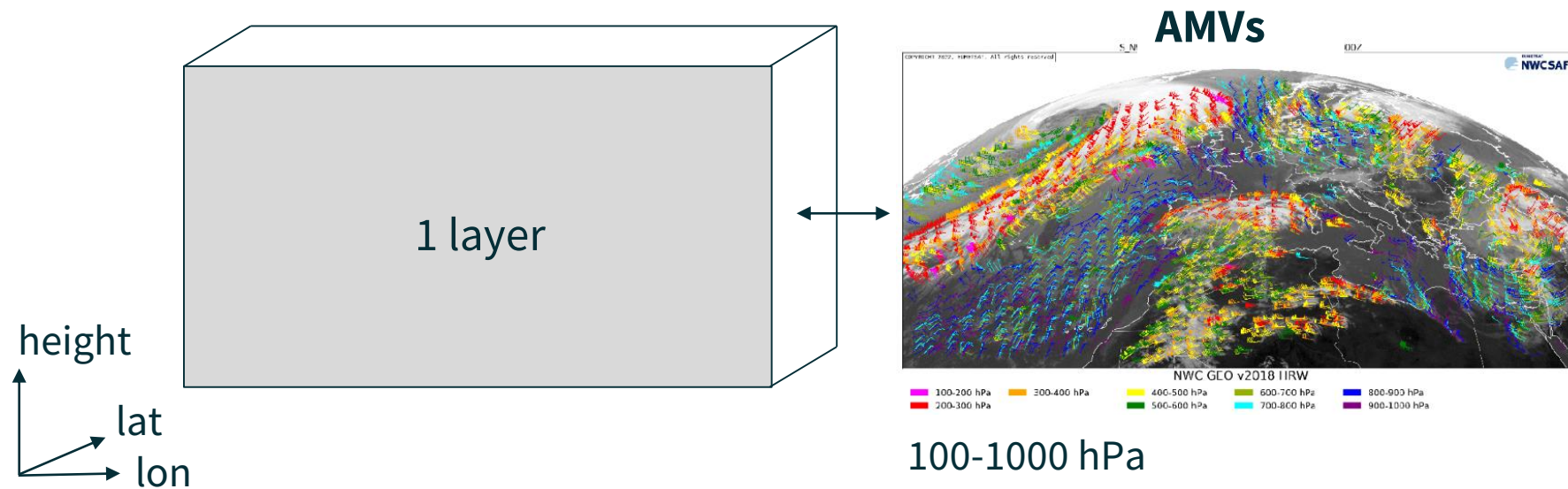
EXIM kinematically **extrapolates** the other **NWC SAF products** as well as **satellite images**.

The extrapolation is done pixel-wise, applying a displacement field based on atmospheric motion vectors (**AMVs**) **provided by** the NWC SAF high resolution winds (**HrW**) **product**.
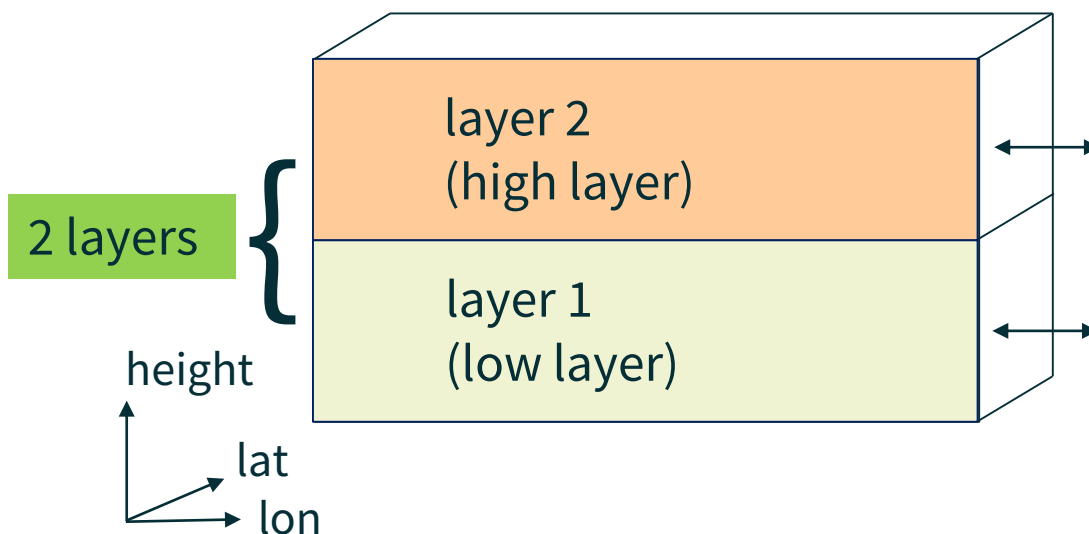
1. **Interpolate** HrW down to pixel level.

2. **Apply** vector field on every pixel.

3. **Move** pixel according to the trajectory of the current position of each time step.

4. (Optional) **Fill gaps** through nearest – neighbour or average interpolation.

5. **Post-processing** (e.g. apply land-sea mask).

- Products / channels (**Portfolio**).

- (up to two) layers – from which pixels are extrapolated with AMVs stemming from the same level (**layer scheme**).

- How to handle cloud-free areas (fill with best estimate or cloudy areas only)

- Domain of interest.

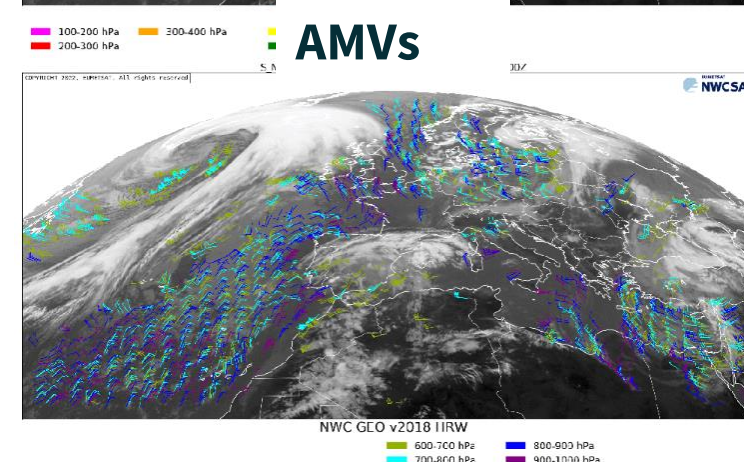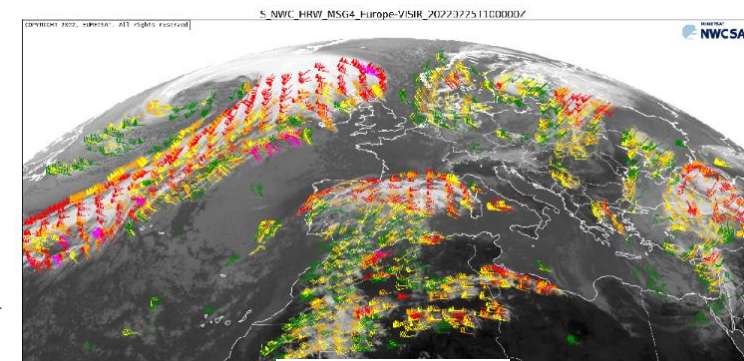- Setting of the preferred HrW layers

MSG channels	VIS 0.6 µm, VIS 0.8 µm	
	HRVIS (to come)	
	IR 3.8 µm	
	WV 6.2 µm, WV 7.3 µm	
	IR 8.7 µm, IR 9.7 µm, IR 10.8 µm, IR 13.4 µm	
MTG	As soon as the software is officially released.	
HIMAWARI/ GOES	Channels corresponding to MSG list – just not scientifically validated.	
NWC SAF products	clouds	CMA (clouds mask)
		CT (cloud type)
		CTTH (cloud top temperature pressure, height, effective cloudiness)
		CMIC (cloud phase, **cloud optical thickness (cot)**)
	precipitation	PC (probability of precipitation)
		PCPh (probability of precipitation from cloud physical properties)
		CRRPh (convective rainfall rate from cloud physical properties)

AMVs

1 layer

height

lat

lon

100-1000 hPa

User can pick their preferred layer scheme, depending on their needs. Default is 1 layer.

2 layers

layer 2 (high layer)

layer 1 (low layer)
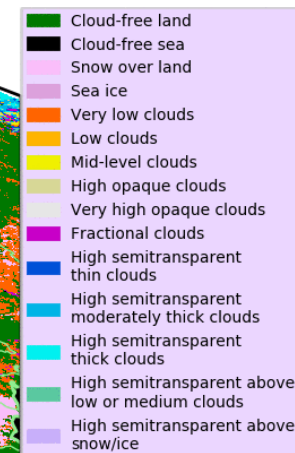
height

lat

lon

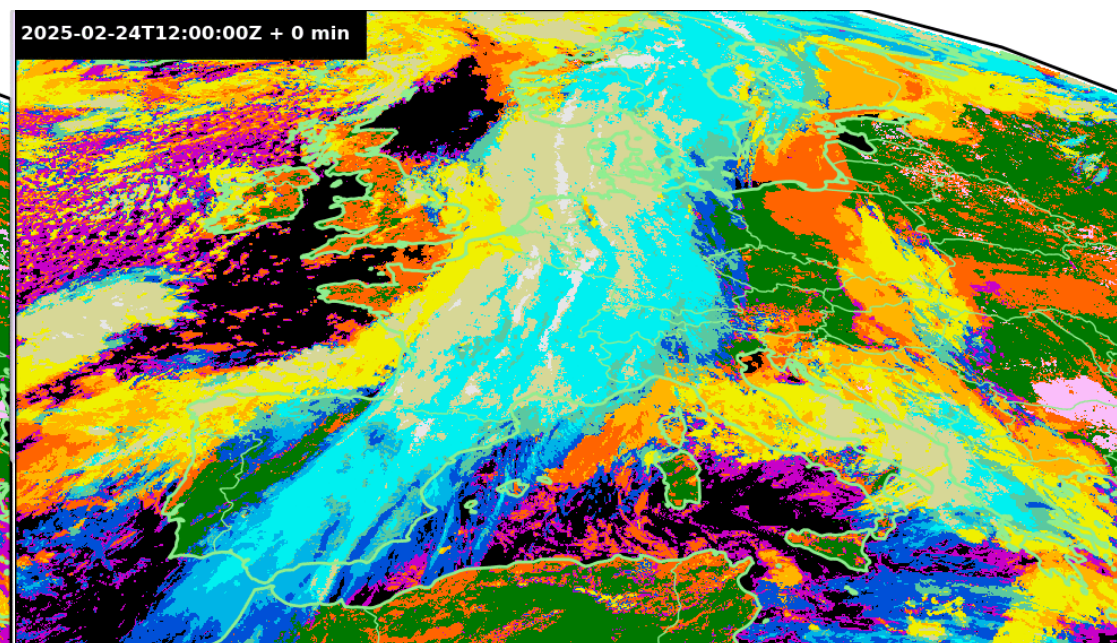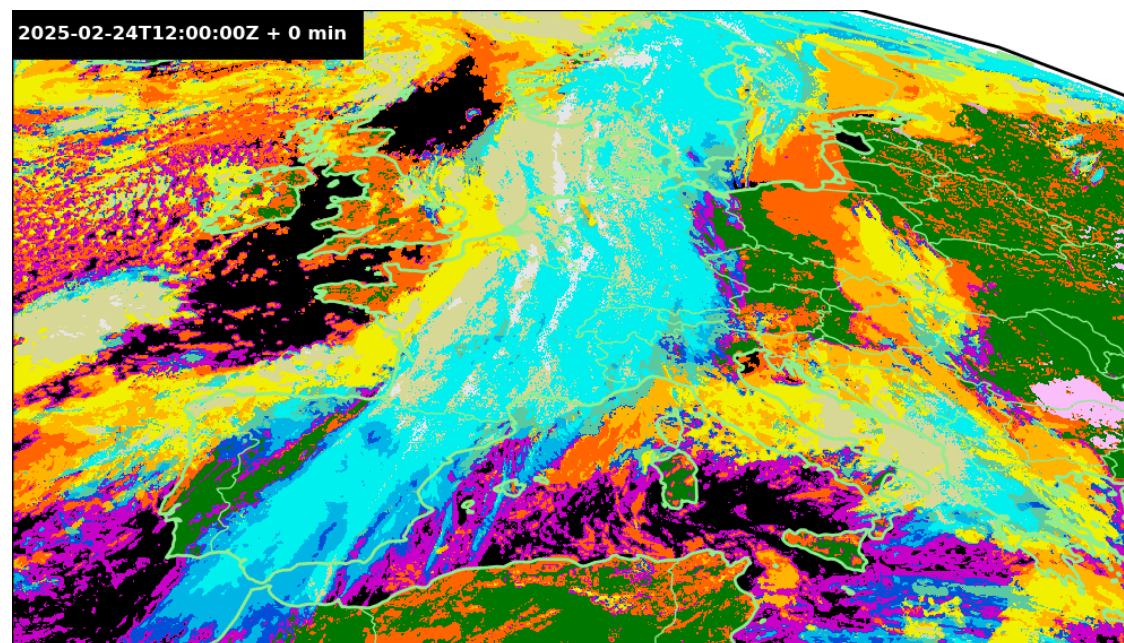100-600 hPa

AMVs

600-1000 hPa

validation report: GEO-EXIM-v2.0.1

MSG-4

MTG-FCI

17 February 2025 10:00 UTC

17 February 2025 10:00 UTC

With a <u>new software release </u>the following feature will come:

- **MTG** processing

- **New sub-product**: cmic cot

Features to expect with the <u>next software release</u>:

- **Faster** processing

- **VIS "corrected"** for sun zenith angle

- **Flexible leadtimes**

- **New sub-product:** HRVIS (MSG)

<u>Under investigation</u>:

- Different **extrapolation scheme** for best possible results

  (e.g. forward/backward scheme)

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Thank you for your attention!

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