Australian VLab Centre of Excellence
Science Week 2015

Australian Government
Bureau of Meteorology

## Using RGB and Derived Products: Practical Session

(Facilitator: Bodo Zeschke, BMTC)
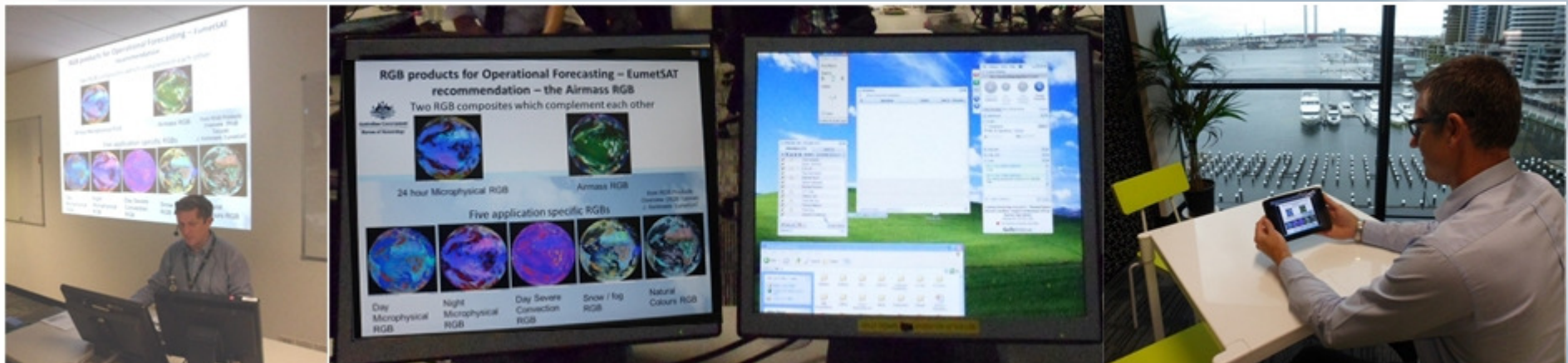
Content

- Brief introduction into RGB and Derived Products

- Derived Products to be used with Himawari-8 data in the Bureau

- Getting our hands dirty - comparing RGB and Derived Products on the EUMETSAT ePort web page.

- The advantage of RGB products over single channel products

- Comparing RGB products with Derived Products – advantages and disadvantages.

- Gaining a better understanding of RGB products by overlaying appropriate NWP parameters (NWP fields).

images courtesy JMA / Eumetsat

Reminder: RGB products (the 24hour Microphysics -Dust RGB)

Himawari-8 channels
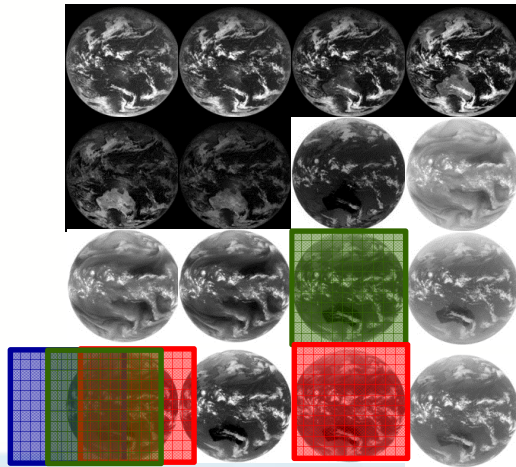
Recommended Range and Enhancement:

Beam	Channel	Range	Gamma	Gamma2
Red	IR12.0 – IR10.8	-4 … +2	1.0	1.0
Green	IR10.8 – IR8.7	0 … +15	2.5	1.0
Blue	IR10.8	+261 … +289	1.0	1.0

Channel combination "recipe" (from EUMETSAT)

Dust RGB : Interpretation of Colours

Cold, thick, high-level clouds	Thin Cirrus clouds Contrails

Thick, mid-level cloud	Thin, mid-level cloud

Low-level cloud (cold atmosphere, Europe)	Low-level cloud (warm atmosphere, Africa)	Dust Storm

Ocean	Warm Desert	Cold Desert	Warm Land	Cold Land

Colour interpretation palette
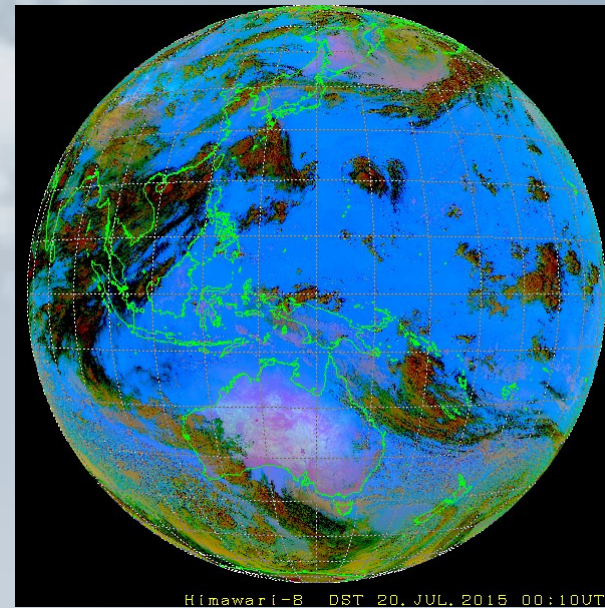
Himawari-8   DST 20. JUL. 2015 00:10UTC

Dust RGB product

Derived Products – the blending of satellite data with NWP
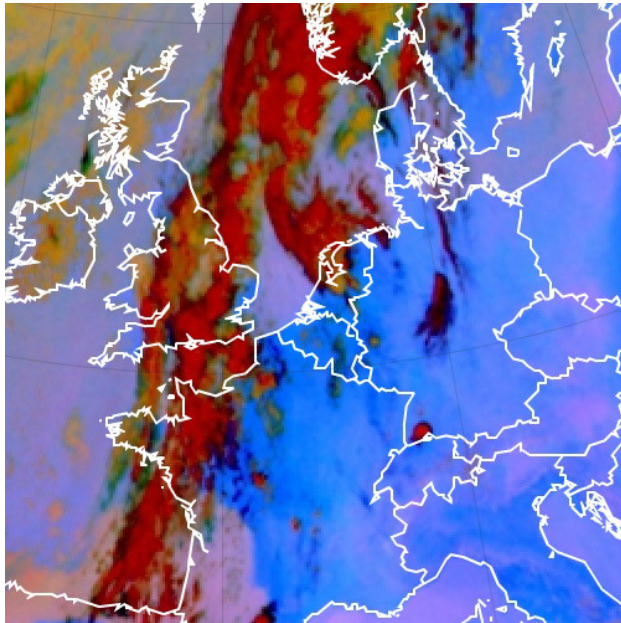
24-hour Microphysics RGB

RGB Image
Real
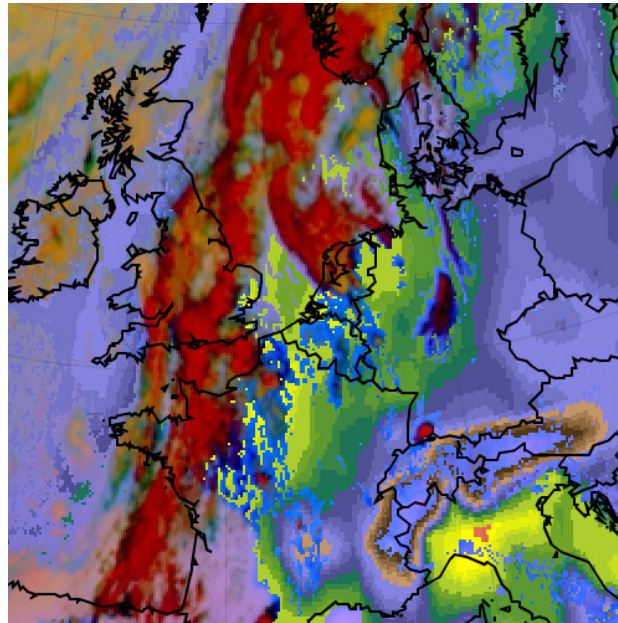
Derived Product (TPW)
"Semi" Real

NWP (TPW)
Not Real

from "RGB Products versus Derived Products" Dr. Jochen Kerkmann, presented at WMO EUMETSAT RGB Satellite Products Workshop 2012
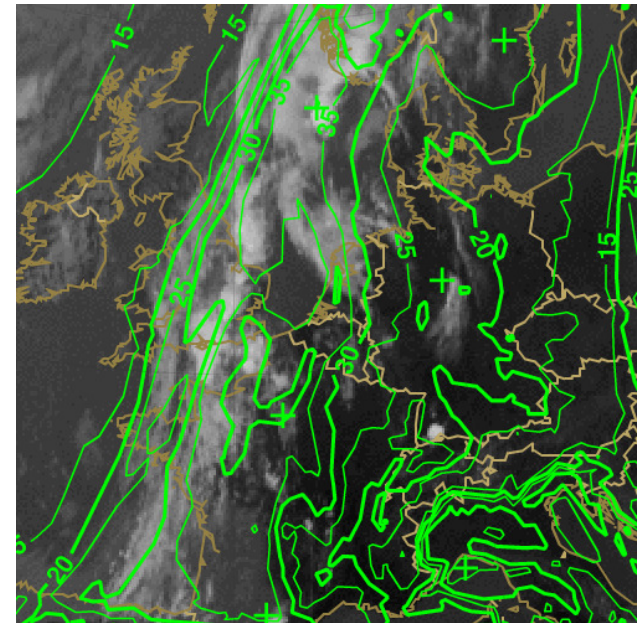
Bureau use of Derived Products (Phase 2)
(from the Himawari 8 and 9 Project HIM89 Project Definition)

PHASE 2A	FOG MASK SUITE [NOAA]	VOLCANIC ASH RETRIEVAL SUITE [NOAA]	CLOUD PROPERTIES [NOAA]
	FOG PROBABILITY SUITE (BY LAYER) [NOAA]	VOLCANIC ASH PROBABILITY SUITE [NOAA]	CLOUD MICROPHYSICAL PROPERTIES SUITE [NOAA]
	ATMOSPHERIC MOTION VECTORS SUITE	SOLAR RADIATION SUITE	SEA SURFACE TEMPERATURE SUITE
PHASE 2B	AIRCRAFT ICING POTENTIAL	VOLCANIC ASH OBJECT INFORMATION SUITE [NOAA]	SEA SURFACE TEMPERATURE SUITE

Reminder: National Himawari-8 Training Campaign

http://www.virtuallab.bom.gov.au/training/hw-8-training/

Reminder: National Himawari-8

http://www.virtuallab.bom.gov.au/tra...

National Himawari-8 Training Campaign Phase 2

Red-Green-Blue (RGB) Product reference information.

In response to the stakeholder feedback during Phase 1 of the Campaign, below are easy-to-use resources pertaining to the RGB products. These .pdf files include:

- How the RGB products are constructed
- Uses and limitations of the products.
- EUMETSAT ePort exercises for you to try in order to gain familiarisation with the products.

Dust RGB	Ash RGB	Airmass RGB	Day Microphysics RGB
Additional RGB (to be added)	Night Microphysics RGB	Day Convec... RGB	

- **RGB product reference .pdf files for easy Forecaster reference.**
- **Most include EUMETSAT ePort exercise.**

National Himawari-8 Training Campaign Resources

EUMETSAT ePort exercises

Activity: Exploring EUMETRAIN ePort – may work best in **FireFox** http://eumetrain.org/eport.html
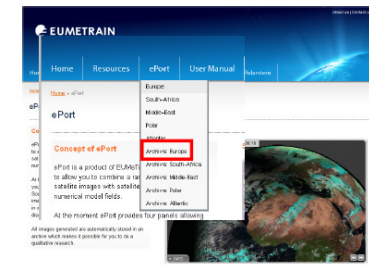
image courtesy EUMETSAT

Case Study 1: Airmass RGB Product, Europe

Activity: Exploring EUMETRAIN ePort

Activity: Exploring EUMETRAIN ePort

image courtesy EUMETSAT

Activity: Comparing single channel images with RGB product
Question: annotate the areas where the RGB product is giving more information

Compare the RGB product with single channel IR and VIS and 6.2 micron water vapour images

- First make all of the highlighted options active
- Then turn the Day Microphys. RGB option on and off

The Airmass RGB vs 6.2 micron water vapour channel

6.2 micron water vapour channel

Thick, high-level clouds	Thick, mid-level clouds	Thick, low-level clouds (warm airmass)	Thick, low-level clouds (cold airmass)

Jet (high PV)	Cold Airmass	Warm Airmass	Warm Airmass
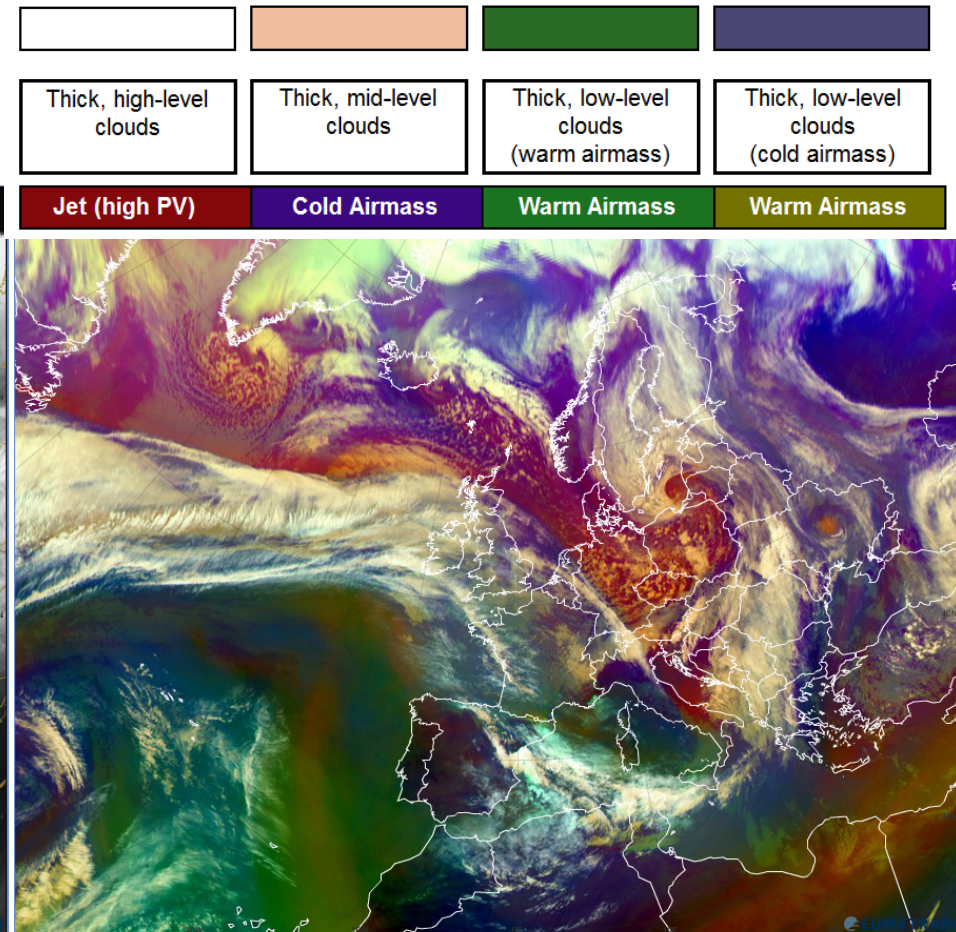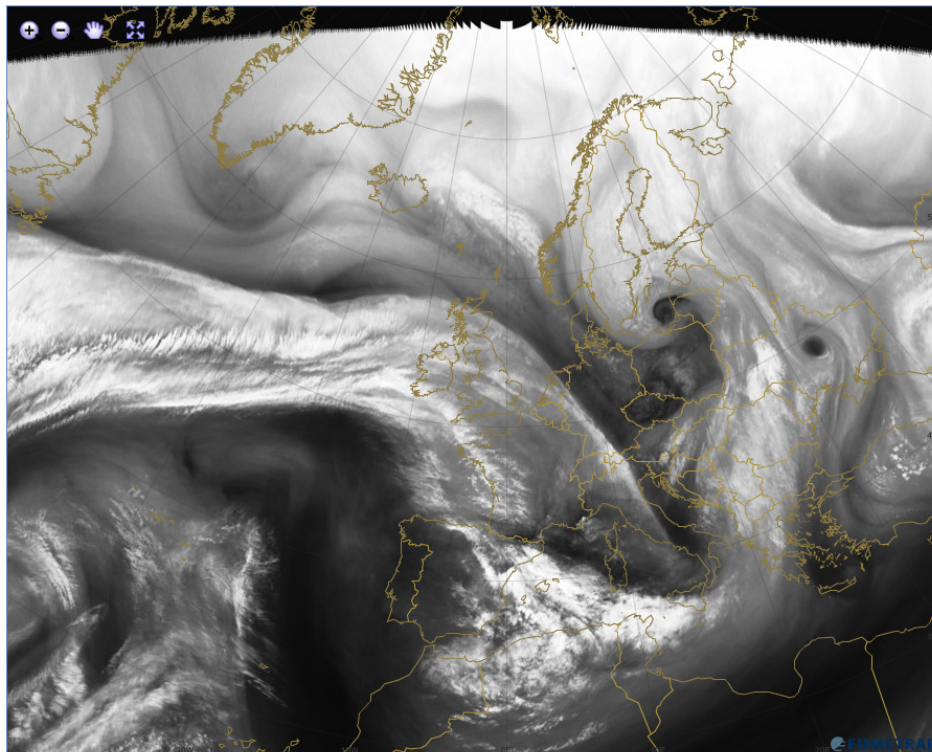
Question – what additional information does the Airmass RGB give you, compared to the 6.2 micron water vapour channel ?	**Your answer:**
Question – what additional detail is the water vapour channel giving you ?.	**Your answer:**

images from EUMETSAT

The Airmass RGB vs 0.6 micron visible channel

0.6 micron visible channel

Thick, high-level clouds	Thick, mid-level clouds	Thick, low-level clouds (warm airmass)	Thick, low-level clouds (cold airmass)

Jet (high PV)	Cold Airmass	Warm Airmass	Warm Airmass
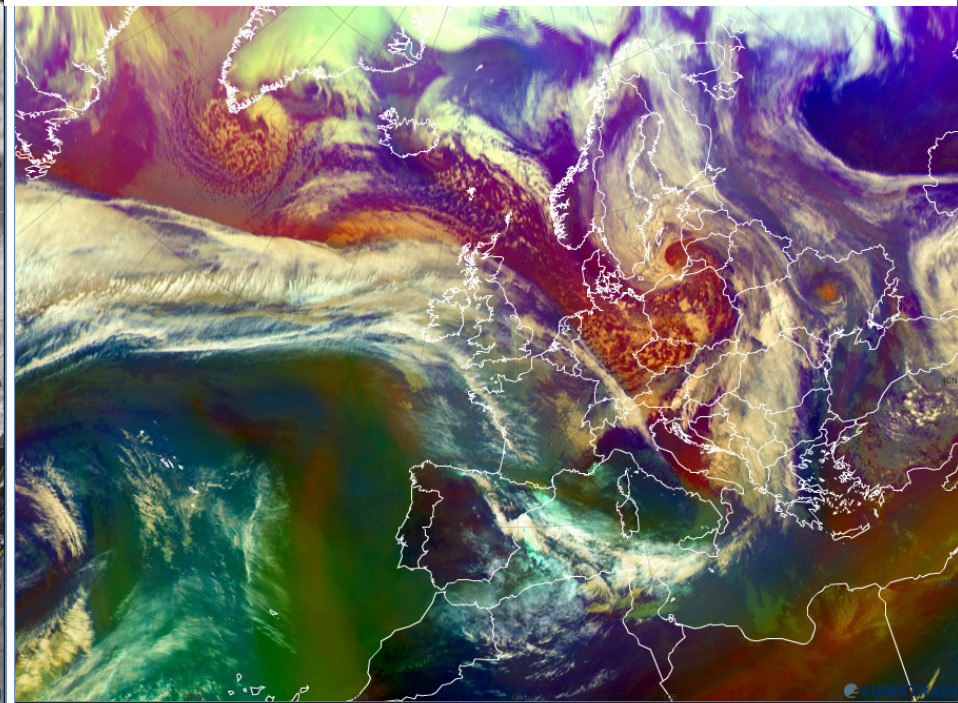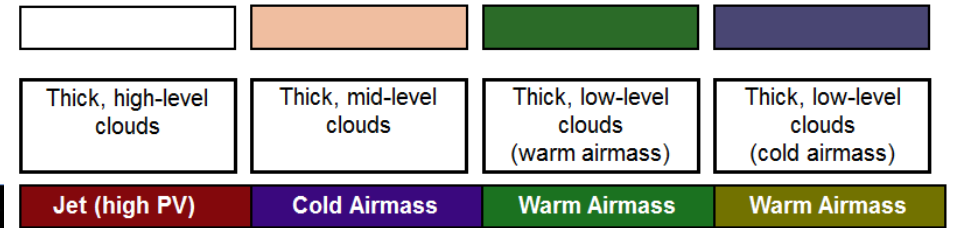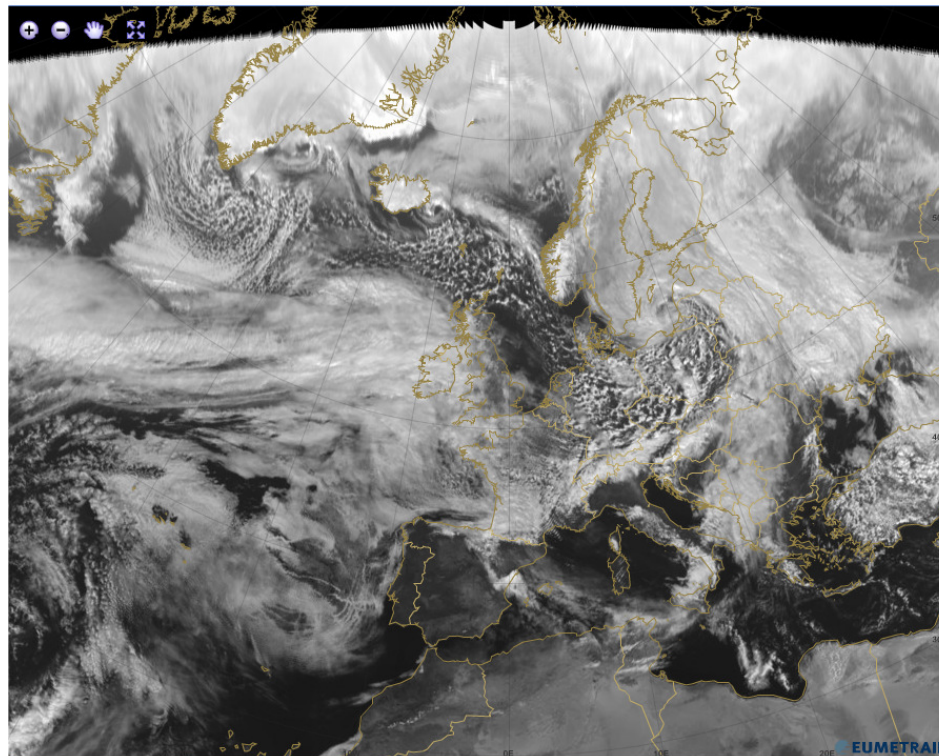
Question – what additional information does the Airmass RGB give you, compared to the 0.6 micron visible channel ?

Your answer:

Question – what additional detail is the visible channel giving you ?.

Your answer:

The Airmass RGB vs 10.8 micron infrared channel

10.8 micron infrared channel

Thick, high-level clouds	Thick, mid-level clouds	Thick, low-level clouds (warm airmass)	Thick, low-level clouds (cold airmass)

Jet (high PV)	Cold Airmass	Warm Airmass	Warm Airmass
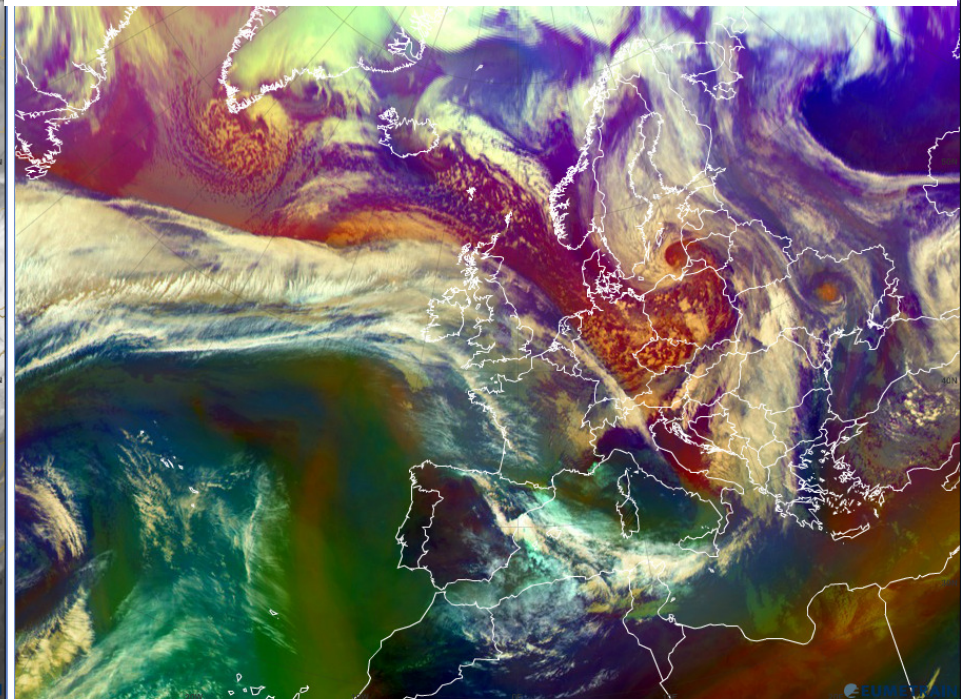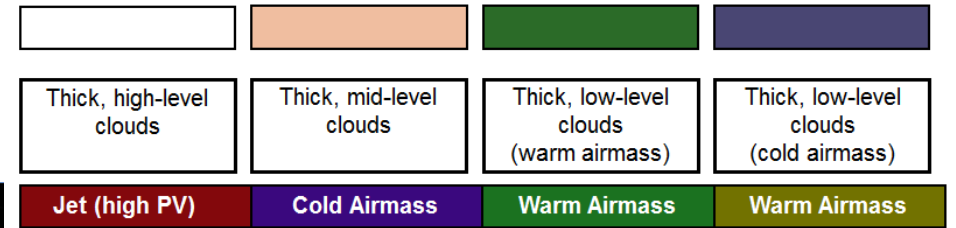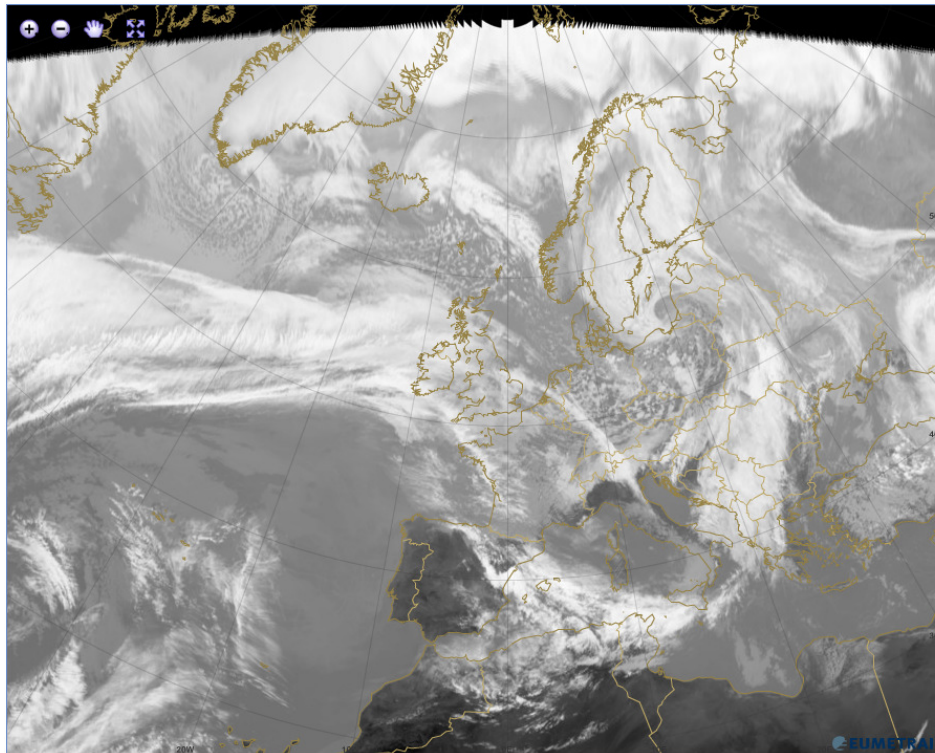
Question – what additional information does the Airmass RGB give you, compared to the 10.8 micron infrared channel ?	**Your answer:**
Question – what additional detail is the water vapour channel giving you ?.	**Your answer:**

image courtesy EUMETSAT

Activity: Derived Product – Cloud Type Product (NWC SAF)

(http://www.nwcsaf.org/HD/MainNS.jsp)

Cloud type classification algorithm

(from http://www.nwcsaf.org/HD/MainNS.jsp)

The CT classification algorithm is based on the following approach:
Main cloud types are separable within two sets: the fractional and high semitransparent clouds, from the low/medium/high clouds. These two systems are distinguished using spectral features : T10.8µm-T12.0µm, T3.9µm-T10.8µm (in night-time conditions only), R0.6µm (in day-time conditions only), and textural features (variance T10.8µm coupled to variance R0.6µm in daytime conditions) .
Within the first set, the fractional and high semitransparent are separated mainly using their T8.7µm-T10.8µm brightness temperature differences, but also their R0.6µm visible reflectance (in daytime conditions only).
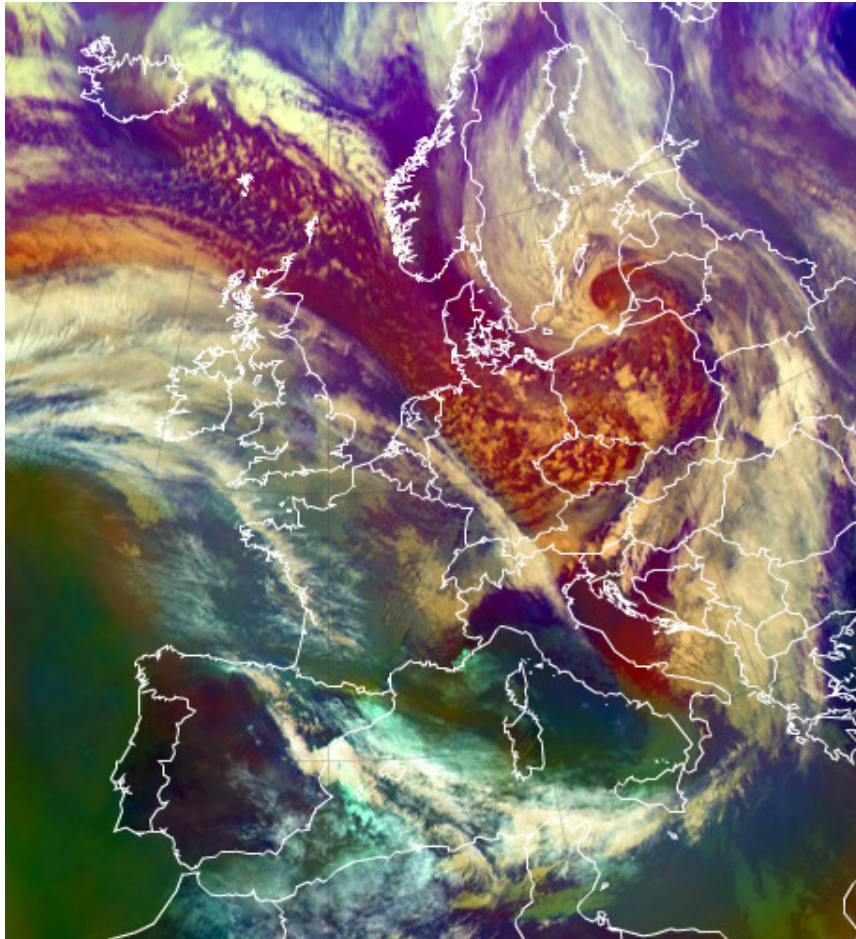The remaining categories are distinguished through the comparison of their T10.8µm to NWP forecast temperatures at several pressure levels. T7.3µm and T8.7µm are also used to refine the separation between low and medium clouds, especially useful in case of low level thermal inversion.
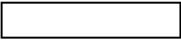No separation between cumuliform and stratiform clouds is performed in the current version of CT.
A separate processing is applied to compute a cloud phase flag, based on the use of CT cloud type, T8.7µm, T10.8µm (all illumination), R0.6µm and R1.6µm (at daytime only).
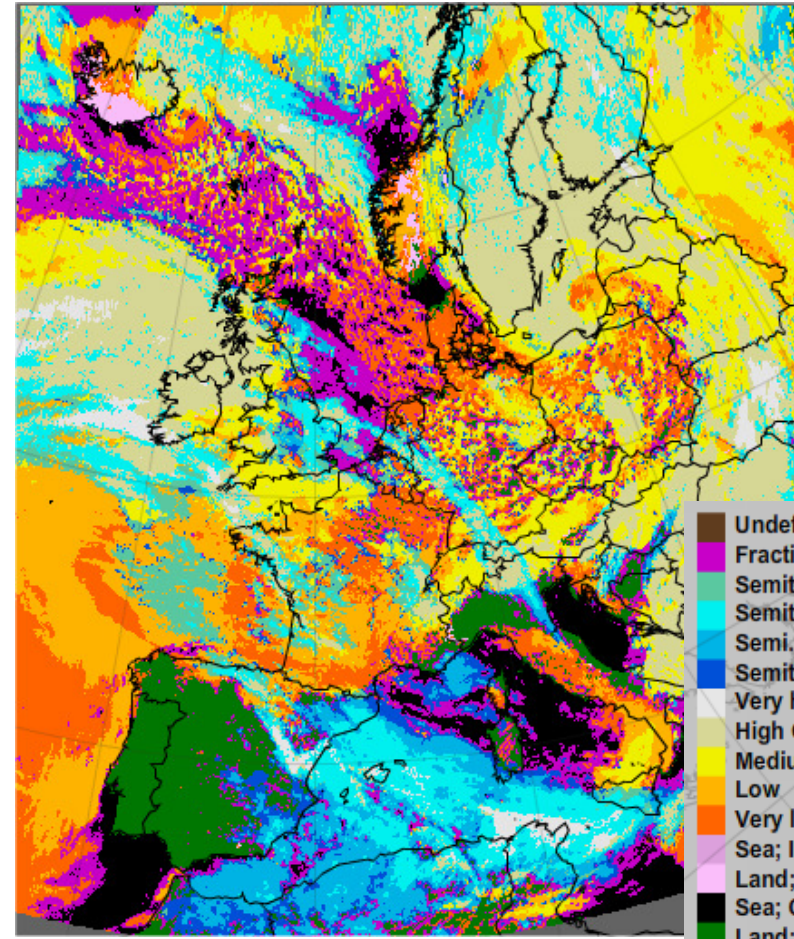
image courtesy EUMETSAT

Activity: Comparing the RGB with the Derived product

Airmass RGB product

Thick, high-level clouds	Thick, mid-level clouds	Thick, low-level clouds (warm airmass)	Thick, low-level clouds (cold airmass)
Jet (high PV)	**Cold Airmass**	**Warm Airmass**	**Warm Airmass**

Undefined
Fractional
Semitransp. above
Semitransp. thick
Semi. meanly thick
Semitransp. thin
Very high opaque
High Opaque
Medium
Low
Very low
Sea; Ice
Land; Snow
Sea; Cloud Free
Land; Cloud Free
Non-processed

CT Derived Product

Question: Give one advantage of the RGB product. Give one advantage of the Derived Product.

Question – Advantages and disadvantages of Derived Products over RGB products

Advantages of Derived Products over RGB products	Disadvantages of Derived Products over RGB products

Answers – Advantages and disadvantages of Derived Products over RGB products

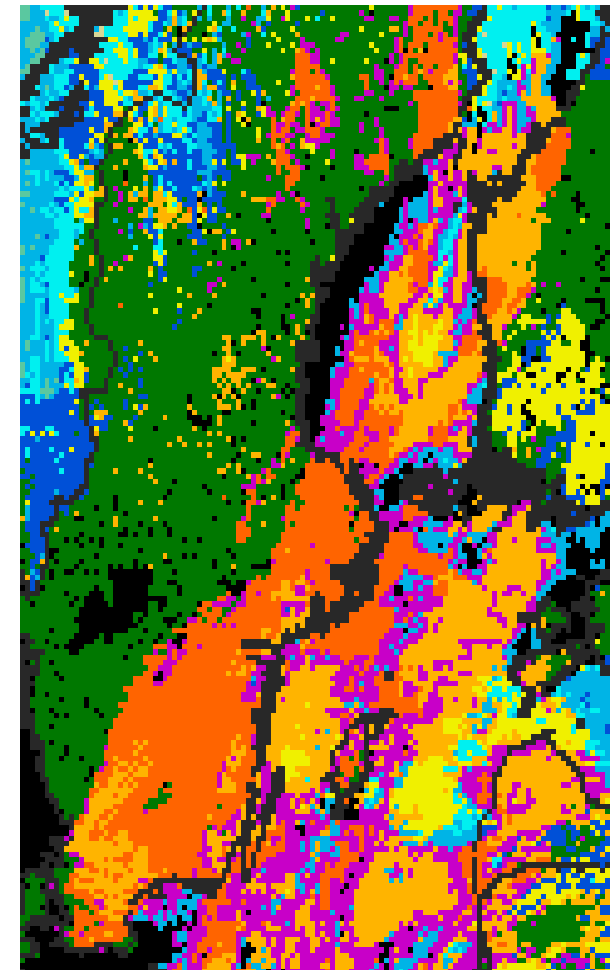| Advantages of Derived Products over RGB products	Disadvantages of Derived Products over RGB products
1 – this data can be calibrated to assist people with colour blindness	1 – loss of texture of the cloud
2 – less subjective	2 – takes time to compute this – generated later
3 – better for climatology studies	3 – dependent on NWP and other ancillary information
4 – not affected by viewing angle – good at all latitudes.	4 – difficult to animate (often noisy)
5 – products can be produced that focus upon particular properties.	5 – not so good for detecting cloud boundaries and thin cloud (thin fog)
	6 – reduced horizontal and vertical resolution

Variations in the Derived Product (Cloud Type) due to different satellite sensors compared to the 24-hours Microphysics RGB
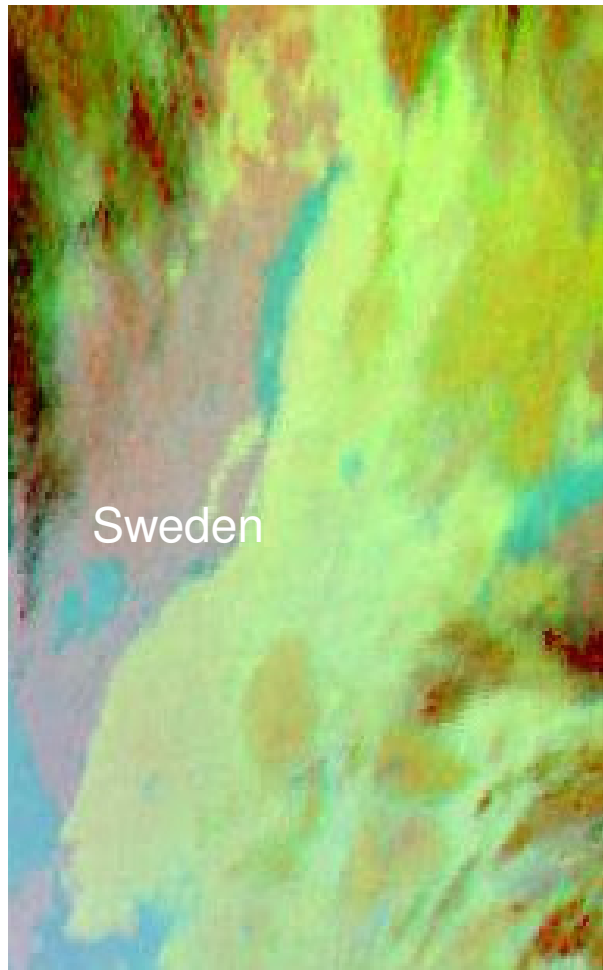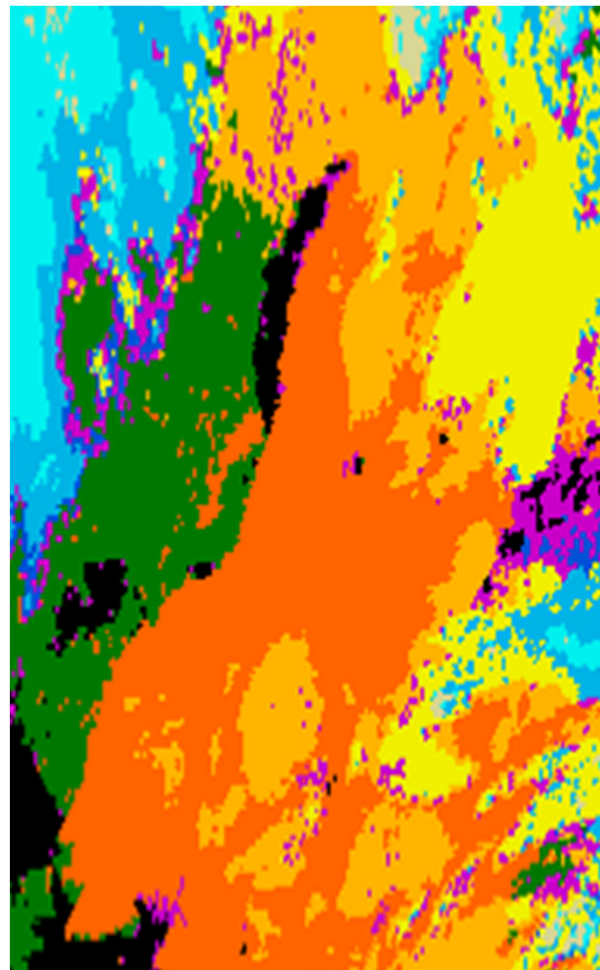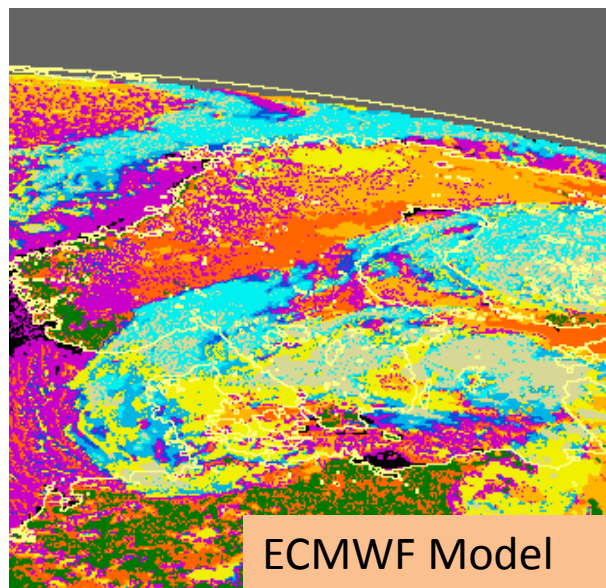

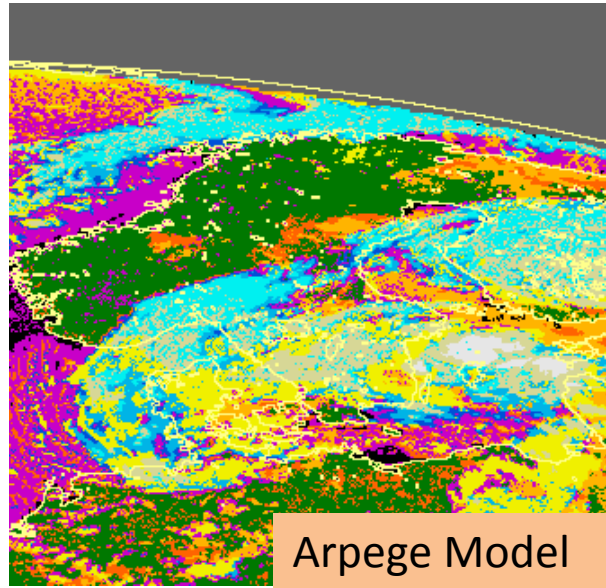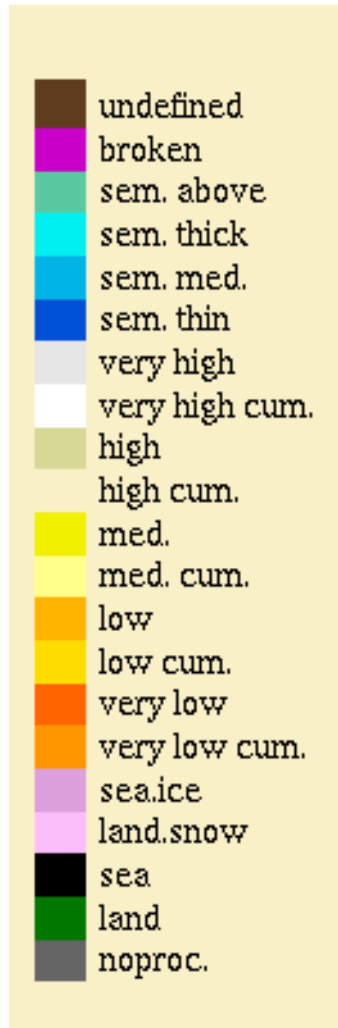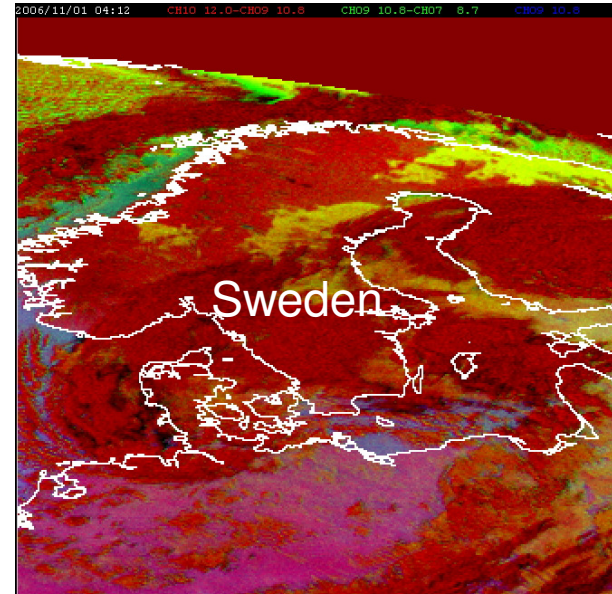24-h Microphys. RGB   Cloud Type (MSG, SMHI)   Cloud Type (NOAA, SMHI)

Met-8, 1 Feb 2007, 01:30 UTC; NOAA-18, 1 Feb 2007, 1:22 UTC

Slide from "RGB Products versus Derived Products" Dr. Jochen Kerkmann, presented at WMO EUMETSAT RGB Satellite Products Workshop 2012

Variations in the Derived Product (Cloud Type) due to different NWP algorithms

Cloud Type Products

24-h Micro RGB

1 November 2006, 4:00 UTC

image courtesy EUMETSAT

Activity: Overlaying Derived Products – Cloud Top Temperature and Height

Cloud Top Temperature and Height (CTTH) Derived Product algorithm summary description (1)
(from http://www.nwcsaf.org/HD/MainNS.jsp)
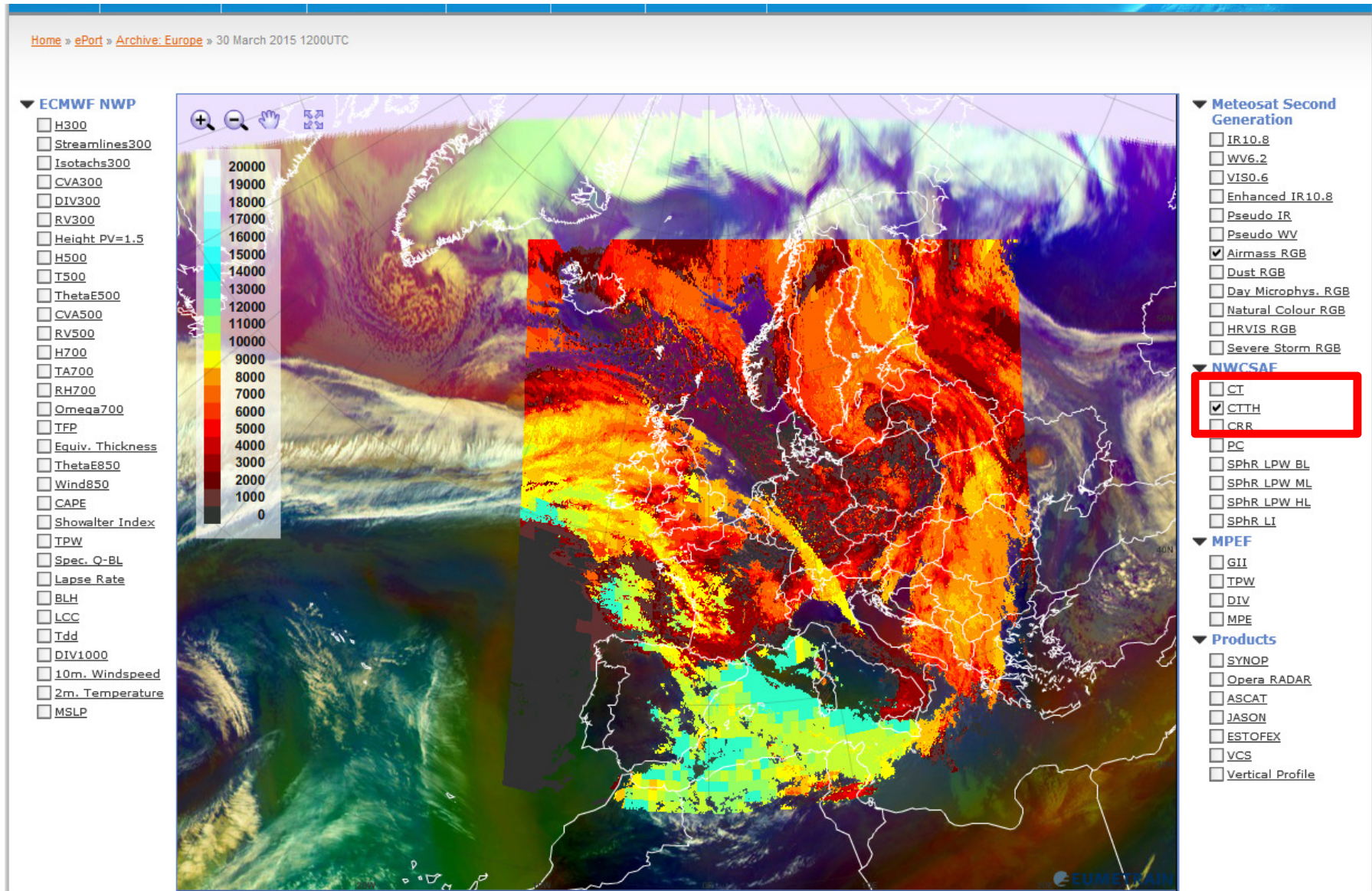
Note that Himawari-8 Cloud Property Applications for Visual Weather includes **Cloud Top Temperature and Cloud Top Height** derived product.

Process of producing this derived product:

- RTTOV radiative transfer model is applied using NWP temperature and humidity vertical profile to simulate 6.2µm, 7.3µm, 13.4µm, 10.8µm, and 12.0µm cloud free and overcast radiances and brightness temperatures.

- The vertical profiles used are temporally interpolated to the exact slot time using the two nearest in time NWP fields input by the user.

- A number of techniques are then used to retrieve the cloud top pressure This depends on the cloud type as derived from the Cloud Type (CT) derived product.

- Cloud top temperature and height (above sea level) is then computed from the pressure.

Cloud Top Temperature and Height (CTTH) Derived Product algorithm summary description (2)
(from http://www.nwcsaf.org/HD/MainNS.jsp)

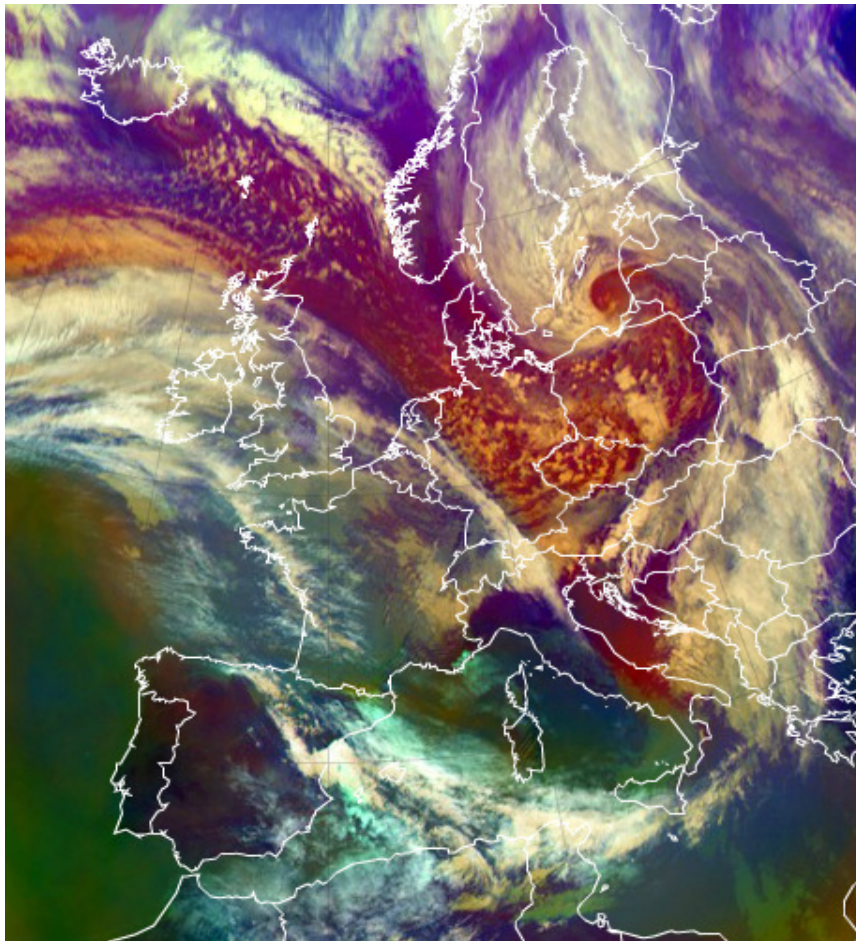Process of producing this derived product (continued):

- Effective cloudiness (defined as the fraction of the field of view covered by the cloud (the cloud amount) multiplied by the cloud emissivity in the 10.8μm window channel) is also computed during the processing. It is equal to 1.0 for thick clouds and takes a value between 0.0 and 1.0 for semi-transparent clouds.

Use of the product:
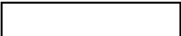
- This product contributes to the analysis and early warning of thunderstorm development.

- Other applications include the cloud top height assignment for aviation forecast activities.

- The product may also be used as input to mesoscale models or to other SAF NWC product generation elements.

- Validation has been performed only in the European Area.

image courtesy EUMETSAT

Activity: Comparing the RGB with the Derived product

Airmass RGB product

CTTH Derived Product

Thick, high-level clouds	Thick, mid-level clouds	Thick, low-level clouds (warm airmass)	Thick, low-level clouds (cold airmass)
Jet (high PV)	Cold Airmass	Warm Airmass	Warm Airmass

Question: Give one advantage of the RGB product. Give one advantage of the Derived Product.

image courtesy EUMETSAT

Activity: Exploring NWP

Activity: please explore the ECMWF NWP fields and indicate which of these NWP fields capture the key features identified in the Airmass RGB product

image courtesy EUMETSAT
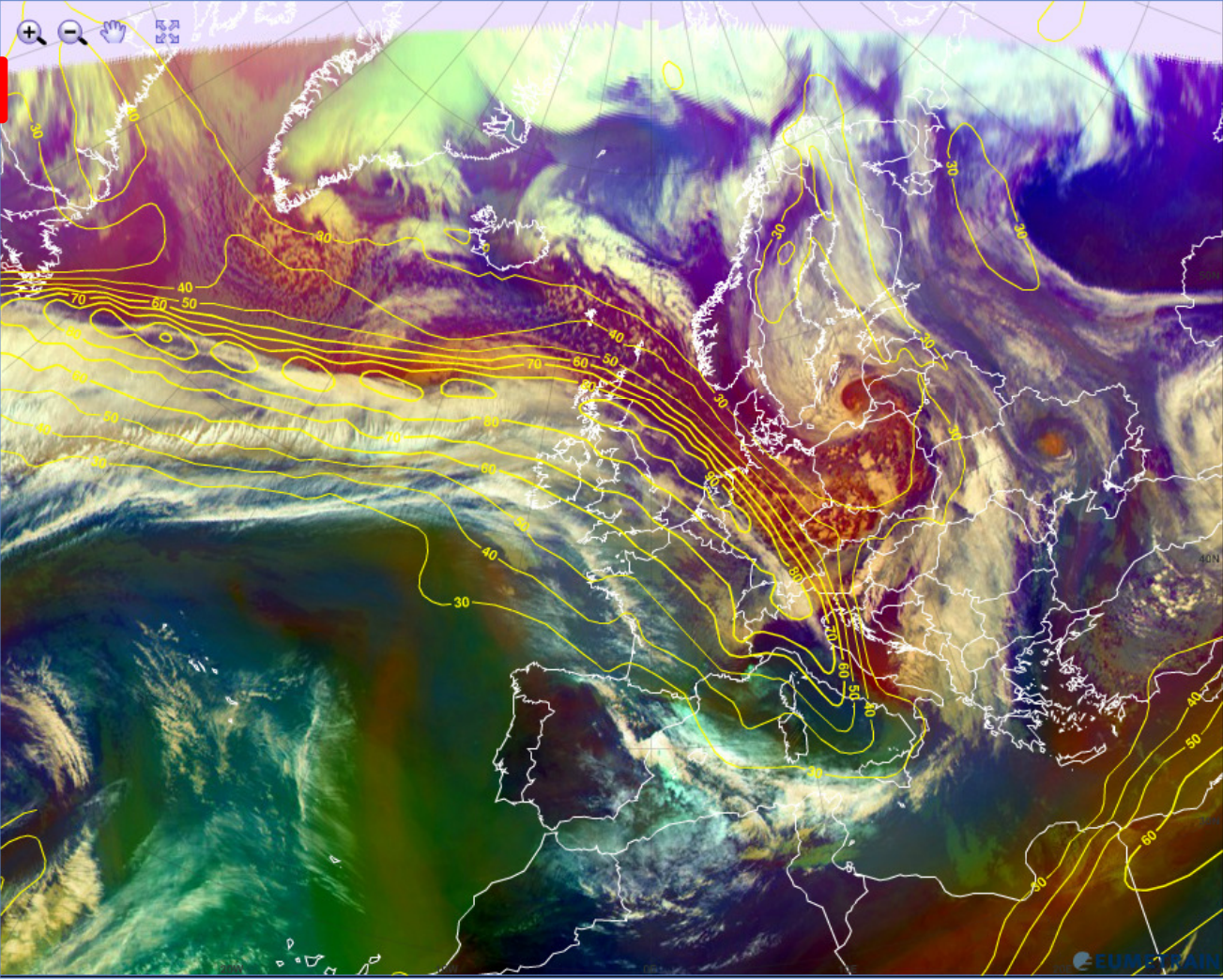
Recommended answer: Airmass RGB and Isotachs 300hPa

image courtesy EUMETSAT

Recommended answer: Airmass RGB and Height PV=1.5

image courtesy EUMETSAT

Case Study 2: Day Convection RGB
http://eumetrain.org/eport.html

Activity: Exploring EUMETRAIN ePort – 19 September 2014

Activity: Exploring EUMETRAIN ePort

Activity: Exploring EUMETRAIN ePort

image courtesy EUMETSAT

Activity: Derived Product – Cloud Type Product (NWC SAF)
(http://www.nwcsaf.org/HD/MainNS.jsp)

image courtesy EUMETSAT

Activity: Overlaying Derived Products – Cloud Top Temperature and Height

Activity: Overlaying Convective Rain Rate (CRR)

Activity: Overlaying Convective Rain Rate (CRR)

Activity: Overlaying Precipitating Clouds (PC)
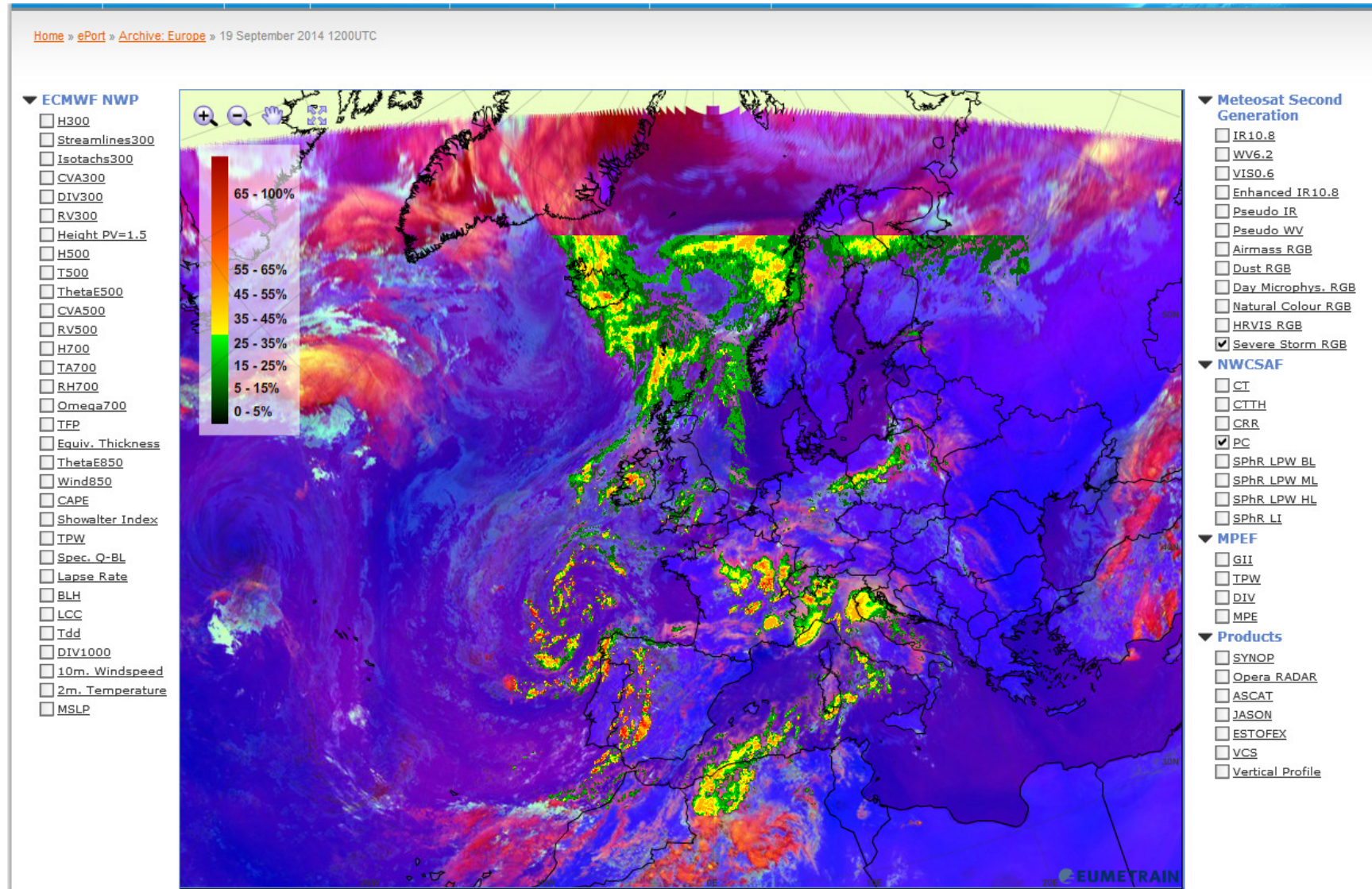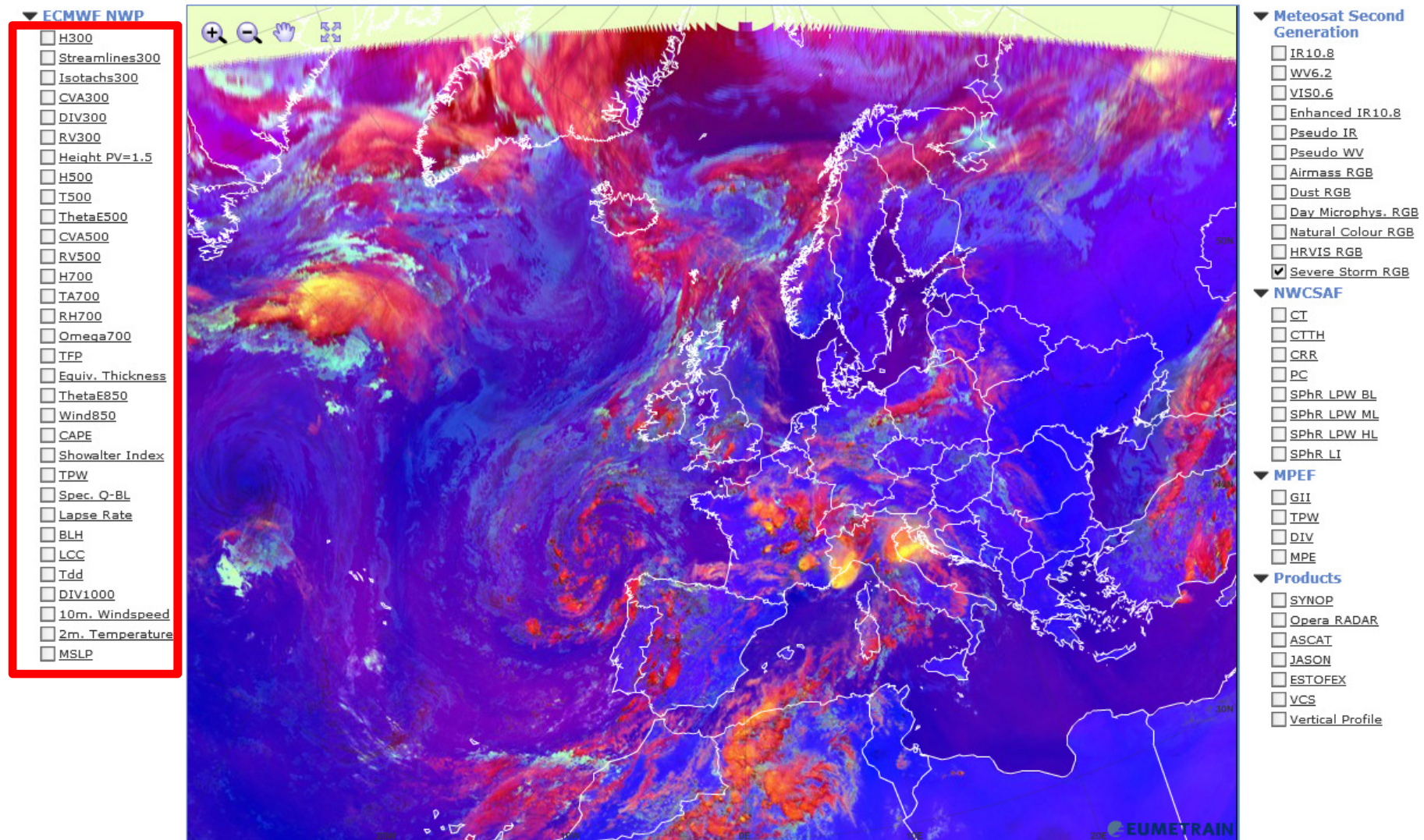
image courtesy EUMETSAT

Activity: Exploring NWP

Activity: please explore the ECMWF NWP fields and indicate which of these NWP fields capture the key features identified in the Day Convection RGB product

Recommended answer: Day Convection RGB and Total Precipitable Water

Recommended answer: Day Convection RGB and Temperature Advection (700hPa)

Recommended answer: Day Convection RGB and Height PV= 1.5 PVU
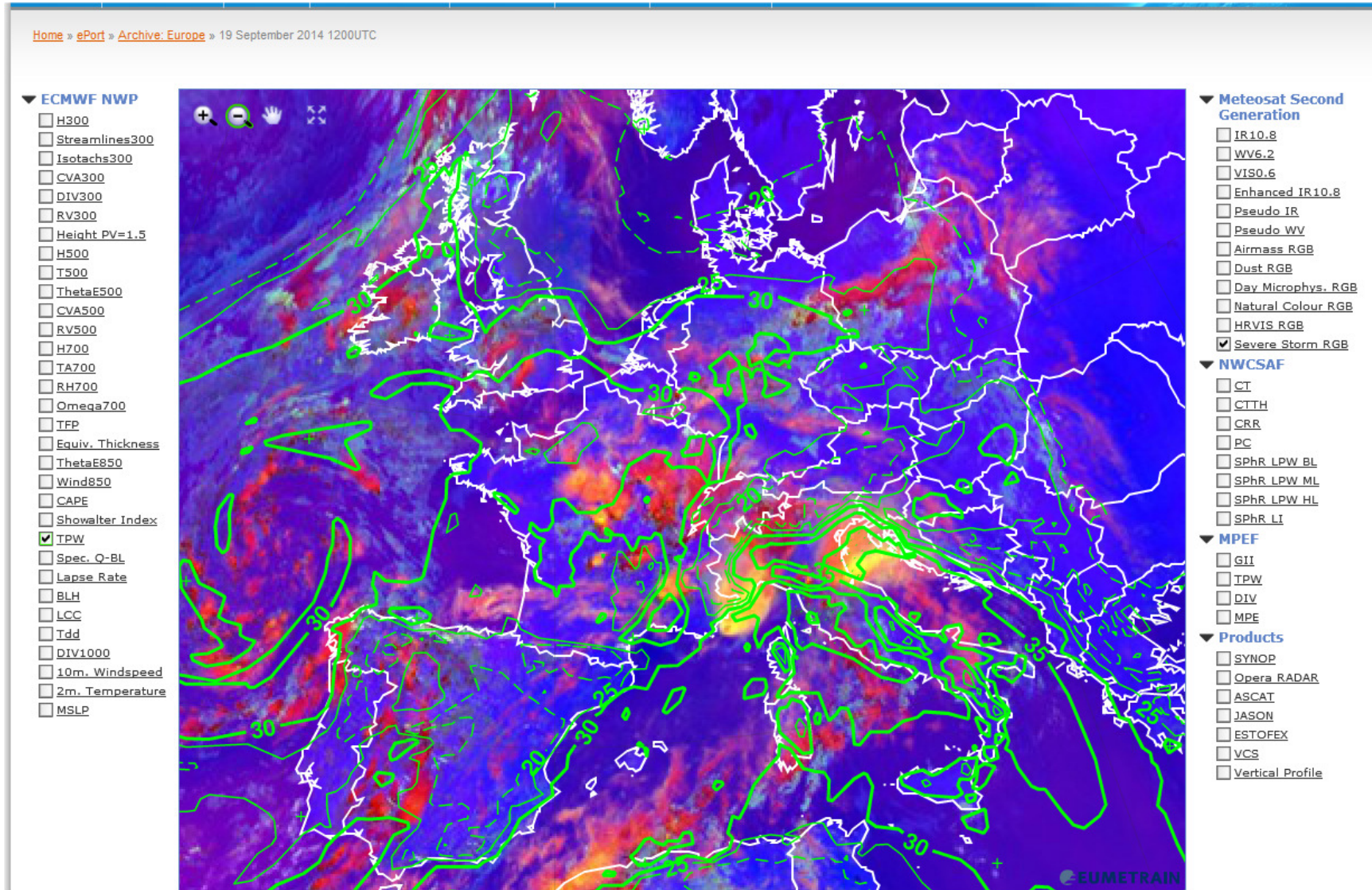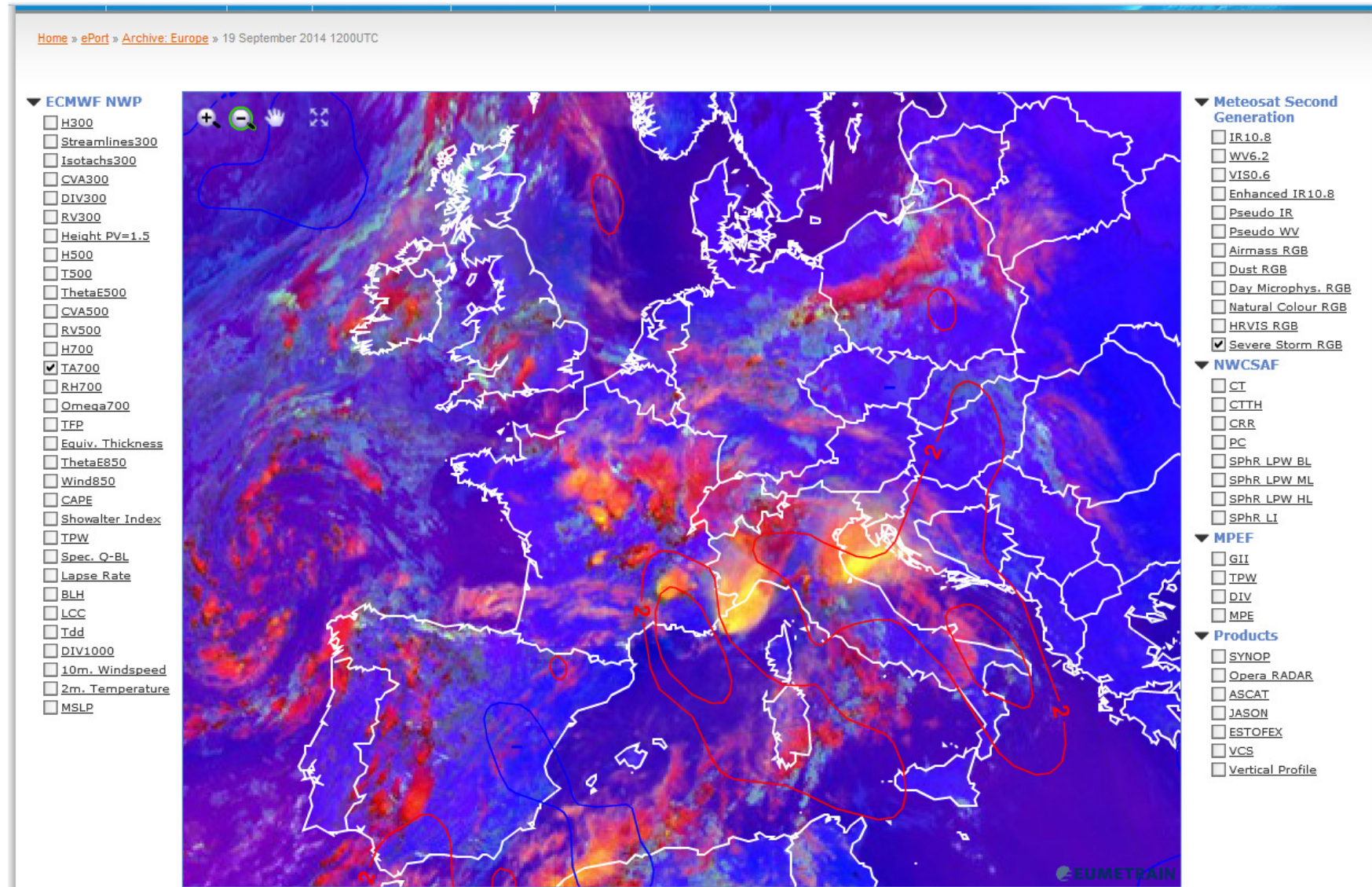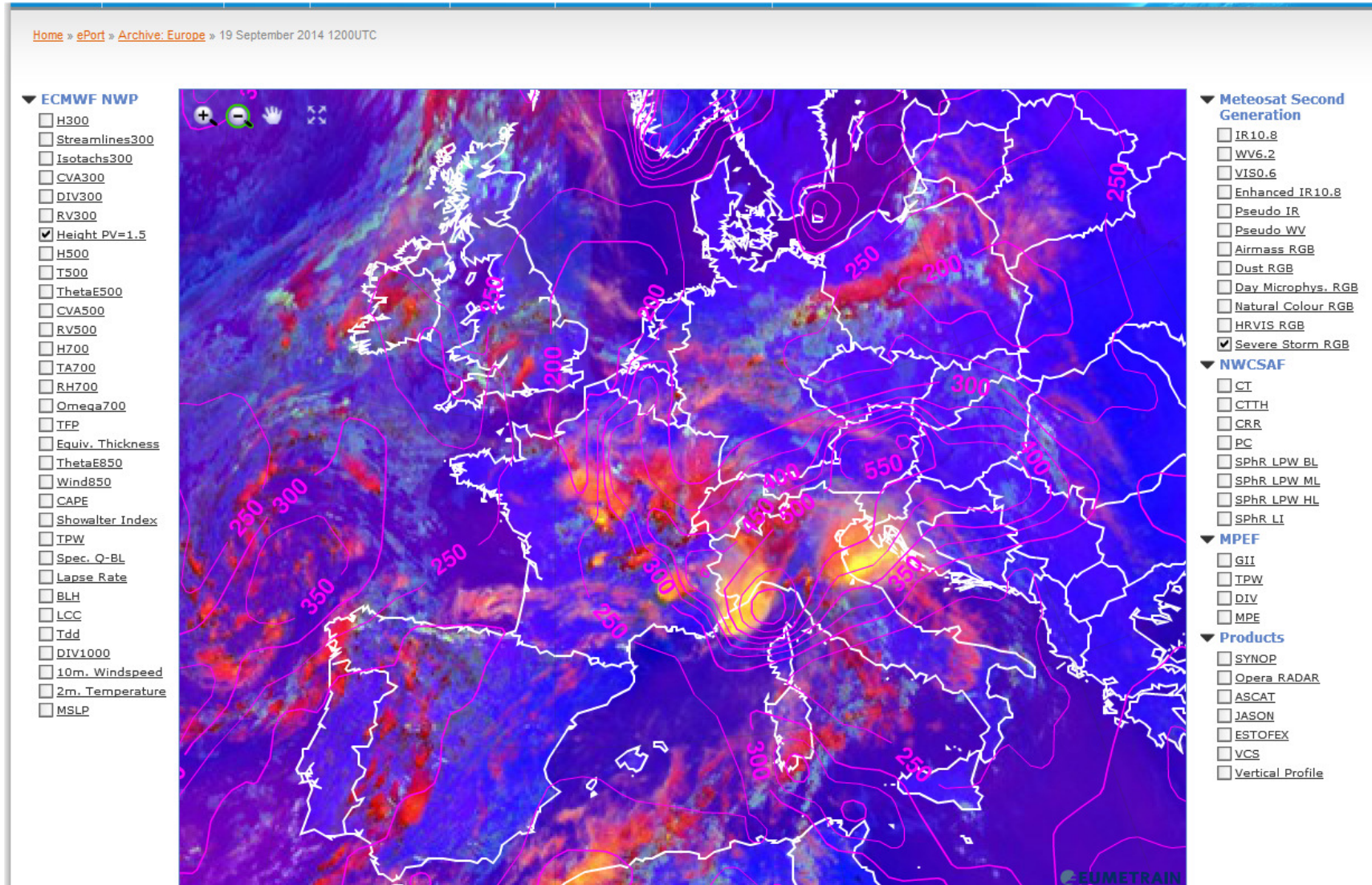
Summary

- Have briefly summarised RGB and Derived Products

- Derived Products to be used with Himawari-8 data in the Bureau

- Using the EUMETSAT ePort web page have interrogated RGB and Derived Products.

- The advantage of RGB products over single channel products

- Have compared RGB products with Derived Products – advantages and disadvantages.

- Gained a better understanding of RGB products by overlaying appropriate NWP parameters (NWP fields).