

ENHANCING THE CRR PRODUCT FOR PRECIPITATION ESTIMATION

Ainoa Pascual Cao

apascualc@aemet.es

Nowcasting SAF

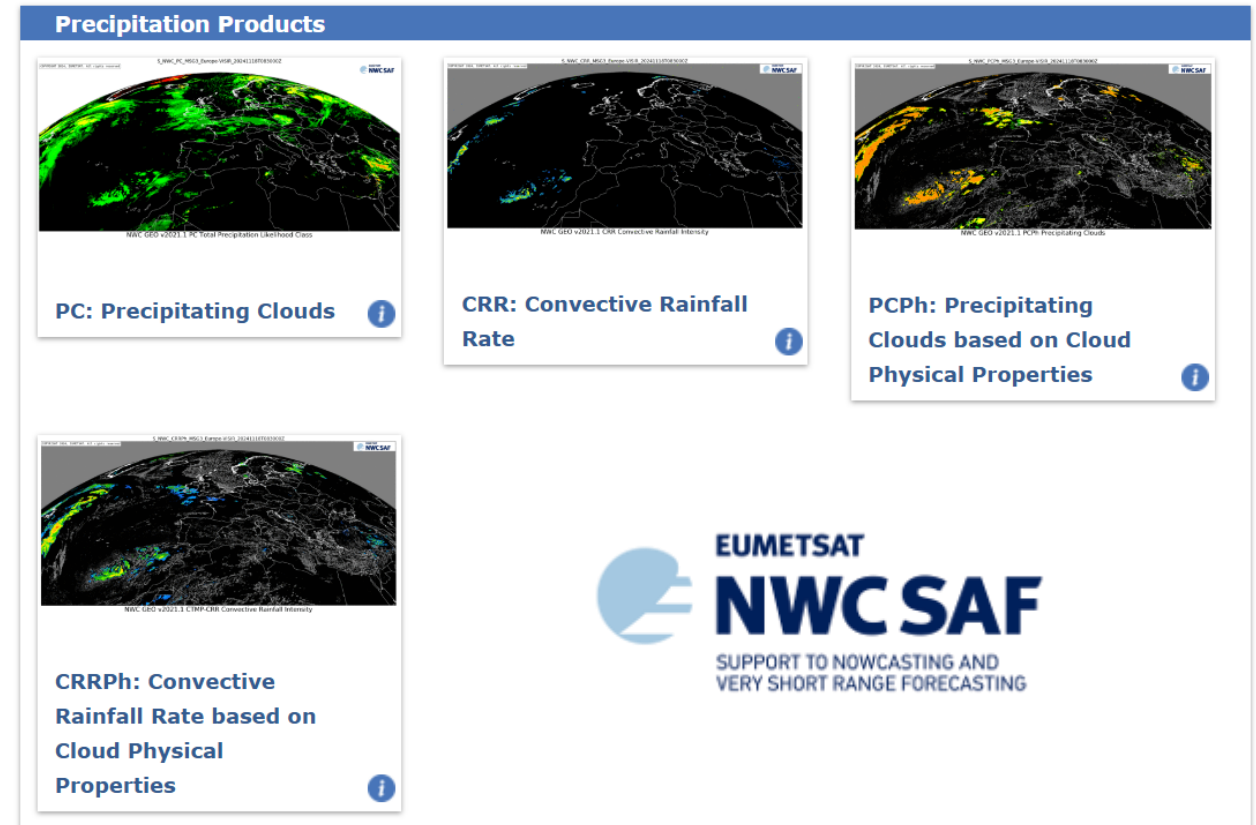
PRECIPITATION PRODUCTS

- **Probability of precipitation**

- PC – Precipitating Clouds
- PCPh

- **Precipitation intensity**

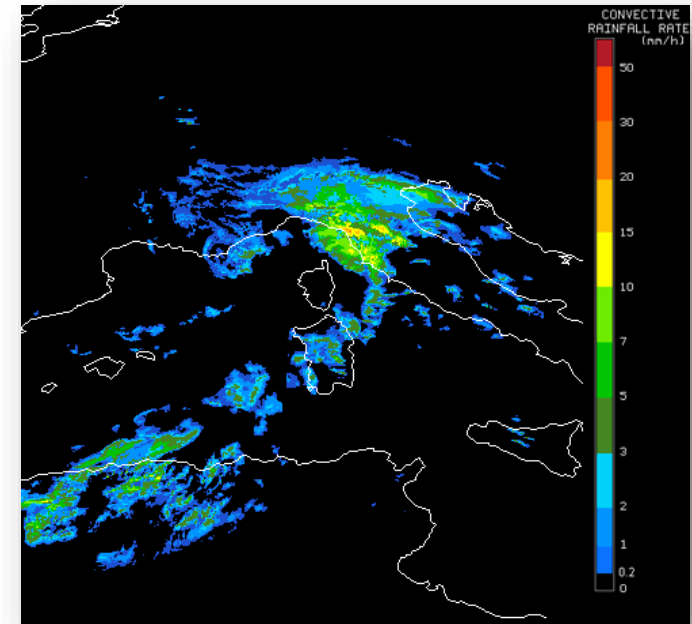
- CRR – Convective Rain Rate
- CRRPh



Intensity of precipitation: CRR

CRR – Convective Rainfall Rate

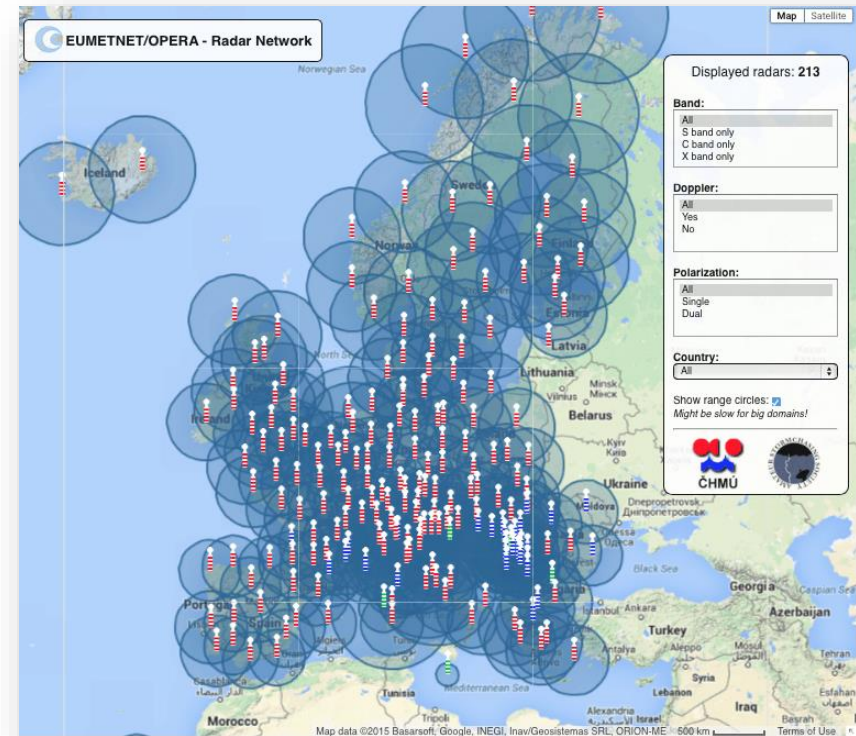
- Estimates the rainfall rate for convective systems.
- Doesn't distinguish the phase.
- Algorithm:
 - **Day:** channels IR-10.8, WV-6.2, VIS-0,6
 - **Night:** channels IR-10.8, WV-6.2
 - + analytical functions for calibration
 - **Spanish radar network**
 - + corrections implemented on software.



Intensity of precipitation: CRR

CRR: Future Challenges. MTG and OPERA

- **Recalibration:**
 - Until now: Spain
 - Objective: OPERA (Europe)
- Adapt CRR to **MTG**
 - IR-10.8 → IR-10.5
 - VIS-0.6 → VIS-0.64
 - WV-6.2 → WV-6.3



Intensity of precipitation: CRR

Starting Point: ATBD

- **Algorithm Theoretical Basis Document, 2021**
- Official documentation for the NWC-SAF products.
- **Procedure:** reproduce the process for MSG and Spain.

	Algorithm Theoretical Basis Document for the Precipitation Product Processors of the NWC/GEO	Code: NWC/CDOP3/GEO/AEMET/SCI/ATBD/Precipitation Issue: 1.0.1 Date: 29/10/2021 File: NWC-CDOP3-GEO-AEMET-SCI-ATBD-Precipitation_v1.0.1 Page: 1/83
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Algorithm Theoretical Basis Document for
the Precipitation Product Processors of the
NWC/GEO

NWC/CDOP3/GEO/AEMET/SCI/ATBD/Precipitation, Issue1 , Rev. 0.1
Date 29th October 2021

CRR recalibration process

FIRST STEP: THE DATA

• 28 days for MTG	NIGHT ALGORITHM	DAY ALGORITHM
• IR-10.8 • WV-6.2 • VIS-0.6 • Latitude • RFR (radar)	- IR-10.8 - WV-6.2 - RFR (radar)	- IR-10.8 - WV-6.2 - VIS-0.6 - Latitude - RFR (radar)

NIGHT-TIME: THE EQUATIONS

$$RR(mm/h) = H(IR) * \exp \left[-0.5 * \left(\frac{(IR - WV) - C(IR)}{W(IR)} \right)^2 \right]$$

$$H(IR) = a * \exp[b * IR]$$

$$C(IR) = c * IR + d$$

$$W(IR) = f * \exp \left[-0.5 \left(\frac{IR + g}{h} \right)^2 \right] + j$$

CRR recalibration process - NIGHT

FIRST STEP: THE DATA

- **IR10.8** and **IR10.8 – WV6.2** data divided in **intervals** of 0.5 width
- For each pair of intervals:
 - Percentil 90 %
 - % of rainy pixels
 - If <45 % → 0 %
 - Multiplication of **p90%** and **%rain**
- **FINAL SET OF DATA:** IR10.8 | IR10.8 – WV6.2 | Multiplication

NIGHT-TIME: THE EQUATIONS

$$a = 1,23 \cdot 10^8$$

$$b = -0,072$$

$$c = 0,52$$

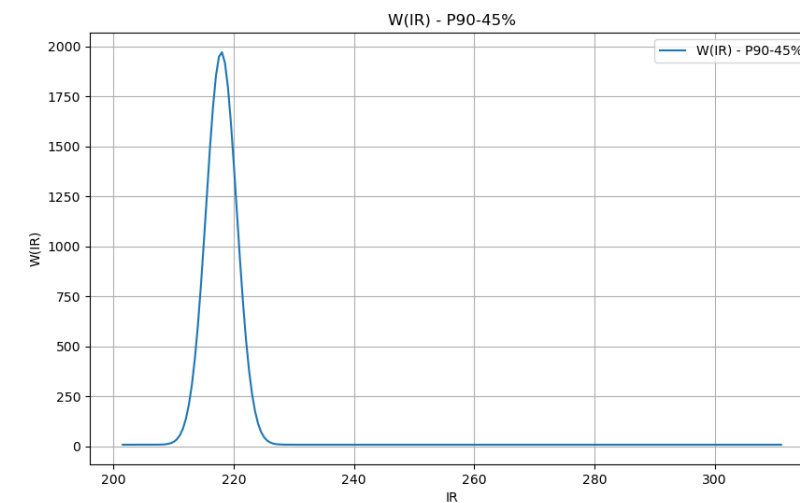
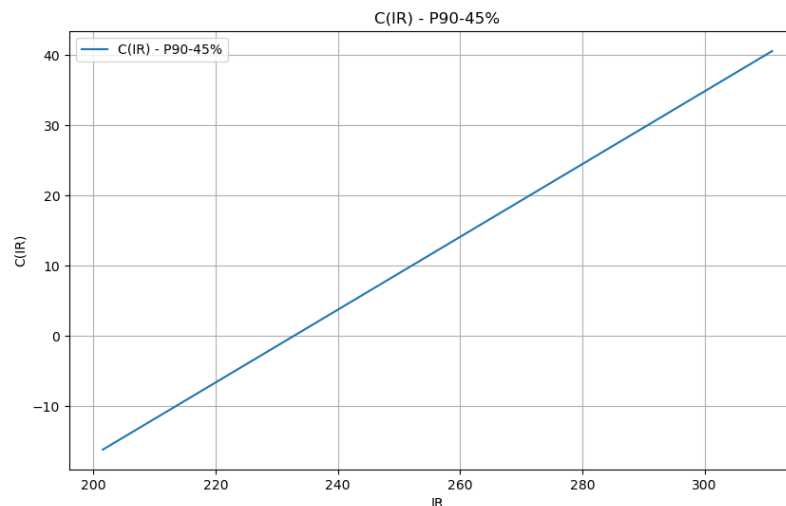
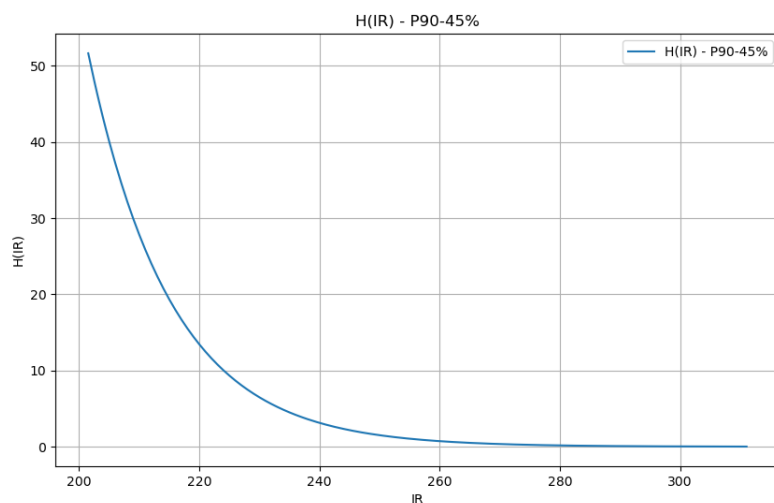
$$d = -120,58$$

$$f = 1966,15$$

$$g = -217,94$$

$$h = 2,53$$

$$j = 7,43$$



$$H(IR) = a * \exp[b * IR]$$

$$C(IR) = c * IR + d$$

$$W(IR) = f * \exp\left[-0.5\left(\frac{IR + g}{h}\right)^2\right] + j$$

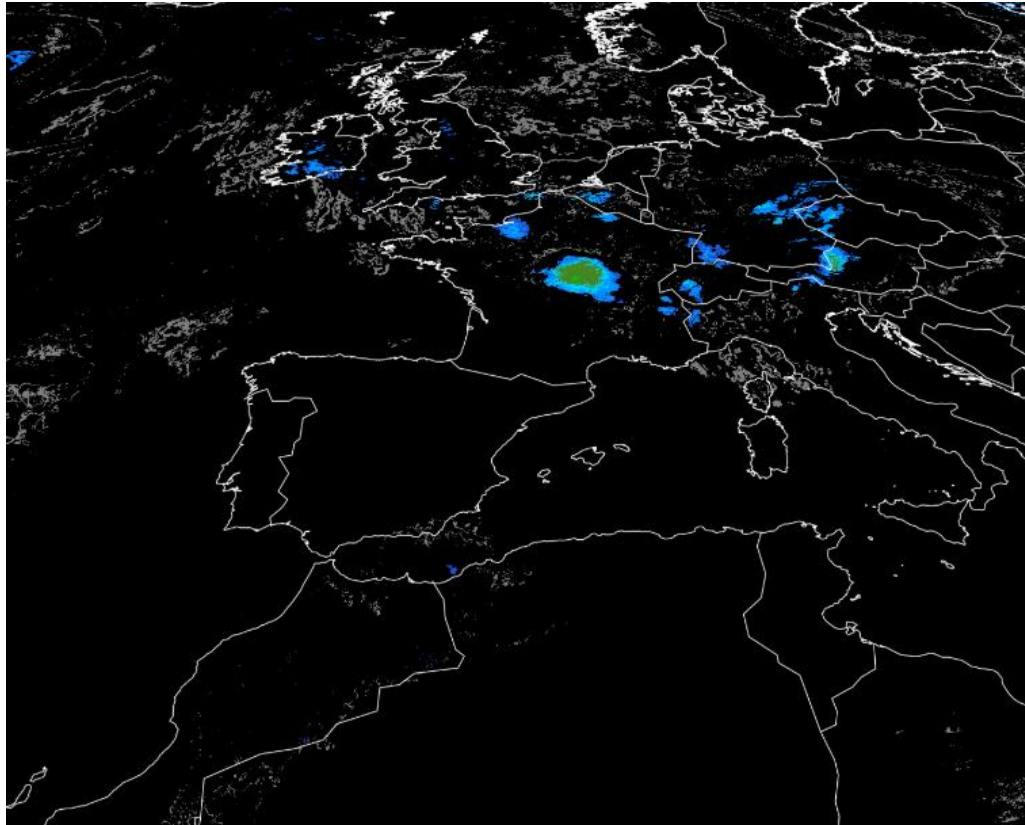
NIGHT-TIME: RESULTS – July 31st 22:00h

*Probability of Detection

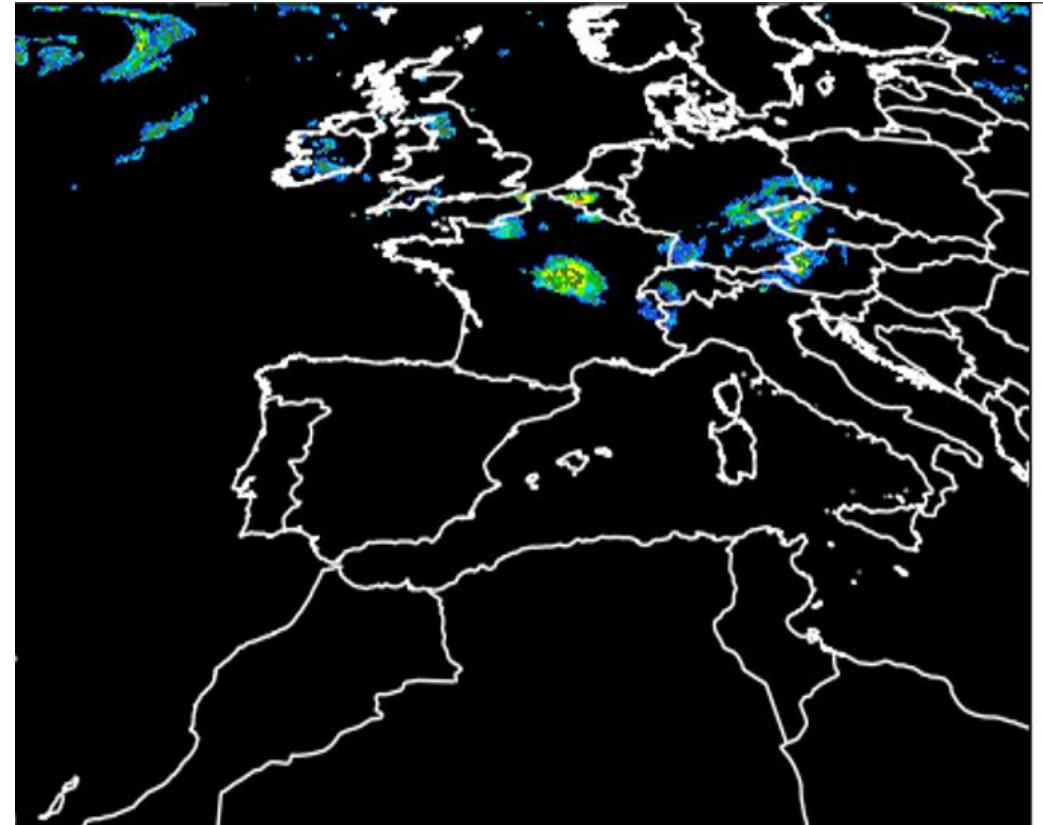
POD: 71,01%

FAR: 31,7%

*False Alarm Ratio



CRRPh



New CRR

DAY-TIME: THE EQUATIONS

$$RR(mm/h) = \exp\left[-0.5 * \left(\frac{VIS_N - C_Vis(Lat)}{8.5}\right)^2\right] * H(IR) * \exp\left[-0.5 * \left(\frac{(IR - WV) - C(IR)}{W(IR)}\right)^2\right]$$

$$H(IR) = a * \exp[b * IR]$$

$$C(IR) = c * IR + d$$

$$W(IR) = f * \exp\left[-0.5 * \left(\frac{IR + g}{h}\right)^2\right] + j$$

$$C_{Vis(Lat)} = c_1 - \frac{(|lat| + c_2)^{c_3}}{c_4}$$

CRR recalibration process - DAY

FIRST STEP: THE DATA

- **IR10.8, VIS0.6 and IR10.8 – WV6.2** data divided in **intervals** of 0.5 width
- **Latitude** divided in **intervals** of 1.5 degrees width
- For each set of intervals:
 - Percentil 96%
 - % of rainy pixels
 - If <40 % → 0 %
 - Multiplication of **p96%** and **%rain**
- **FINAL SET OF DATA:** IR10.8 | IR10.8 – WV6.2 | VIS0.6 | Lat | Multiplication

DAY-TIME: THE EQUATIONS

$$a = 1,4 \cdot 10^4$$

$$b = -0,03$$

$$c = 0,49$$

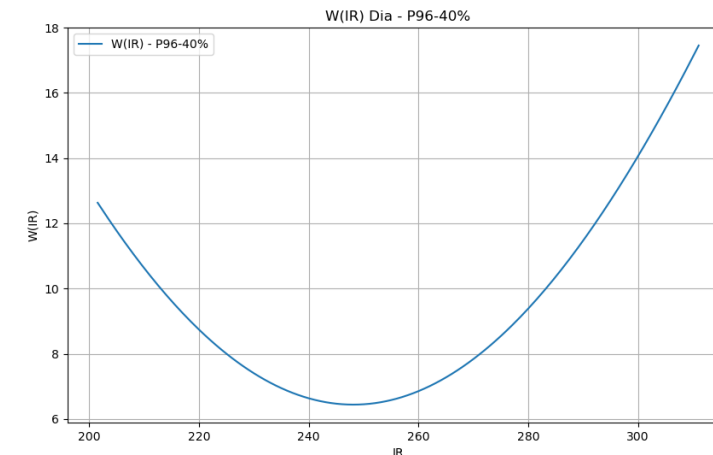
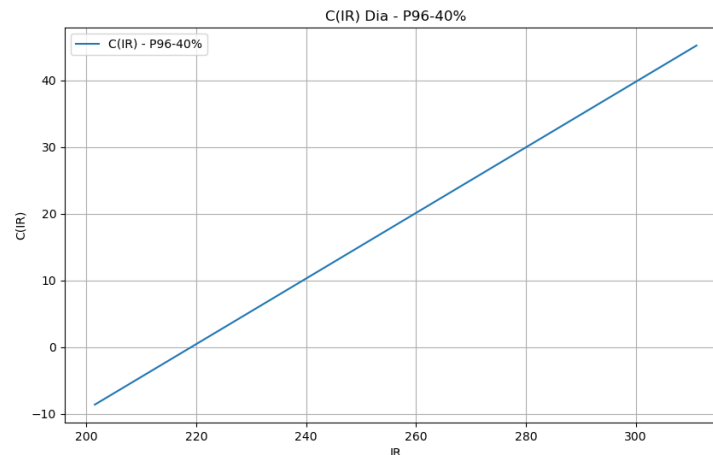
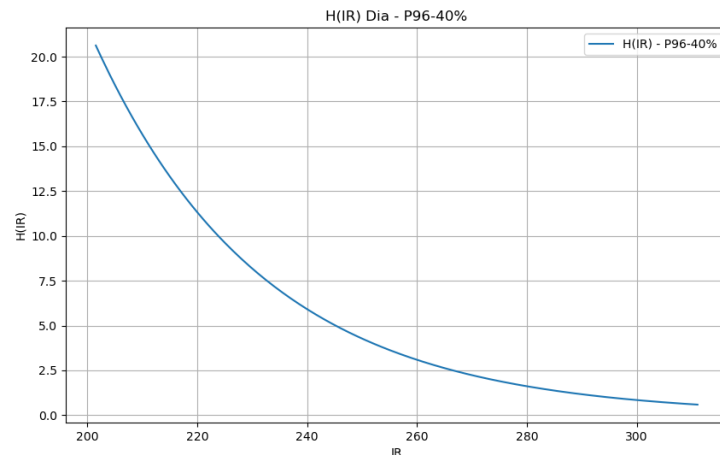
$$d = -107,73$$

$$f = -103,39$$

$$g = -248,12$$

$$h = 132,58$$

$$j = 109,83$$



$$H(IR) = a * \exp[b * IR]$$

$$C(IR) = c * IR + d$$

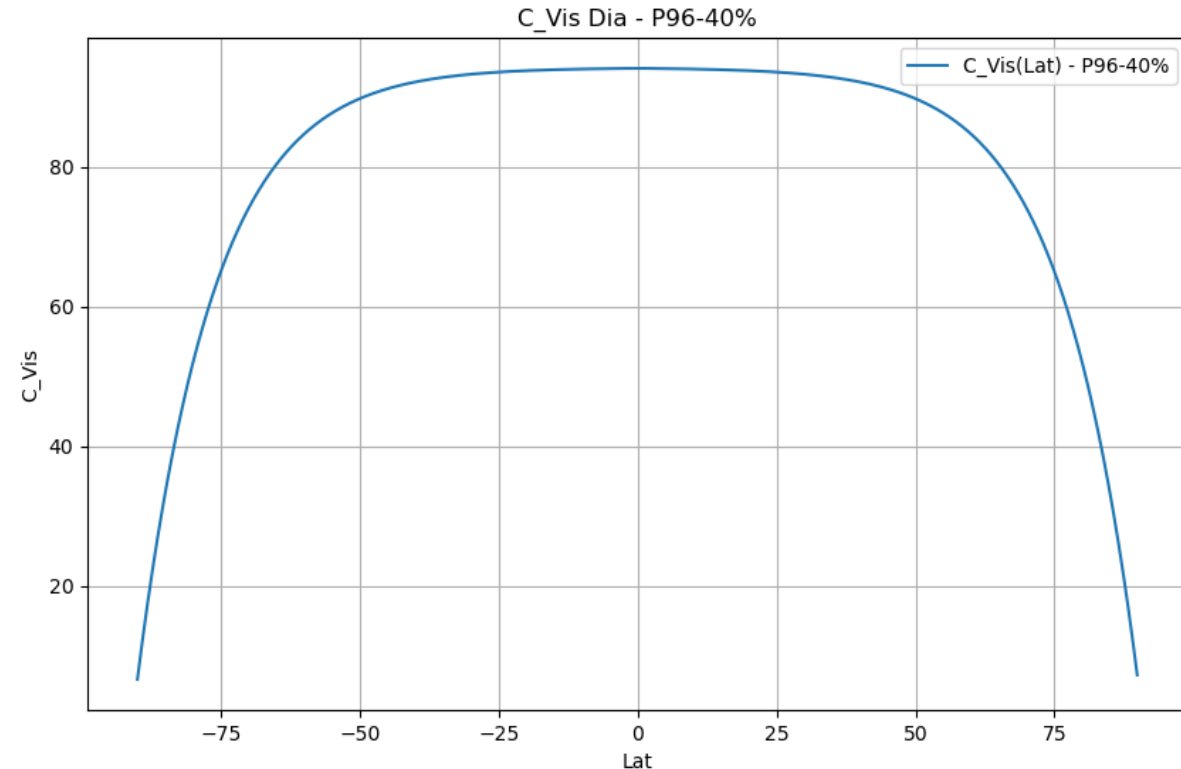
$$W(IR) = f * \exp\left[-0.5\left(\frac{IR + g}{h}\right)^2\right] + j$$

DAY-TIME: THE EQUATIONS

$$C_{Vis(Lat)} = c_1 - \frac{(|lat| + c_2)^{c_3}}{c_4}$$

$$c_1 = 94,16 \quad c_3 = 50,00$$

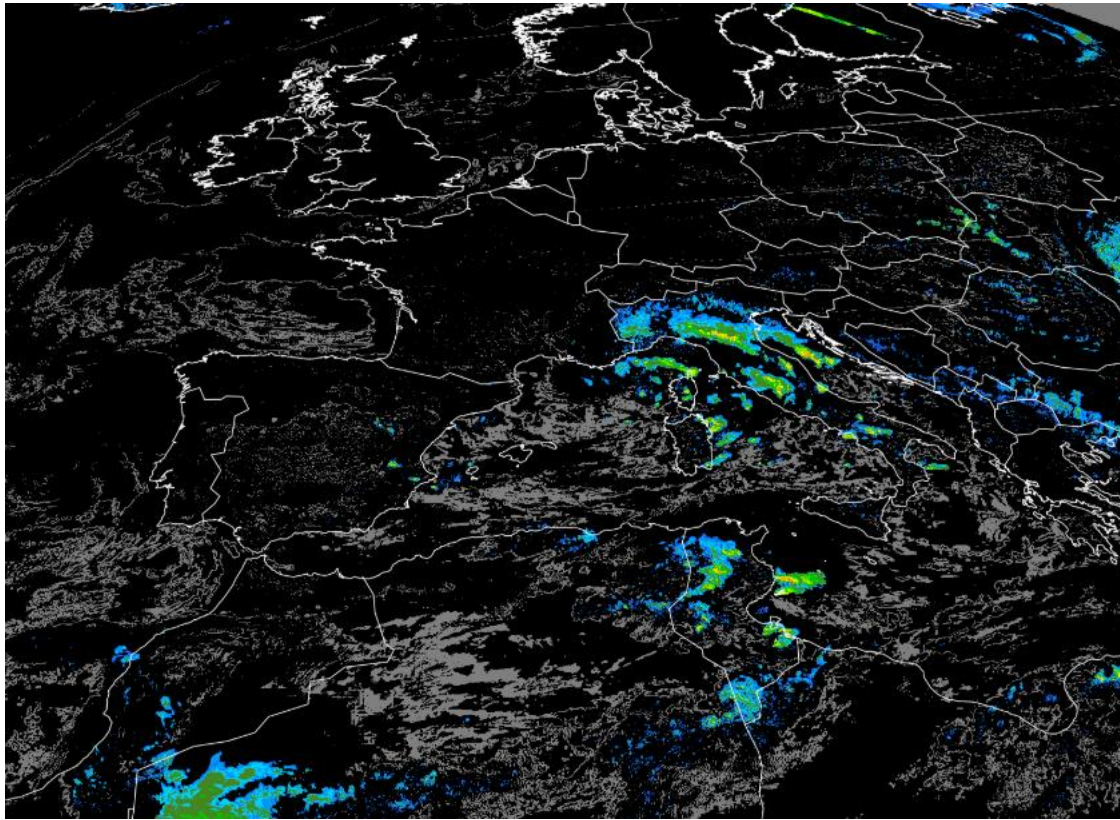
$$c_2 = 600,00 \quad c_4 = 10^{140}$$



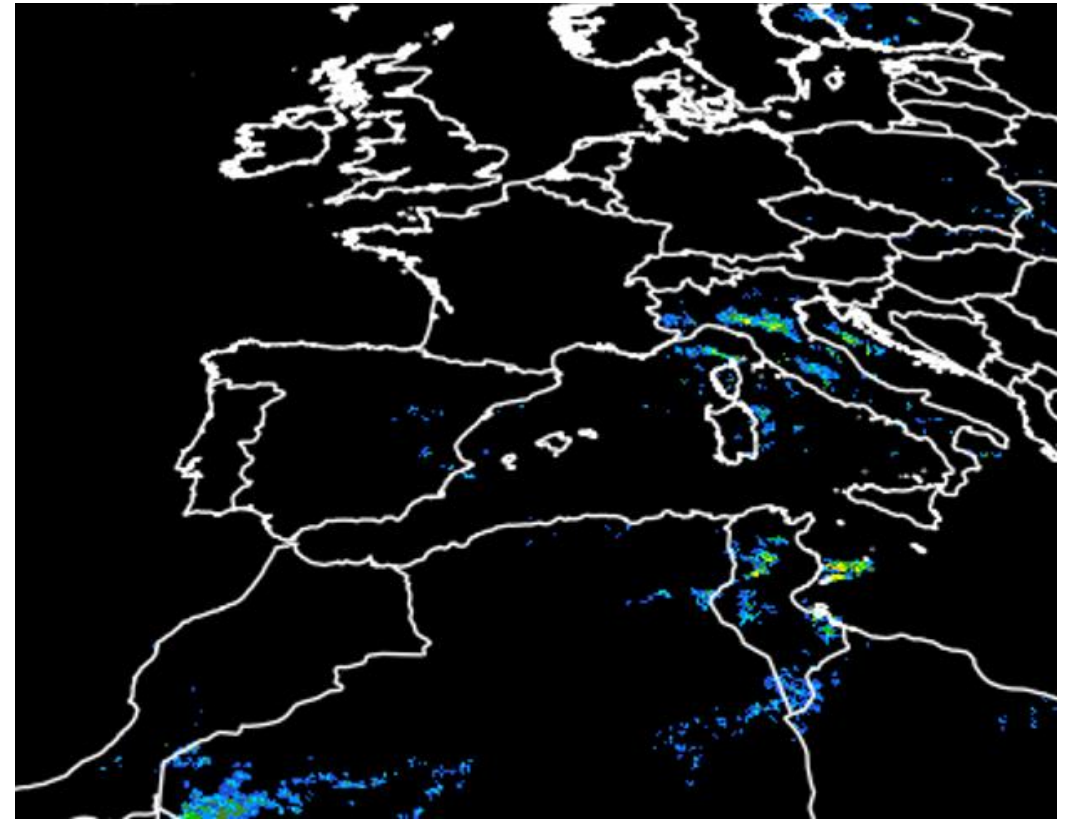
DAY-TIME: RESULTS – September 18th 13:00h

POD: 57,96%

FAR: 17,67%



CRRPh



New CRR

**THANK YOU FOR YOUR
ATTENTION**

Any questions?