

PROYECTO TRAMPAS

Primera Reunión: 2 y 3 de diciembre de 2021

Campus UIB: Sala de Reunions - Edifici Ramon Llull

# **Some controversial aspects in the way towards a medicane definition**

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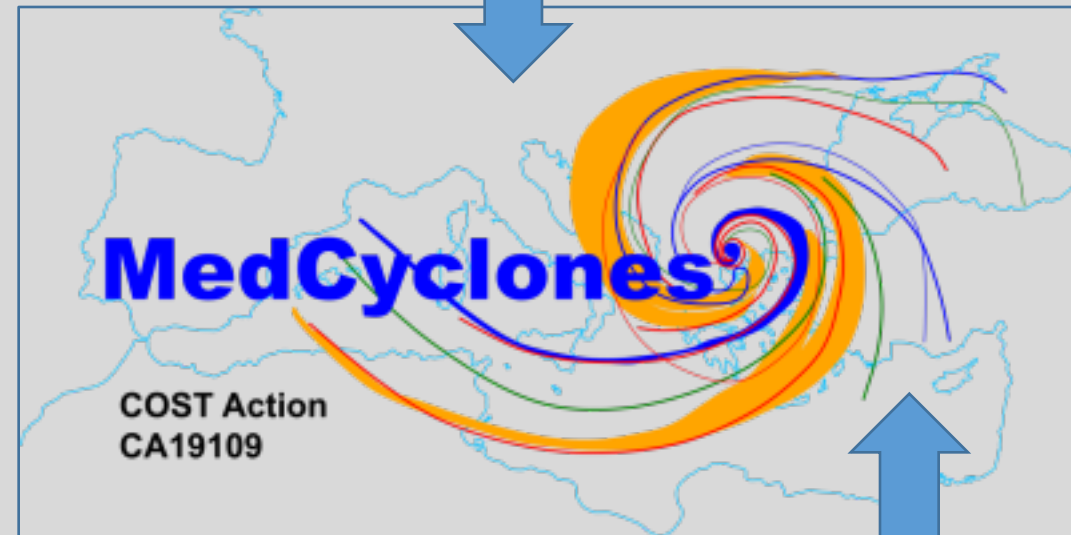


# HyMeX

HYdrological cycle in Mediterranean EXperiment

Science Teams

ST-Medcyclones: Mediterranean Cyclones



Initiative for a  
***medicane definition***  
(Initially proposed by L Fita)

*The MedCyclones COST-19109 activities are organised in three objectives or working groups*

## WG2 ongoing activities

- Medicanne definition: try to converge towards a shared definition, able to bring together the numerical and satellite approach, the meteorological and the climatological perspective in a single and complete vision.

Willing to join? → **m.miglietta@isac.cnr.it**



Vista

Emmanouil Flaounas

Agusti Jansa

Mario Marcello Miglietta

Francesco Ragone

Stavros Dafis

Florian Pantillon

elsa

Juan Jesus Gonzalez-Aleman

Helena Flocas

enrico scoccimarro CMCC

Diego Carrió

M. Angels Picornell

rossella

David Schultz

Fabien

Medicane definition  
26 February 2021  
virtual meeting

Silenciar

Parar Video

15 Participantes

Chatear

Compartir pantalla

Grabar

Reacciones

Salir



*A contribution to the Medicanes Definition Group from my presentation to the Workshop in Paris, 2017:*

Among the variety of Mediterranean cyclones, what a medicanes is?

*medicanes* = Mediterranean tropical-like cyclone, warm core Mediterranean cyclone, Mediterranean mini-cyclone

A medicanes is a small, high vorticity, deep cyclone

Are the following necessary or sufficient conditions for a Mediterranean cyclone to be a medicanes?

**Central dense overcast** (according glossary NHC?) (Tous & Romero, 2011, 2013; see Dvorak, 1975)

**Characterisation** (size, gradient, wind:  $\Phi < 300$  km,  $1 \text{ hPa}/10 \text{ km}$ ,  $w > f8, f10, f12 \text{ B}$ ) (Jansà, 2003)

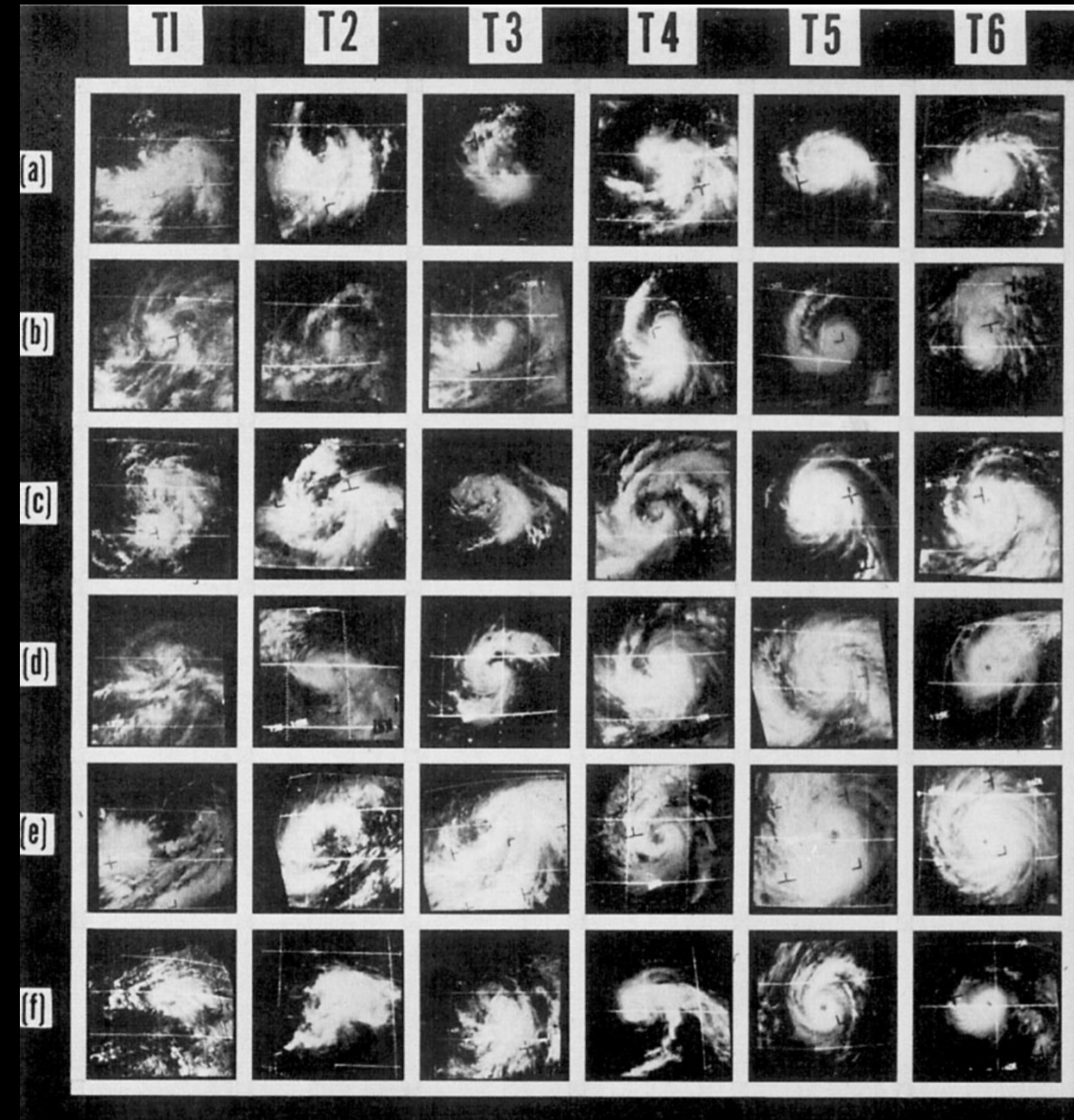
**Thermal structure** (Hart diagrams: warm/deep/symmetric?) (Picornell et al., 2014, among other)

**Cyclogenetic mechanism** (purely diabatic? Diabatic process necessary but not enough? Baroclinic/diabatic synergism?)

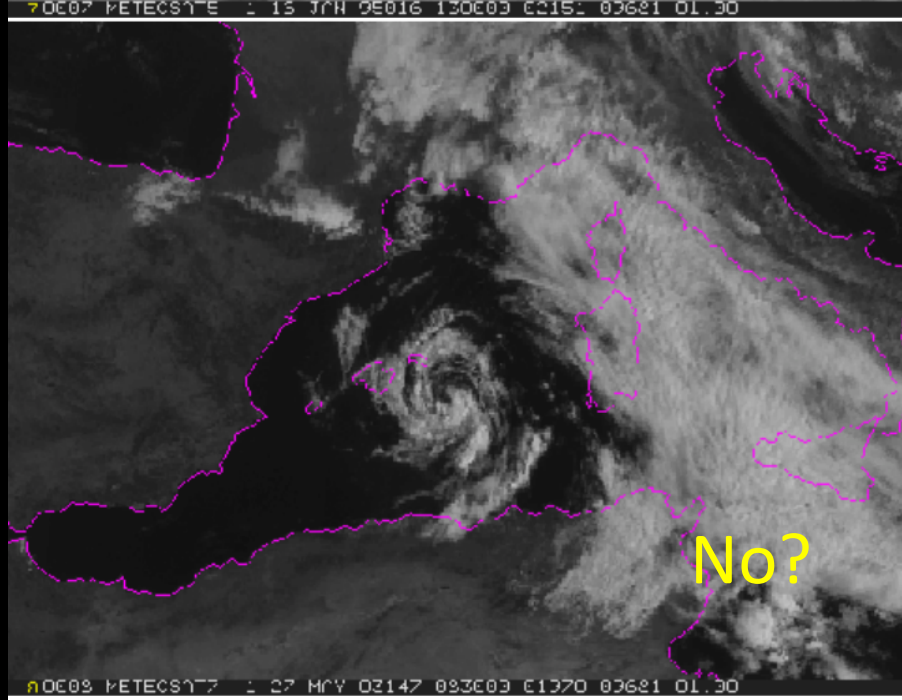
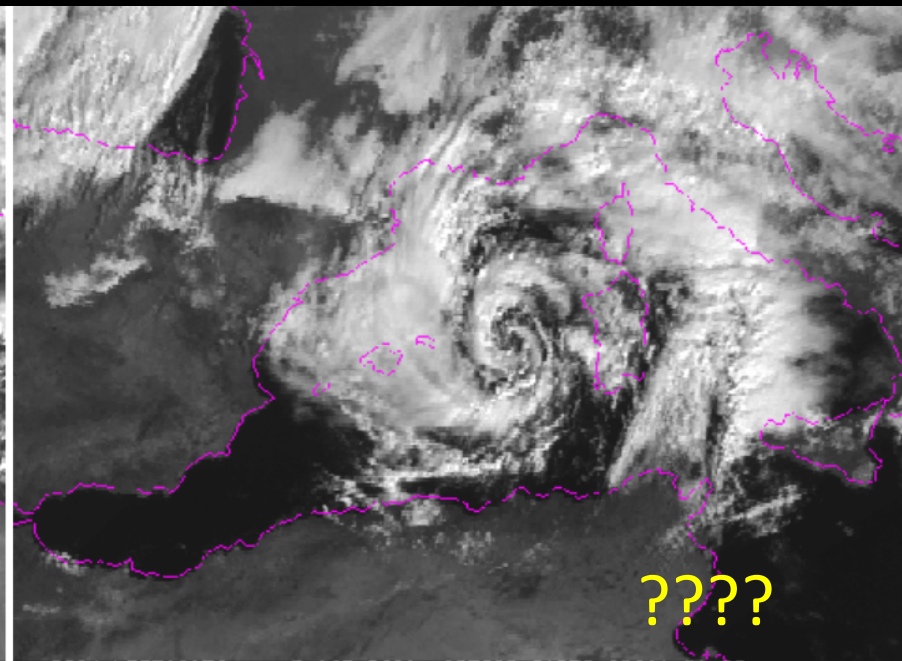
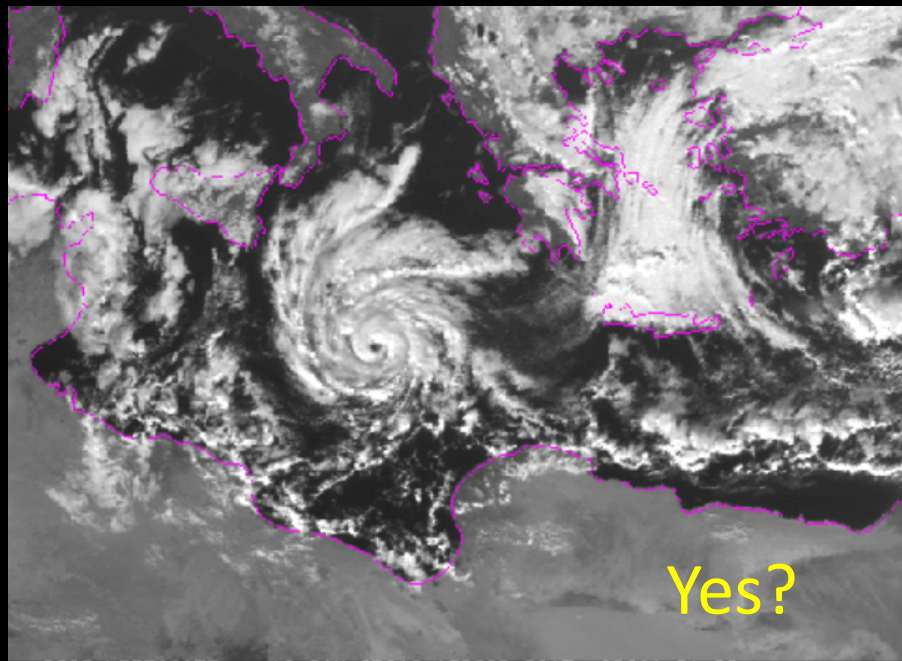
Regarding a definition only based on the morphology, as seen by satellite, [as in Romero and Tous, 2011, 2013] two concepts are used: symmetry and CDO. Is it necessary to be very strict in these concepts? Mostly strict, if the descriptive images of Dvorak (1975) are considered as a reference



Dvorak (1975): different types (a → f) of evolution (from pre-TS to mature TC: T1 → T6)







Few examples:

From *Fita et al (2007)*





About the observed winds, on site measurements are giving usual values around 15-20 m/s of sustained wind and 25-30 m/s maximum gusts.

*Medicane **lanos** would be an exception: according Lagouvardos et al (2021) **lanos** produced a 44 m/s maximum sustained wind, on land, in a Ionic island observatory (???)*

Although there is no a final decision about this, to include a threshold for maximum sustained wind speed as an element in the medicane definition has been considered.

*An additional point:  
1 min sustained wind?  
10 min sustained wind?*

Possible thresholds (regarding 1 min or 10 min maximum sustained wind speed):

- 17 m/s, 34 kts (equivalent to **tropical storm** limit)
- 32 m/s, 64 kts (equivalent to **hurricane** limit –according the Saffir-Simpson scale-)

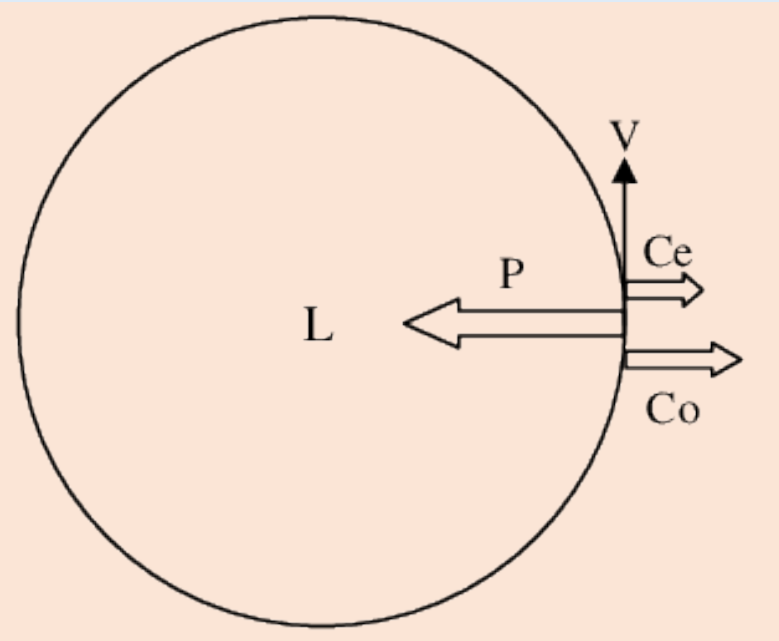
*Note that perhaps only **lanos** would have reached category 2 hurricane level, although there are doubts about the representativeness of some measurements*

Most of medicanes would only reach tropical storm level

Some medicanes would not had surpassed the tropical depression level

A possible complement in the medicane definition (*regarding characterisation*):  
*The radius of the **maximum winds ring** (corresponding to extremely high pressure gradients) is very small, namely **30-50 km***

A very small radius of rotation does not permit extremely strong winds, even with high pressure gradients, *as 1 or 1.5 hPa / 10 km*



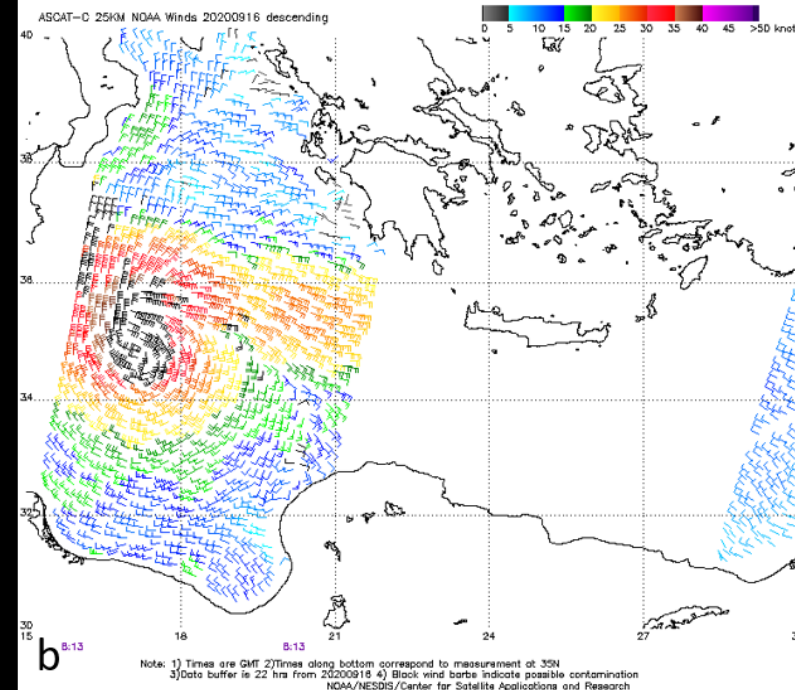
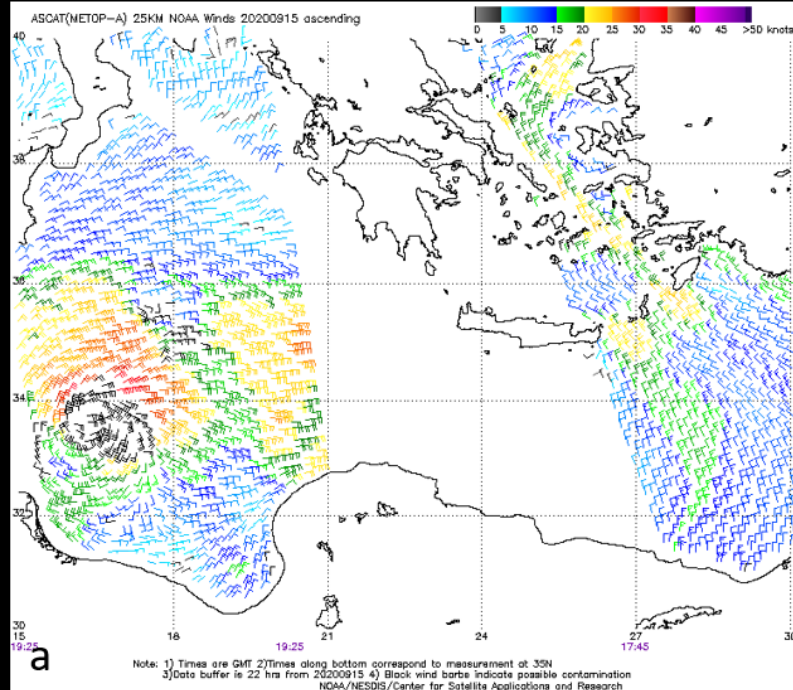
A simple theoretical **balance wind**, without drag, would be the **gradient wind** (*pressure gradient force = Coriolis force + Centrifugal force*)

$$V_{gr} = -\frac{fr}{2} + \sqrt{\frac{f^2 r^2}{4} + \frac{r}{\rho} \frac{\partial p}{\partial r}}$$

Theoretical approach



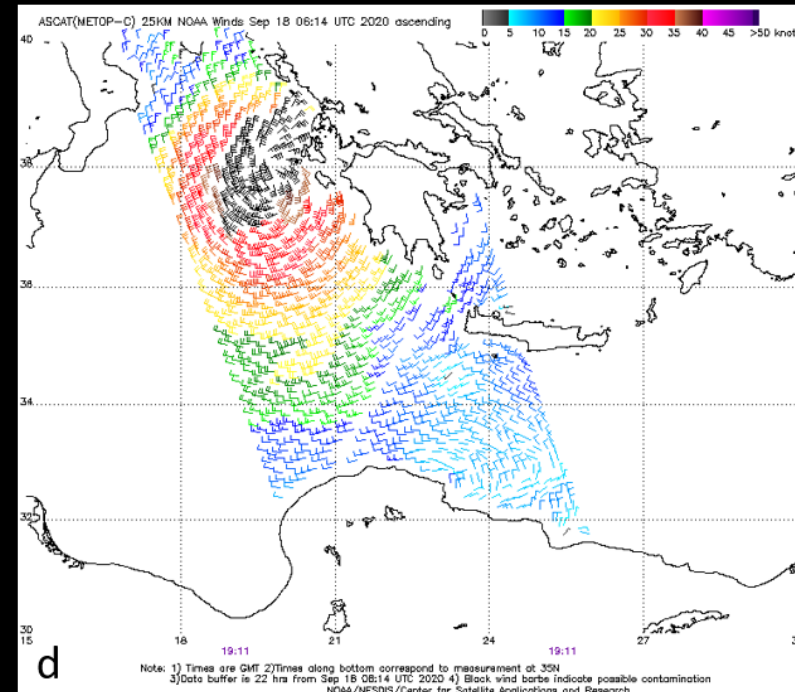
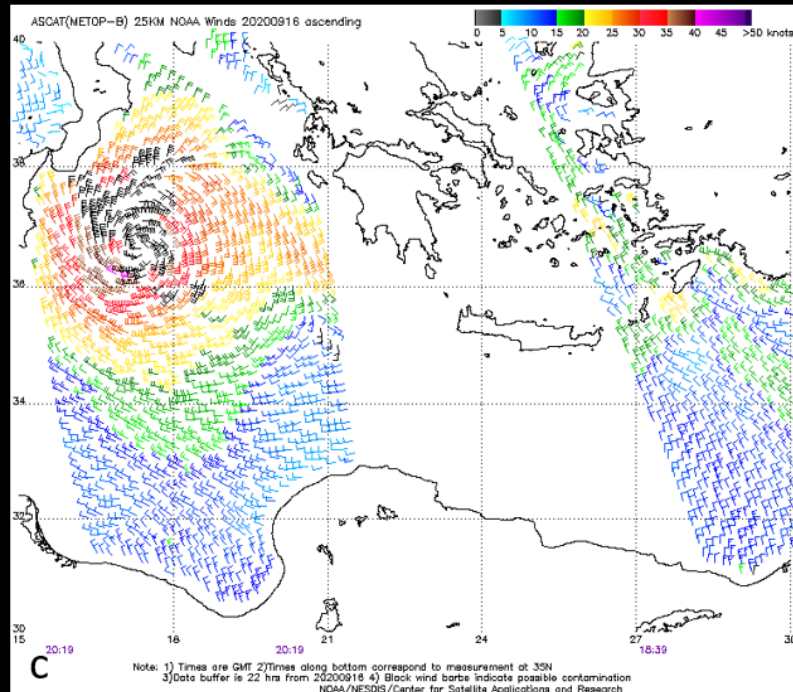
Gradient wind at 40° lat			
Radius (Km)	Pressure gradient (hPa/10 km)	Wind (m/s)	Wind (kts)
30	1	14,5	29
30	1,5	18,0	36
80	1	22,3	44
80	1,5	28,1	56
200	1	32,5	65
200	1,5	41,5	83
500	1	45,3	91
500	1,5	59,1	118



*Observed winds (satellite)*

**Ianos cyclone**

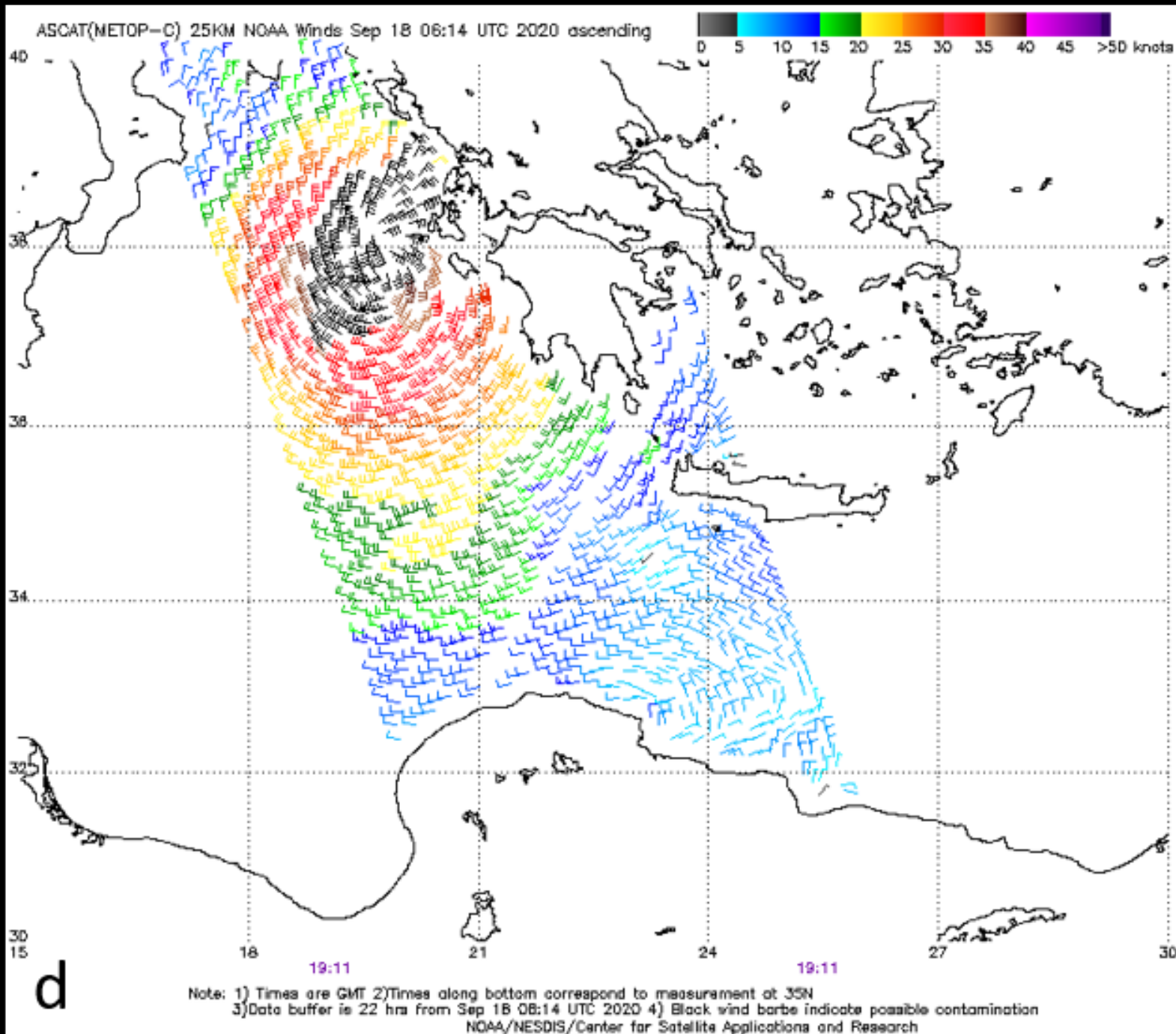
Metop – ASCAT winds (kts)



*Cyclone diameter:  
250 km, aprox*

*Radius maximum wind ring:  
Around 50 km*

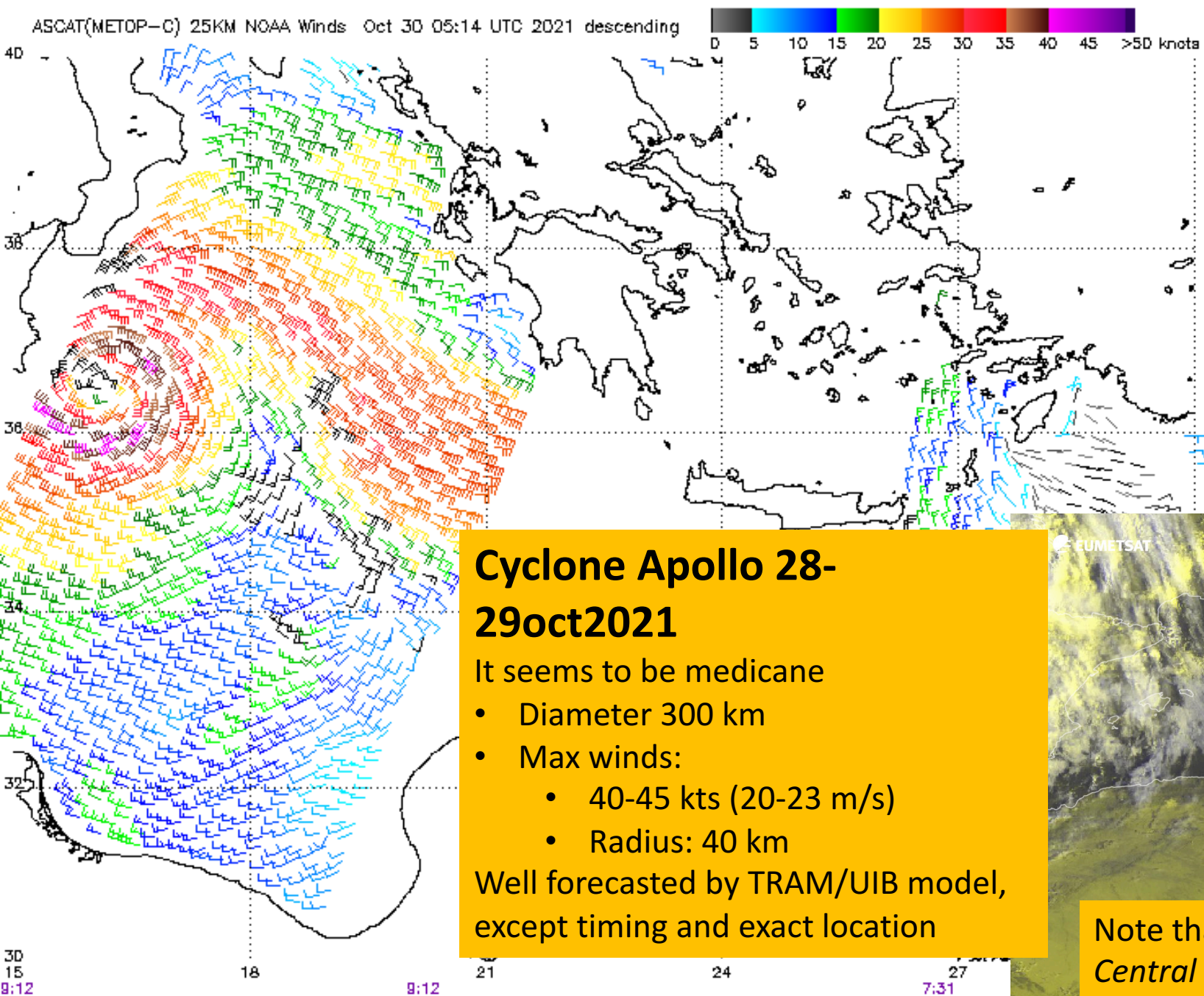




*ASCAT maximum wind :  
35-40 kts (17-20 m/s)*

*Easily compatible with  
gradient winds of about  
20 m/s*

*Difficult compatibility with on  
land measurements of 44 m/s*

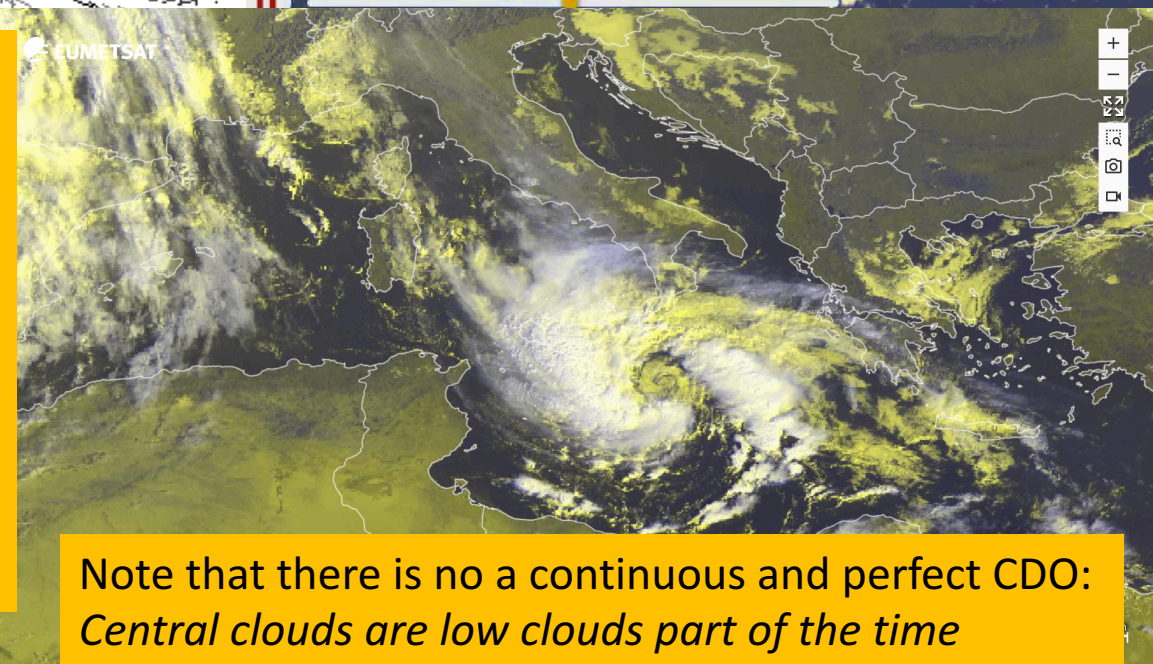
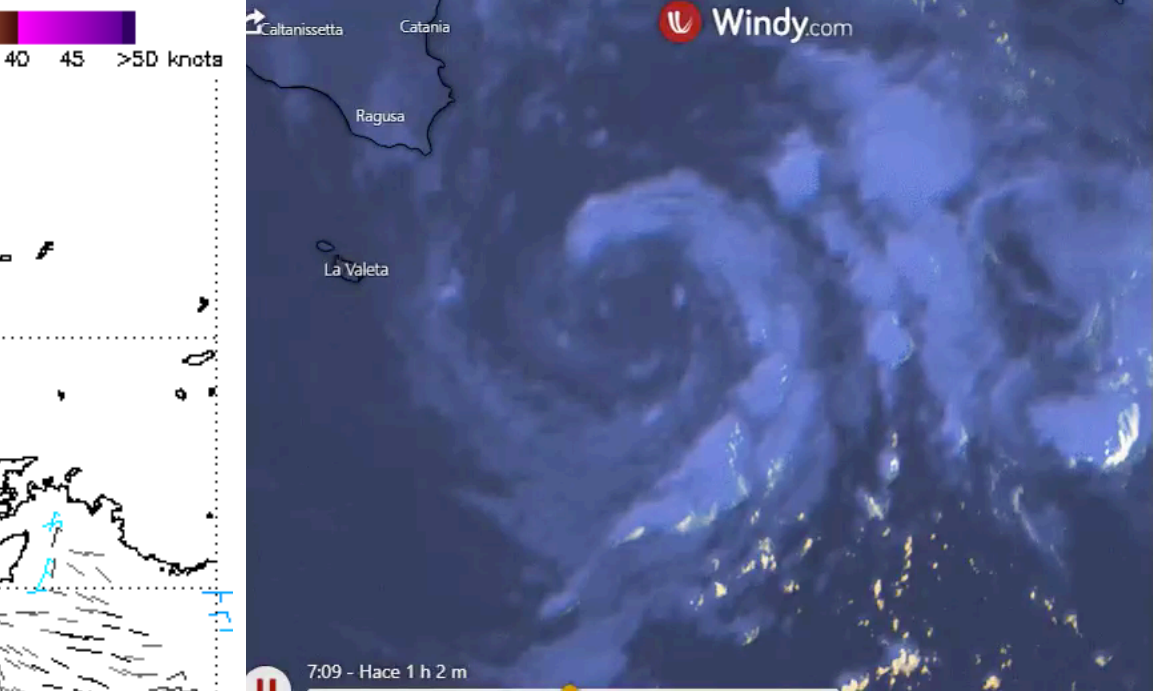


## Cyclone Apollo 28-29oct2021

It seems to be medicane

- Diameter 300 km
- Max winds:
  - 40-45 kts (20-23 m/s)
  - Radius: 40 km

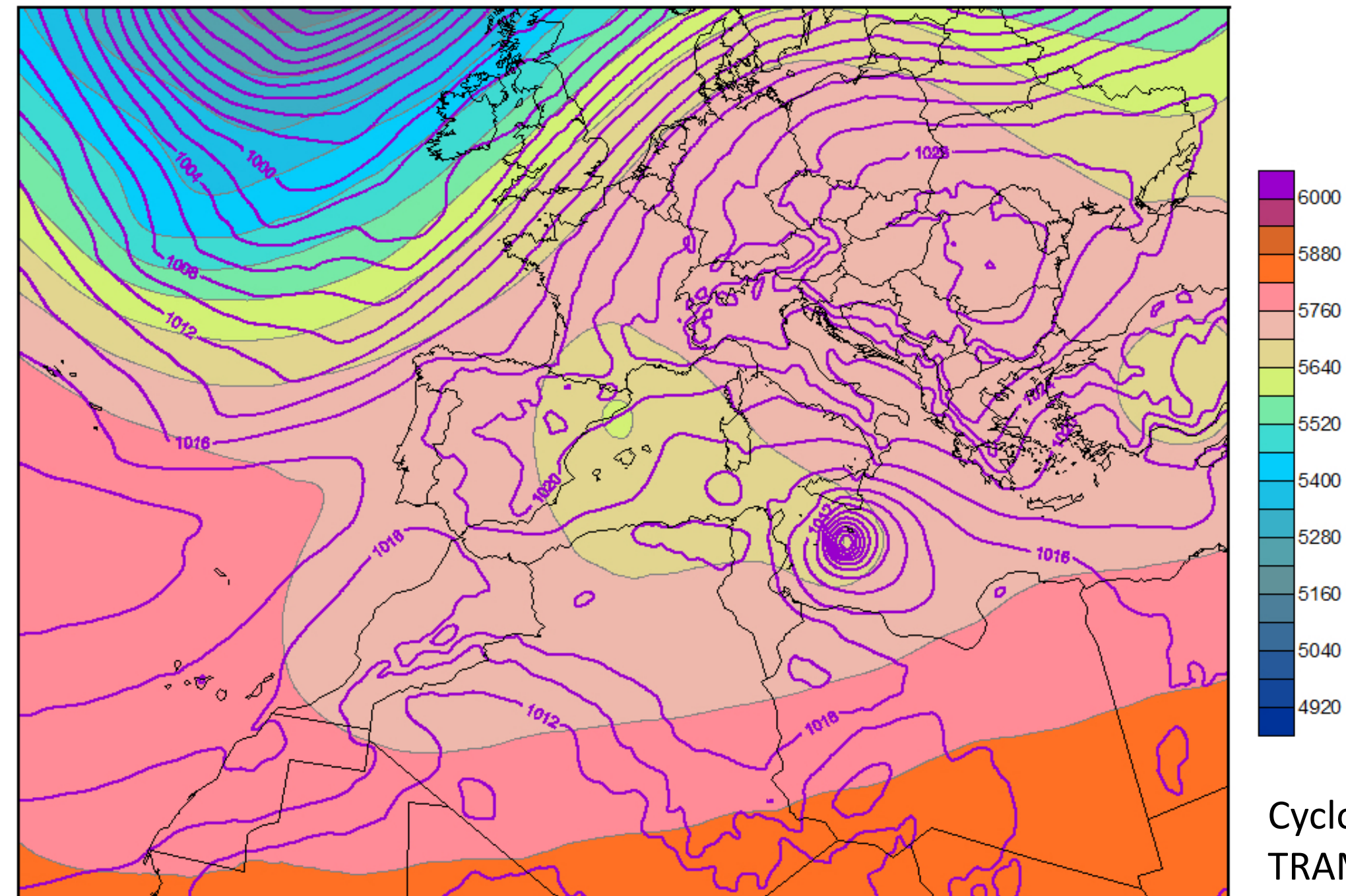
Well forecasted by TRAM/UIB model, except timing and exact location



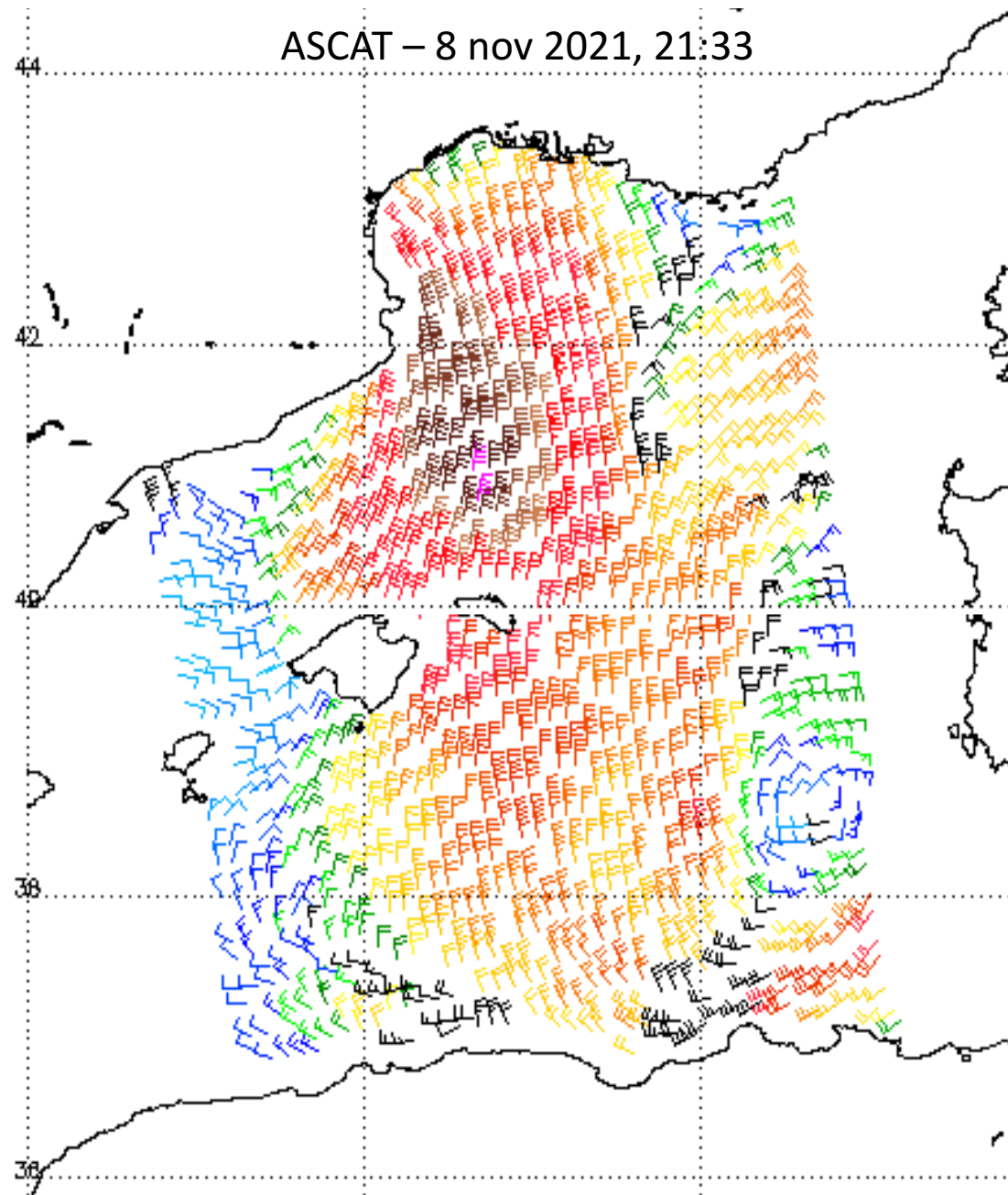
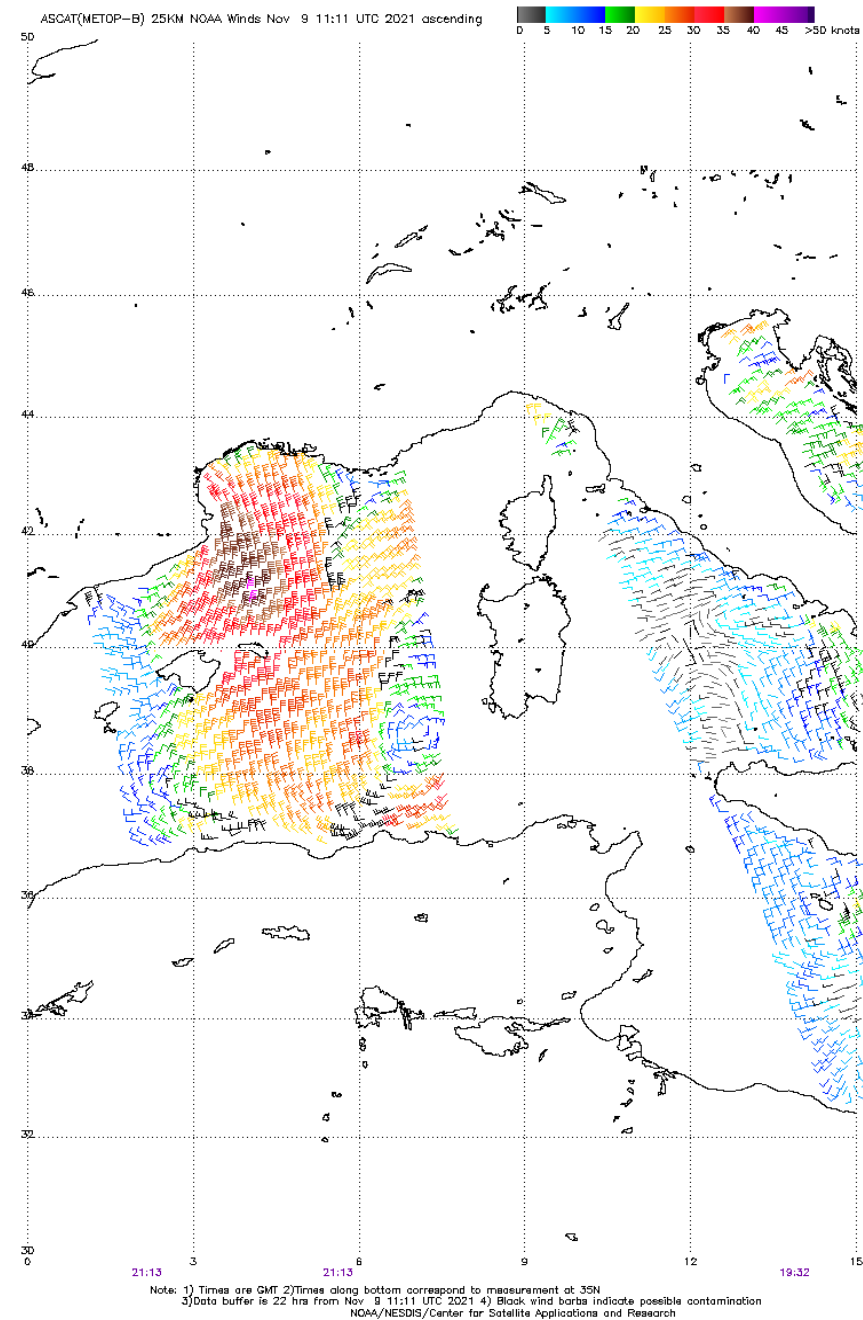
Note that there is no a continuous and perfect CDO:  
*Central clouds are low clouds part of the time*

Note: 1) Times are GMT 2) Times along bottom correspond to measurement at 35N  
3) Data buffer is 22 hrs from Oct 30 05:14 UTC 2021 4) Black wind barbs indicate possible contamination  
NOAA/NESDIS/Center for Satellite Applications and Research





Cyclone Apollo  
TRAM/UIB forecast



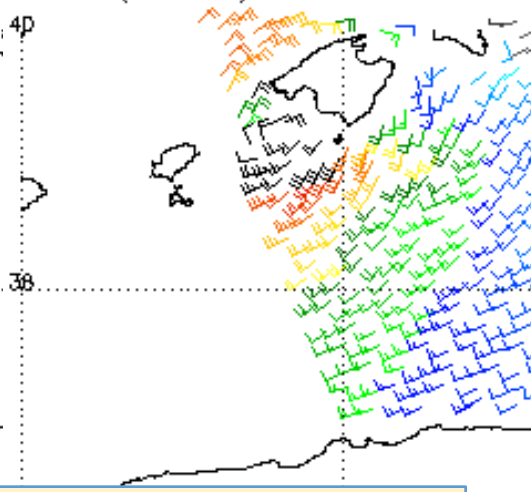
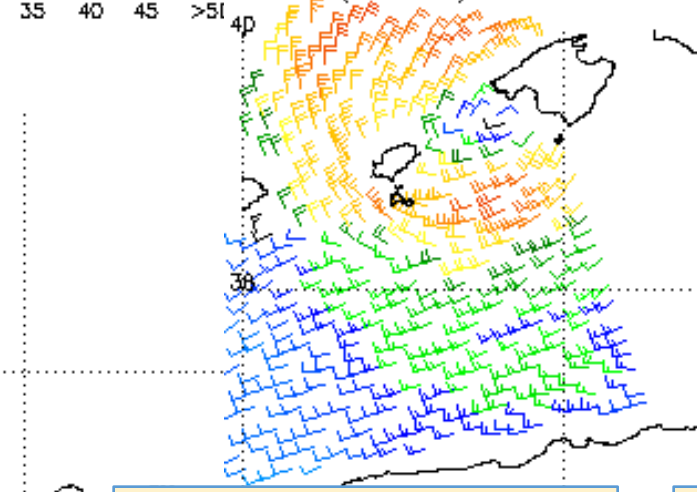
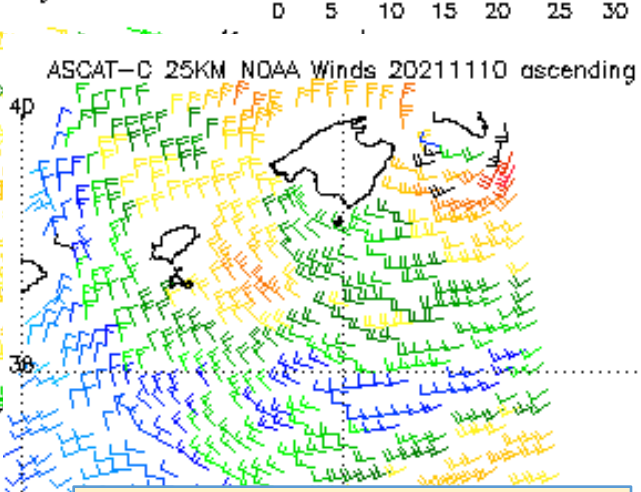
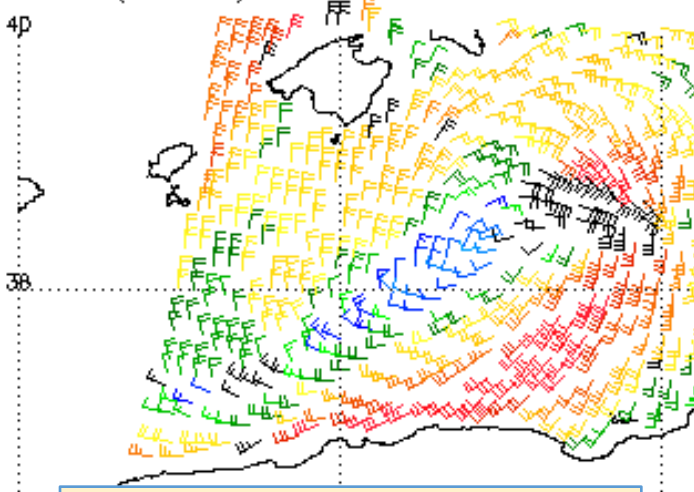
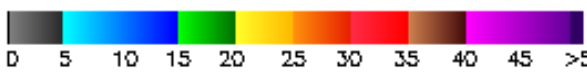
## Cyclone Blas (6-14 Nov 2021)

Weak winds close  
to the cyclone  
centre

Strong winds  
(more than 40 kts)  
very far from it

*Not a medicane at  
this time*





ASCAT – 9 Nov 2021, 09:12  
Max wind 30-35 kts  
Radius about 80-100 km  
(without symmetry)

ASCAT – 9 Nov 2021, 21:24  
Max wind 30-35 kts  
Radius about 40 km  
(without symmetry)

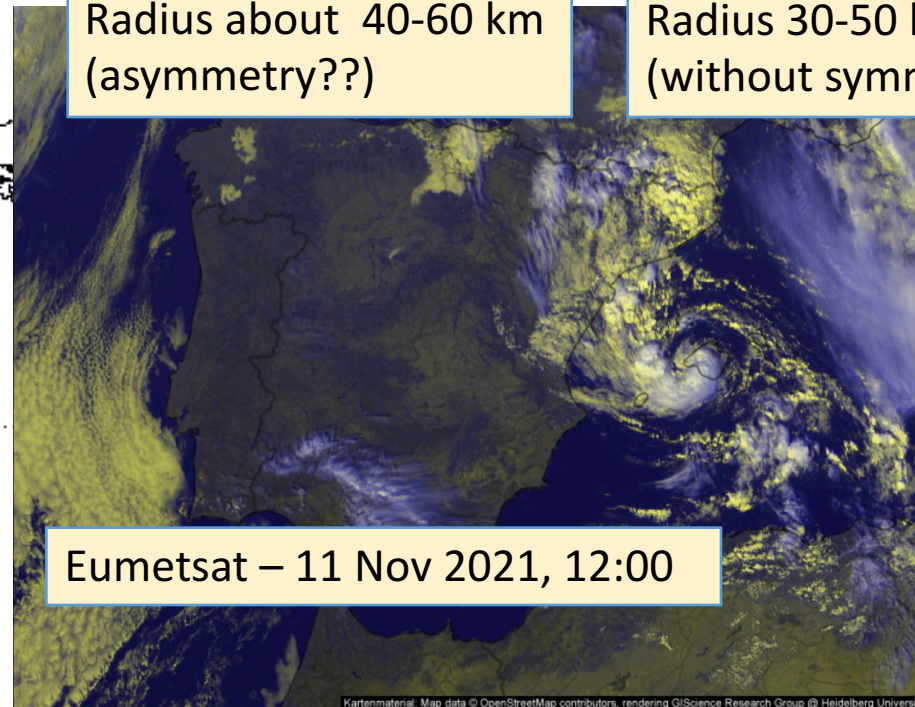
ASCAT – 11 Nov 2021, 18:53  
Max wind 30-35 kts  
Radius about 40-60 km  
(asymmetry??)

ASCAT – 11 Nov 2021, 20:11  
Max wind 30-35 kts  
Radius 30-50 km  
(without symmetry)

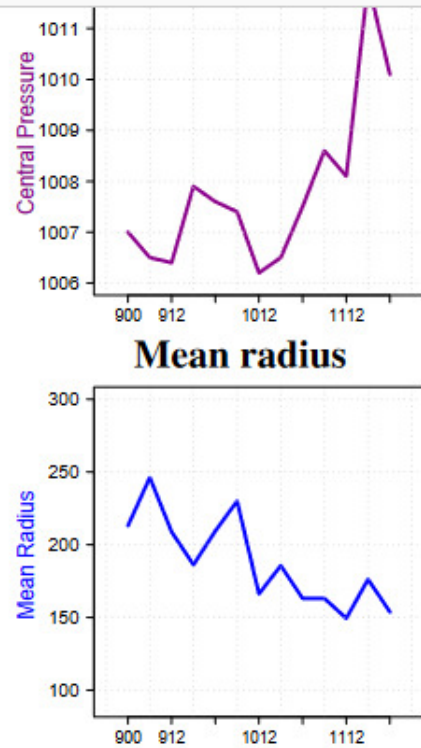
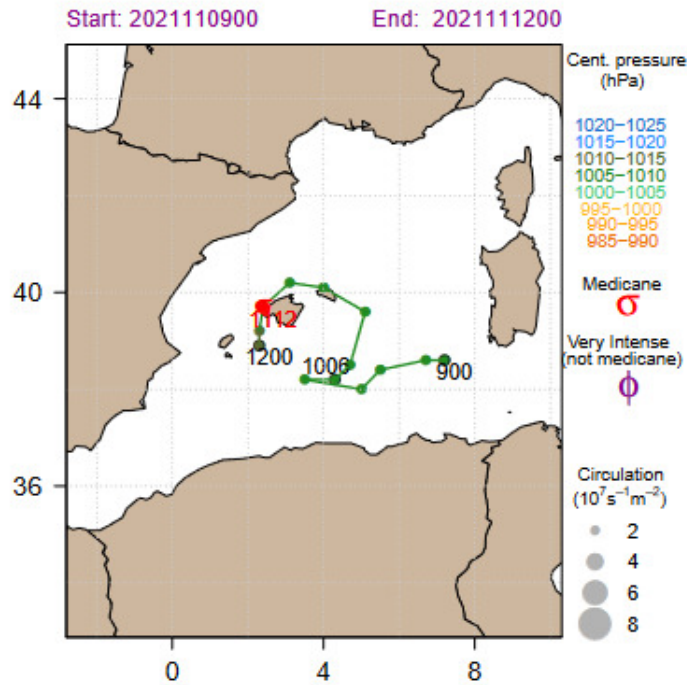
## Blas evolution

To discriminate if it is medicane is sometimes difficult considering the wind/gradient criterion. In that case the satellite images suggest a possible tropicalisation

Other criteria could be needed, namely: ***thermal structure***



Eumetsat – 11 Nov 2021, 12:00

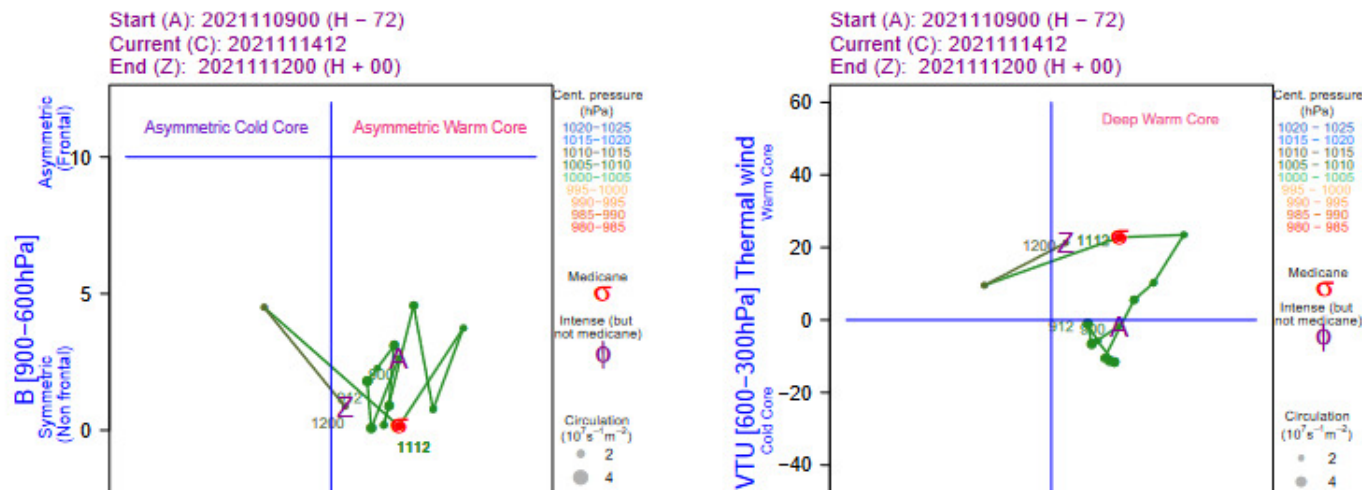


## Cyclone BLAS:

Adapted **HART** diagrams  
(see Picornell et al, 2014)

Red plot means *Symmetric deep warm core* (that is: *Blas* was a *medicane* for a short time, if the **thermal structure criterion** is taken as absolute)

### Hart diagrams



(courtesy of Mari Àngels Picornell)



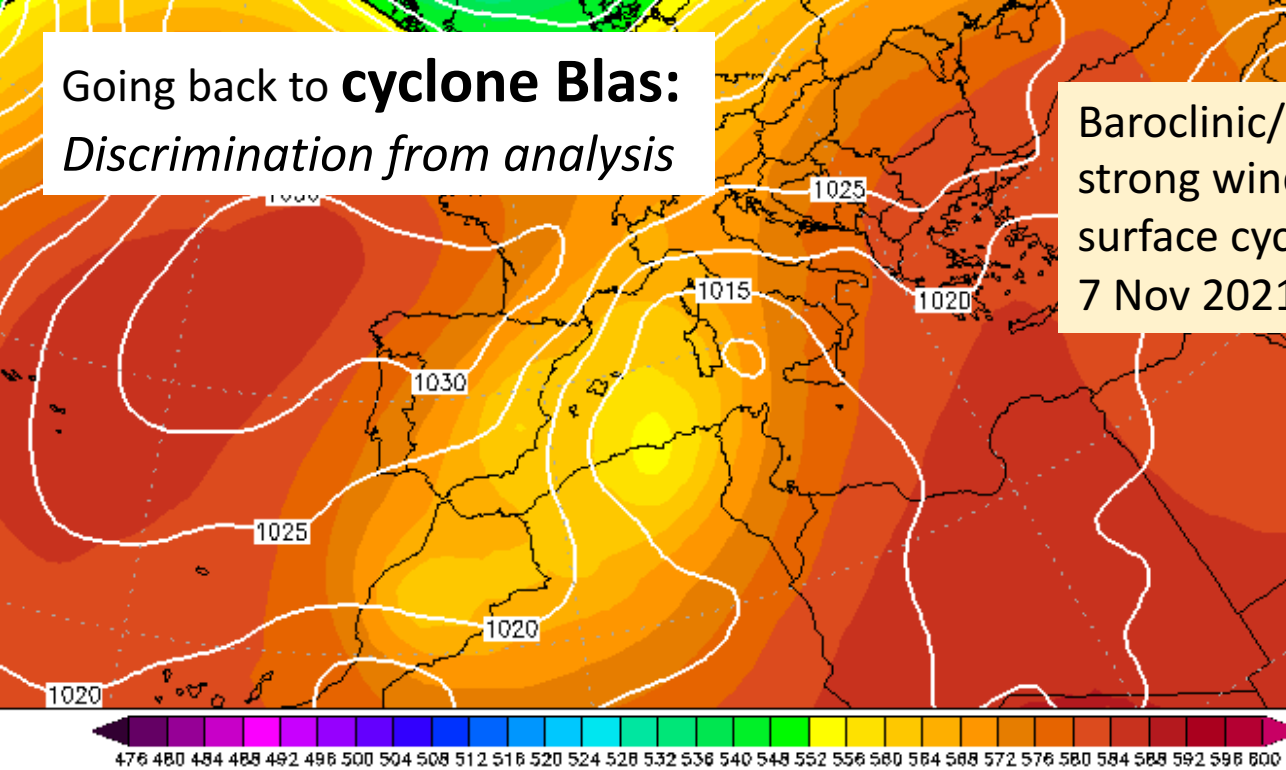
Other criteria can be considered to identify medicanes (*or Mediterranean tropical-like cyclones*), like ***those based on the cyclone evolution and/or the involved cyclogenesis mechanisms***

**Existence (*or not*) of upper level *divergence* and/or low level baroclinicity → baroclinic/ extratropical evolution (*or other evolution*)**

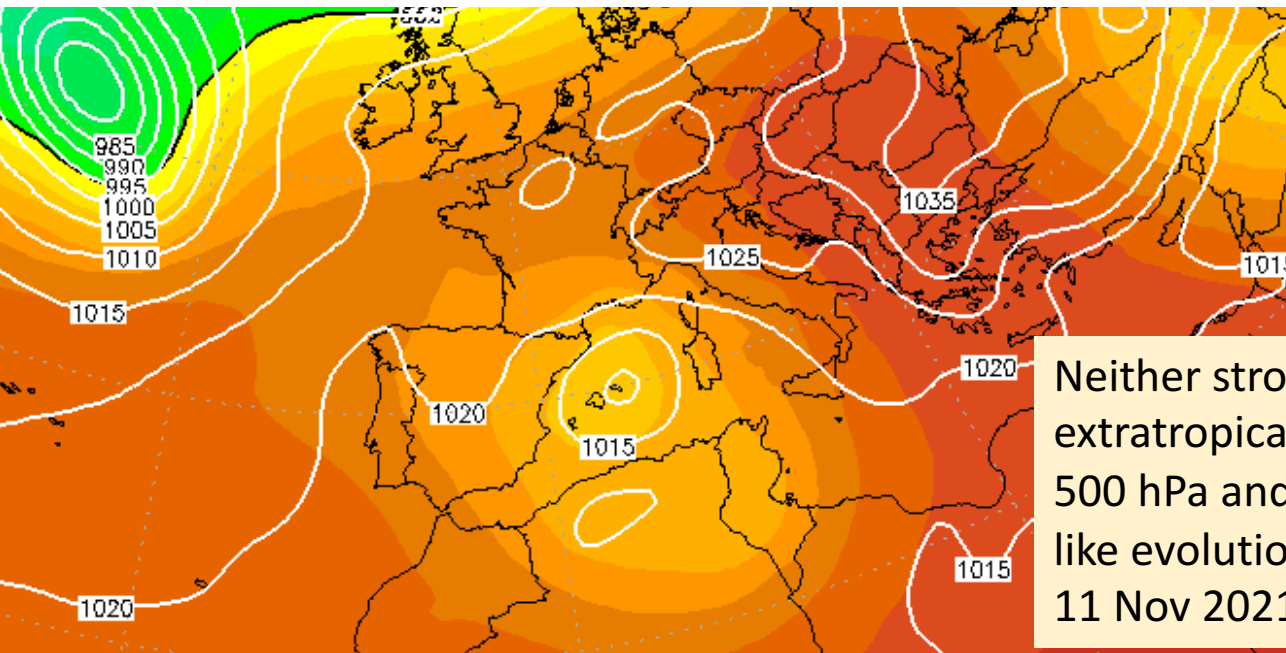
**Existence sometime (*or not*) of deep convection rotating around the cyclone centre → tropical-like evolution (*or other evolution*)**  
(see Stravos Dafis, 2021)

**Direct discrimination of the kind of evolution can be possible from analyses or from satellite images. Another way is the numerical experimentation (*Carrió et al., 2017, among other*)**

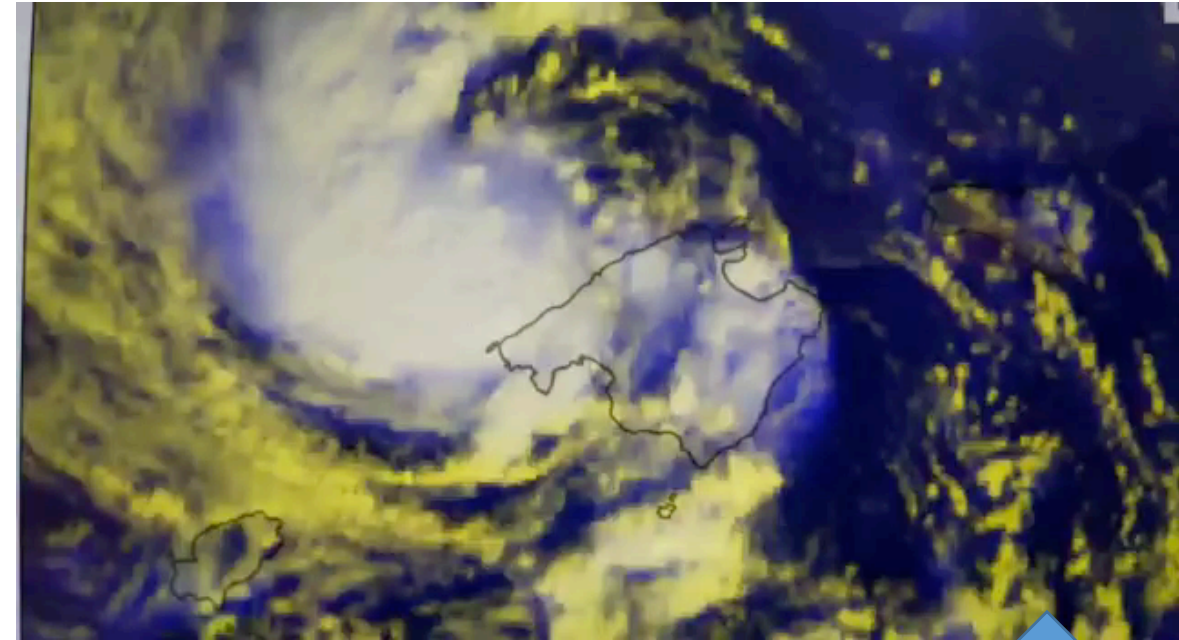
Going back to **cyclone Blas**:  
*Discrimination from analysis*



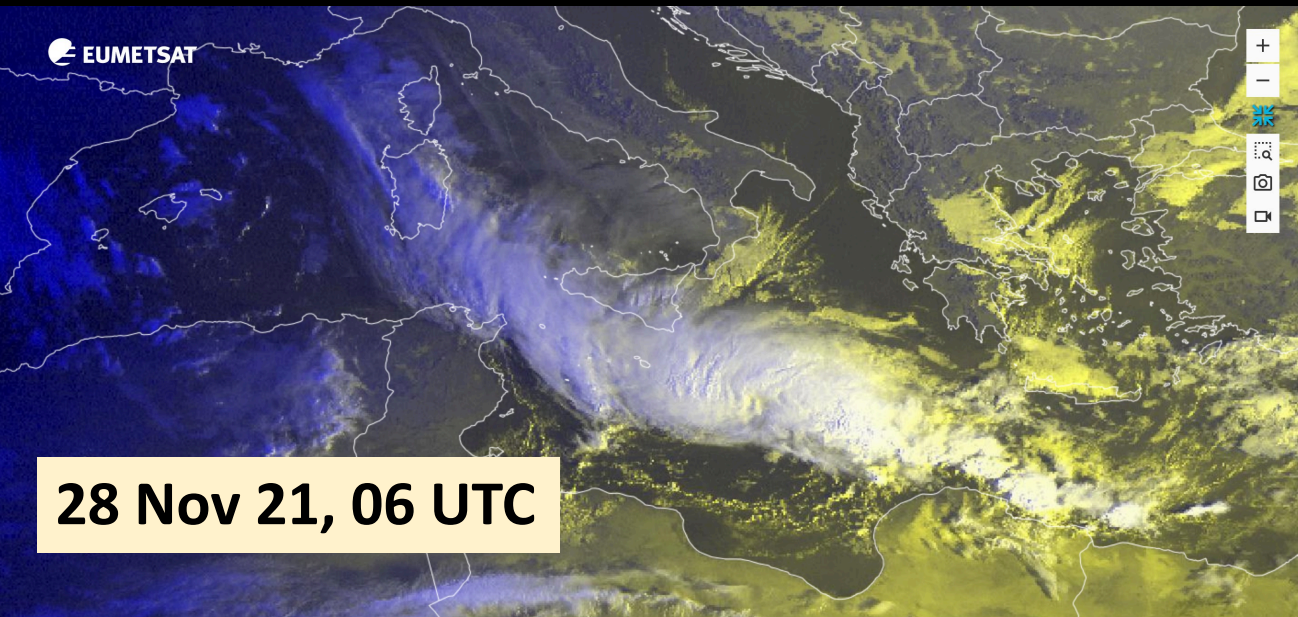
Baroclinic/ extratropical phase –  
strong wind [and divergence] at 500 hPa, above the  
surface cyclone centre –  
7 Nov 2021, 00 UTC – CFSR analysis



Neither strong wind nor divergence at upper levels → No baroclinic/  
extratropical phase –  
500 hPa and surface cyclone centre are vertically coupled – Tropical-  
like evolution is possible: satellite images suggest it  
11 Nov 2021, 00 UTC – CFSR analysis

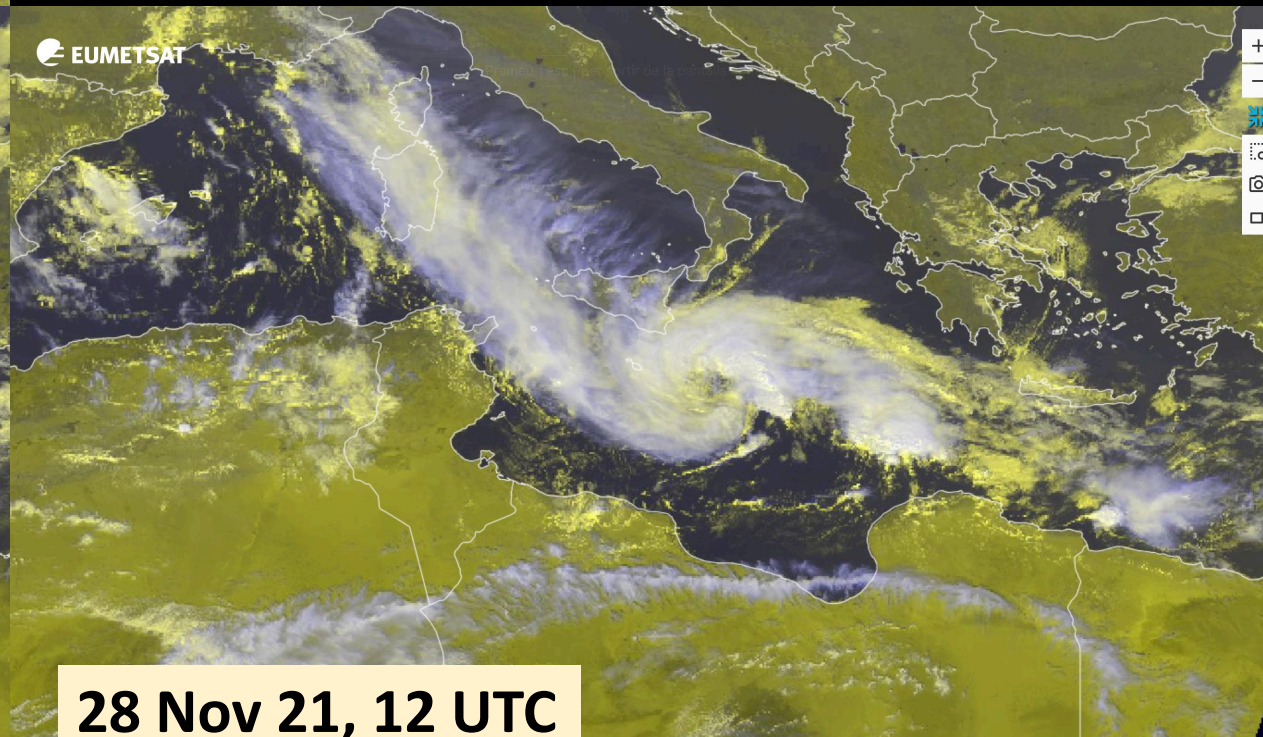
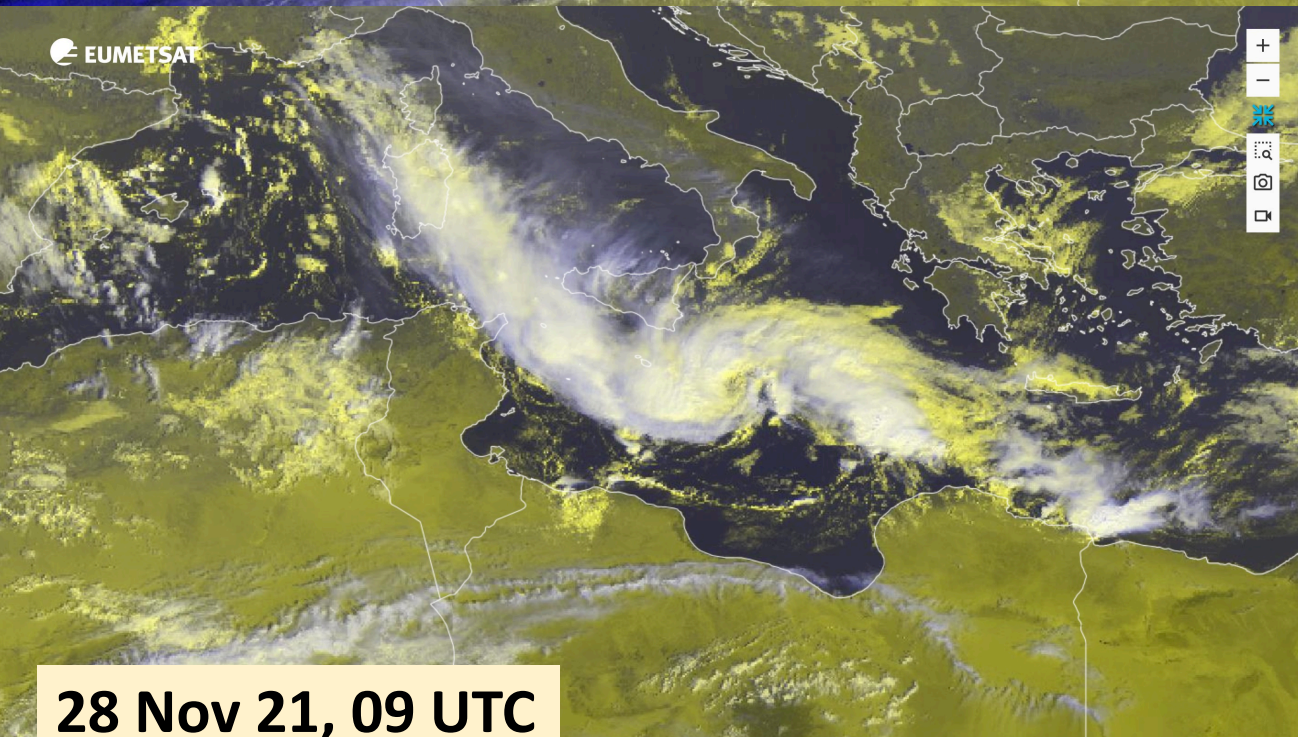






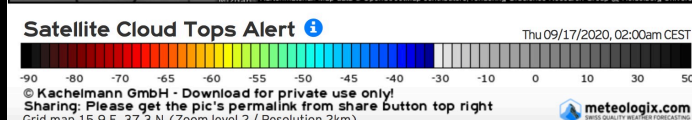
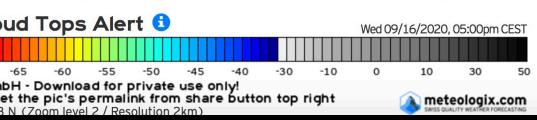
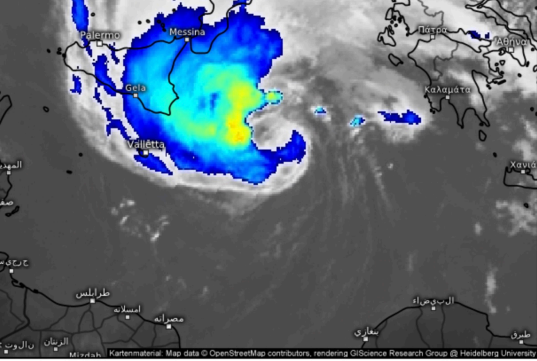
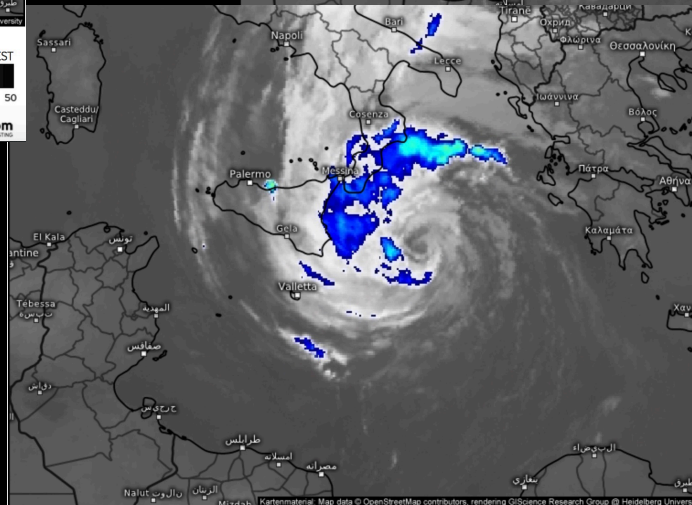
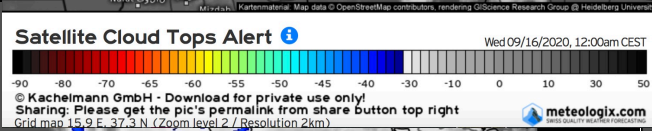
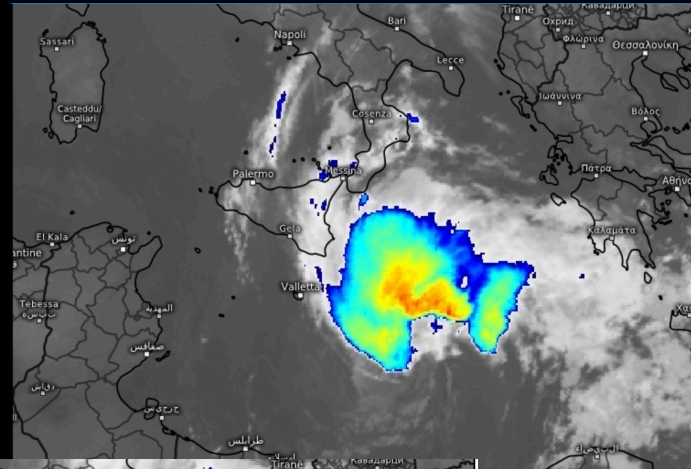
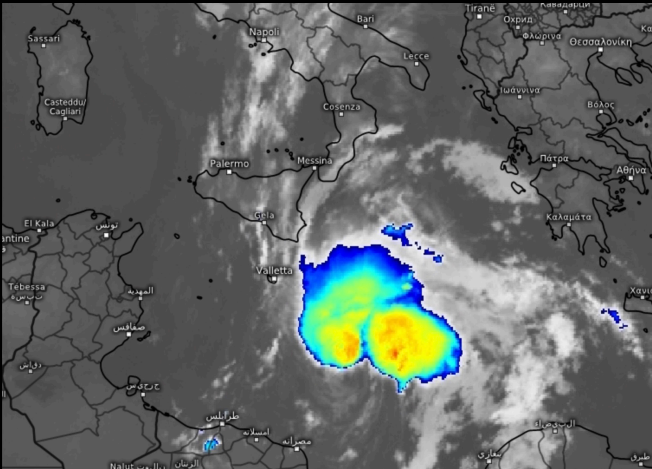
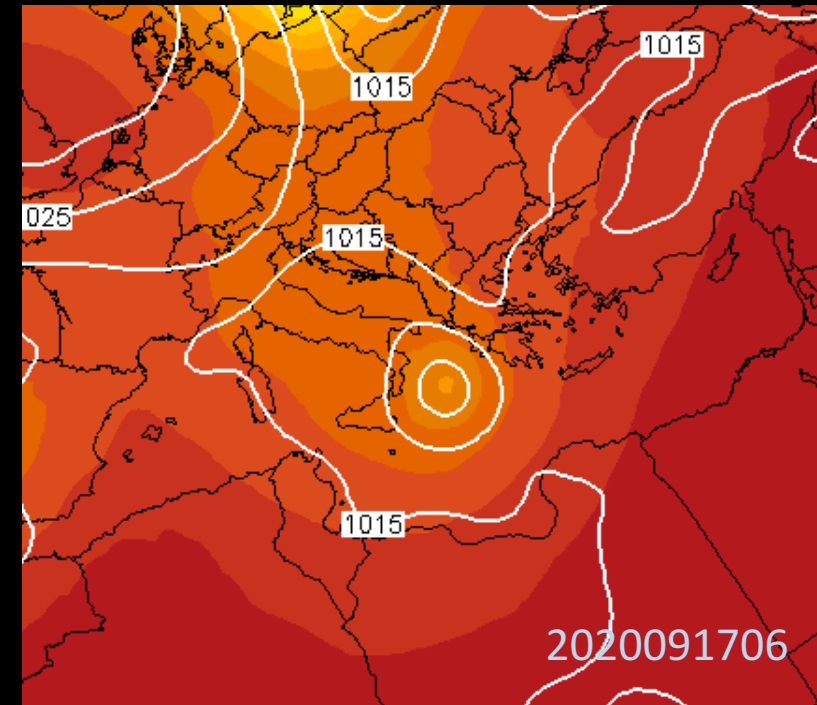
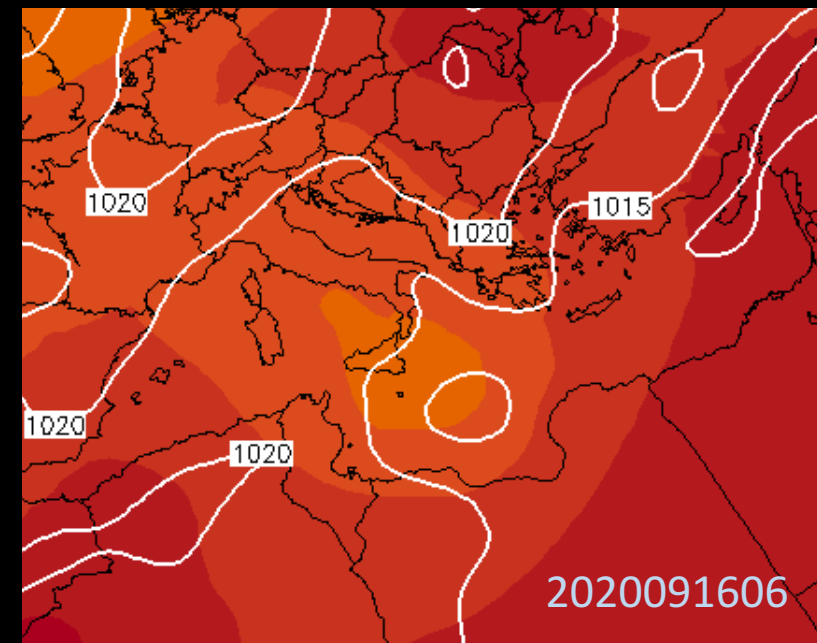
**Apollo,**  
Kind of evolution discrimination from  
satellite images:

*from no rotating convective systems  
(extratropical phase),  
to rotating convective clouds  
(possible tropical-like phase)*





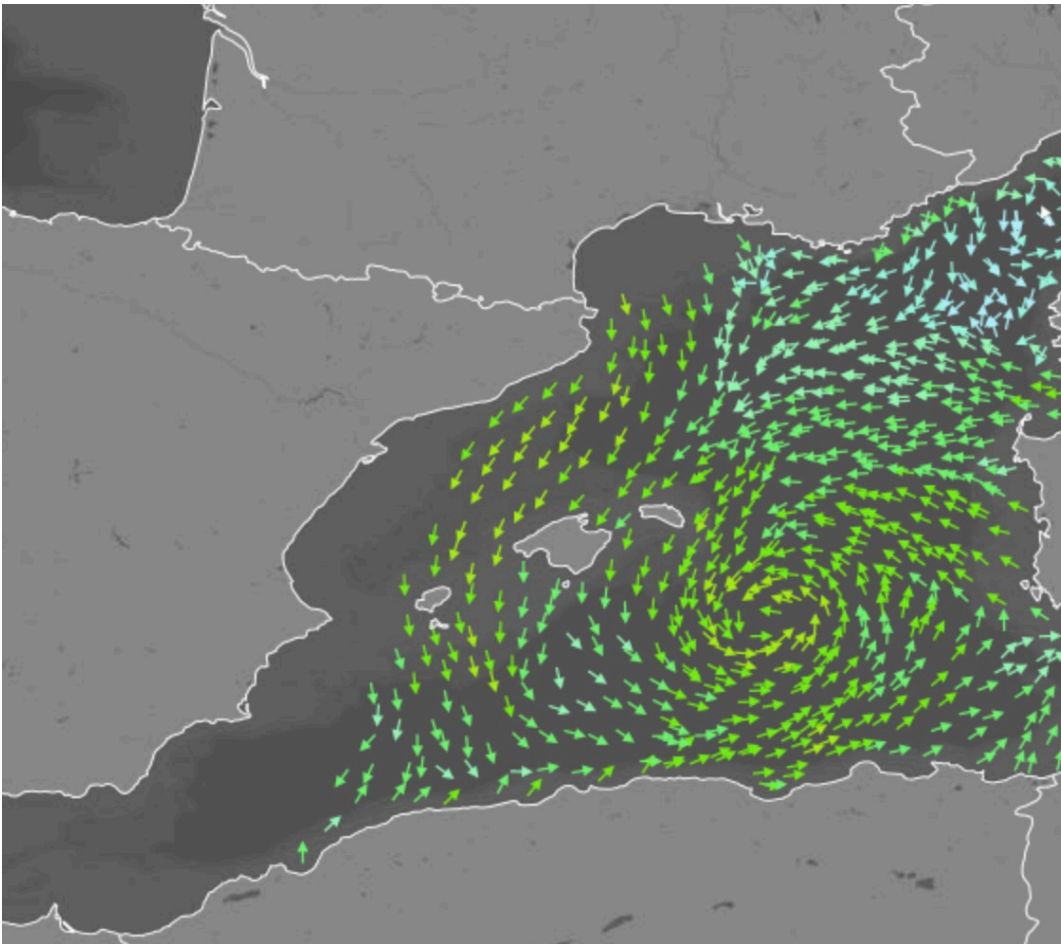
**Cyclone Ianos:** It is accepted it is a classic medicane, *but no rotating deep convection is observed at the beginning and only phases of rotating deep convection appear along the long cyclone life cycle.*  
*Analyses suggest a **non tropical phase** and a **possible tropical-like phase***





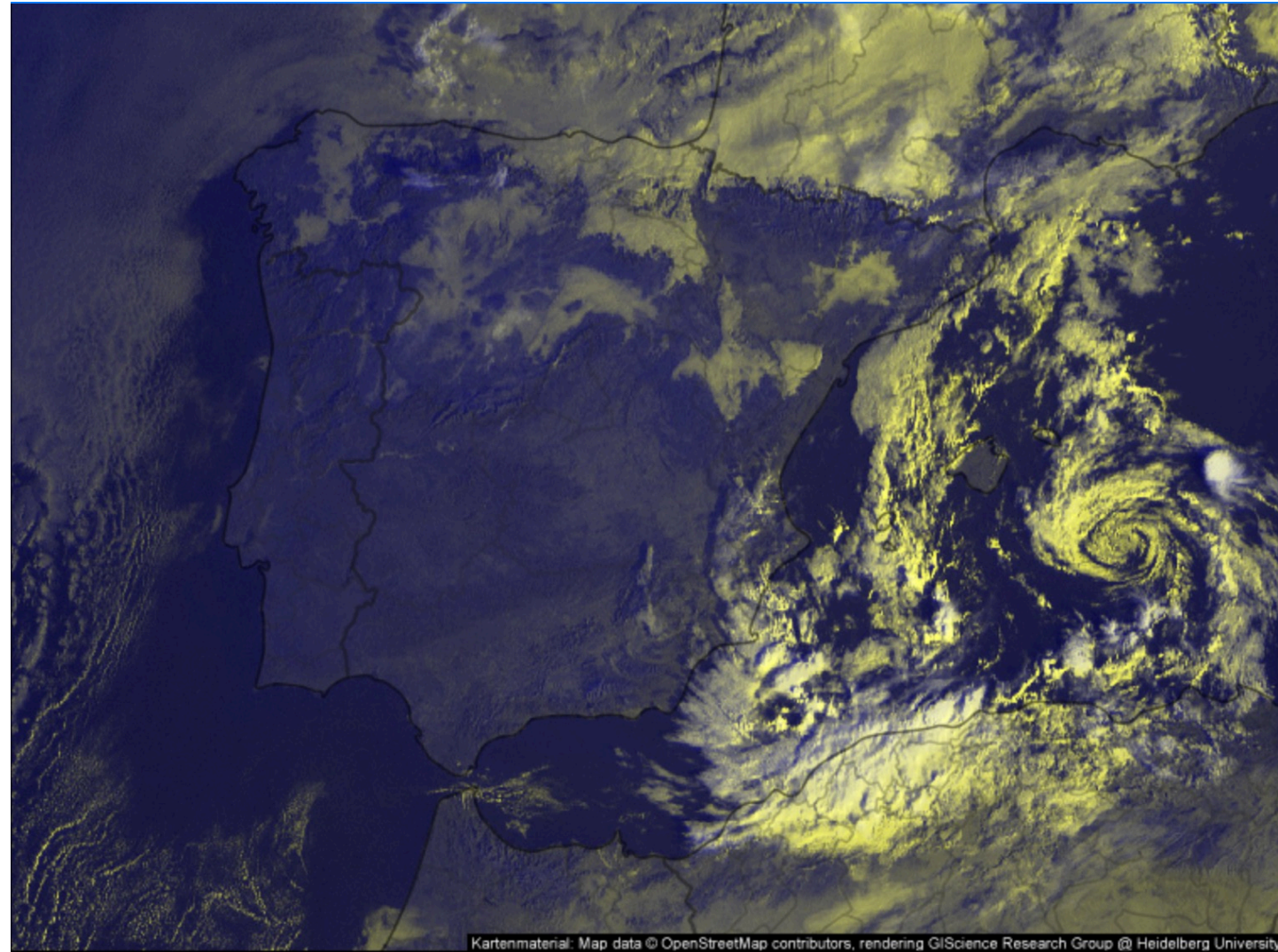
**Which kind of cyclone is Blas after its moment of medicane?** It is still a warm core cyclone, but, Is it intense enough?

Clouds around the centre are mainly low level clouds



ASCAT – 13 Nov 21, 0824

*Yellow is 30 kts*



**Satellite HD** 

Sat 11/13/2021, 09:00am CET

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Spain

To be categorical is always difficult!

Thank you!