

The Rapid Developing Thunderstorm (RDT) product CDOP to CDOP2

Product of the SAF Nowcasting (<http://nwcsaf.org>)

Meteo_France

(Yann Guillou, Frederic Autones)

Yann.guillou@meteo.fr

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NWC SAF



METEO FRANCE
Toujours un temps d'avance

Goal of the RDT Product

The RDT, Rapid Development Thunderstorm, product has been developed by Meteo-France in the framework of the EUMETSAT SAF in support to Nowcasting. Using mainly geostationary satellite data, it provides information on clouds related to significant convective systems, from meso-alpha scale (200 à 2000 km) down to smaller scales (few pixels):

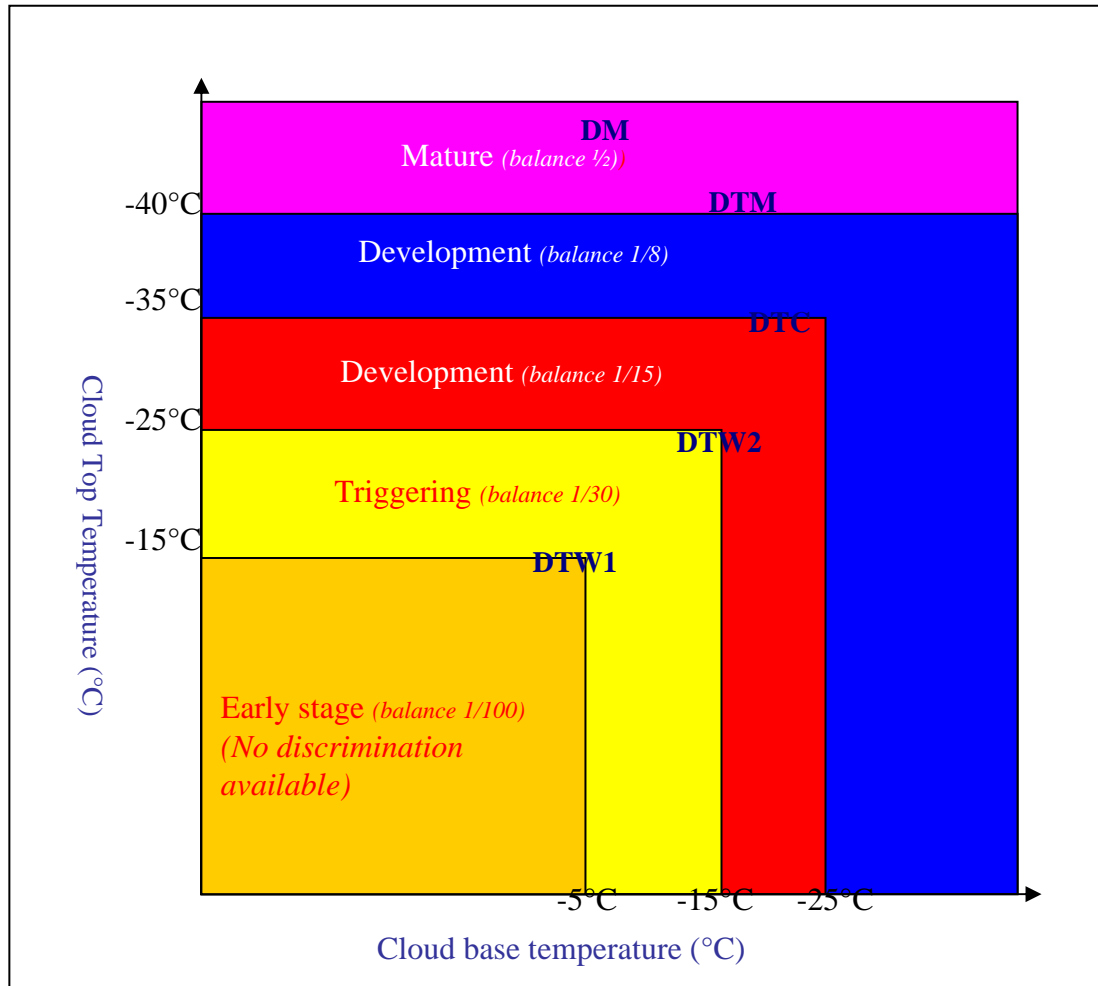
- The identification, monitoring and tracking of intense convective system clouds
- The detection of rapidly developing convective cells

The object-oriented approach underlying the RDT product allows to add value to the satellite image by characterizing convective, spatially consistent, entities through various parameters of interest to the forecaster : motion vector, cooling and expansion rate, cloud top height,..., and their time series. It supports easy and meaningful downstream data fusion (surface observations, NWP fields, radar data...).

Thereby, Moreover to be a tool for forecaster or convection research teams, the RDT could be integrated into convection warning system.

The Major Improvement (CDOP)

The Discrimination scheme



4 Discrimination Moments:

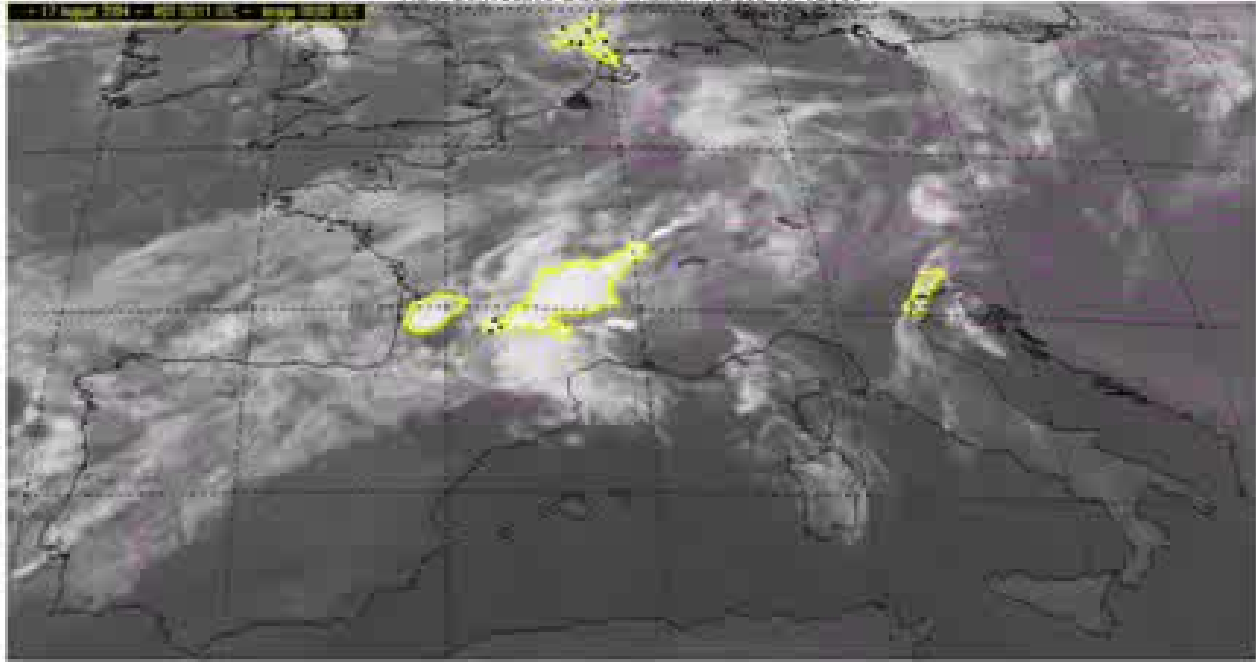
- Warm1 crossing:
 - Cloud top < -15°C
 - Cloud base < -5°C

- Warm2 crossing
 - Cloud top < -25°C
 - Cloud base < -15°C

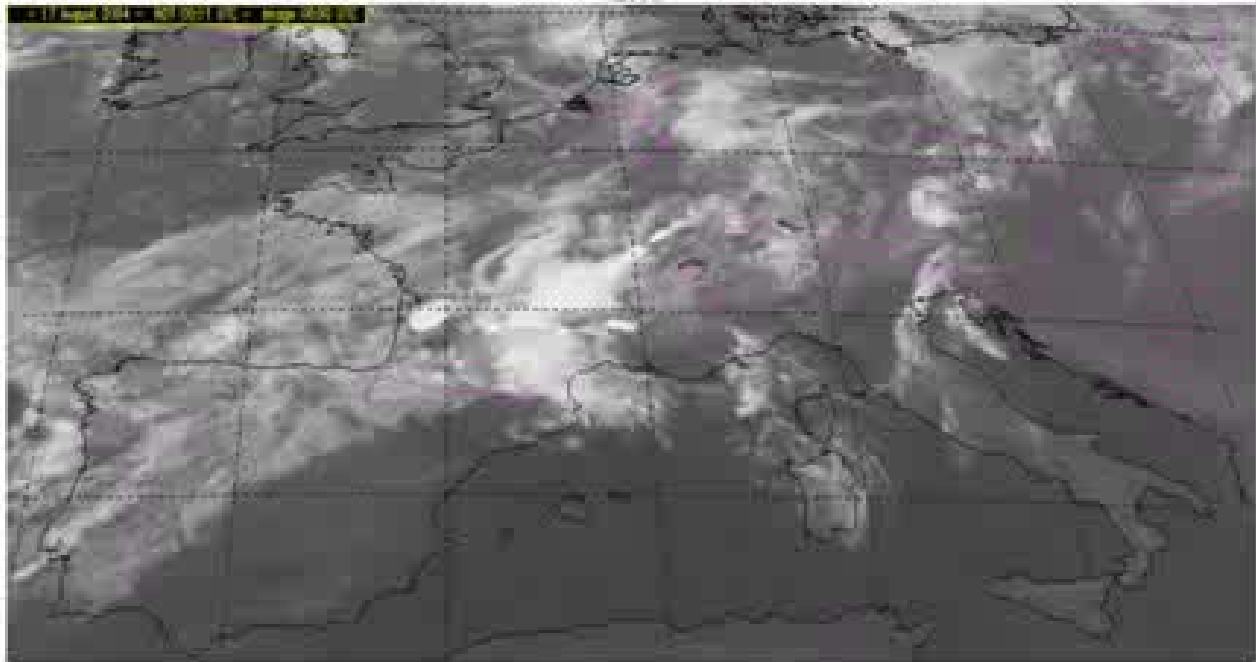
- Cold crossing
 - Cloud top < -35°C
 - Cloud base < -25°C

- Mature crossing
 - Cloud top < -40°C

RDT Convective Discrimination: V2008 vs V2009



V2008



V2009

The RDT product

Discrimination skill

■ **The Objective Score (MSG)**

- Probability of detection (POD): 71 % of convective period (lightning flashes associated)
- Probability of false detection (POFD): < 2%
- False alarm rate (FAR or F): 36 %
 - The majority of false alarm is done
 - on lightning flashes vicinity
 - on lee cloud
 - for latitude > 55° (error on BTD calculation due to parallax)
- Threat Score (TS): 50 %

■ **The Precocity of convective classification (MSG)**

- 25% of good detection are classified before the first lightning occurrence
- 50% of good detection are classified convective at the first lightning occurrence
- 30 minutes after the first lightning occurrence, 85% of good detection have been classified

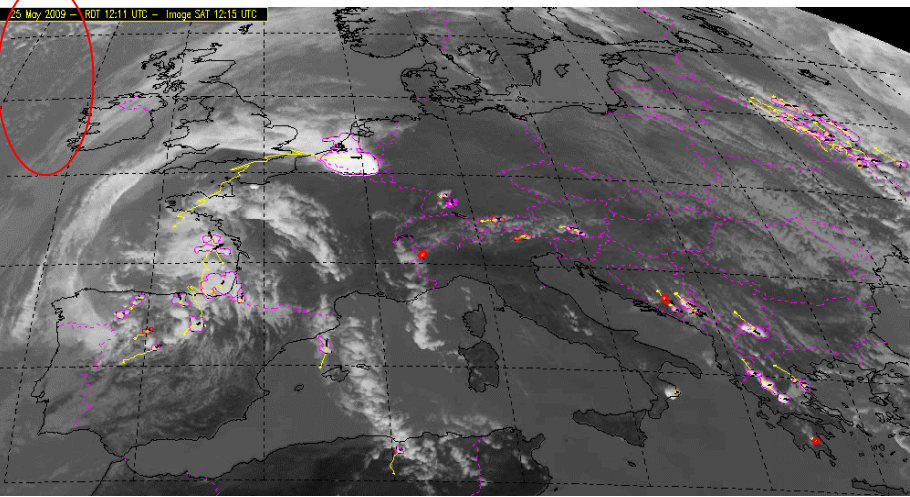
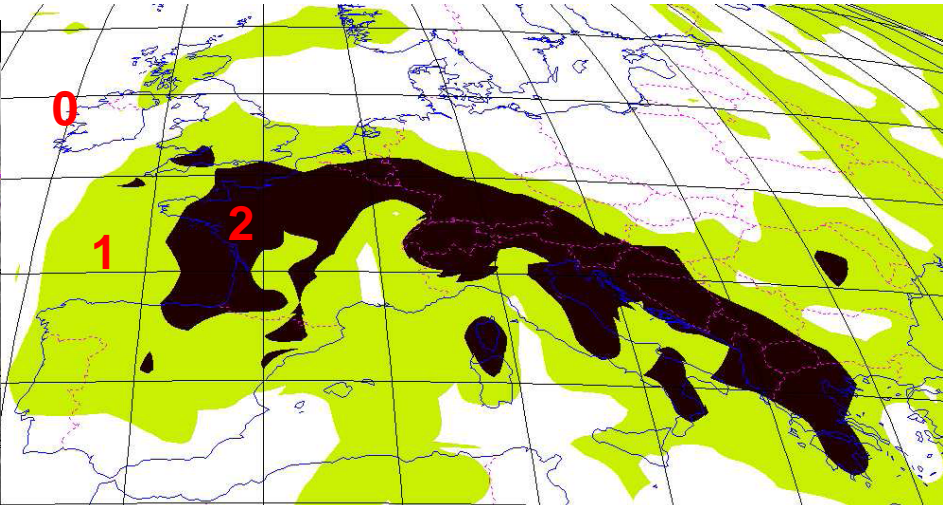
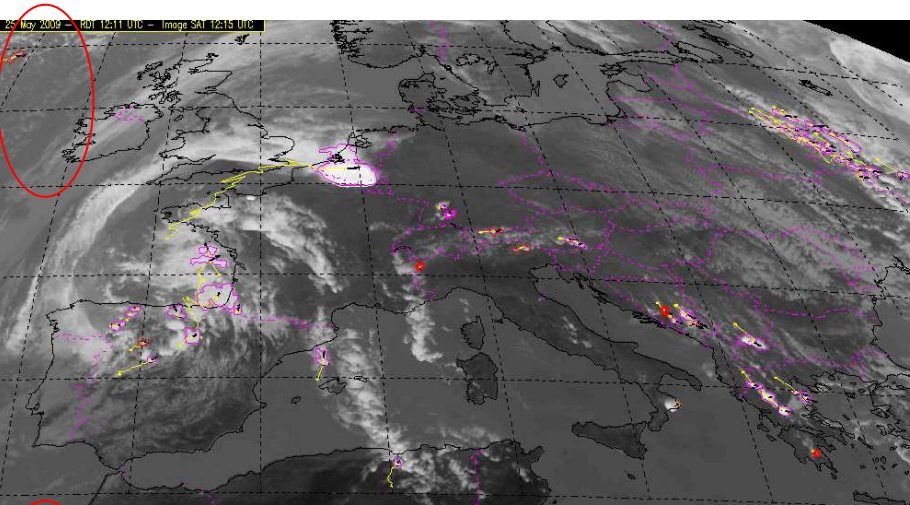
The next RDT Version (CDOP)

- RDT V2010
 - Two new channels: 8.7 μ m and 12 μ m (see SAFNWC web site: Topical Images Gallery)
 - Improvement of cold classification

- RDT V2011
 - NWP Instability
 - NWP Tropopause Height
 - Lower False alarm
 - Discrimination skill improvement (warm cloud)

- RDT V2012
 - New channel 3.9 μ m
 - PGE13 instability
 - Severity diagnosis

RDT V2011



NWP Instability: Lifted Index < 0

K-index > 25

Showalter < 0

Mask

Reduction of the unbalance between convective and no convective population

Requirements pending (*Collection of major points*)

Description of convective phenomenon:

- The convective objects are defined from the bases of cloud towers (viewed by IR channel). This approach is relevant for the discrimination pattern but limited for operational use where more details are needed.
- Trajectory depiction is erratic (based on gravity center)

Detection precocity:

- The early detection compared to lightning activity is a major objective which is not full satisfied after CDOP. Even if the majority of convective objects are detected not more than 30 minutes after the first lightning occurrence, less than 25% are detected before the lightning activity

Diagnostic of severity:

- The RDT doesn't provide information to nowcast severity associated to a convective object

Diagnostic more than Nowcast:

- Even if the RDT provides trend and displacement of convective object, the RDT doesn't provide nowcast convective object

Enhancements Proposal

Description of convective phenomenon:

- Add objects: Anvil, overshoot, updraft, U/V shape
 - Recast the algorithms of object definition and monitoring in order to define a multiple objects tracking levels
- Add nowcast objects
 - Based on simulated satellite image (other SAFNWC products)
- Add severity diagnosis
 - Based on new convective objects and microphysics (other SAFNWC products)

Detection precocity:

- Add specific products on convection triggering probability (combine pixel and object approach)

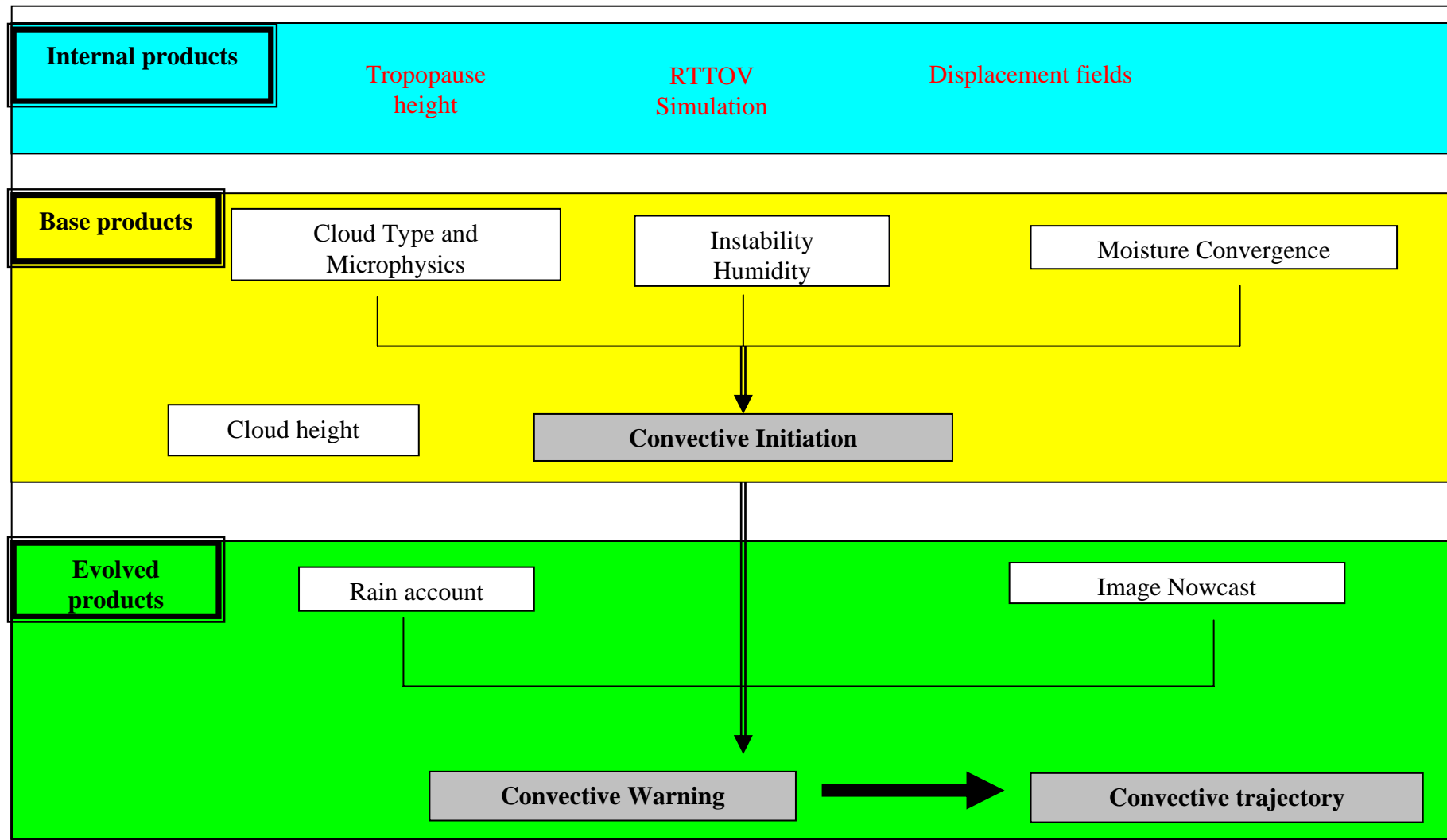
Complete and coherent convective information:



- Assume data fusion with others SAFNWC products

Make the convective product more accessible

- Add a new format (issued from Web technology)

CDOP2 Proposal



 Optionnal input
 Obligatory input

CONCLUSION

The Rapid developing Thunderstorm is an efficient software to monitor and nowcast thunderstorms. The first convective classification is closed to the first lightning occurrence.

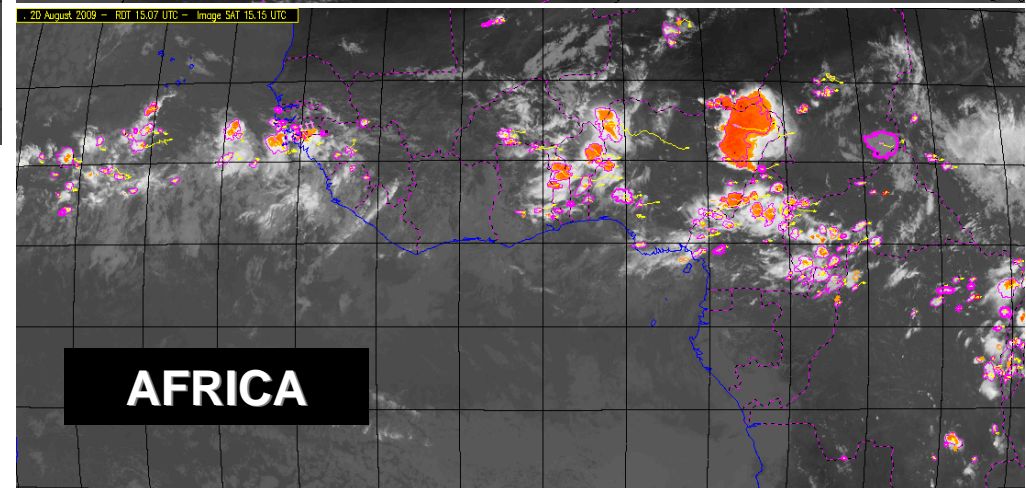
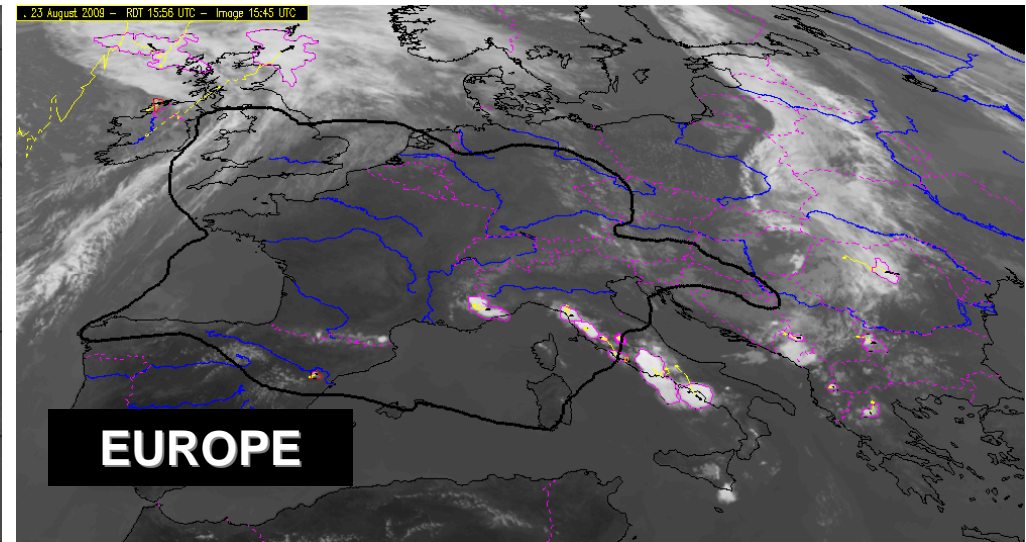
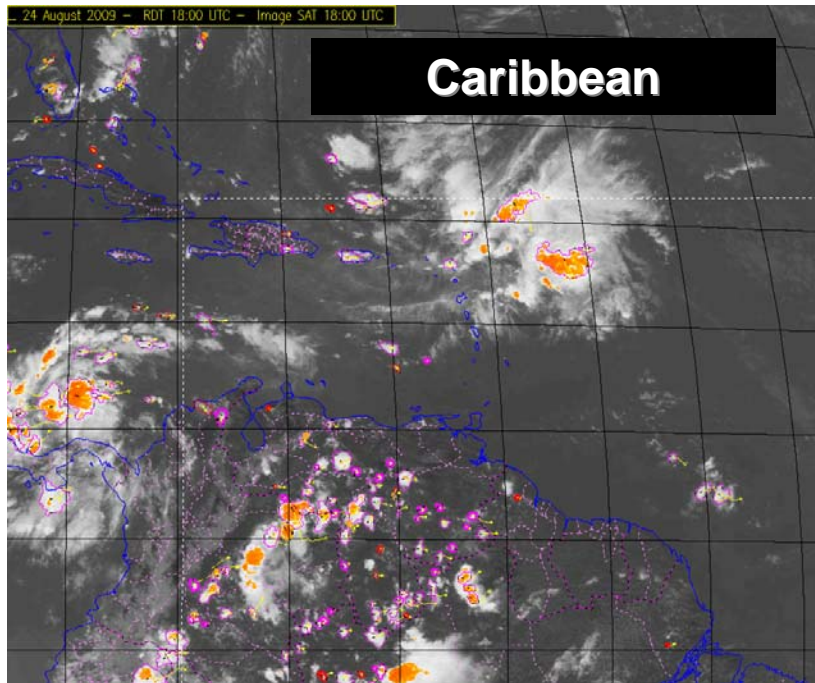
Nevertheless, the product is not perfect and have some limitations:

- Single level monitoring
- Incompressible time required in object approach to classify

The CDOP2 proposal on the “thunderstorm nowcasting” thematic comes in part of the continuation of previous phases with further PGE11_RDT enhancements and new software designed around:

- § The early detection
- § The nowcasting up to one hour

RDT – Operational Use



Europe (MSG and Rapid Scan)

<http://nwcsaf.org>

Africa (MSG)

<http://aoc.amma-international.org/>