

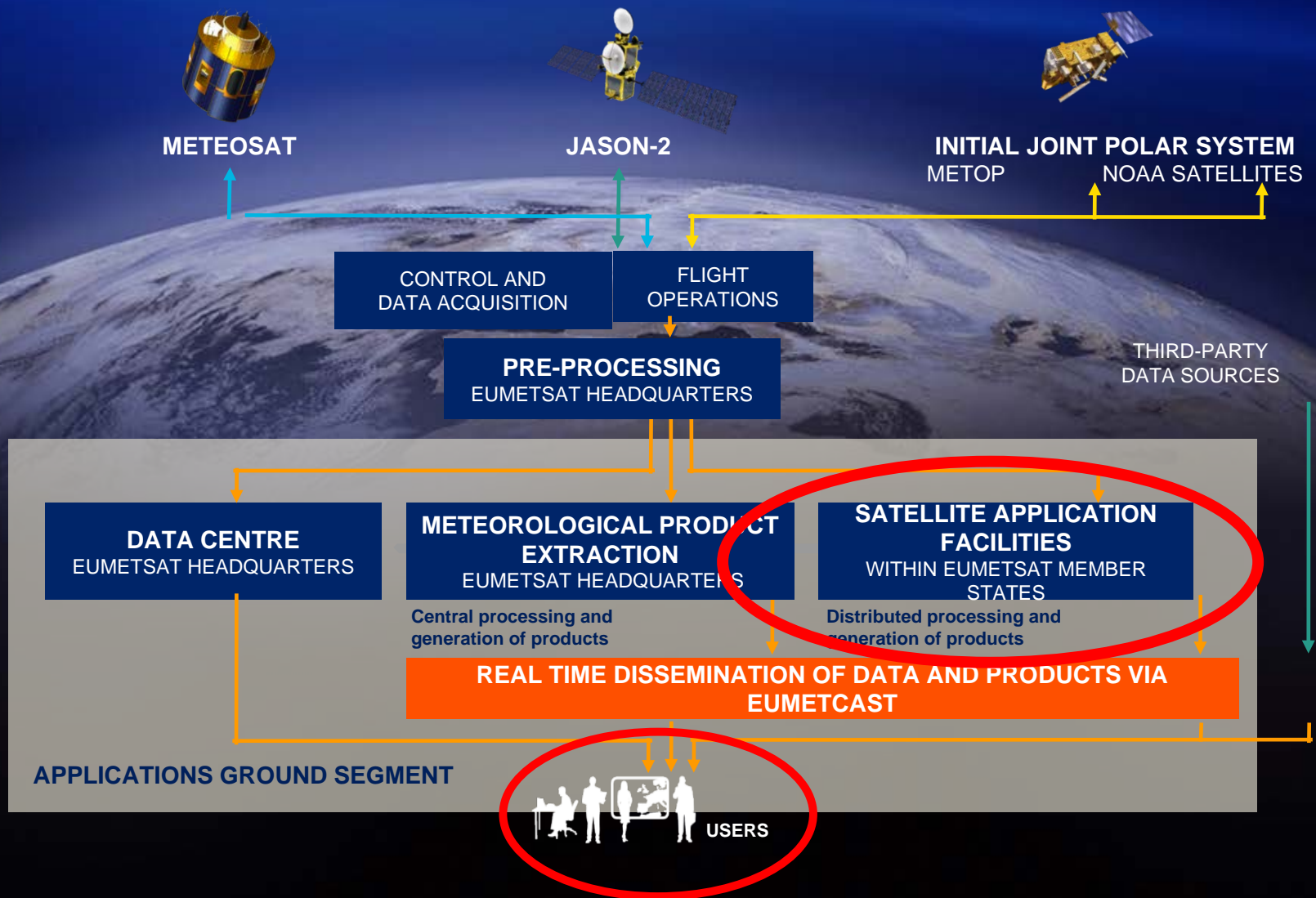
EUMETSAT NWC SAF products

Pilar Rípodas (AEMET)
NWC SAF Project Manager
NWC SAF Team
26 July 2016
Hong Kong

Outline

- EUMETSAT SAF Network
- Nowcasting SAF Consortium
- Nowcasting SAF SW packages
- Nowcasting SAF products
- How to get access to NWC SAF products

EUMETSAT ground segment overview



EUMETSAT SAF network across Europe



Support to Operational Hydrology and Water Management
Led by Italian Meteorological Institute



Radio Occultation Meteorology
Led by Danish Meteorological Institute



Ozone and Atmospheric Chemistry Monitoring
Led by Finnish Meteorological Institute



Land Surface Analysis
Led by Portuguese Meteorological Institute



Support to Nowcasting and Very Short Range Forecasting
Led by Agencia Estatal de Meteorología, Spain



Ocean and Sea Ice
Led by Météo France



Climate Monitoring
Led by Deutscher Wetterdienst, Germany



Numerical Weather Prediction
Led by Met Office (UK)

EUMETSAT NETWORK
OF SATELLITE
APPLICATION
FACILITIES

NWCSAF concept: objectives

- ✓ The general objective of the NWC SAF is to provide operational services to ensure the optimum use of meteorological satellite data in Nowcasting and Very Short Range Forecasting by targeted users.
- ✓ To achieve this goal , the NWC SAF is responsible for the development and maintenance of appropriate SW Packages (GEO and POLAR Satellites), as well as of all related tasks for user's support.

NWC SAF Software Packages

Geostationary Satellites:

MSG v2013: available to users since August 2013

Applicable to MSG data

GEO v2016, available after 2016 summer

Continuous monitoring, space resolution and illumination conditions good for low and middle latitudes

Polar Satellites:

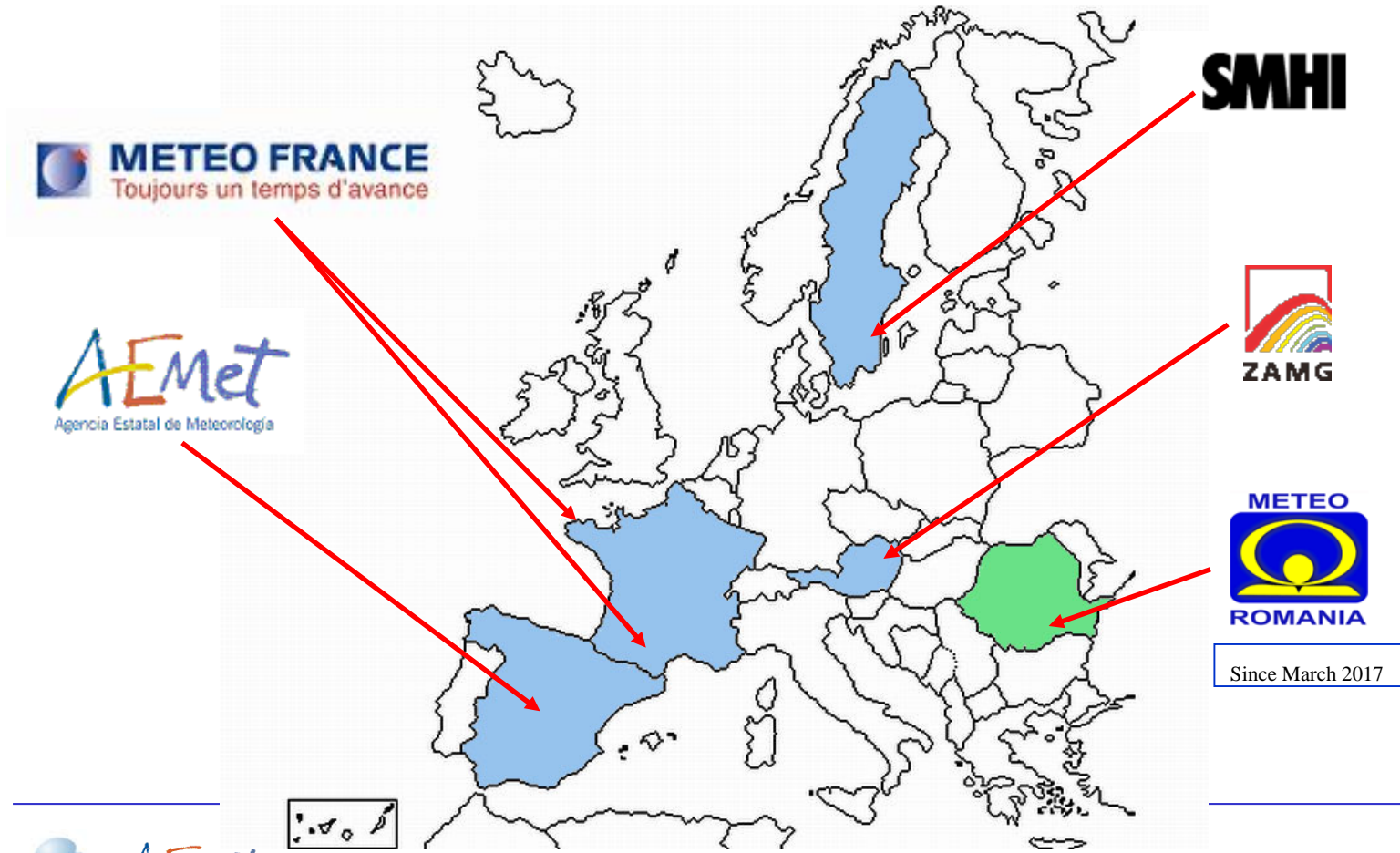
PPS v2014: available to users since October 2014

Process data from the joint polar system (EUMETSAT and NOAA polar satellites)

New version planned for 2018

Relatively good coverage for high latitudes

NWC SAF CONSORTIUM



Help Desk

NWC SAF

The European Agency for Satellite Applications in the Field of Meteorology

NWC SAF
Support to Monitoring and Early Short Range Forecasting

AEtMet
Agency for Earth-Meteorology Interactions

MAE

M80

MSG Cloud Products

- Cloud Mask (Geostationary) 
- Cloud Type (Geostationary) 
- Cloud Top Temperature and Height (Geostationary) 

MSG Precipitation Products

- Precipitating Clouds (Geostationary) 
- Convective Rainfall Rate (Geostationary) 
- Pre-Prod. Cloud Physical Properties (Geostationary) 

MSG Clear Air Products: Physical Retrieval

- Total Precipitable Water (Geostationary) 
- Layer Precipitable Water (Geostationary) 
- Stability Analysis Imagery (Geostationary) 

MSG Winds, Conceptual Model and Convection Products

- High Resolution Winds (Geostationary) 
- Automatic Satellite Image Interpretation (Geostationary) 
- Rapid Development Thunderstorms (Geostationary) 

PPS

- Cloud Mask (Geostationary) 
- Cloud Type (Geostationary) 
- Cloud Top Temperature and Height (Geostationary) 

- Precipitating Clouds (Geostationary) 
- Cloud Physical Properties (CFM) (Geostationary) 
- Cloud Physical Properties (SNPP) (Geostationary) 

EUMetTrain

News

- Nowcasting SAF - EUMetTrain Event Week 2013 (en español)
- MSG v0013 patch in SAF Packages and Process site (en español)
- Examples of CRPN and PCRN (en español)

Help Desk

You are not registered. Sign in:

User:

Password:

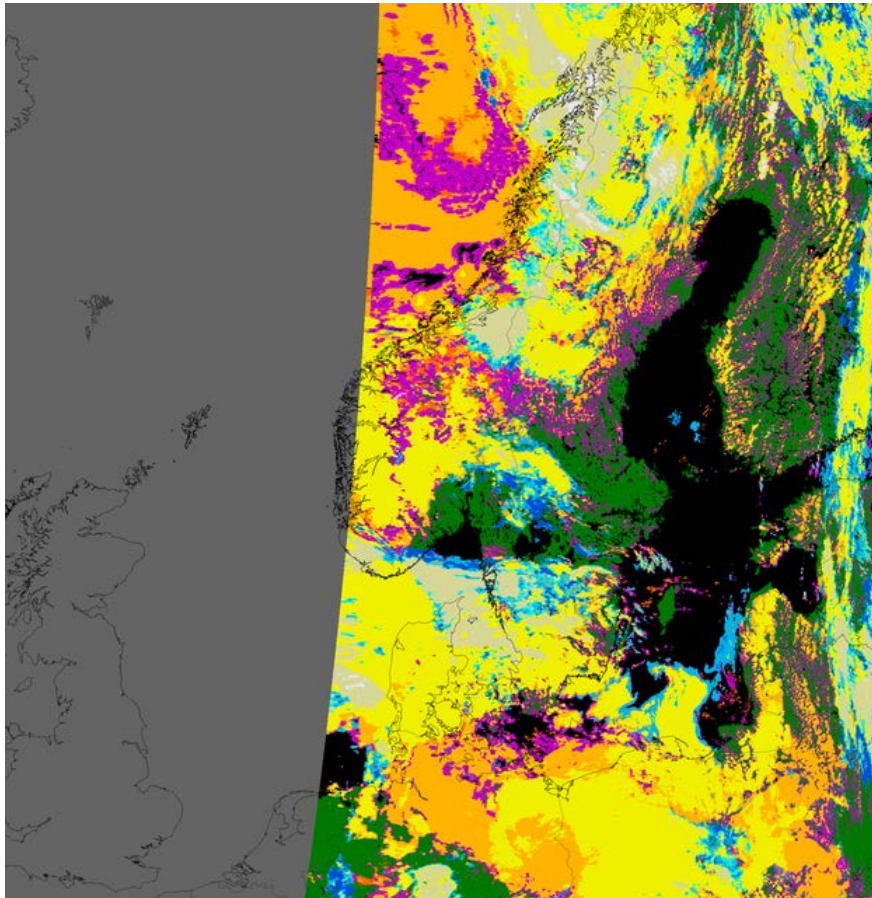
Help

- The general procedure for running NWC SAF software are:
 - MSG package: MSG SERVIR logs and NWP on some of them
 - PPS package: GUMSIS logs and NWP on some of them
- The user should be aware that using old NWP data might reduce the quality of the product.
- The processing area could be any rectangular area inside MSG full disk for the MSG package.
- The quality of the products is not guaranteed out of MSG full disk (Europe, North Africa and adjacent seas).
- For the PPS package the coverage area is half of the MSG satellite – depending on local radio horizon.

NWC SAF SW package for polar satellites: PPS v2014

- Developed by SMHI, Sweden
- Process data from the joint polar system (EUMETSAT and NOAA polar satellites)
- Products:
 - ✓ **Cloud products:** Cloud Mask, Cloud Type, Cloud Top Temperature and Height, Cloud Physical Properties
 - ✓ **Precipitation product:** probability of precipitation

NWC SAF PPS v2014: Cloud Type



- | | |
|--------------|------------------|
| Cloud free | Very thin cirrus |
| Cloud free | Thin cirrus |
| Snow | Thick cirrus |
| Snow/Ice | Cirrus above |
| Very low | Fractional |
| Low | Unclassified |
| Medium level | Unprocessed |
| High | |
| Very high | |

18 July 2016

NWC SAF SW package for GEO satellites: MSG v2013

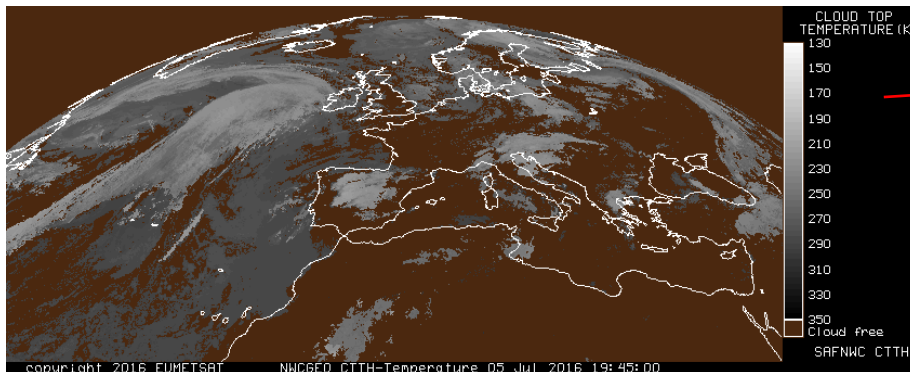
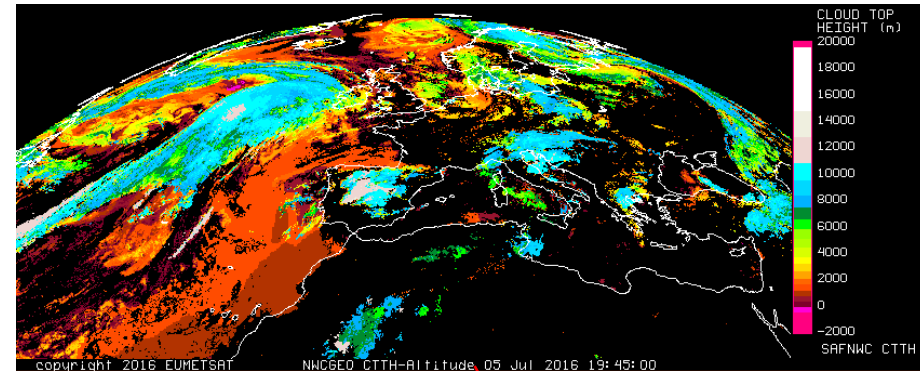
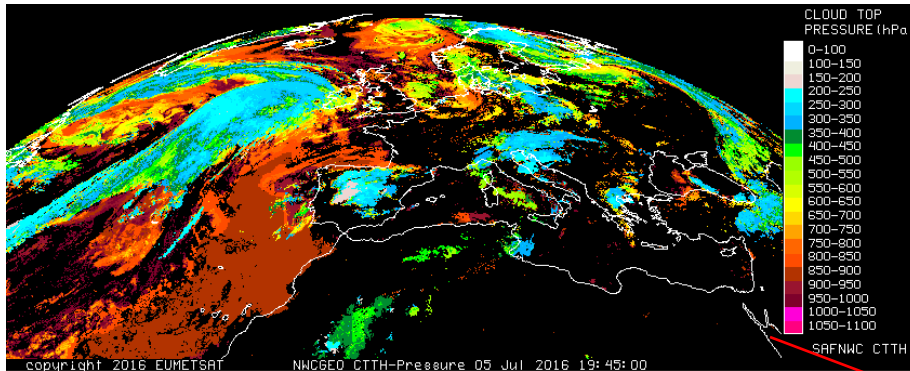
- **Applicable to MSG data**
- **Products:**
 - ✓ **Cloud products (Météo-France)** :Cloud mask, Cloud Type, Cloud Top Temperature and Height, Cloud phase
 - ✓ **Wind Product (AEMET, Spain):** High Resolution Winds (HRW)
 - ✓ **Automatic Satellite Interpretation (ZAMG, Austria)**
 - ✓ **iSHAI (AEMET, Spain):** total water content and water content at different levels and Instability indices
 - ✓ **Precipitation Products (AEMET, Spain):** probability of precipitation and convective rainfall rate
 - ✓ **Convection products (Météo-France):** Rapid Development Thunderstorms

GEO v2016: main improvements

- Improvement of products
- New products:
 - ✓ **CMIC**: cloud phase, cloud water path, effective radius, optical depth
 - ✓ **ASII-NG**: automatic satellite interpretation new generation
 - ✓ **EXIM**: extrapolation of SEVIRI imagery or NWCSAF products up to a lead time of 1 hour
 - ✓ **CI**: convection initiation
- Adaptation of HRW to GOES-N satellites (included validation)
- New output format: NetCDF

NWC SAF GEO Cloud Top Temperature and Height

Cloud Top pressure is inferred comparing simulated and measured radiances. The process depends on the Cloud Type.



Pressure, Height and Temperature of the Cloud Top

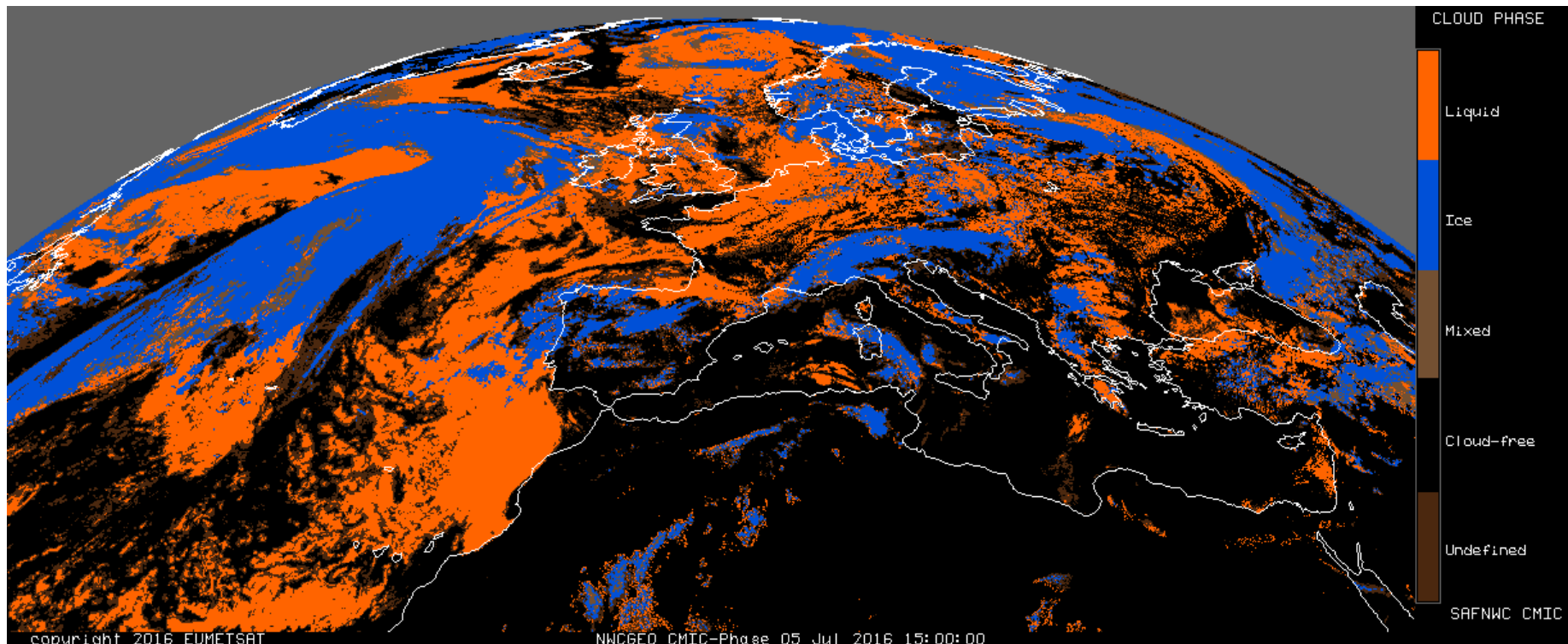
Applications in:
Aviation forecast
Input to other products

NWC SAF Cloud Microphysics (CMIC): Cloud Phase

Cloud Phase

Empirical used of (T8.7 μ m -T10.8 μ m), yT10.8 μ m, CT

Complemented during daytime with measured/simulated R0.6 μ m y R1.6 μ m

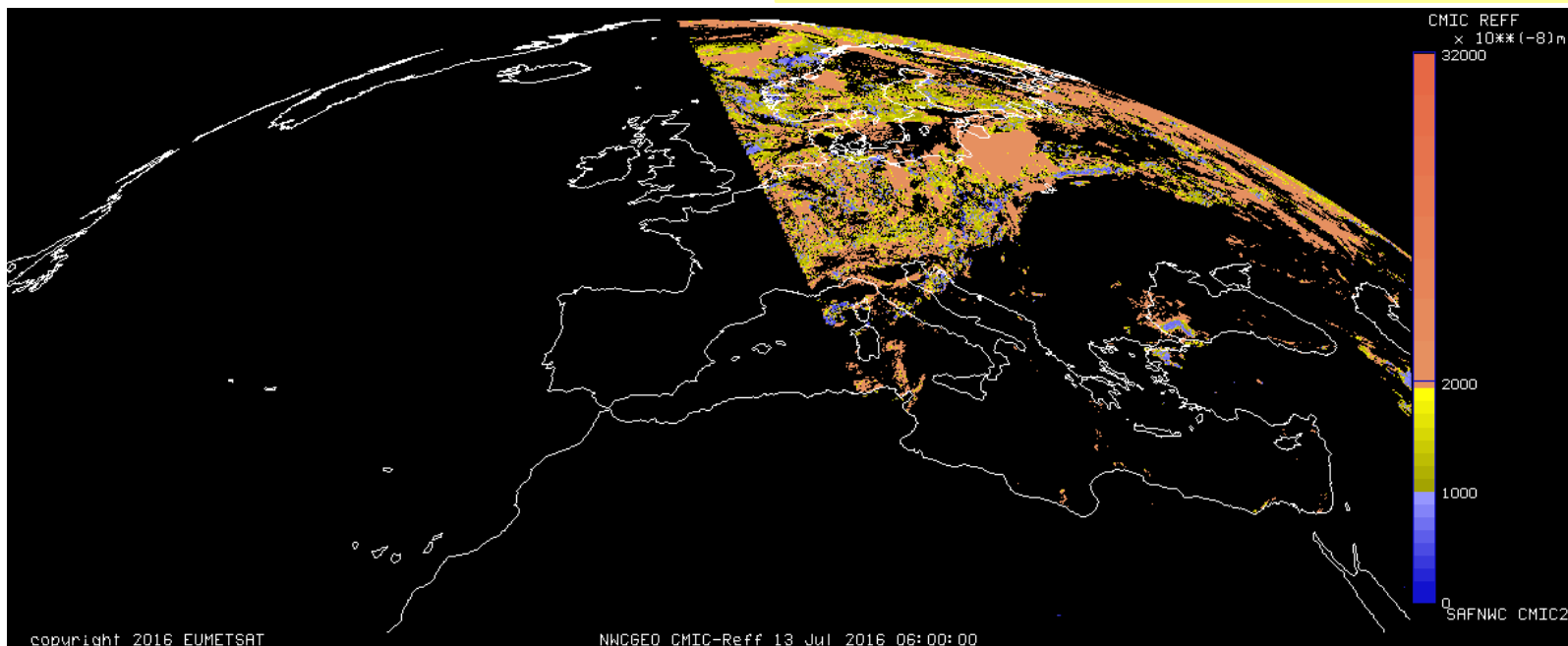


Cloud Phase + CTTH can be used to detect icing

NWC SAF Cloud Microphysics (CMIC): Effective Radius

Why we do not have information in the west area?

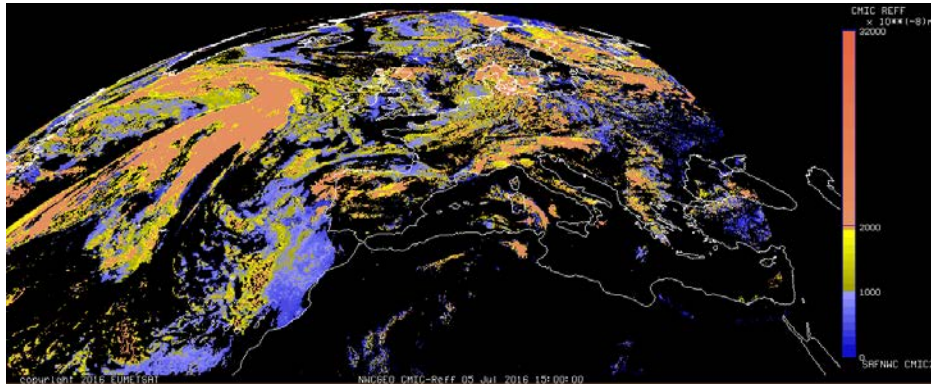
The product makes use of solar channels, not available at night time!



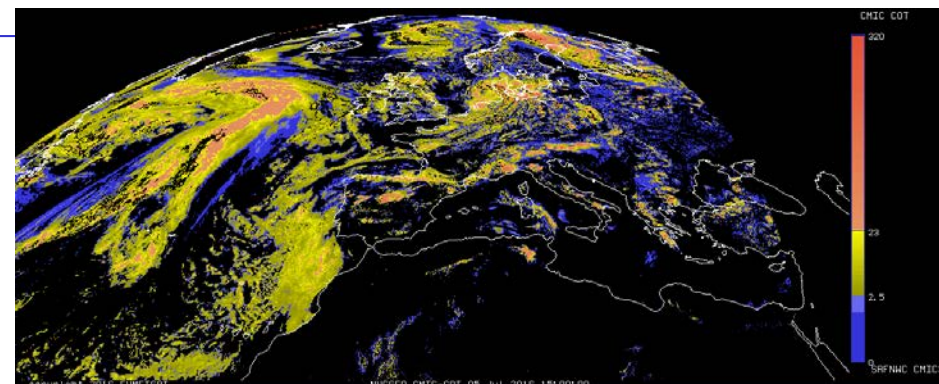
NWC SAF Cloud Microphysics

New GEO v2016!

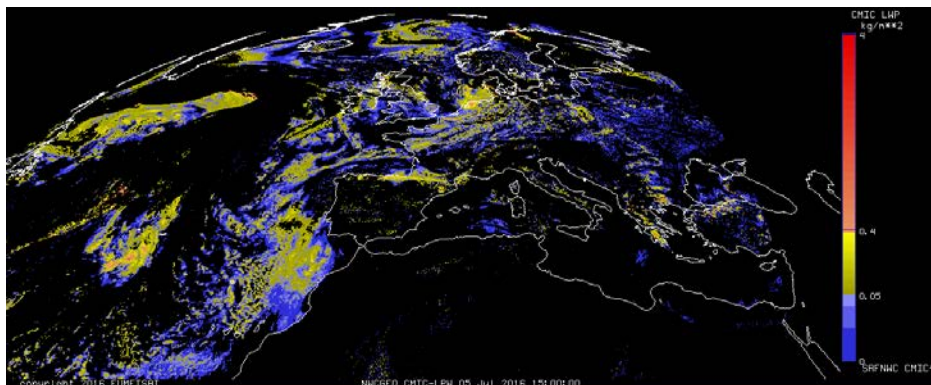
Day time product!



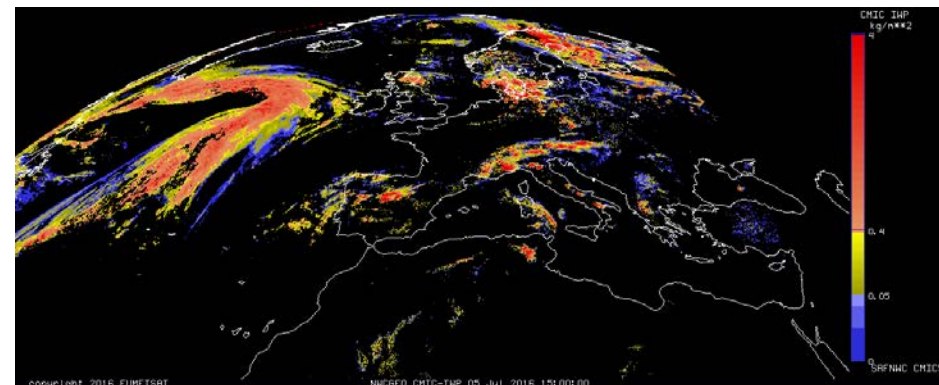
Effective Radius



Cloud Optical Thickness



Liquid Water Path

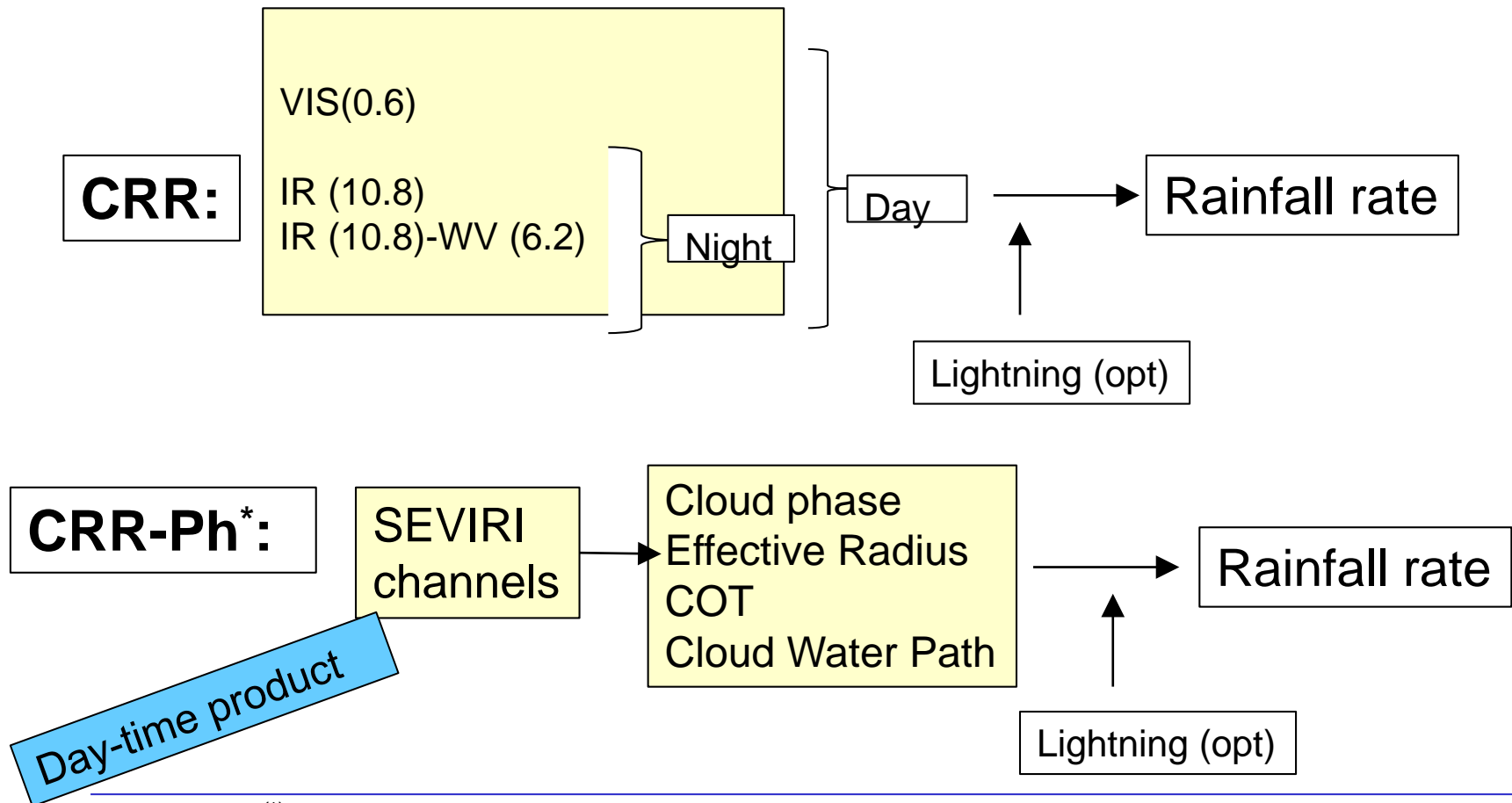


Ice Water Path

5 July 2016 15:00 UTC

Convective Rainfall Rate. CRR and CRR-Ph

Intensity of precipitation associated to convective systems.



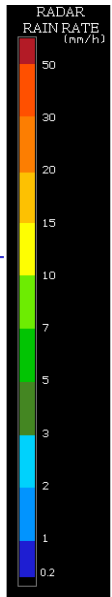
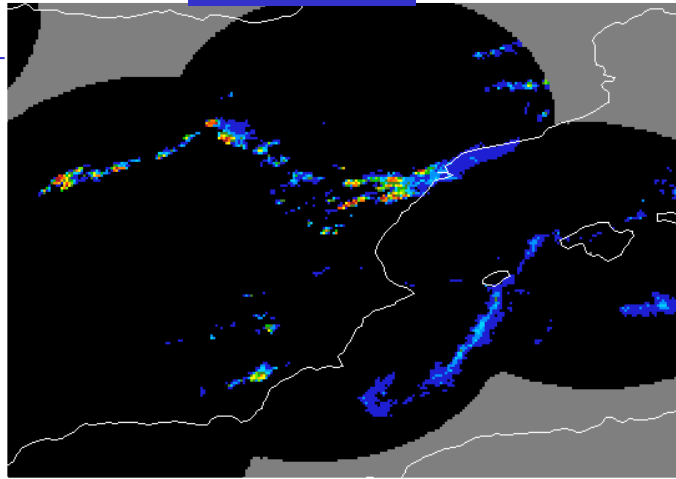
(*)Based on algorithm from Roebeling, R. A. and I. Holleman, 2009

Convective Rainfall Rate (CRR)

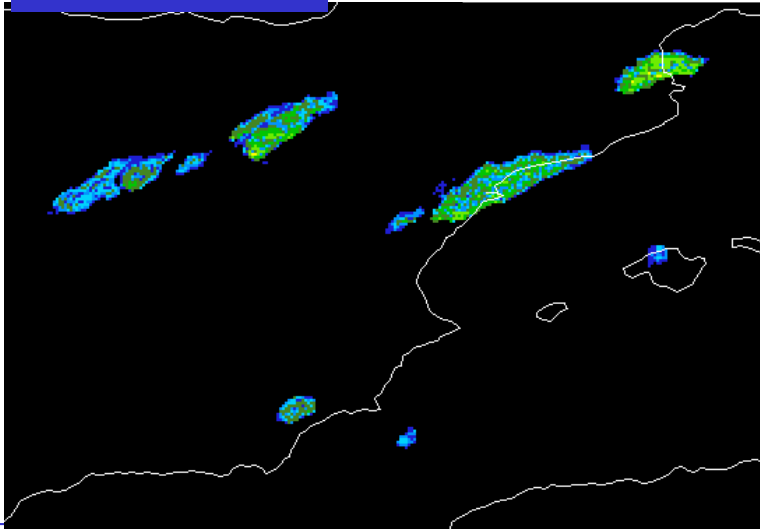
Visual example

22th August 2008
14:00 UTC

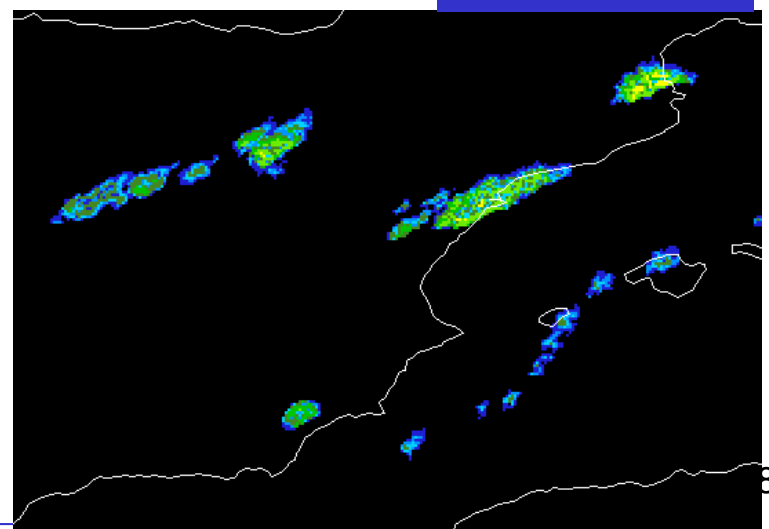
RADAR (PPI)



CRR 2V FUNCTION



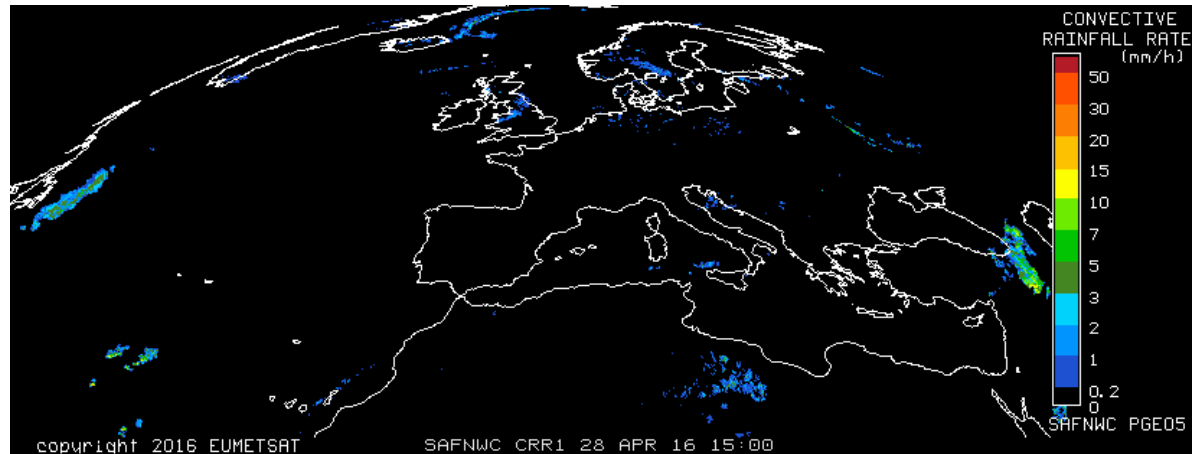
CRR 3V FUNCTION



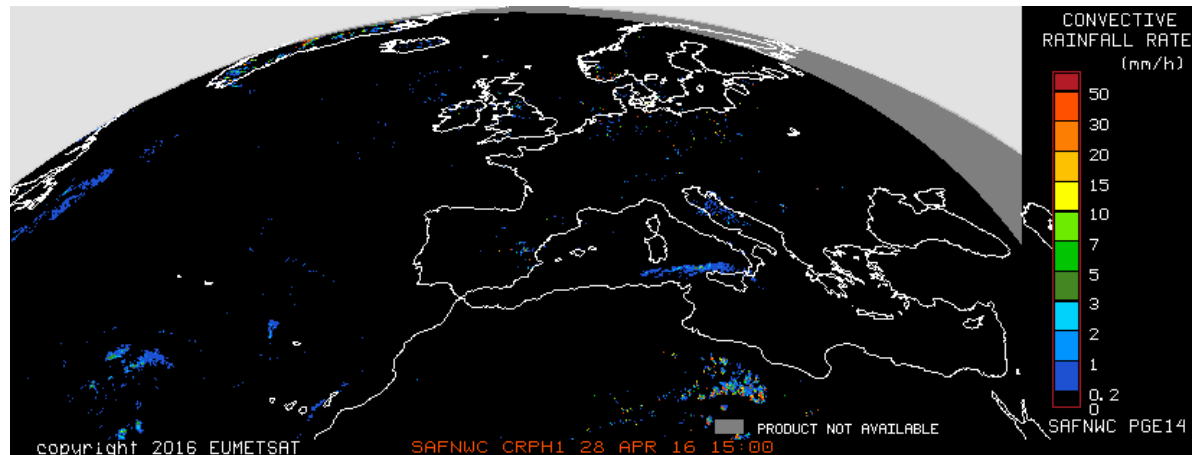
Convective Rainfall Rate. CRR and CRR-Ph

Intensity of precipitation associated to convective systems.

CRR

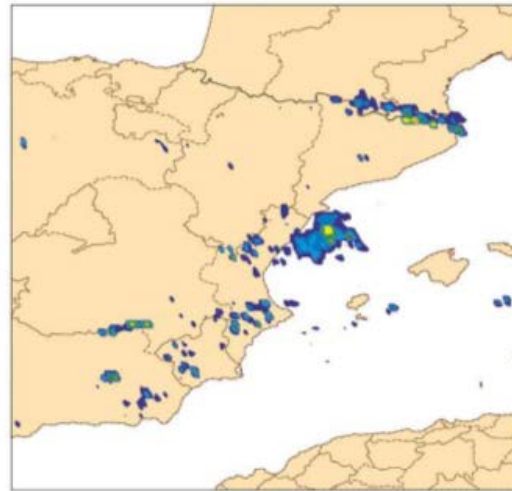


CRR-Ph

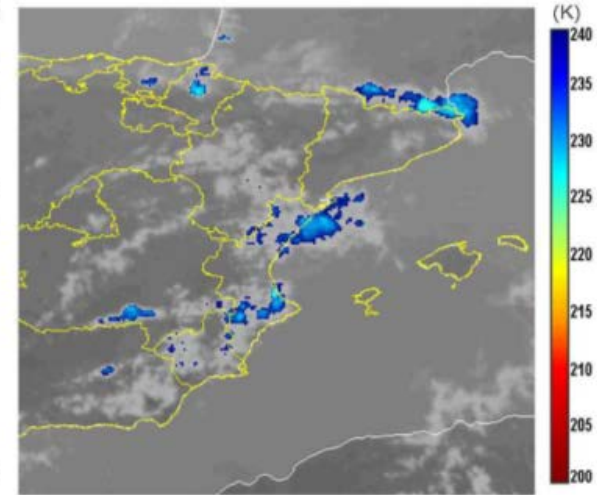


Convective Rainfall Rate CRR and CRR-Ph

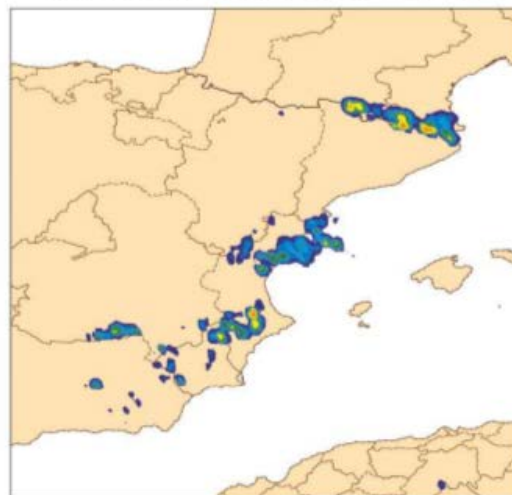
Radar Precip. 11 Aug 2012 at 14:10 UTC



SEVIRI IR10,8 11 Aug 2012 at 14:00 UTC



CRPh Precip. 11 Aug 2012 at 14:00 UTC



CRR Precip. 11 Aug 2012 at 14:00 UTC

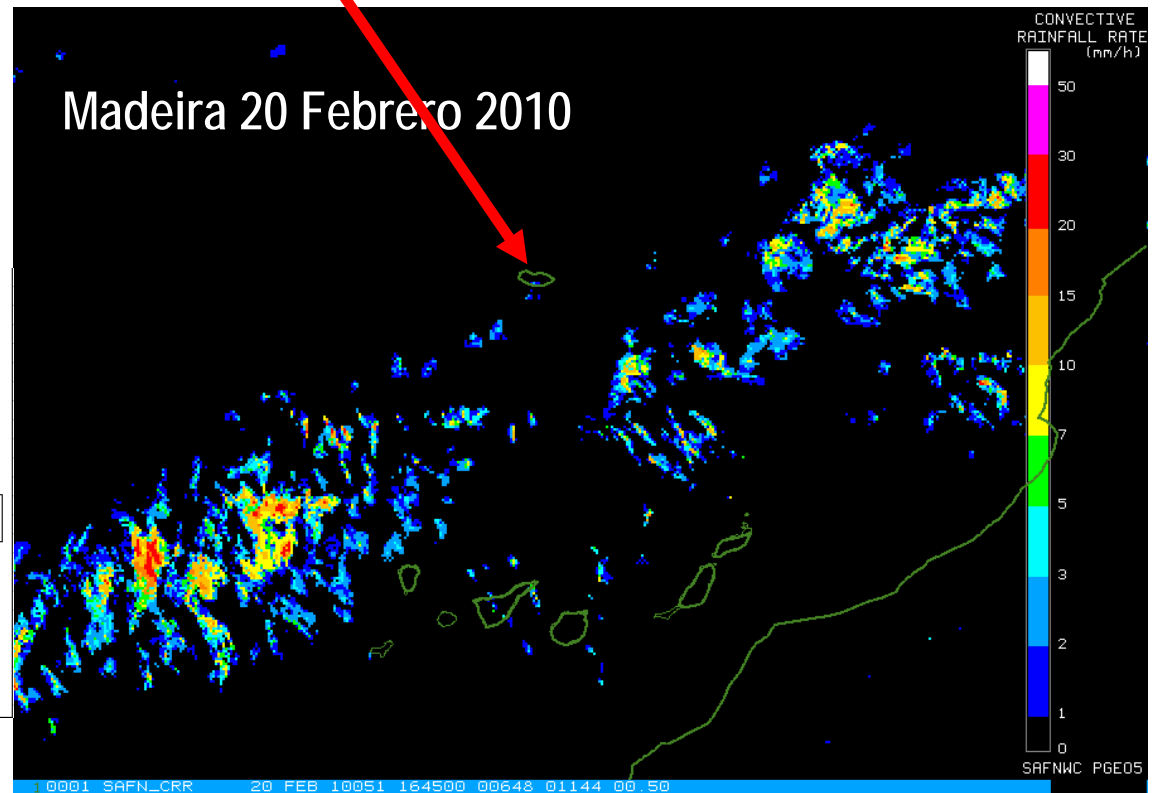
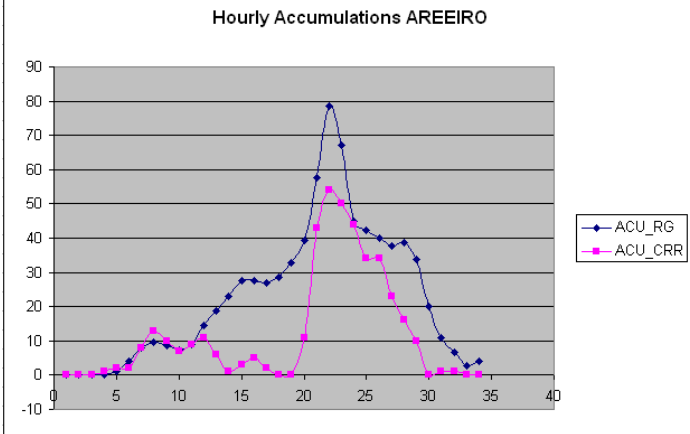


Cecilia Marcos,
AEMET

Convective Rainfall Rate (CRR)

Very useful if radar data is not available

CRR

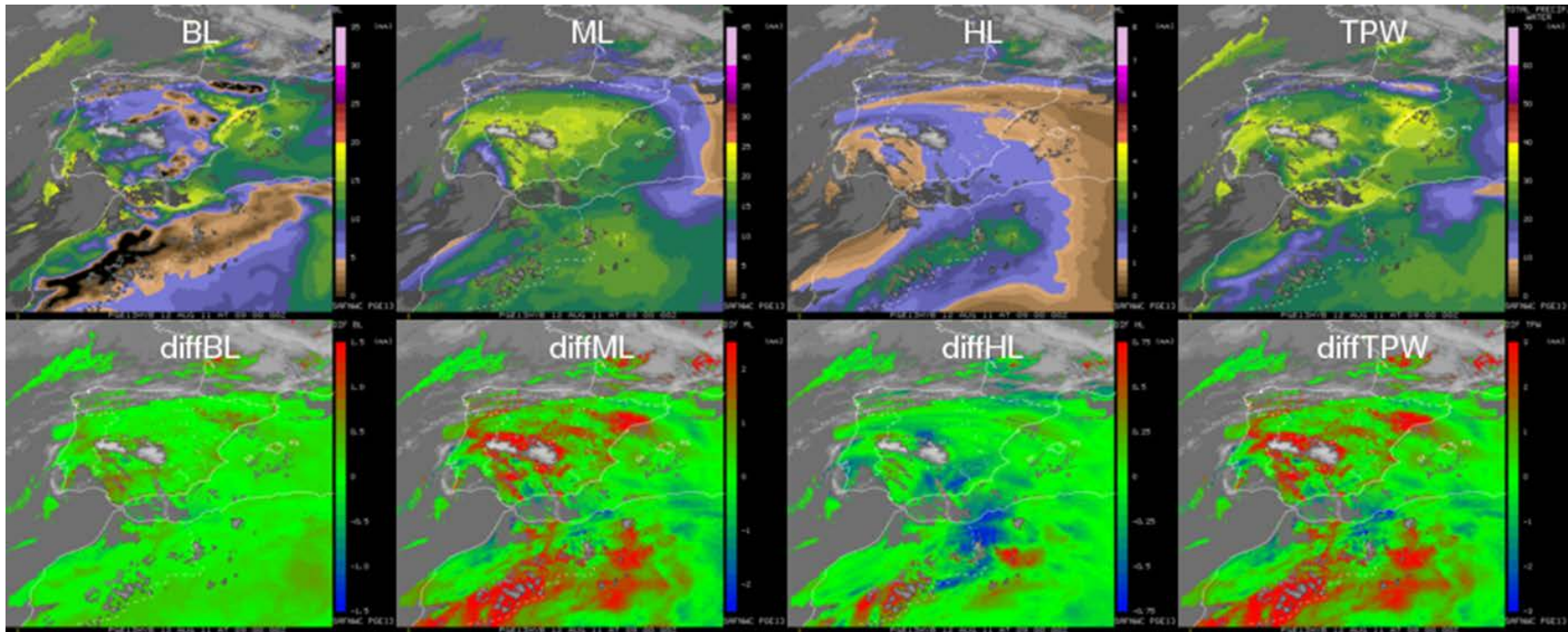


iSHAI: imaging Satellite Humidity and Instability.

- Calculated at cloud free pixels
- Application: detection of pre-convective areas
- Specially useful when NWP model does not capture the actual situation

iSHAI: imaging Satellite Humidity and Instability.

Outputs: Precipitable fields



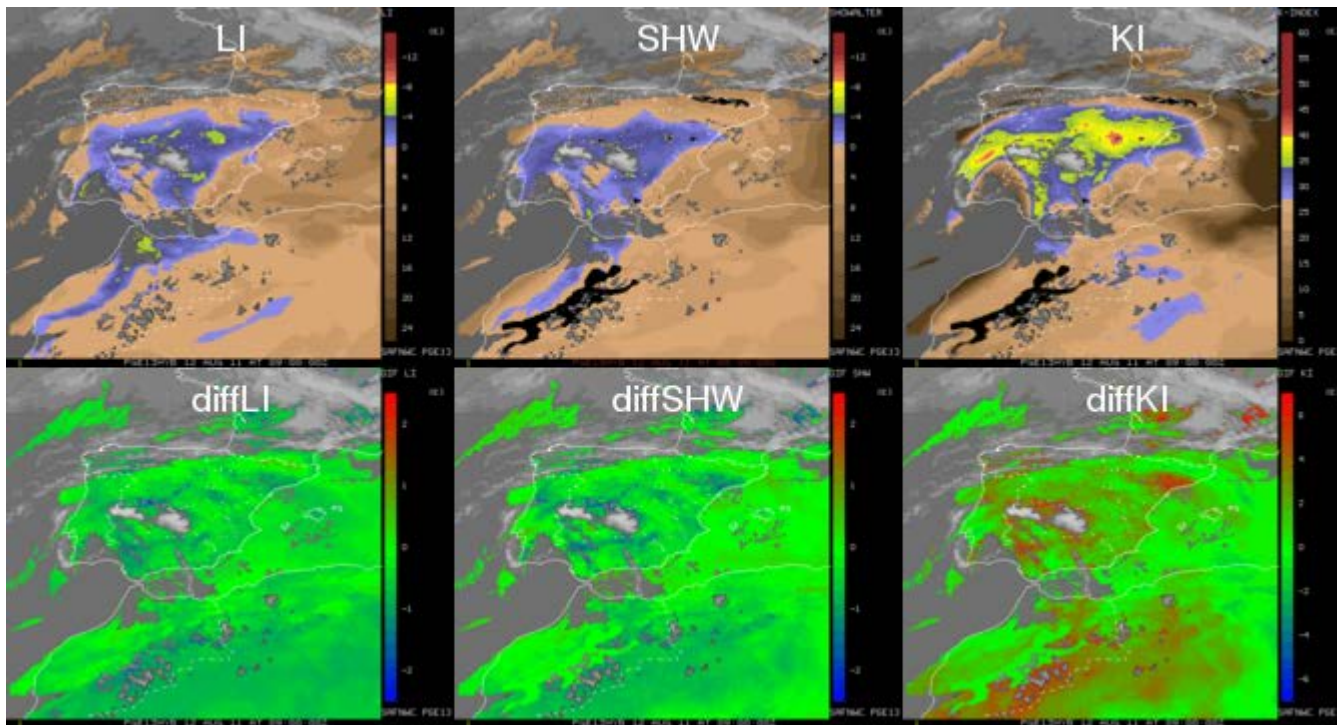
BL
Precipitable Water in
Boundary Layer
(Psf-850hPa)

ML
Precipitable Water
in Middle Layer
(850-500 hPa)

HL
Precipitable Water
in High Layer
(500-0.1 hPa)

TPW
Total Precipitable Water in Middle
Layer
(Psf-0.1 hPa)

iSHAI: imaging Satellite Humidity and Instability. Outputs: instability indices fields



Lifted Index

Showalter Index

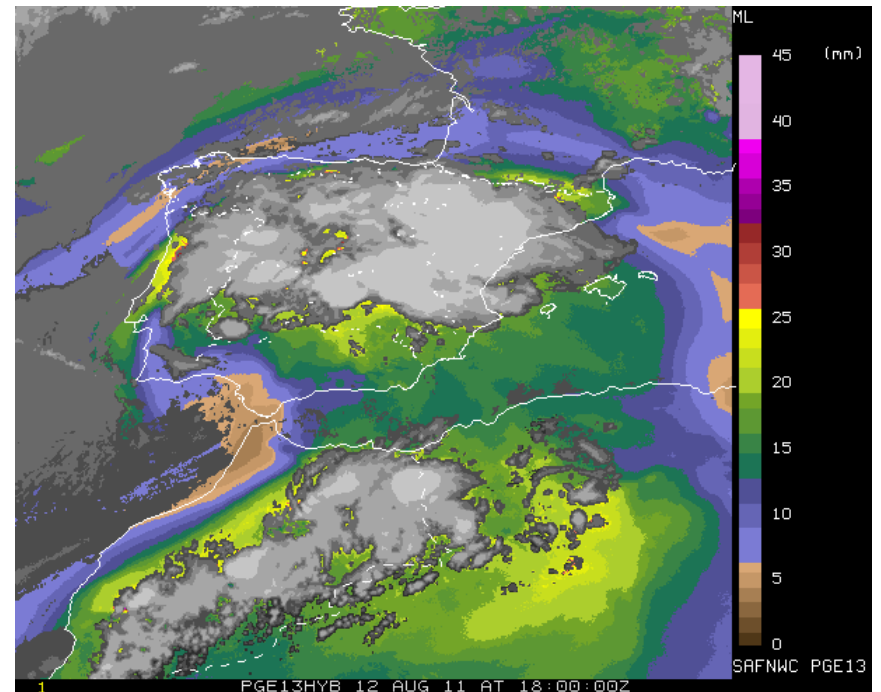
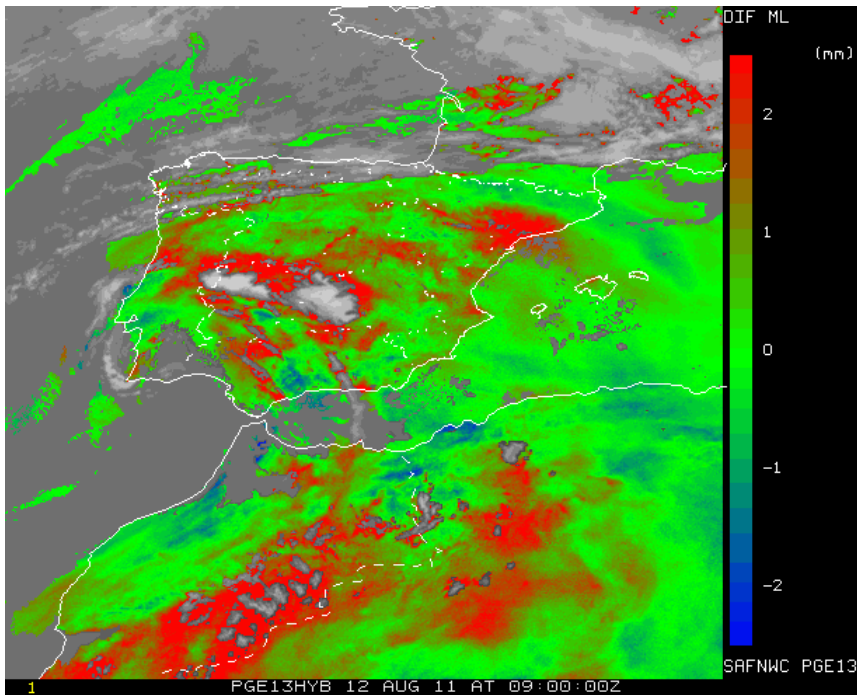
K Index

12th August 2011 9:00 UTC

Application: identification of pre-convective areas

12th August 2011 9:00 UTC

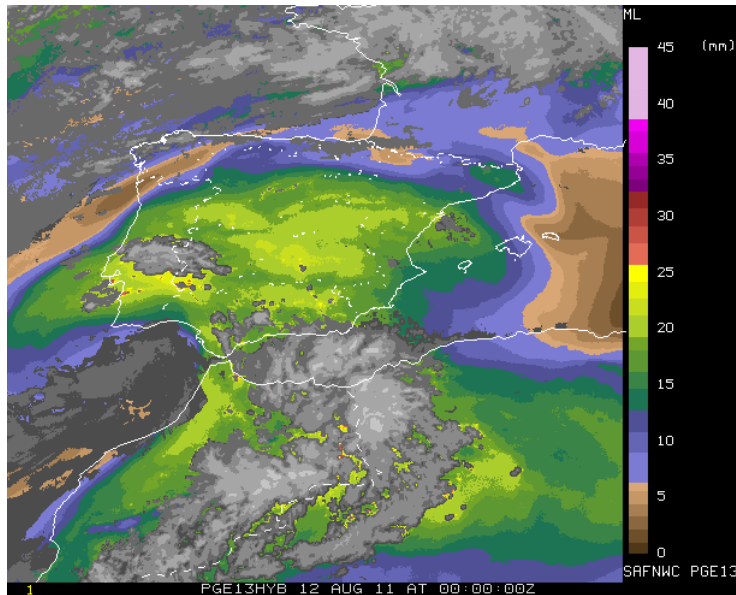
12th August 2011 18:00 UTC



Differences with the NWP model:
Precipitable Water in Middle Layer
ML(850-500 hPa)

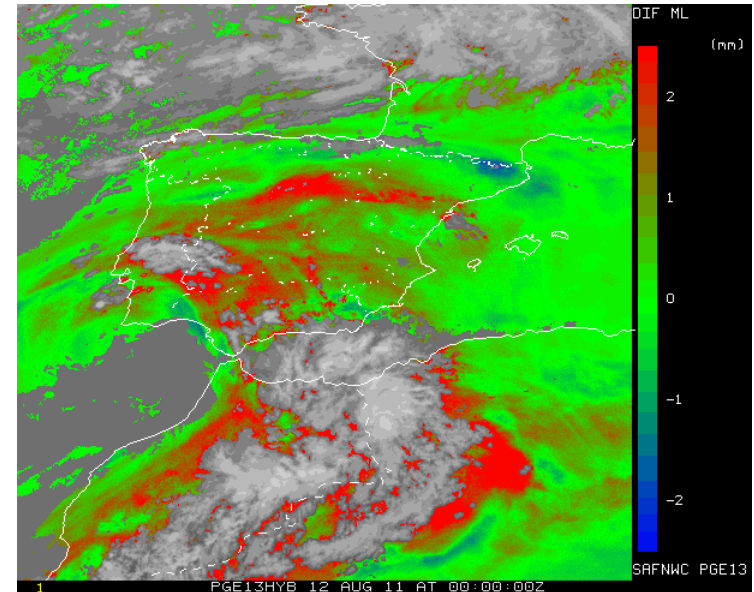
Precipitable Water in Middle Layer
ML(850-500 hPa)

Application: identification of pre-convective areas



Precipitable Water in
Middle Layer
ML(850-500 hPa)

12th August 2011



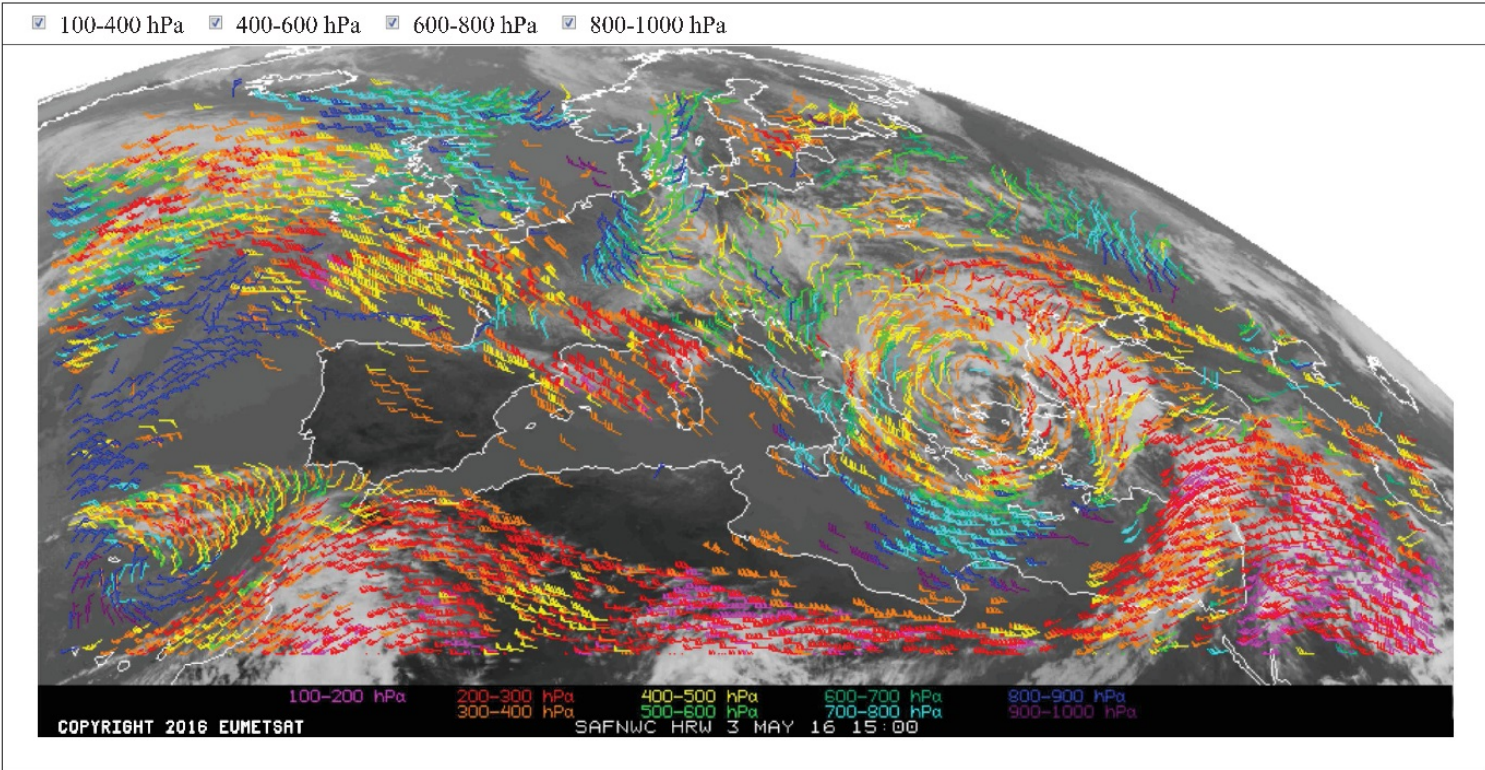
Differences with the
numerical model:
Precipitable Water in
Middle Layer
ML(850-500 hPa)

HRW: calculation of winds at different levels from the tracking of tracers in consecutive satellite images.

Product assimilated in MetOffice model

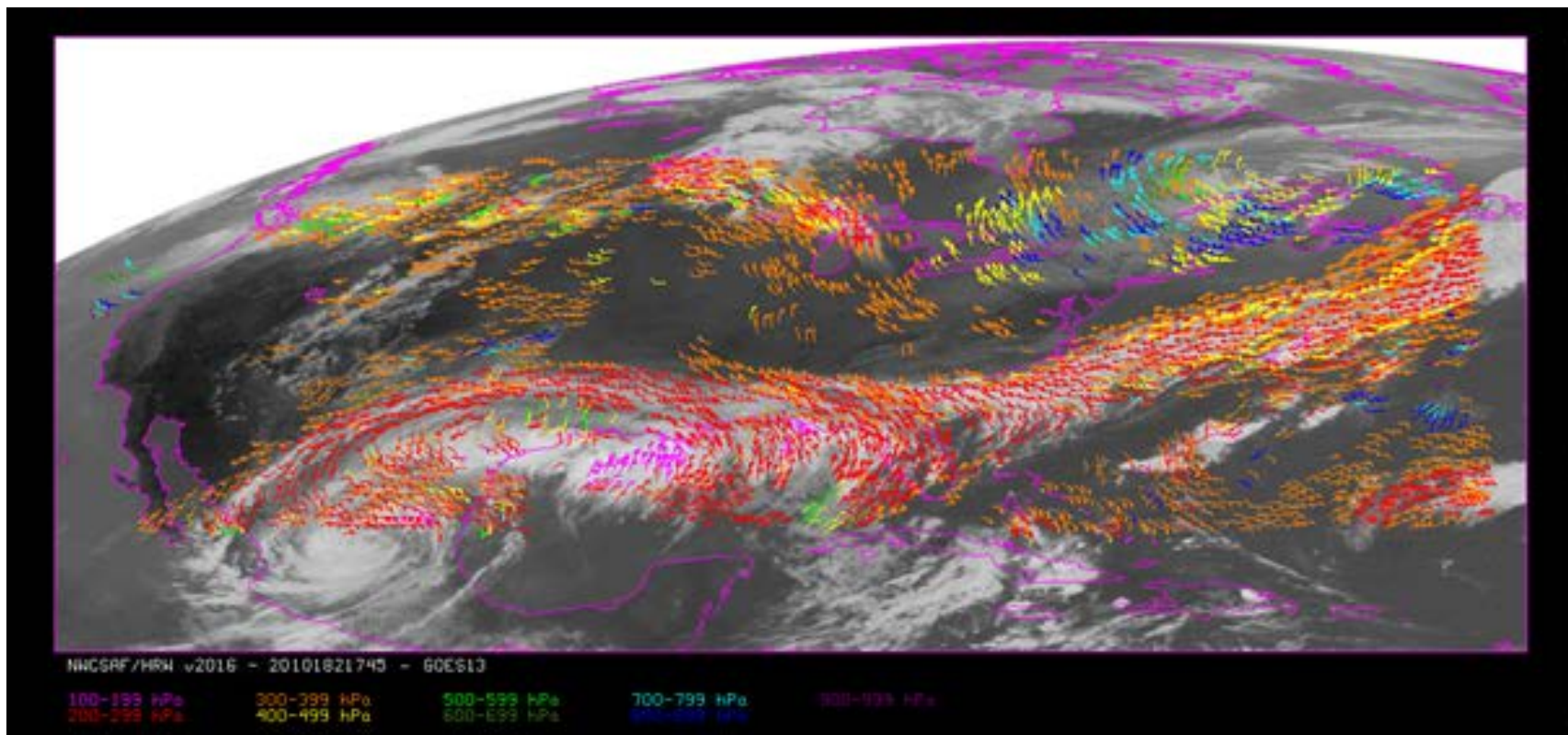
Applications:

- Nowcasting (strong winds, convergence/divergence lines,...)
- Assimilation in NWP models
- Aviation



NWC SAF High Resolution Winds (HRW)

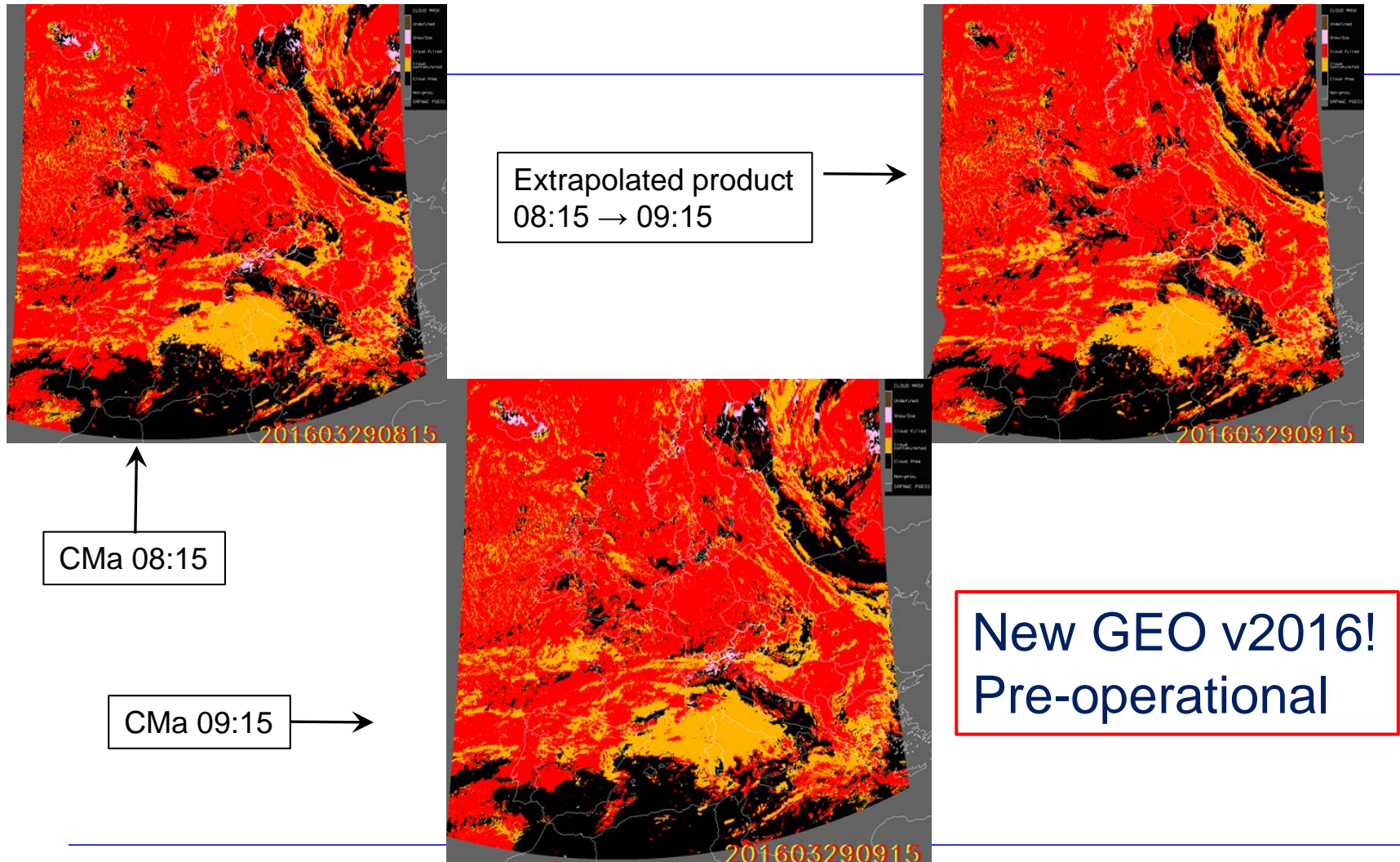
HRW adapted to GOES-N: new in GEO v2016!



*NWC/GEO High Resolution Winds v2016 AMV output
example in the Continental United States region (1 July
2010 1745Z, GOES13 satellite),*

Javier García
Pereda, AEMET

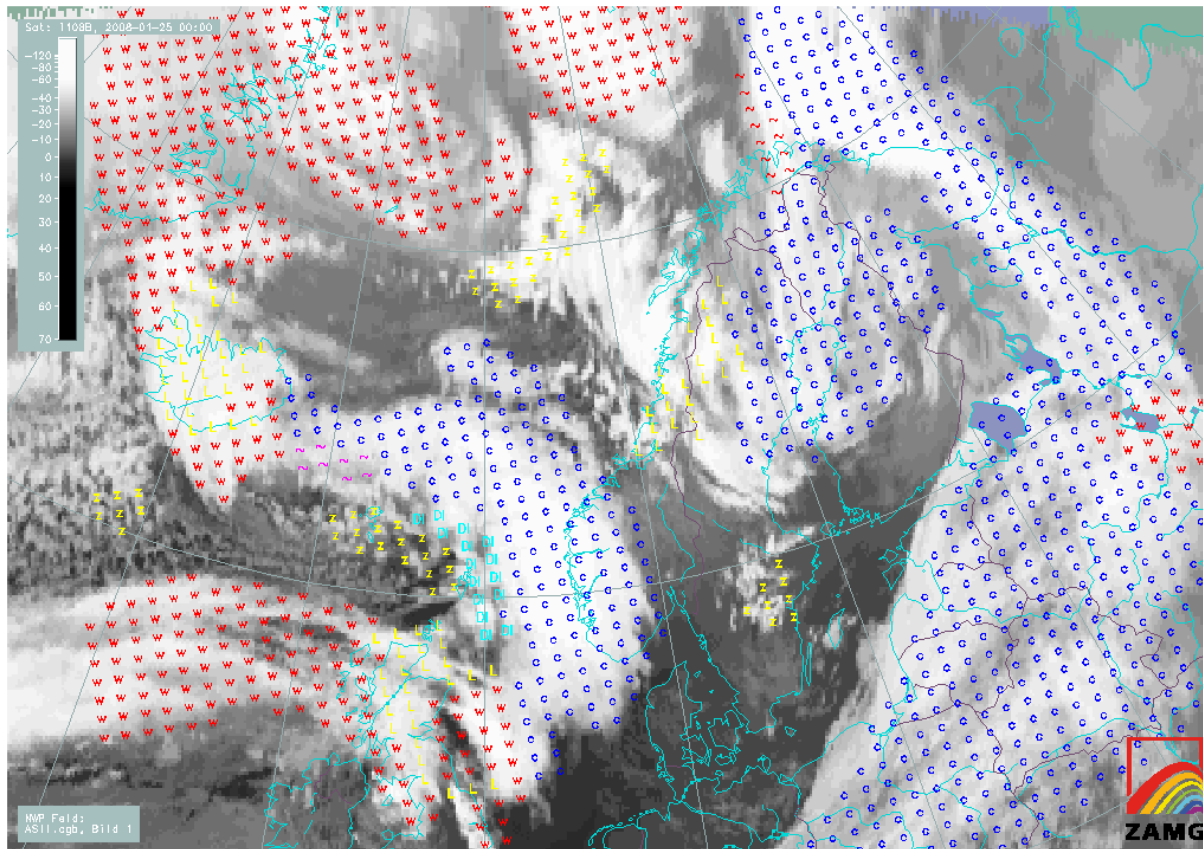
Extrapolated Imagery (EXIM): extrapolation of MSG images and NWC SAF products using the NWC SAF HRW winds



Automatic Satellite Image Interpretation

ASII: provides an automatic satellite image interpretation in terms of conceptual models (CMs)

SEVIRI images + NWP model



analysis for 25 January 2008, 0000 UTC (ASII).

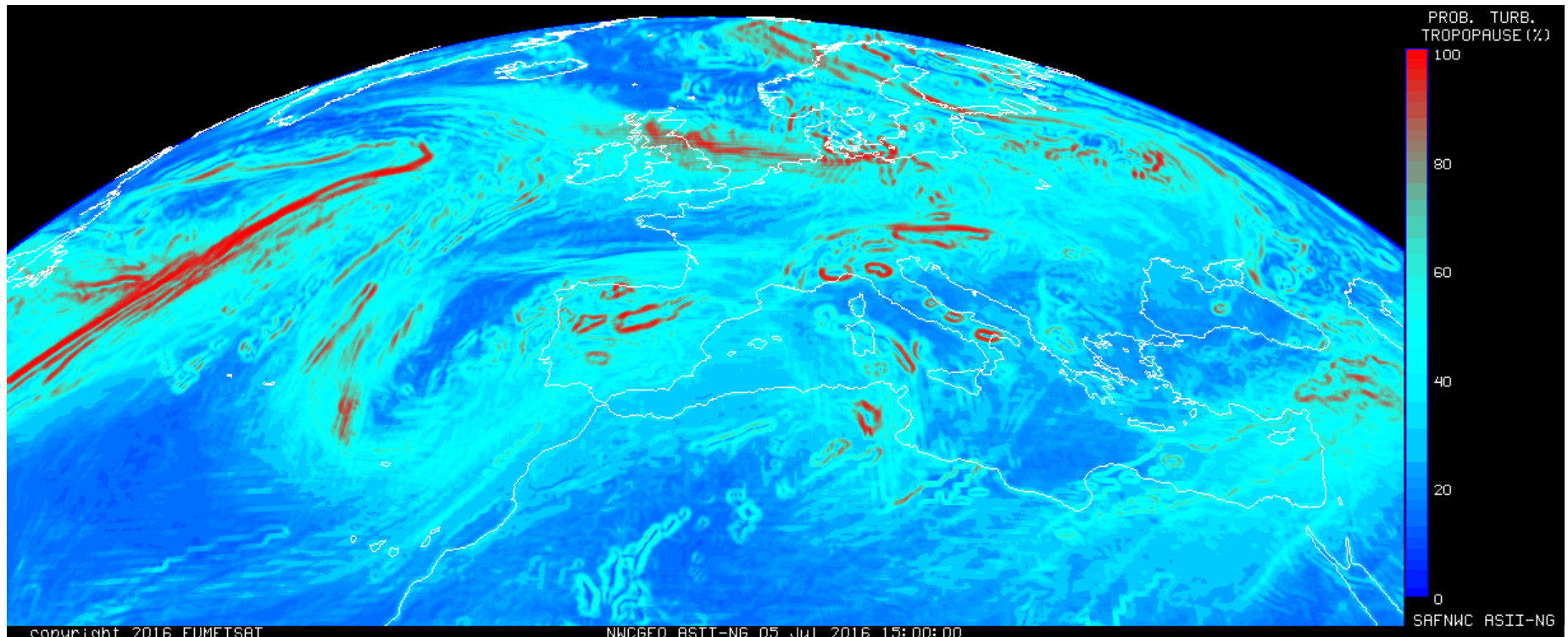
A. Wirth, ZAMG

Automatic Satellite Image Interpretation

New Generation (ASII-NG): probability of occurrence of meteorological phenomena

Probability of occurrence of tropopause folding.
Next version will include mountain waves

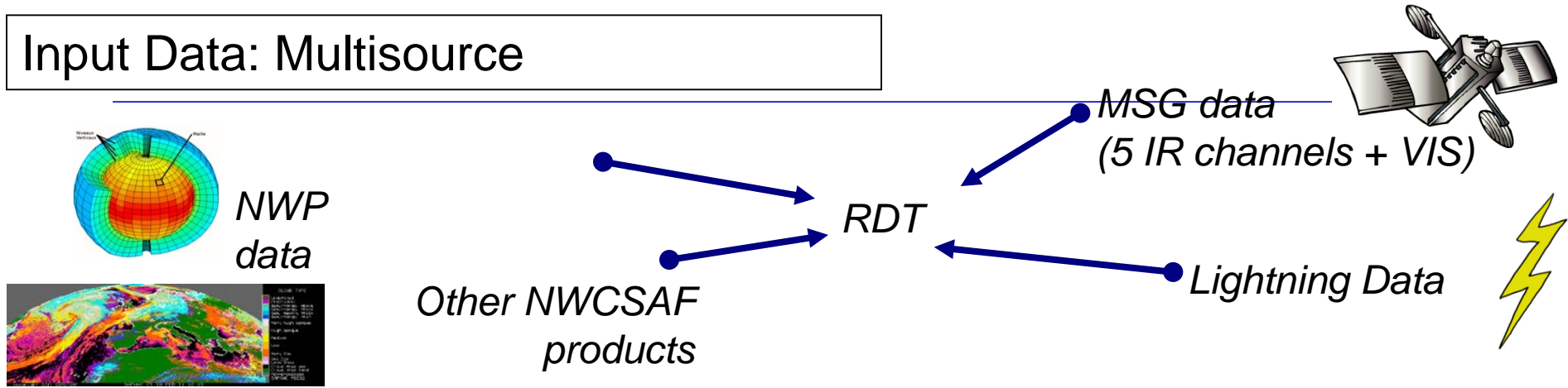
New GEO v2016!
Pre-operational



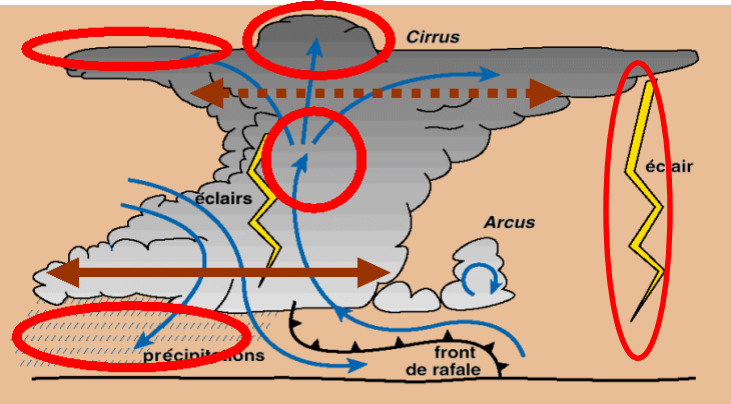
Rapid Development Thunderstorms product

RDT: data fusion for description of convection

Input Data: Multisource



Output: Multilevel Description Of Convection

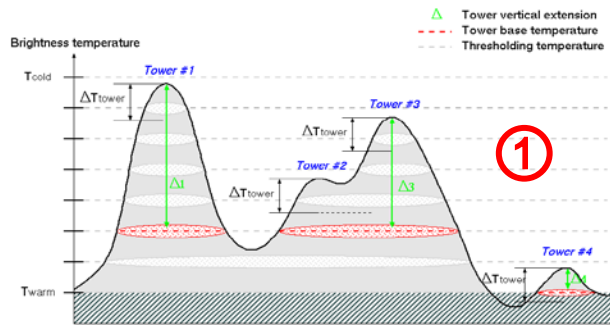


- Main description of cell: Yes/No convection diagnosis, cell-development phase, position, surface, T, gap to tropopause, cloud type and phase, cloud top pressure. Severity Index high IWC hazard. Displacement Relevant trends are calculated
- Overshooting Tops, Lightning Activity, Convective Index, Rainfall Activity

4-steps algorithm of RDT

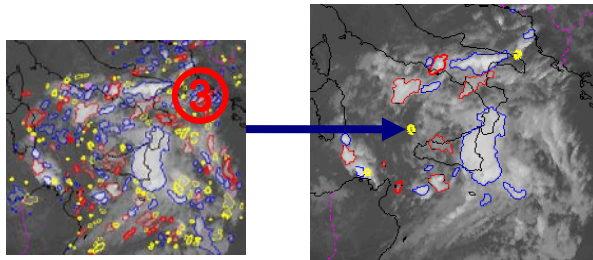
STEP1: 10.8 μm detection

- In order to detect cells
- Vertical extension: at least 6°C



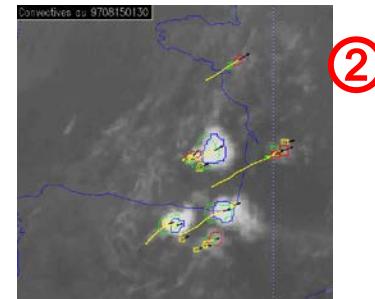
STEP3: Discrimination

- In order to identify convective cells
- Statistical process



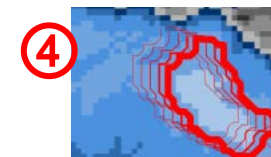
STEP2: Tracking

- In order to recognize each cell in the previous slot)
- Trends calculation is then allowed



STEP4: Forecast (v2016)

- No creation, no dissipation of cells
- Improvement of tracking (NWP, HRW)



RDT product

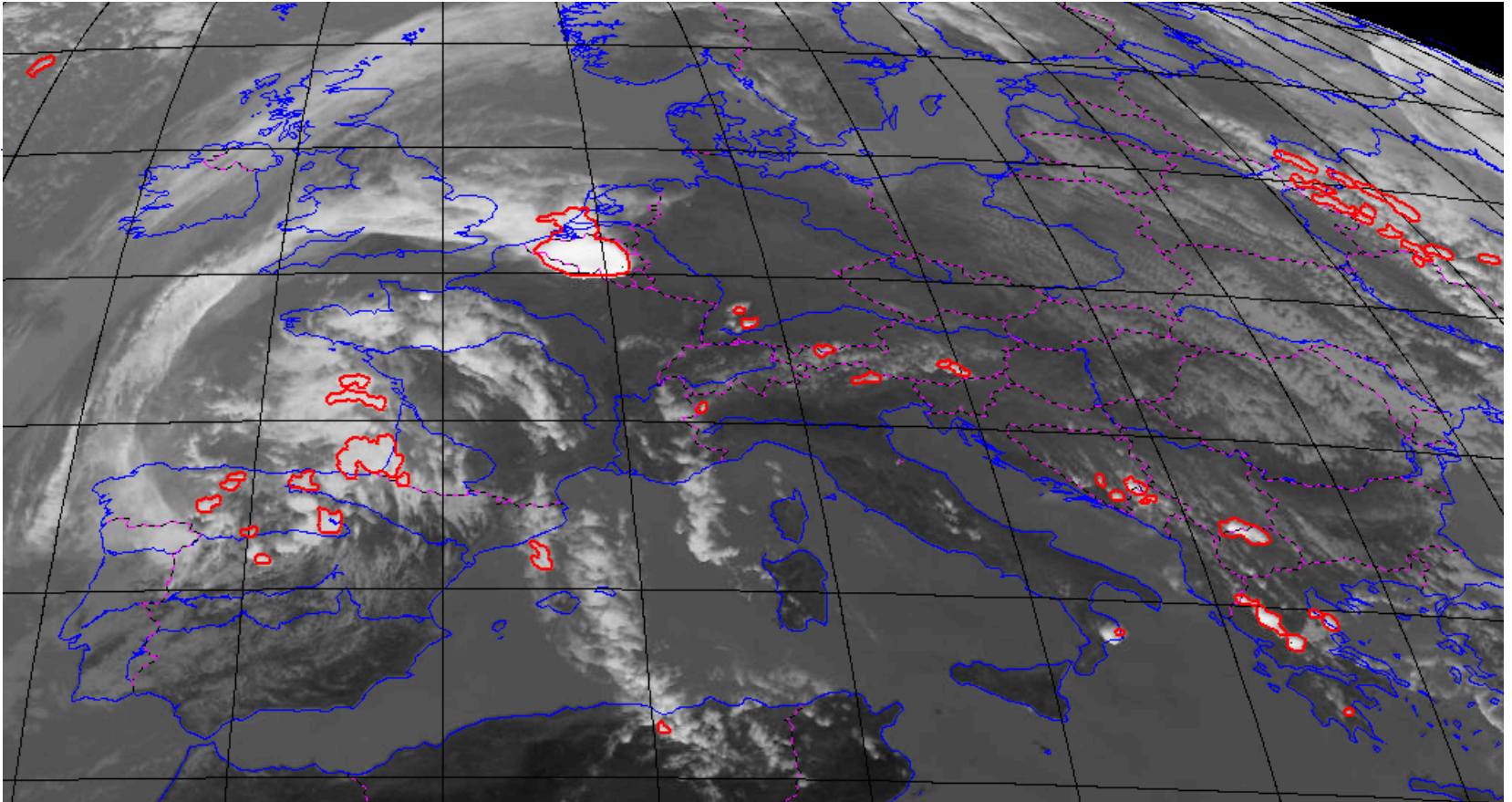
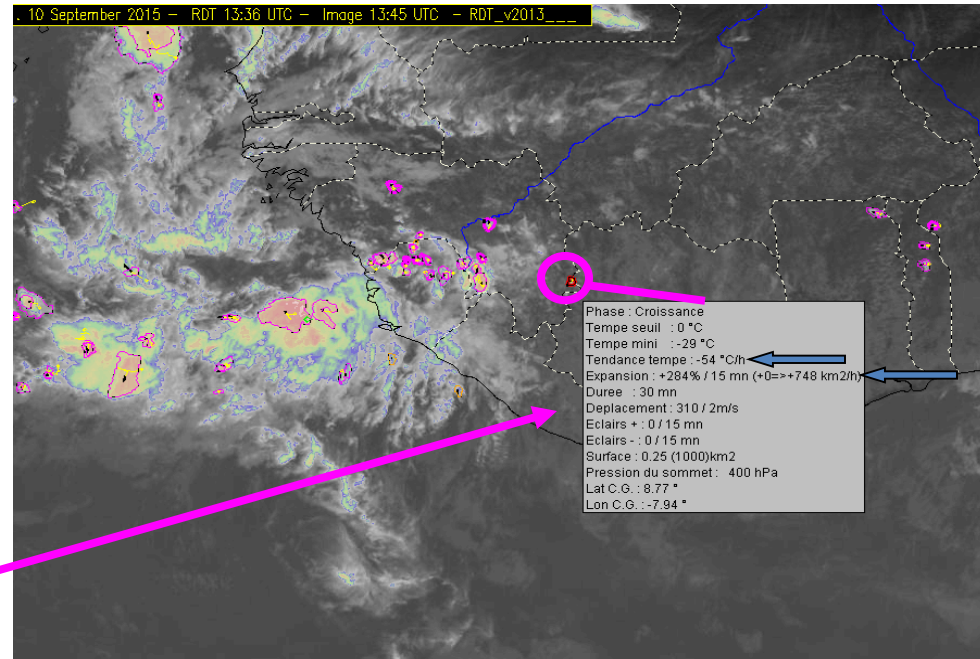


Figure 5: 25th May 2009, 12UTC – RDT-CW objects (red outline) after convective discrimination

RDT – Severity Attribute

- ❑ Each feature of convection is interesting and kept
- ❑ But it is also interesting to summarize severity in a single attribute. Based on following elements
 - Cooling rate
 - Overshooting Top presence
 - BTD 6.2-10.8 trend
 - Horizontal expansion rate
 - Convective rain rate
 - Lightning activity
- ❑ Implemented in v2016

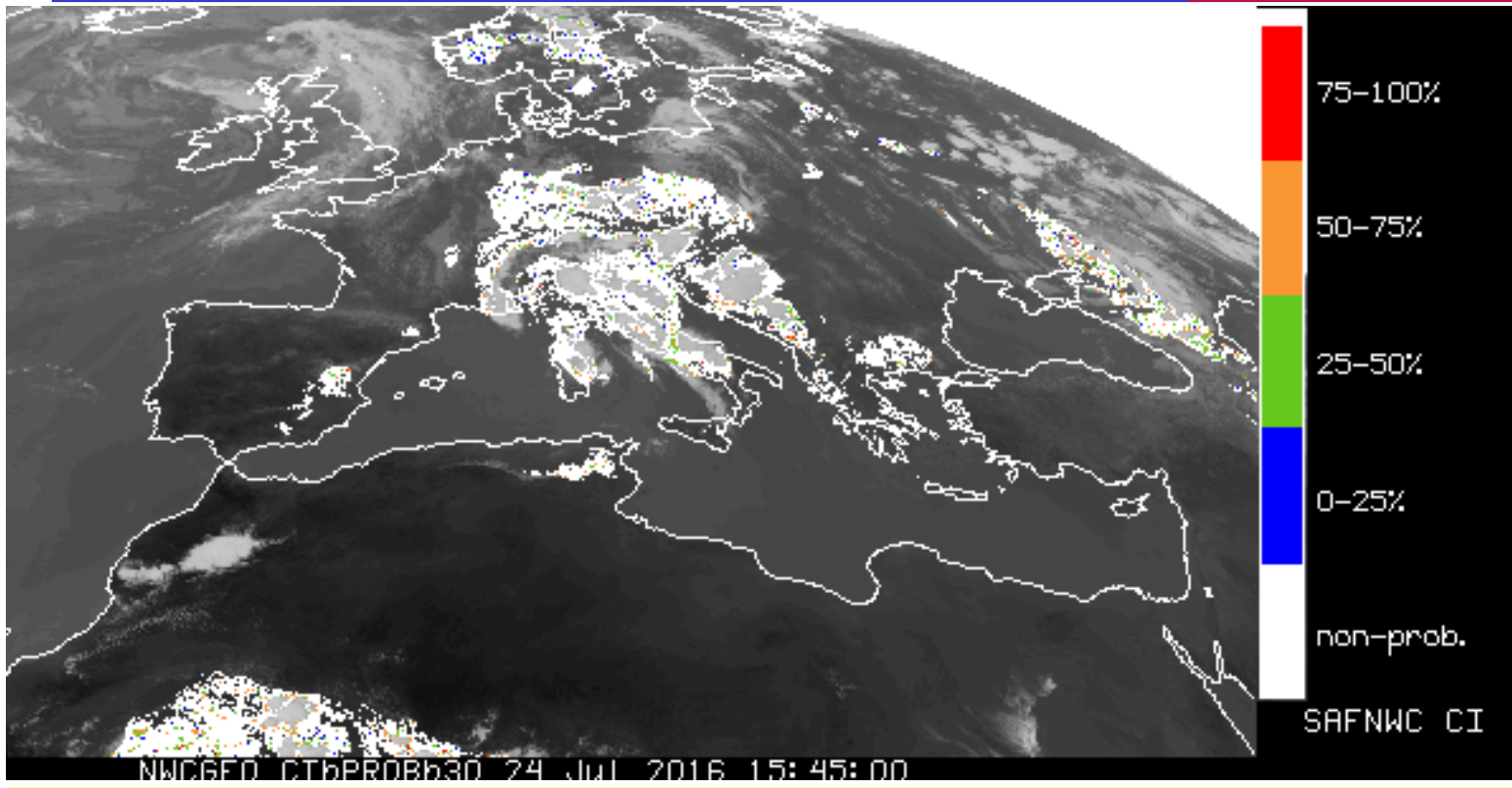
This small system rapidly develops on horizontal and vertical scales. Diagnosed as « severe » in severity algorithm (even if no lightning network available)



New product: Convection initiation CI

Probability of a cloudy pixel to become a thunderstorm in a given following period range

New GEO v2016!
Pre-operational



24/07/2016 15:45 UTC –CI Probability that a cloudy pixel becomes a thunderstorm in the following 30 min.

HOW TO GET THE NWC SAF SW

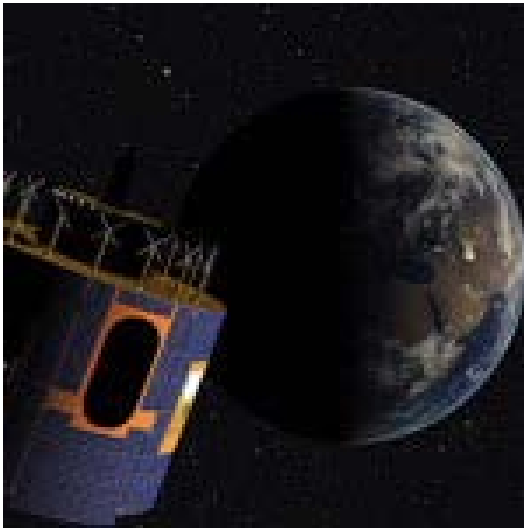
The software is distributed freely to registered users of the meteorological community and is used for Nowcasting and as a development and research tool

1. **Write an email expressing your interest to:**
safnwchd@aemet.es (cc pripodasa@aemet.es)
2. **You will be sent:**
The Application Form, that should be fulfilled and sent by email
The **License Agreement**, that should be signed and sent by ordinary mail
3. **You will be provided the credentials to access the Help Desk restricted area:**
You can download the SW (GEO & PPS)

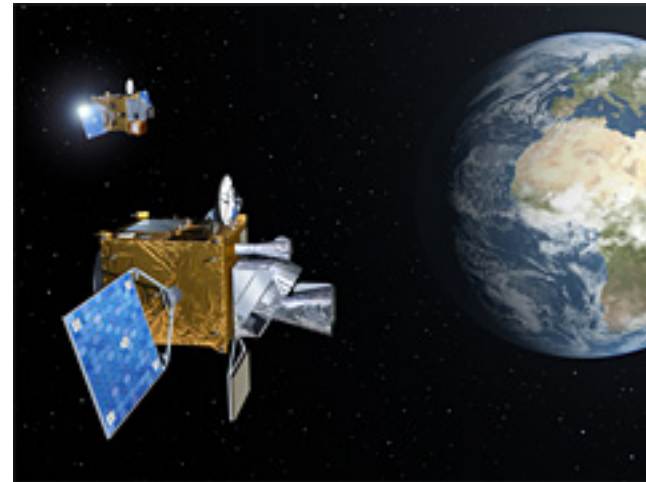
NWC SAF Software

- The user runs the SW package and generate the products
- Advantage: users can configure the SW to fit their needs (e.g. the user define the area where the products are generated)
- Potential problem: users need access to EUMETSAT satellite images and a NWP model output

Thanks for your attention!!



Meteosat Second Generation MSG



Meteosat Third Generation MSG