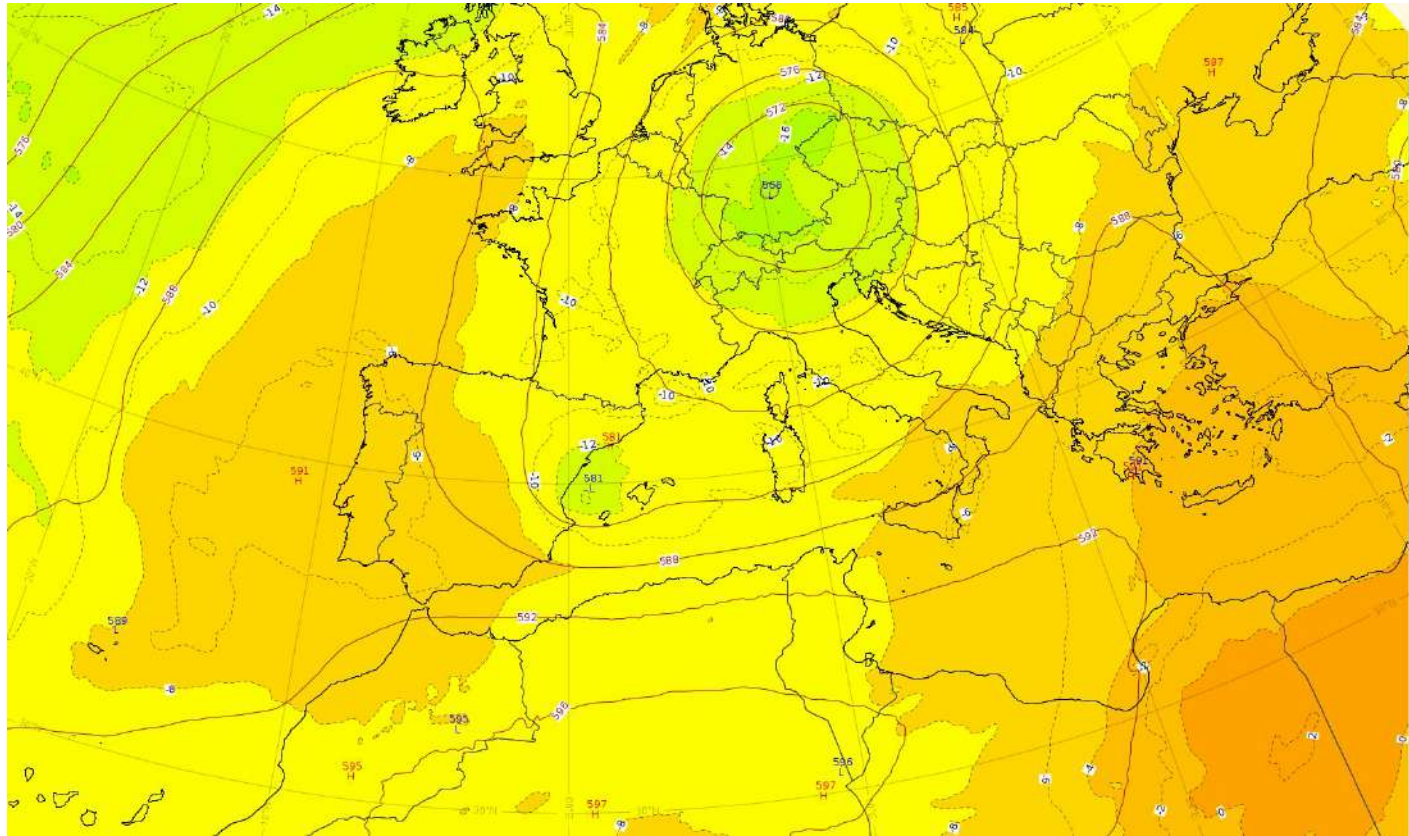
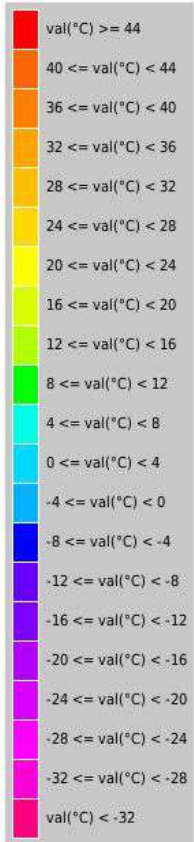


# Comparing Arome model and observations

July 15th 2021

# Synoptic conditions

# Geopotential height + Temperature at 500 hPa at 12 UTC (Arpege 0.1 Run 0 UTC)



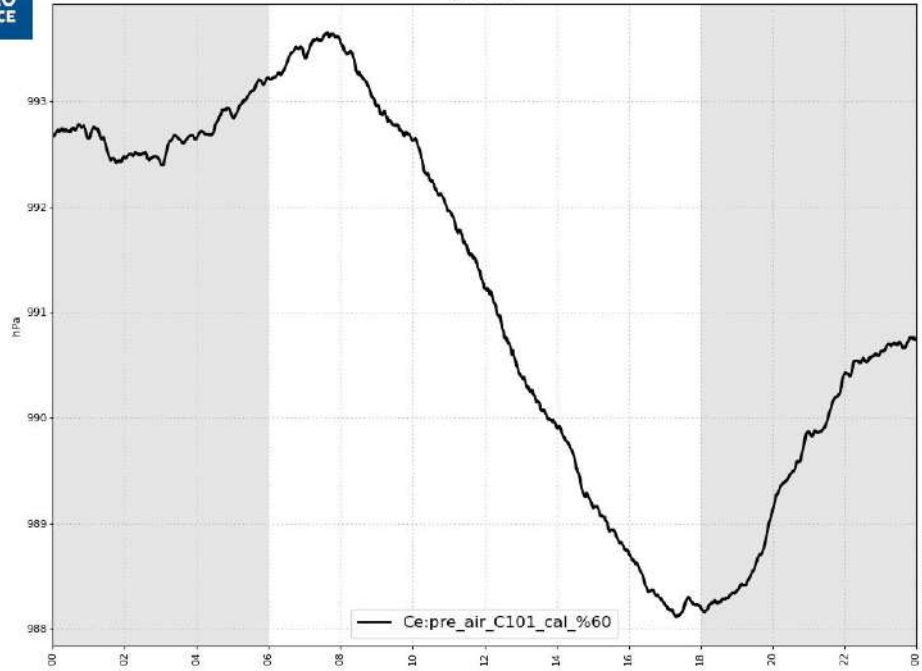


# Pressure at La Cendrossa



15/07/2021 La cendrossa

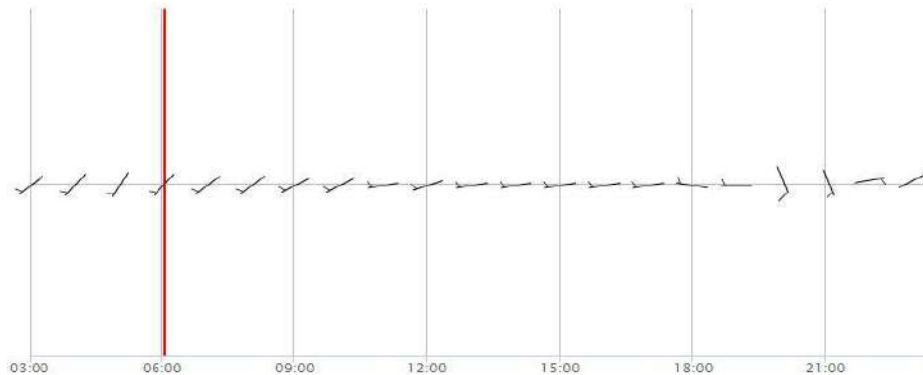
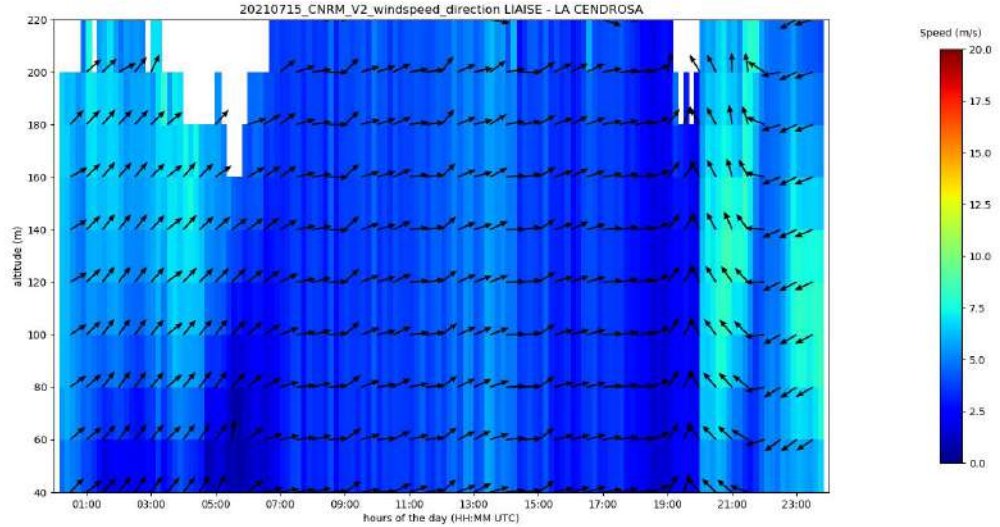
pressure



Sea breeze

# Sea breeze

Wind speed and wind direction observations



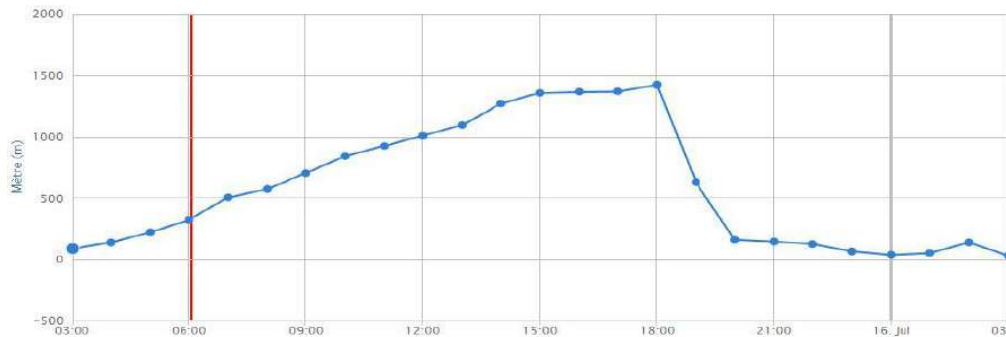
forecast of wind direction and wind speed



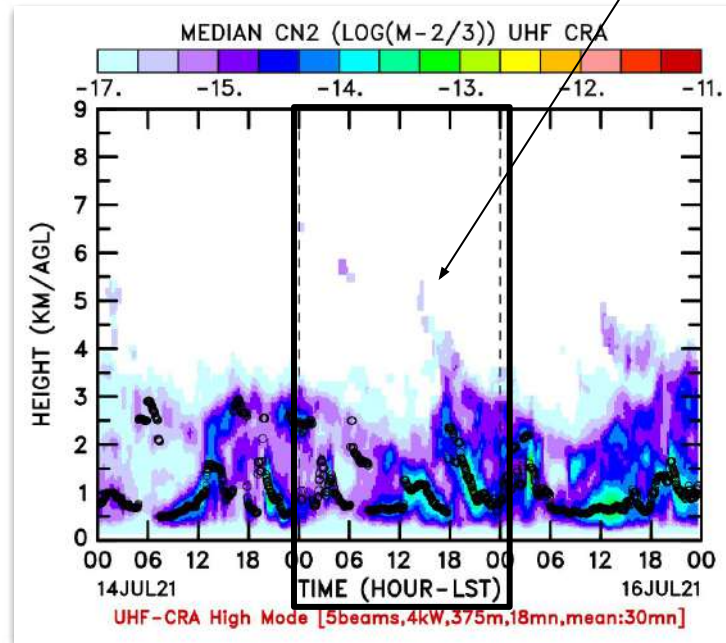
Planetary boundary layer

# Atmospheric boundary layer thickness (Arome run 3 UTC 16/07) for Friday 16 July in Mollerussa

Reflectivity on July 15th 2021



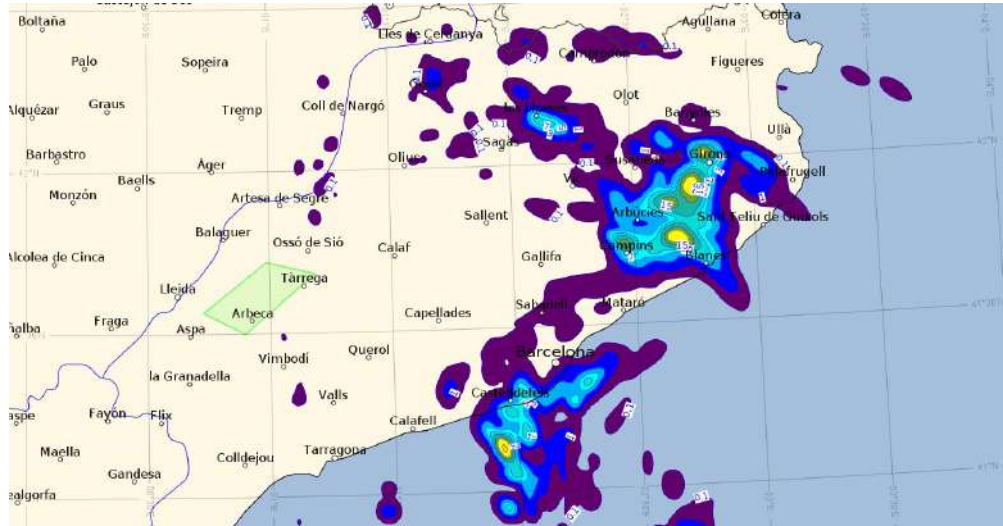
Planetary boundary layer thickness forecast by Arome



Observations - ReflectivityZI at Els plan

# Rainfall

# Rainfall - forecast and observations






Rainfall forecasted by Arôme on July 16th 2021

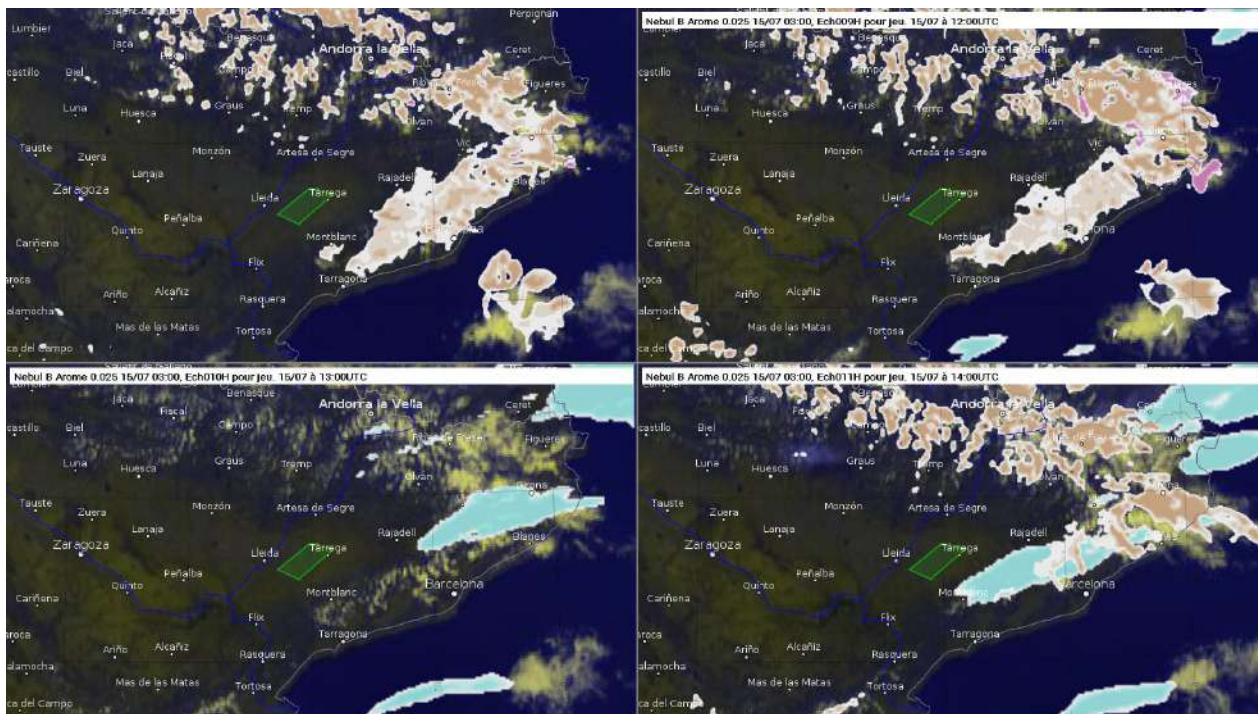
Cloud cover

# Cloud cover - Forecast and satellite image (Arome 3 UTC)

12 UTC

13 UTC

-  Low cloud cover
-  Middle cloud cover
-  High cloud cover



14 UTC

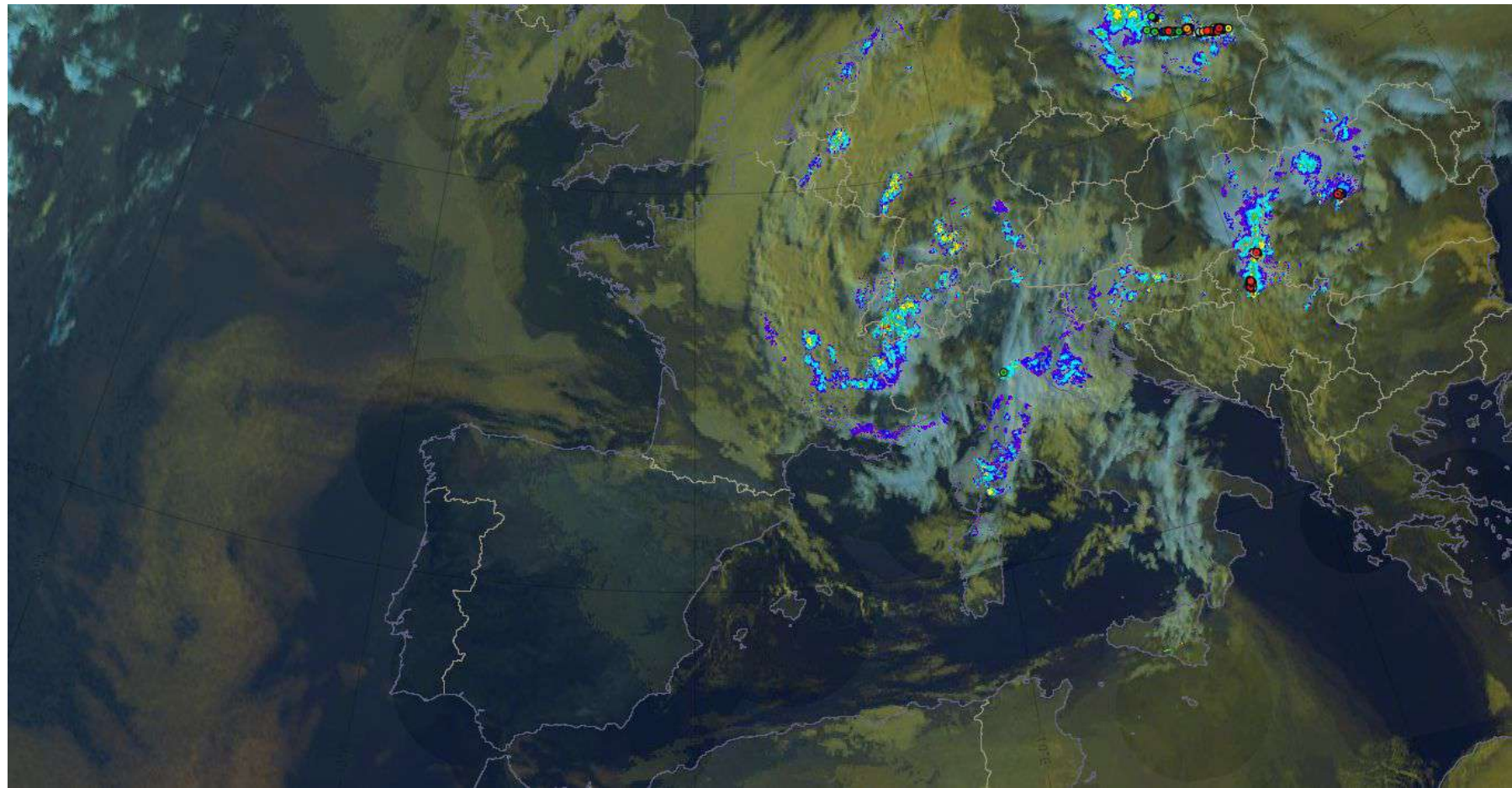
15 UTC

16/07/2021

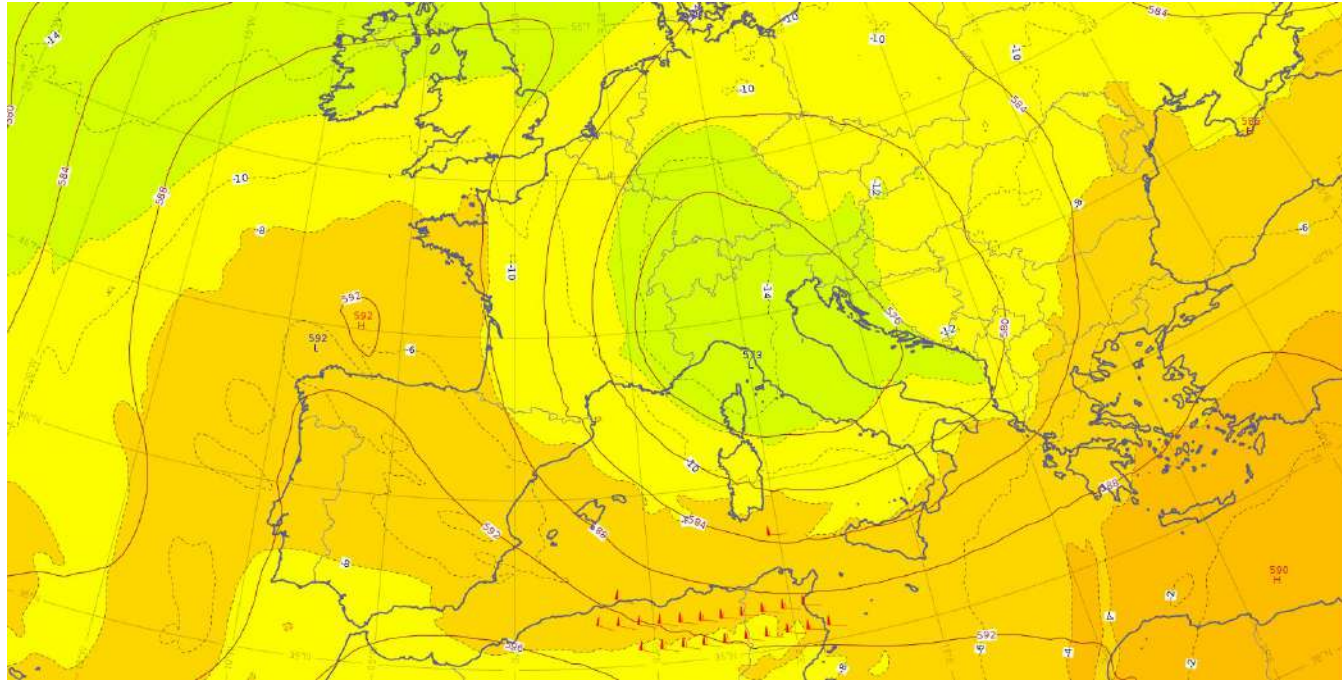
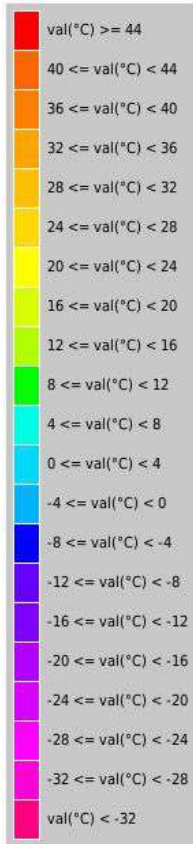
# Synoptic conditions



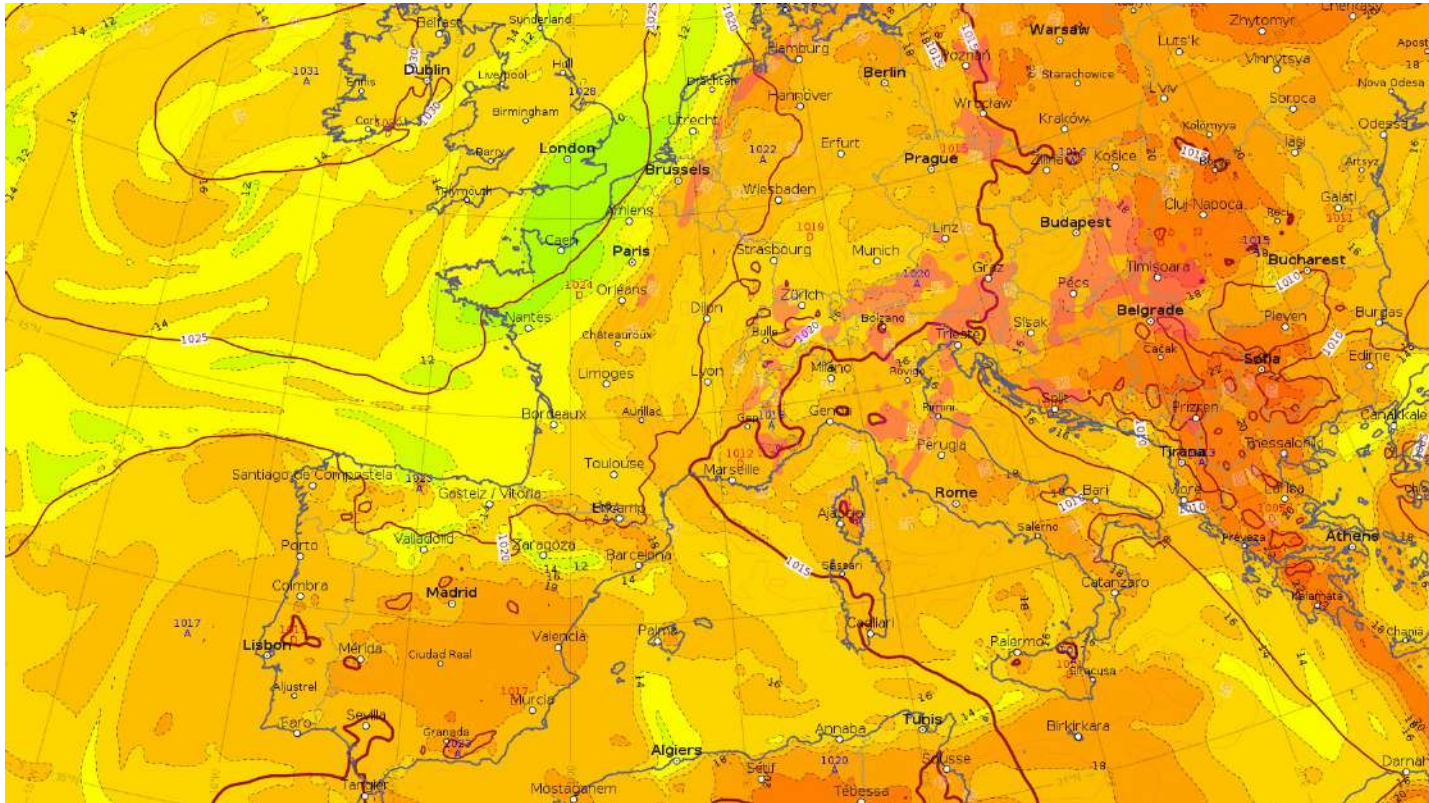
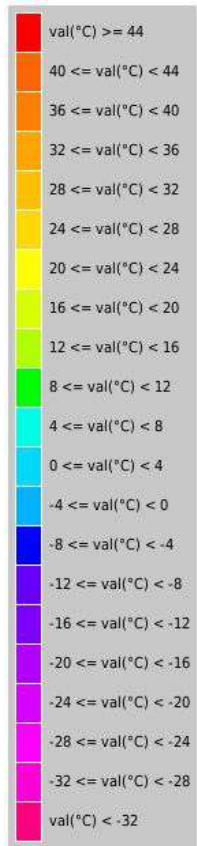
Color composite at 05:35 UTC



# Geopotential height + Temperature at 500 hPa at 12 UTC (Arpege 0.1 Run 0 UTC)



# Wet bulb potential temperature at 850 hPa + SLP at 12 UTC (Arpege 0.1 Run 00 UTC)

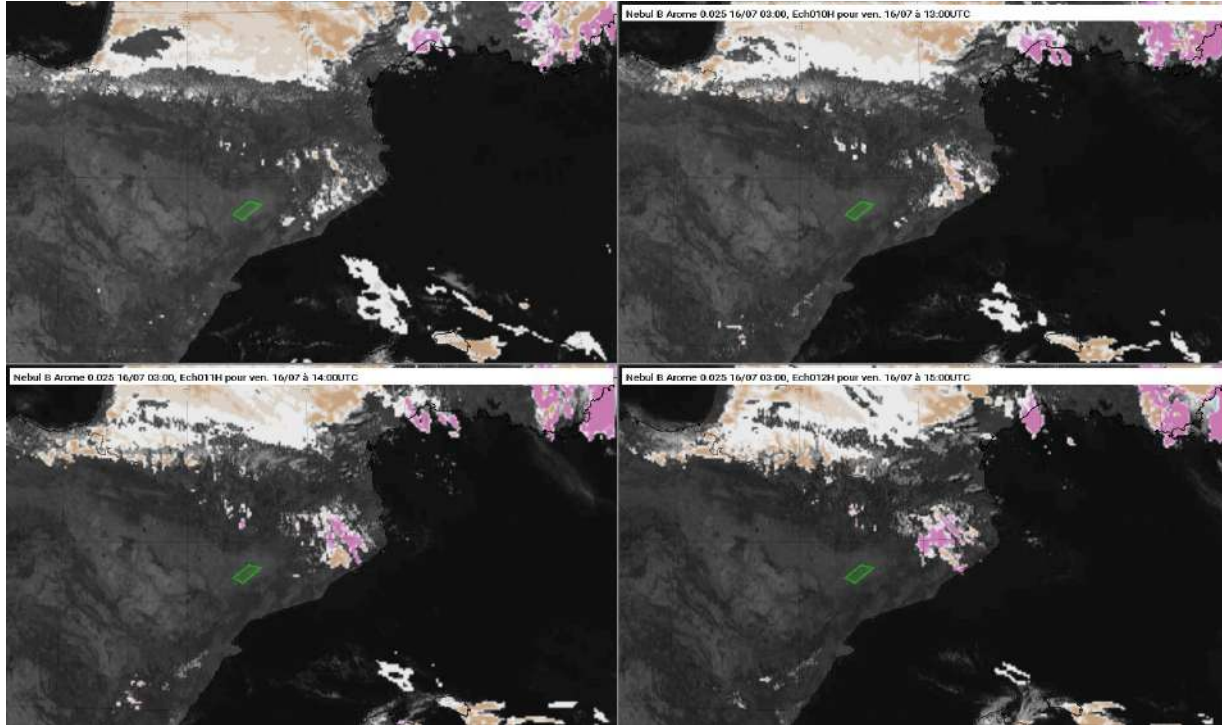
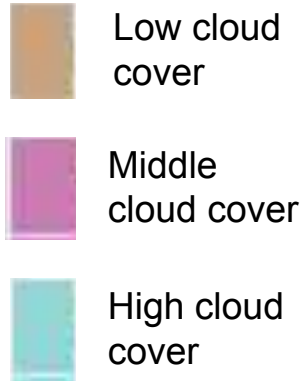


# Cloud Cover

# Cloud cover - Forecast and satellite image (Arome 3 UTC)

12 UTC

13 UTC



14 UTC




15 UTC

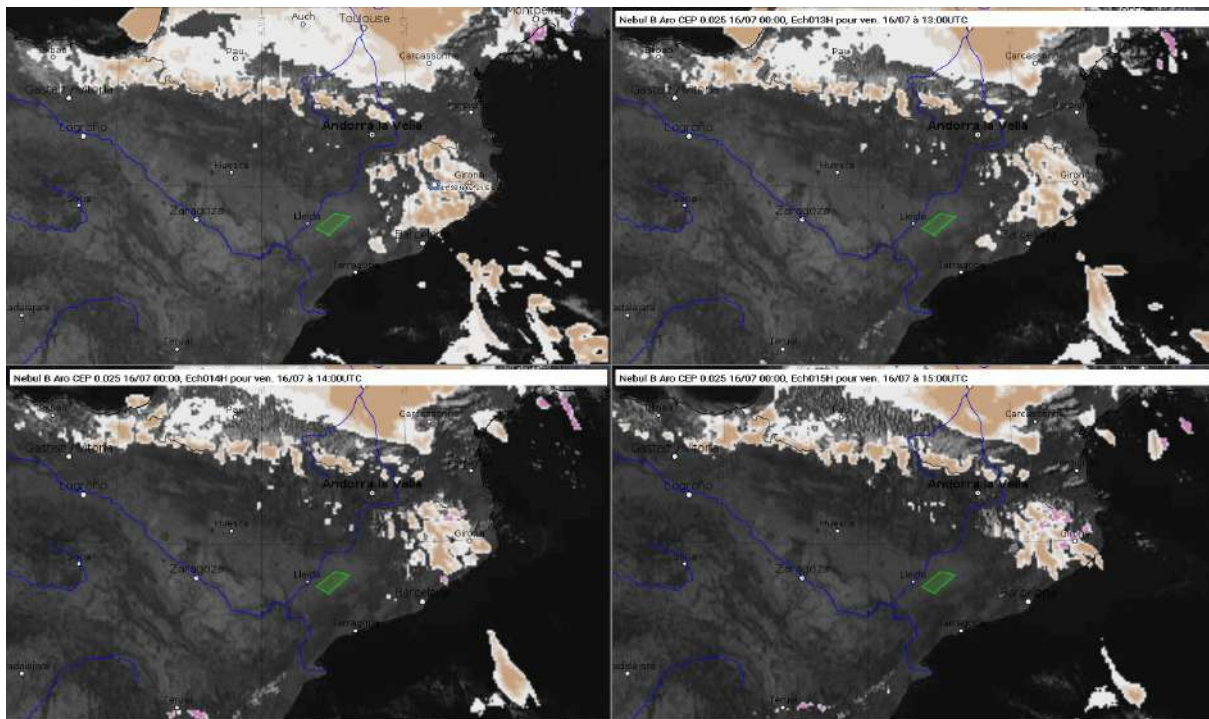
16/07

# Cloud cover - Forecast and satellite image (AROIFS 0 UTC)

12 UTC

13 UTC

-  Low cloud cover
-  Middle cloud cover
-  High cloud cover



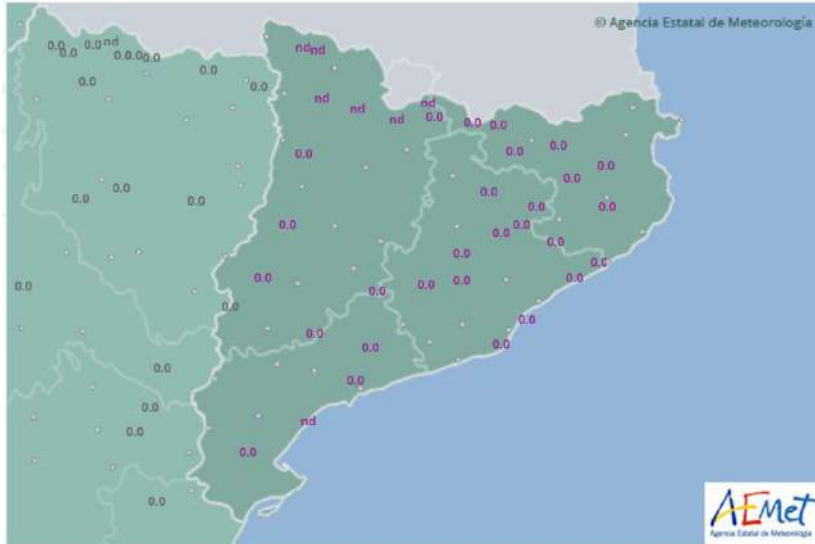
14 UTC

15 UTC

16/07

# Rainfall

# Rainfall - forecast and observations



Observation - rainfall on aemet website



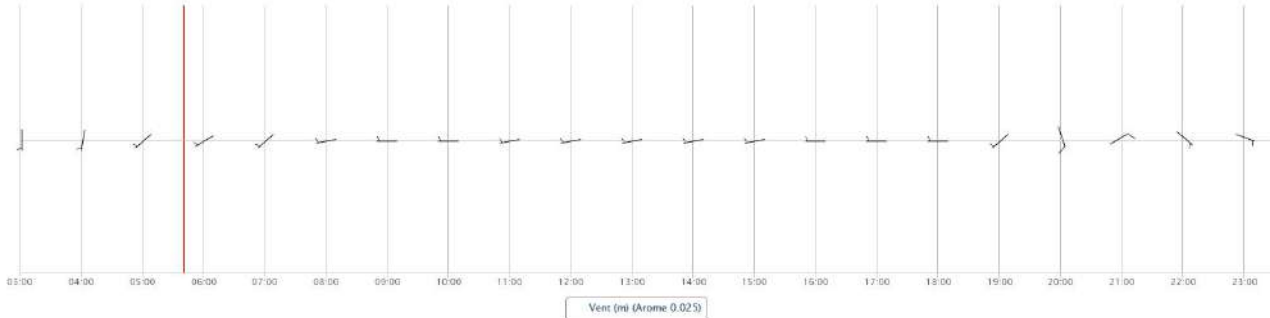
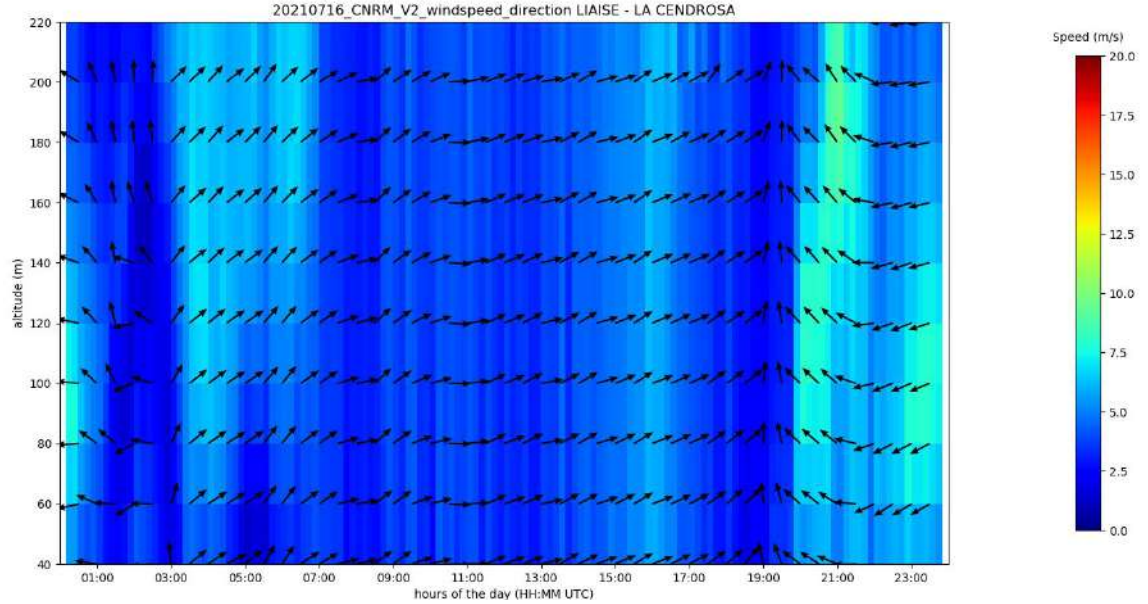
Rainfall forecasted by Arome on July 16th 2021



Wind

# Sea breeze

Wind speed and wind direction observations



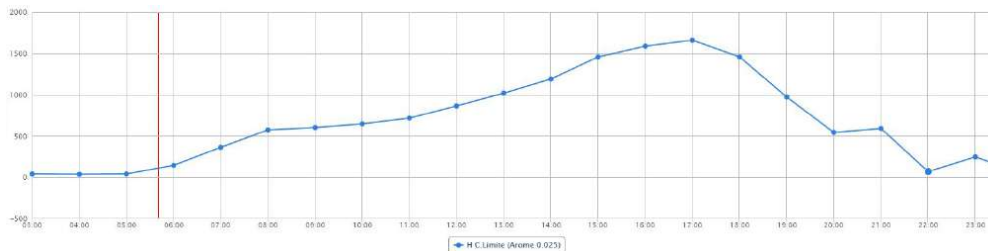
forecast of wind direction and wind speed

The model Arome forecasted a shift in wind direction related to the arrival of the sea breeze between 19 UTC and 20 UTC. Actually at 19 UTC the wind began to shift into a south-westerly wind and at 20 UTC, it becomes a south-easterly wind which is typical of the sea breeze.

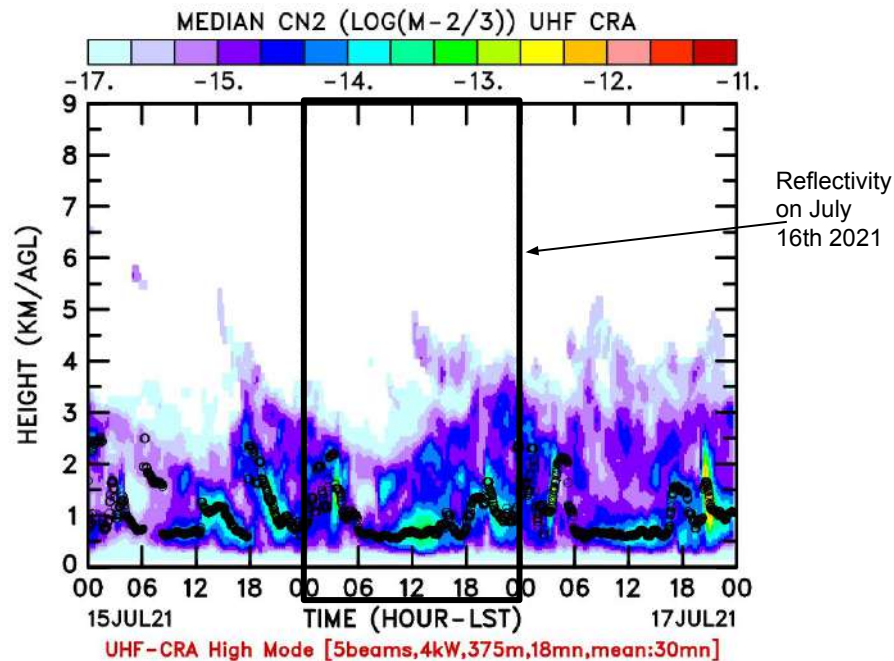
The observations and measurements of wind speed and wind direction made by a Lidar at La Cendrosa shows that the sea breeze arrives on La Cendrosa between 19 UTC and 20 UTC, then the sea breeze should have arrived sooner on the easternmost part of the area.

# Planetary Boundary Layer

# Atmospheric boundary layer thickness (Arome run 3 UTC 16/07) for Friday 16 July in Mollerussa



Planetary boundary layer thickness forecast by Arome



Observations - ReflectivityZI at Els plan

According to the model, the boundary layer reach 1700m at 17 UTC and start to decrease after that.

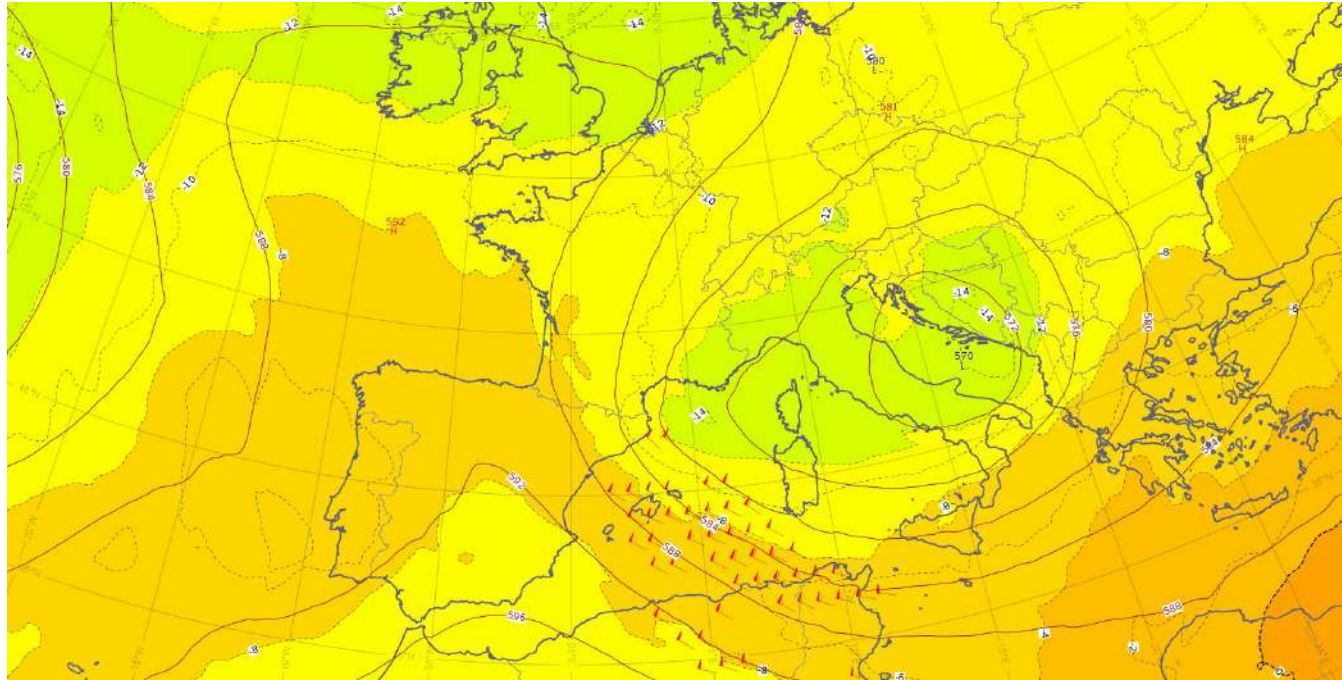
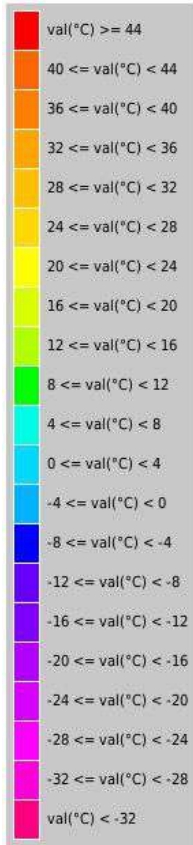
However the observations shows that the planetary boundary layer is around 2000m at 03 UTC and decrease, durant most of the day it stagnates under 1000m until 17 UTC. At 17 UTC there is a little peak over 1000m but under 1500m, then the boundary layer becomes deeper at Els Plan. For this day, the model seems to overestimate the boundary layer thickness and it did not forecast the increase after 18 UTC.

17/07/2021

# Synoptic Condition

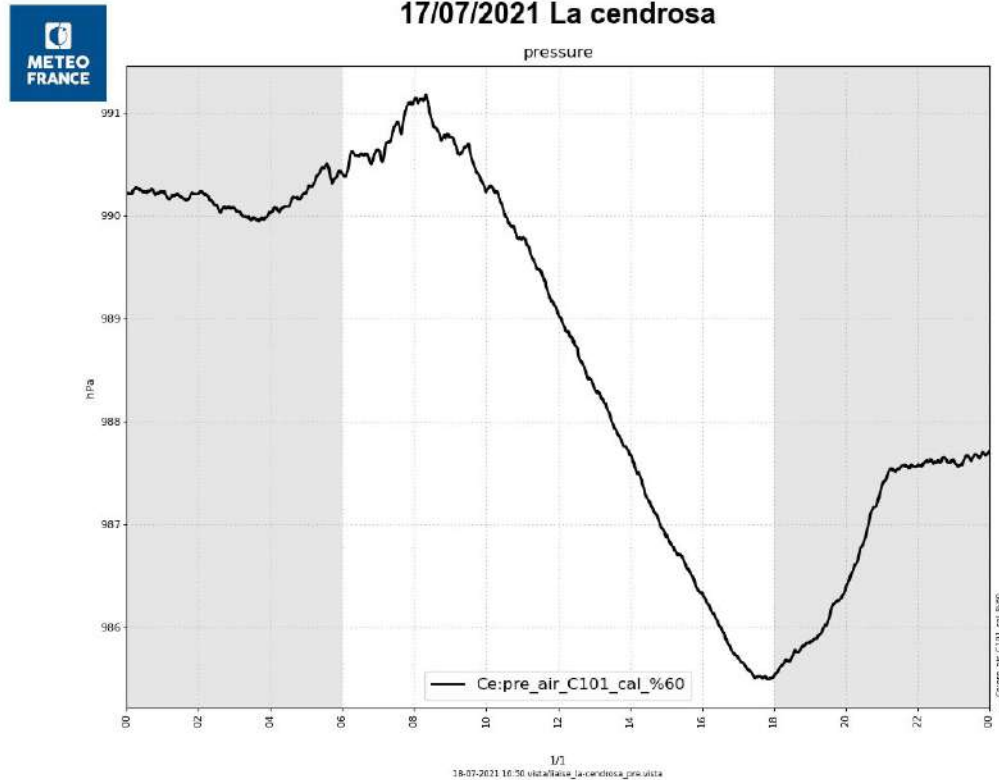


# Geopotential height + Temperature at 500 hPa at 12 UTC (Arpege 0.1 Run 0 UTC)



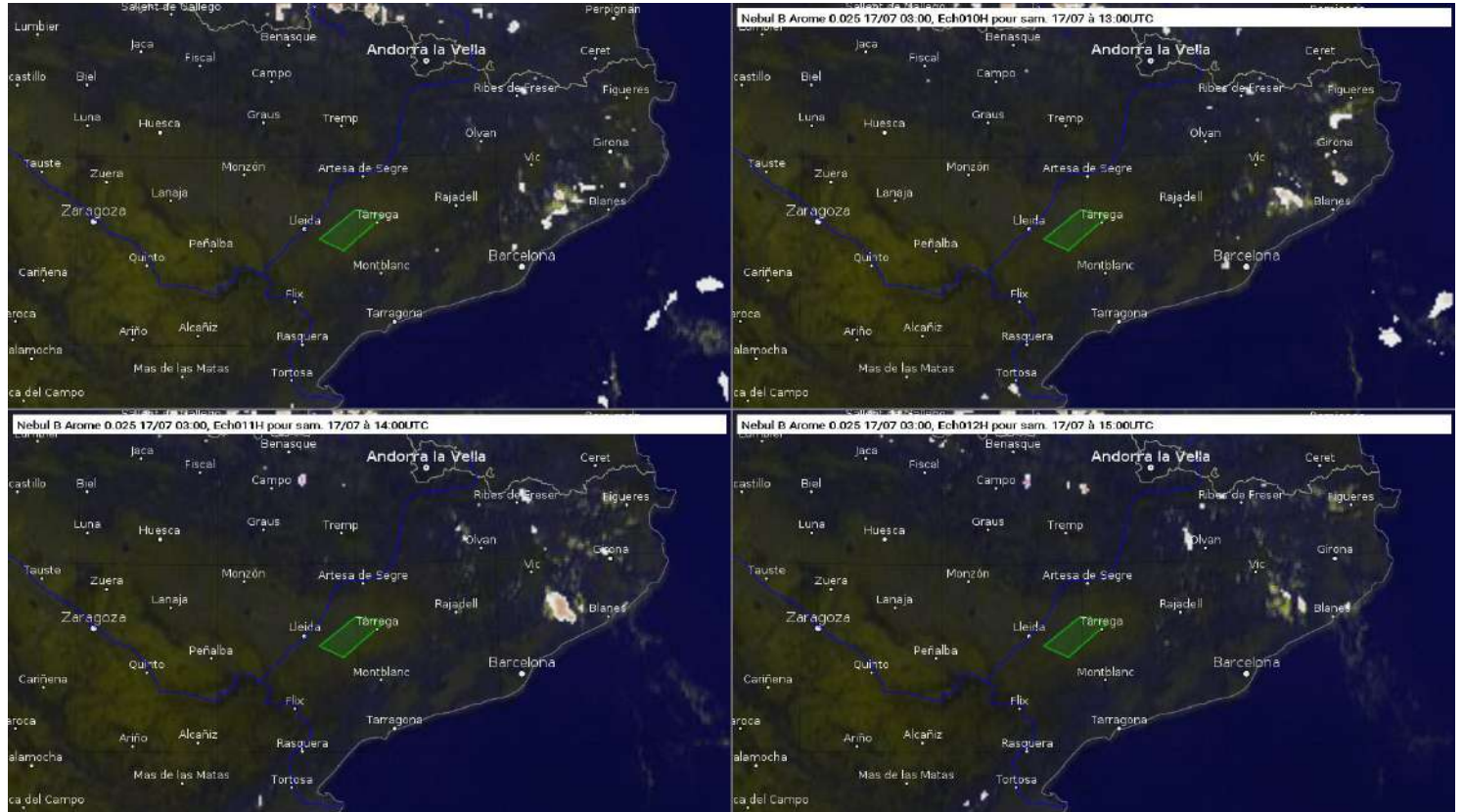
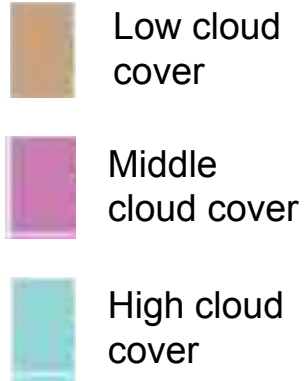


# Pressure at La Cendrossa

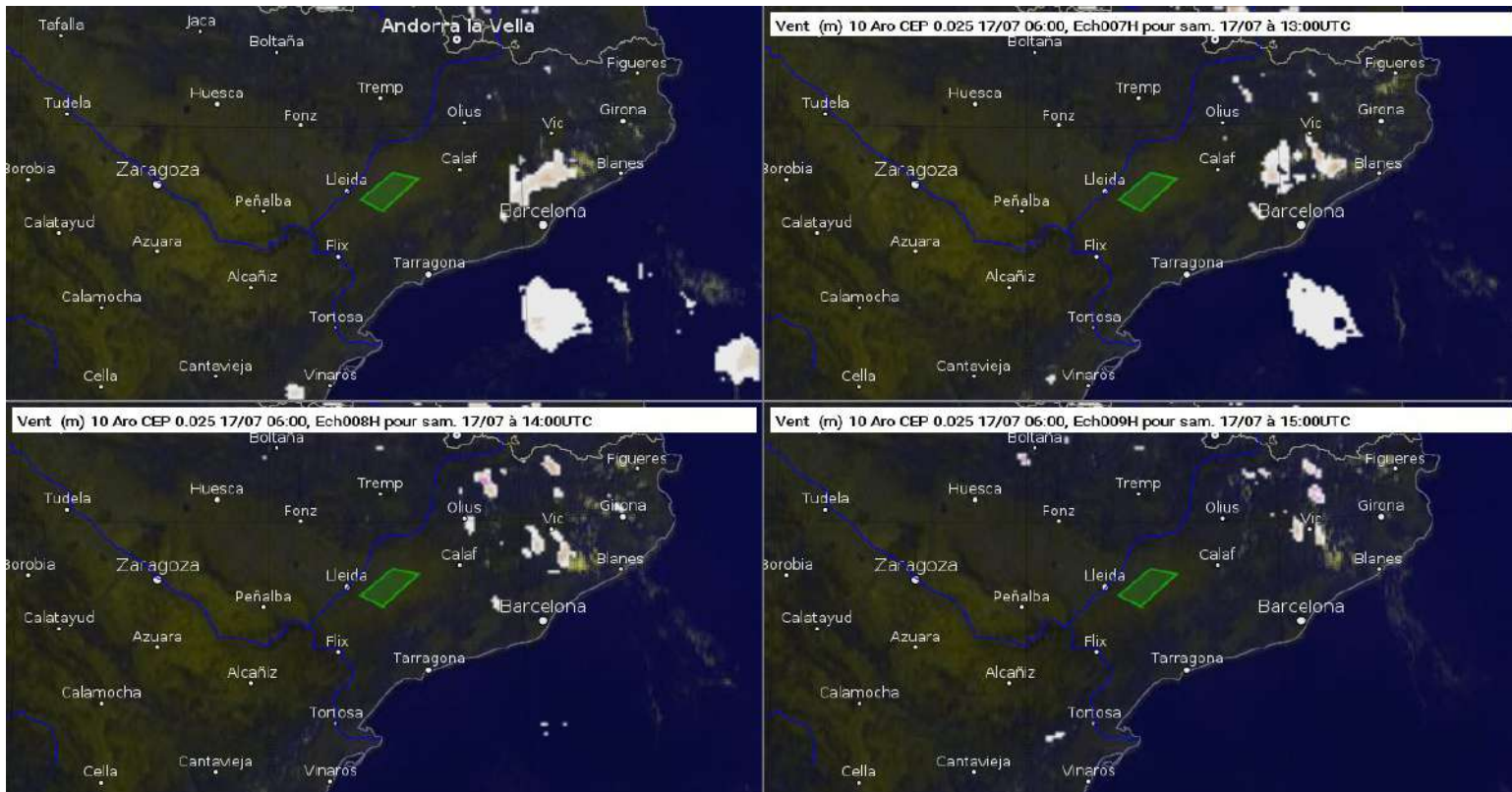


# Cloud Cover

# HR\_VIS observation + Cloud cover from the modele at 12 to 15 UTC (arome run 03UTC)



# HR\_VIS observation + Cloud cover from the modele at 12 to 15 UTC (AROCEP run 00UTC)

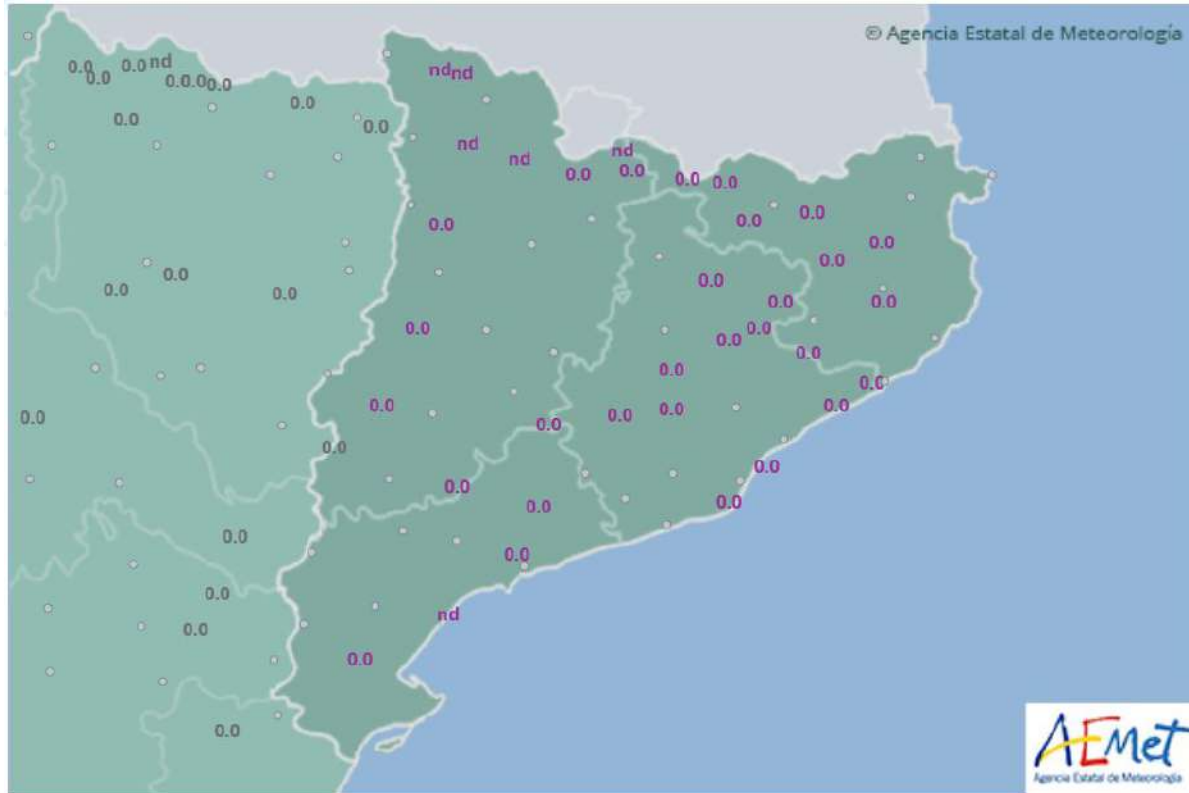


- No cloud seen during the afternoon in the area
- Some low clouds seen in the East around Blanes and the models satisfyingly predicted them

# Rainfall



# Observations - aemet - rainfalls

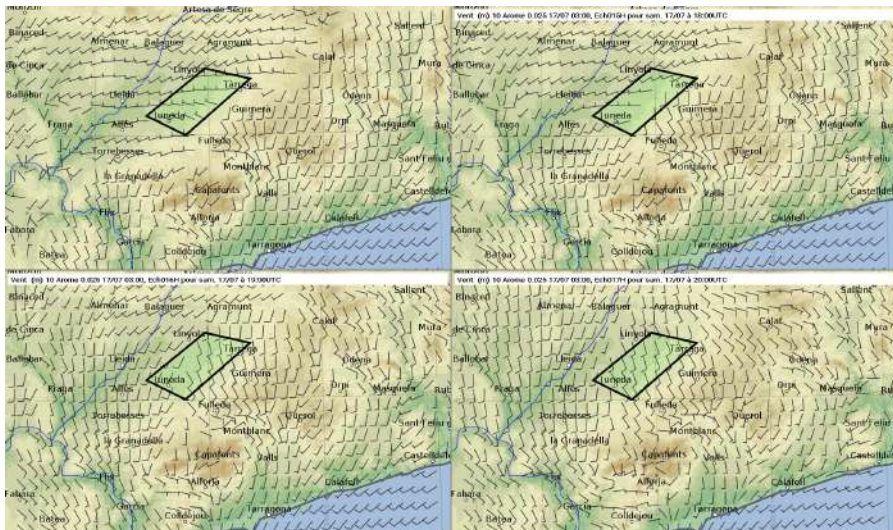


Wind

# Wind at 10 m Arome Run 03 UTC and Obs

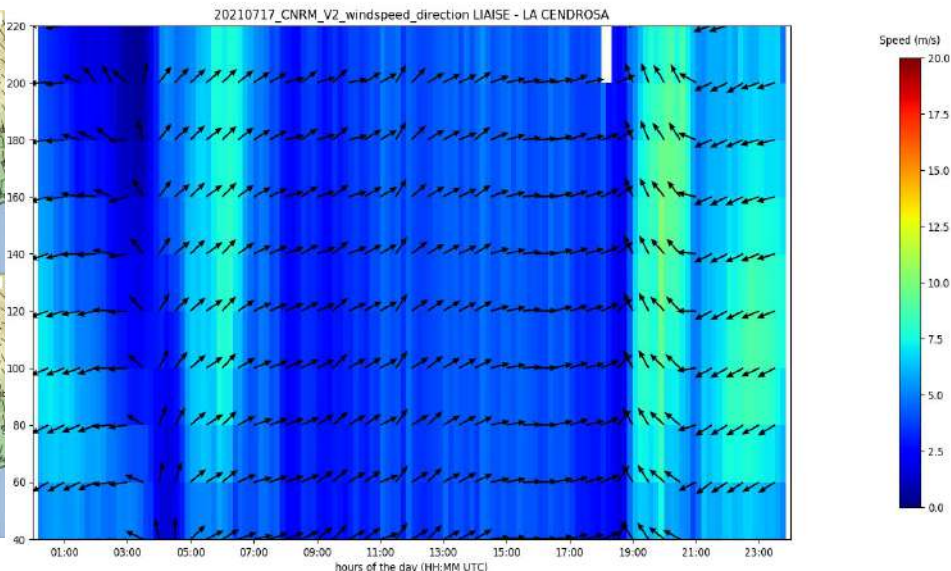
17 UTC

18 UTC



19 UTC

20 UTC



Wind at 10 m Arome Run 03 UTC

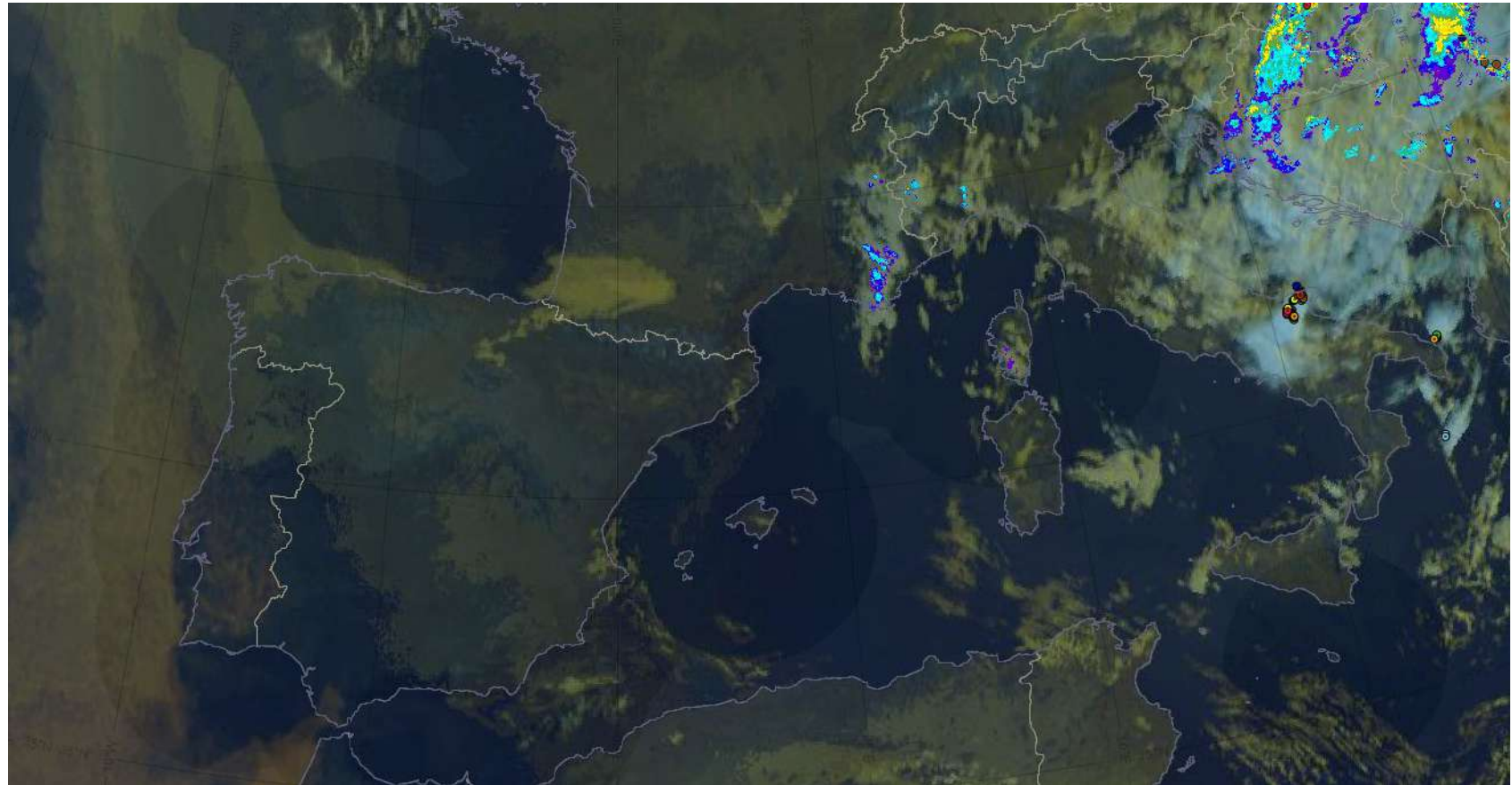
Observations - La Cendrosa -  
Wind profiler Lidar Windcube

The sea breeze arrived at approximately 19UTC with a SSE inclination as expected but the model underestimated the intensity of the wind

19/07/2021

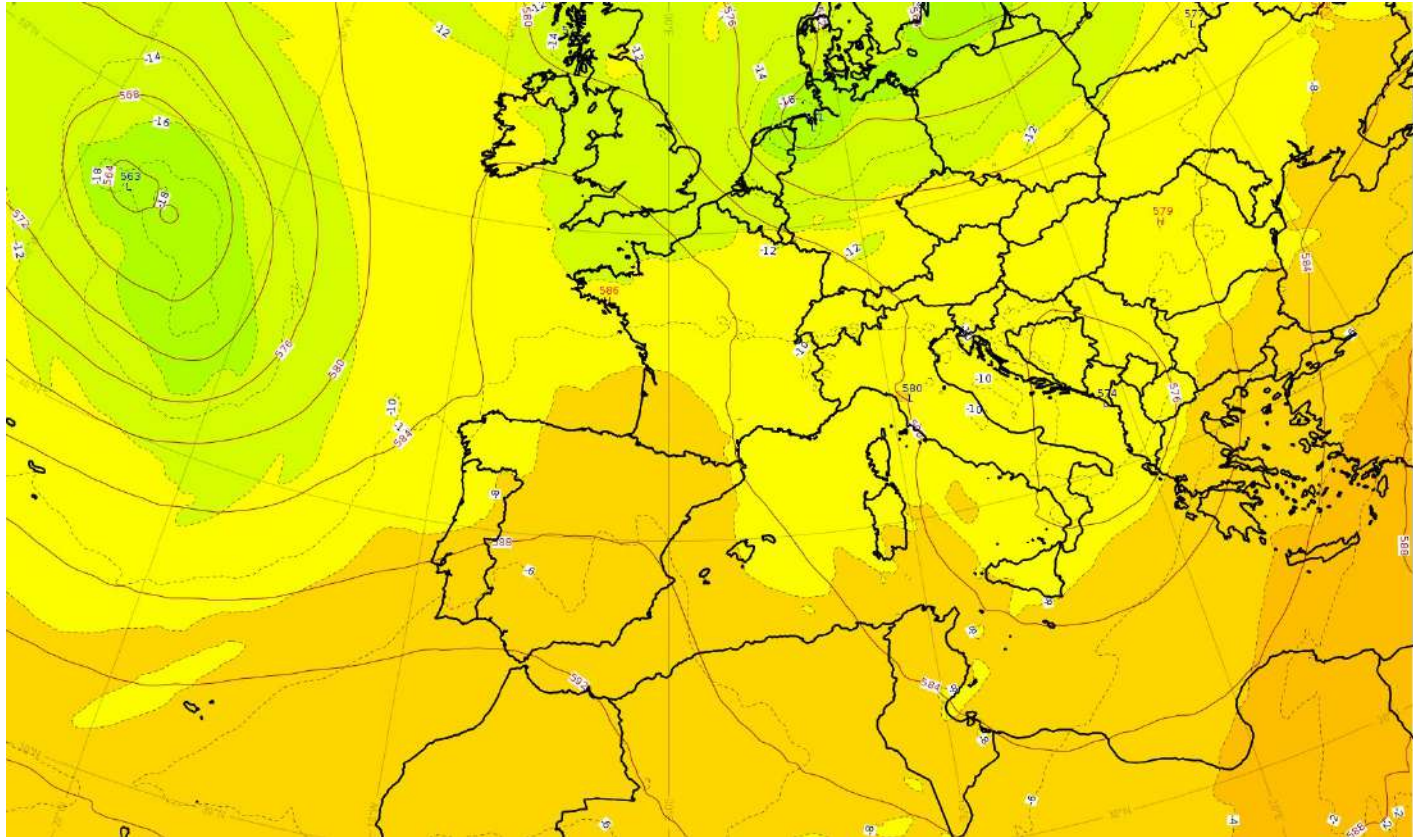
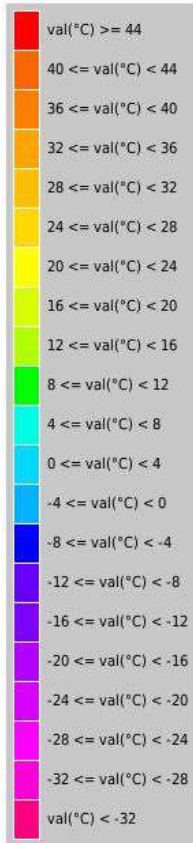
# Synoptic conditions

Color composite at 05:40 UTC



19/07

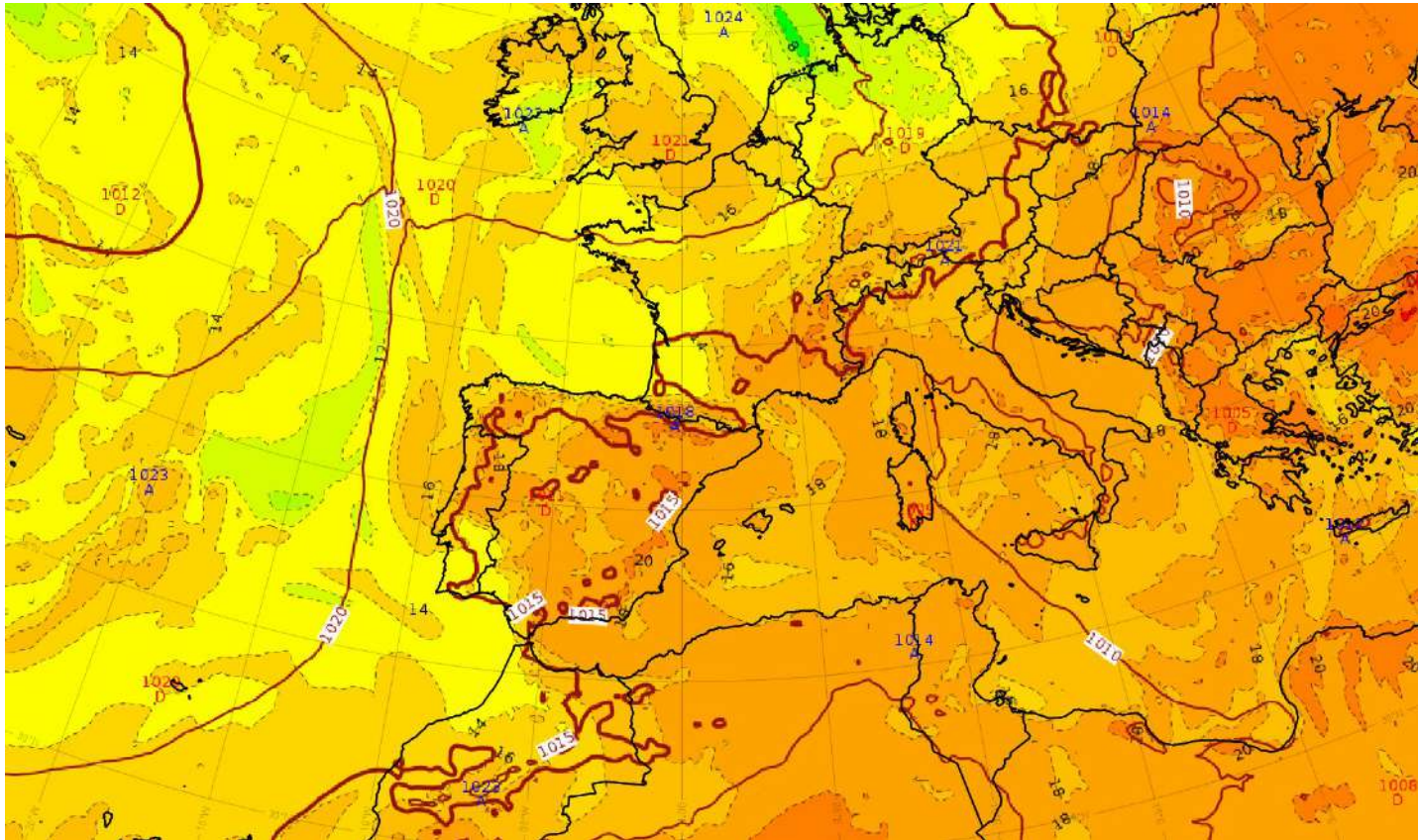
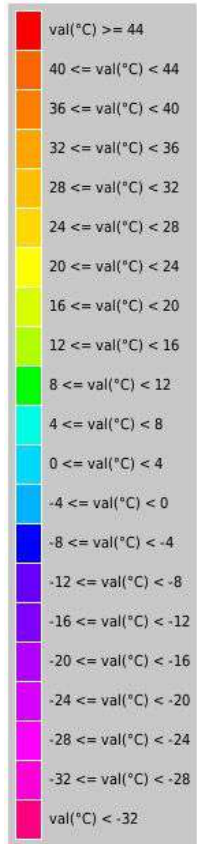
# Geopotential height + Temperature at 500 hPa at 12 UTC (Arpege 0.1 Run 0 UTC 19/07)



19/07



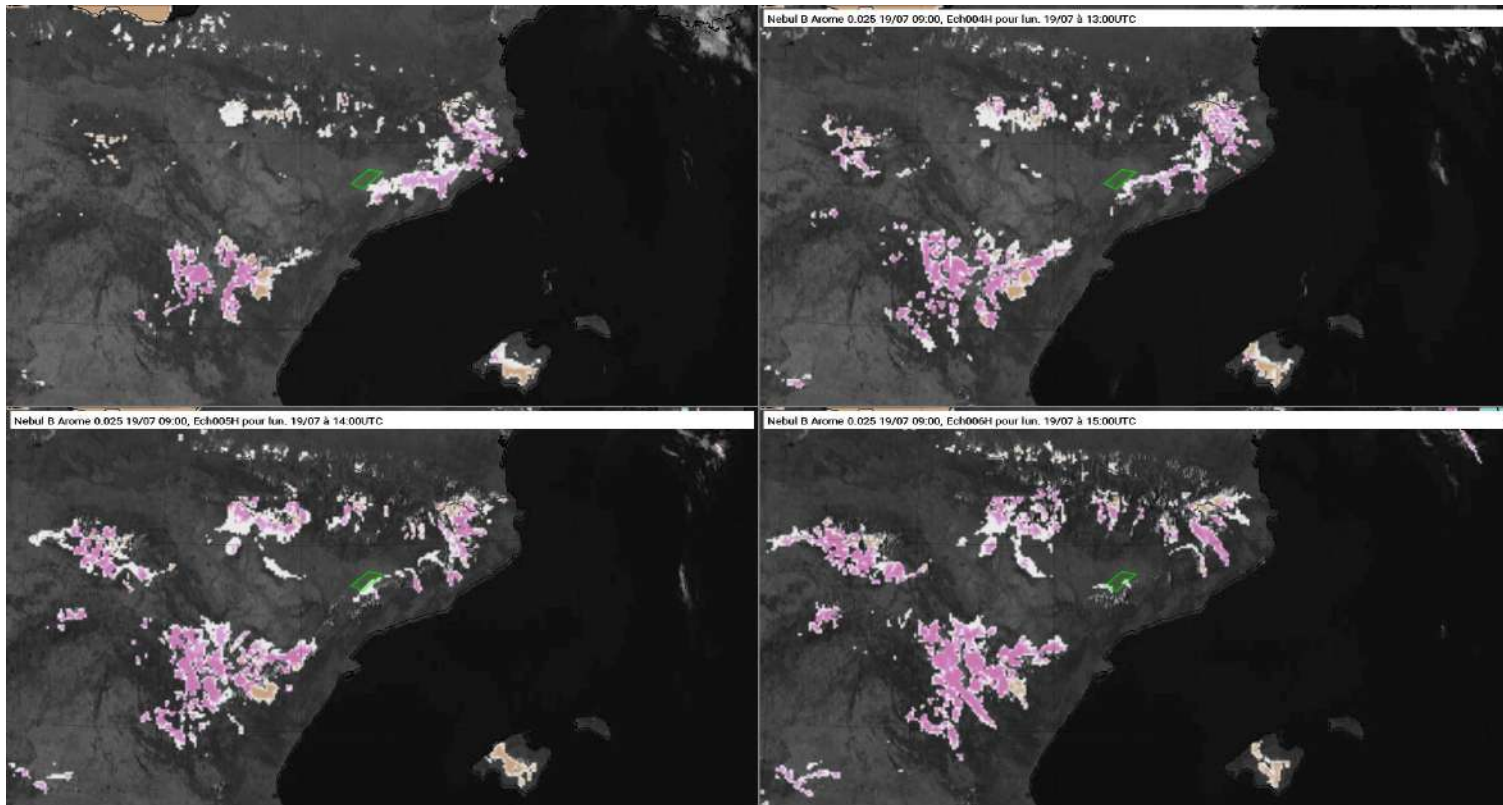
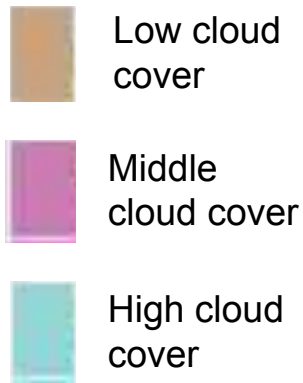
# Wet bulb potential temperature at 850 hPa + SLP at 12 UTC (Arpege 0.1 Run 00 UTC 19/07)



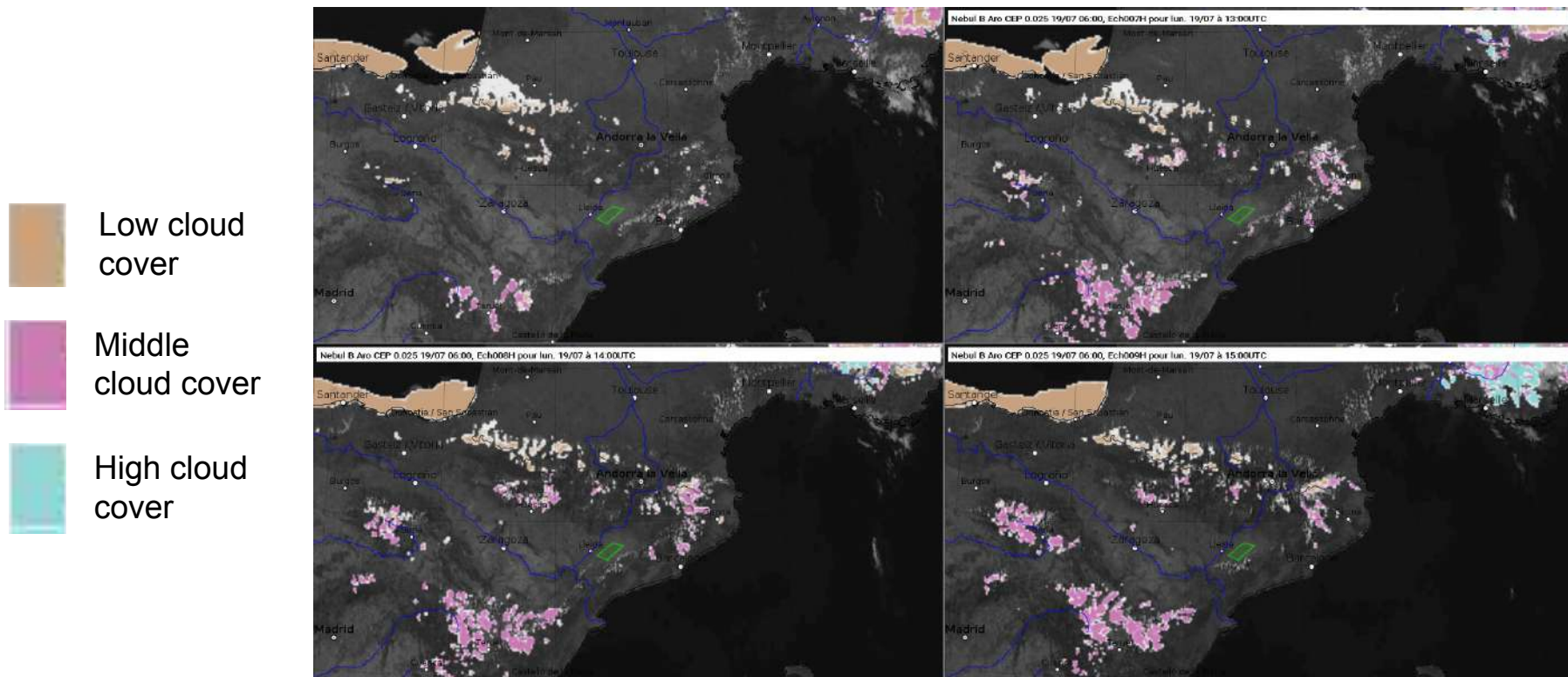
Conditions remain anticyclonic from the surface to 500 hpa.

# Cloud Cover

# HR\_VIS observation + Cloud cover from the modele at 12 to 15 UTC (arome run 03UTC)

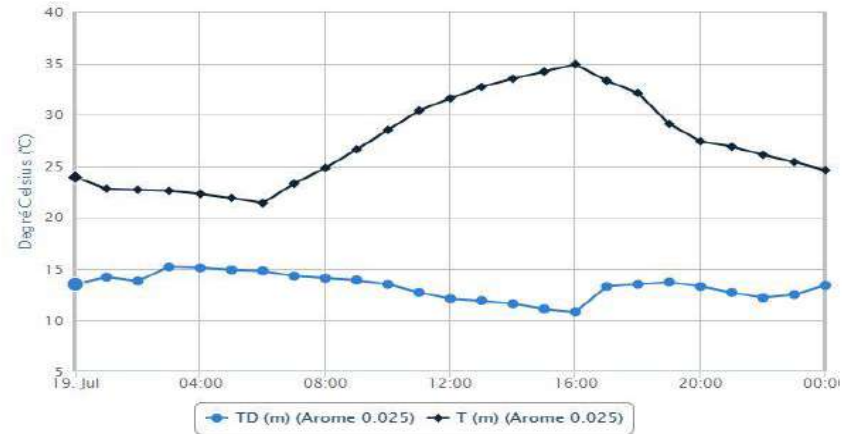
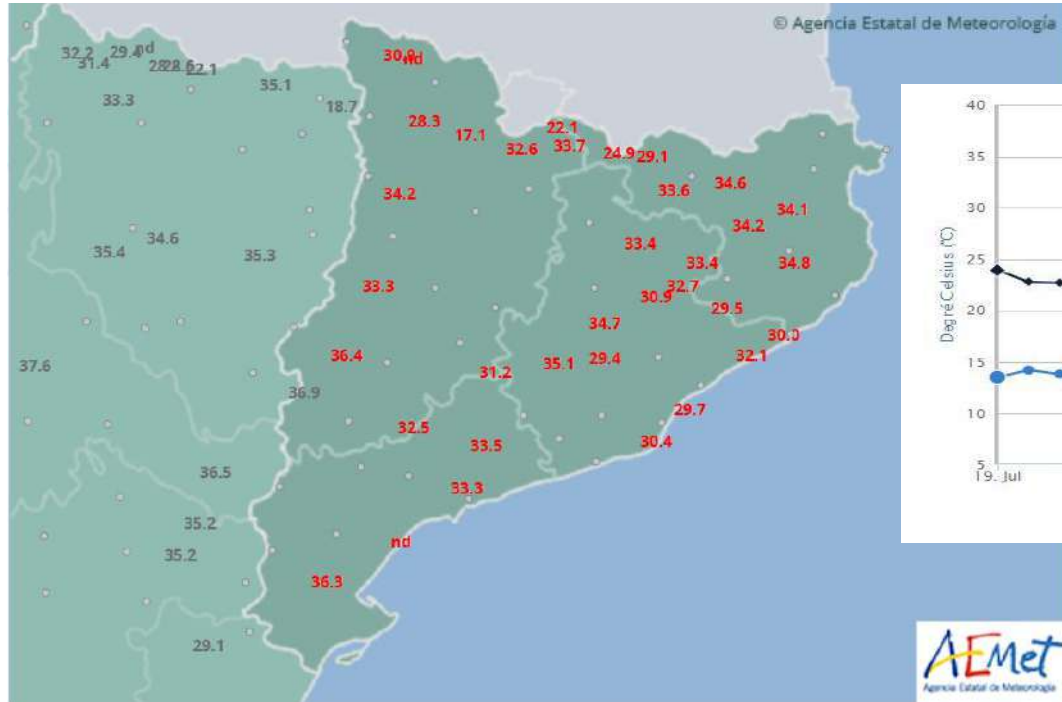


# HR\_VIS observation + Cloud cover from the modele at 12 to 15 UTC (AROCEP run 00UTC)



Temperature

# Observations - aemet - maximum temperature



Arome (Run 3h UTC 18/07 for 19/07) - Temperature and dew point - Mollerussa

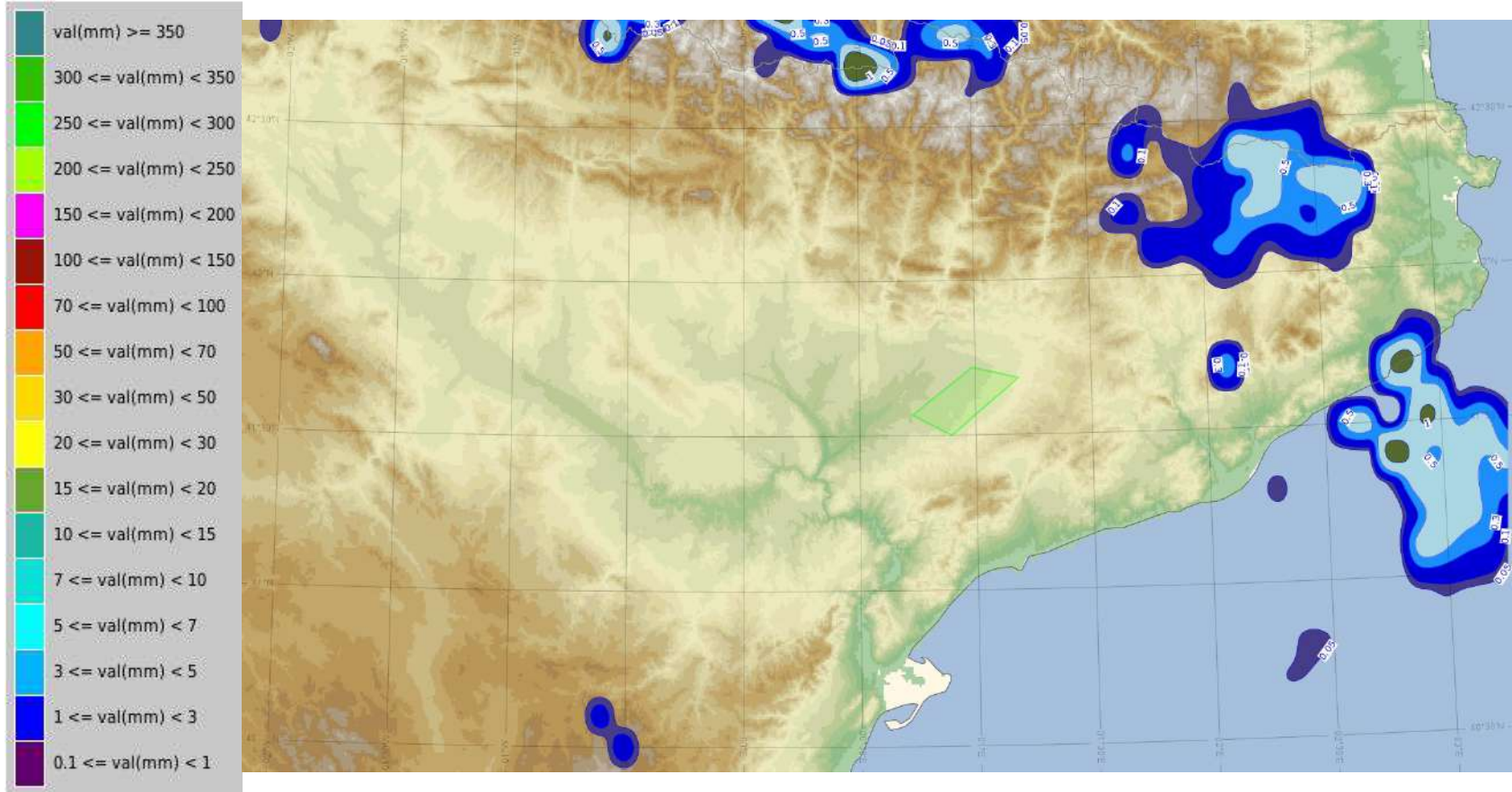


The prediction matched well the observations.

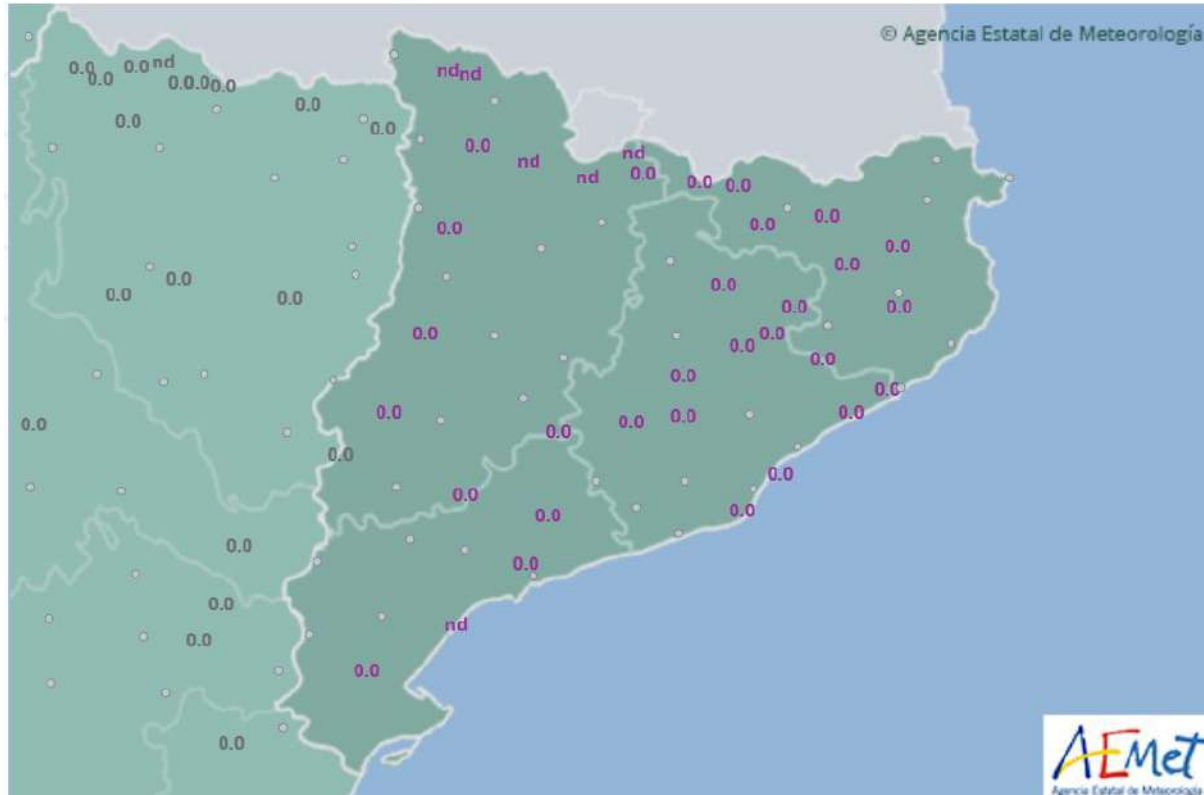


# Rainfall

# Total rainfall in 24h (Arpège 00h UTC 18/07 for 19/07)



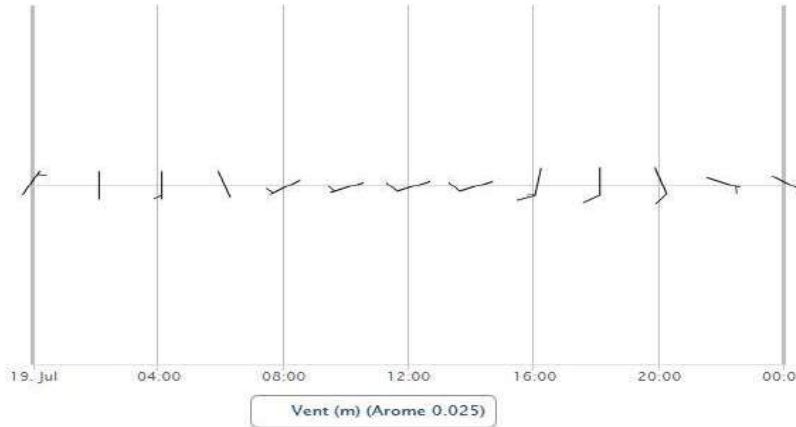
# Observation - aemet - rainfall



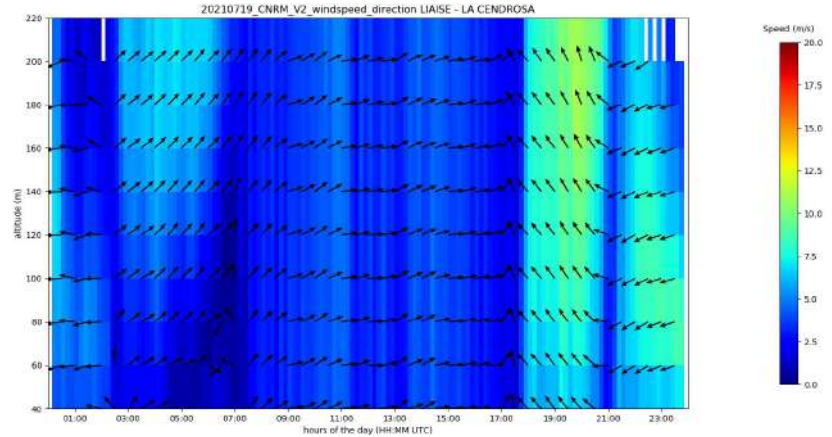
Total rainfall was overestimated by Arpege.

Wind

# Wind at 10 m Arome Run 03 UTC 18/07 for 19/07 and Obs



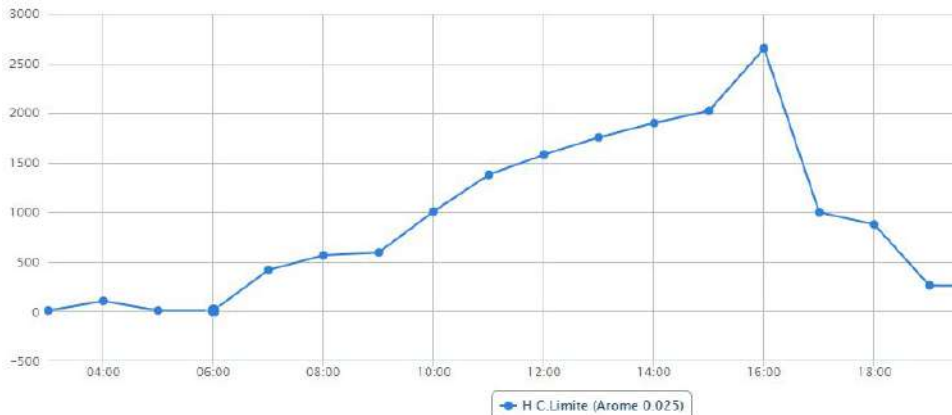
Wind at 10 m Arome Run 03 UTC



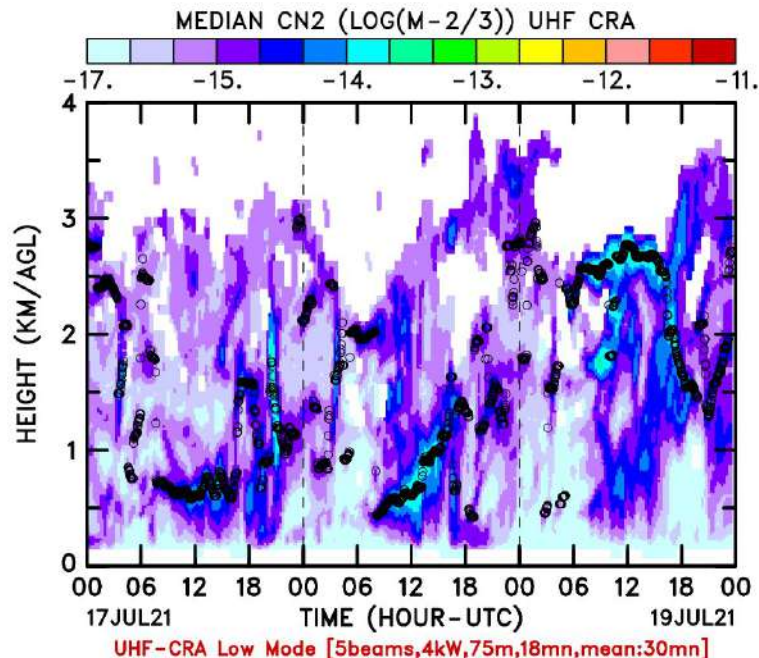
Observations - La Cendrosa -  
Wind profiler Lidar Windcube

# Planetary Boundary Layer

# Atmospheric boundary layer thickness (Arome run 3 UTC) in Mollerussa and Obs



# Atmospheric boundary layer thickness (Arome run 3 UTC 18/07 for 19/07) in Mollerussa



Observations - Els plan  
ReflectivityZI

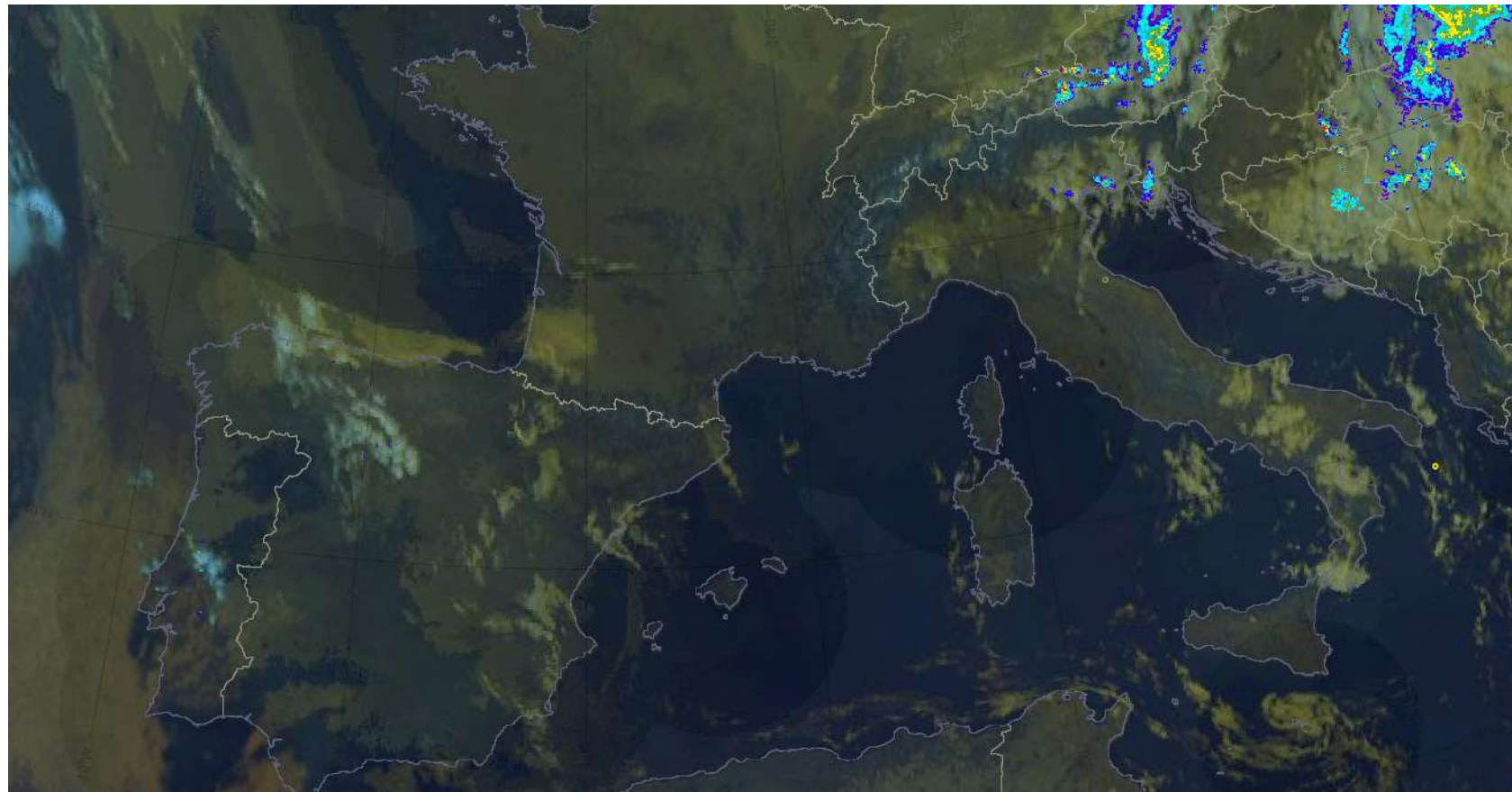


The prediction seems to match well the observations. According to the model, the PBL was expected to reach 2500 m.

20/07/2021

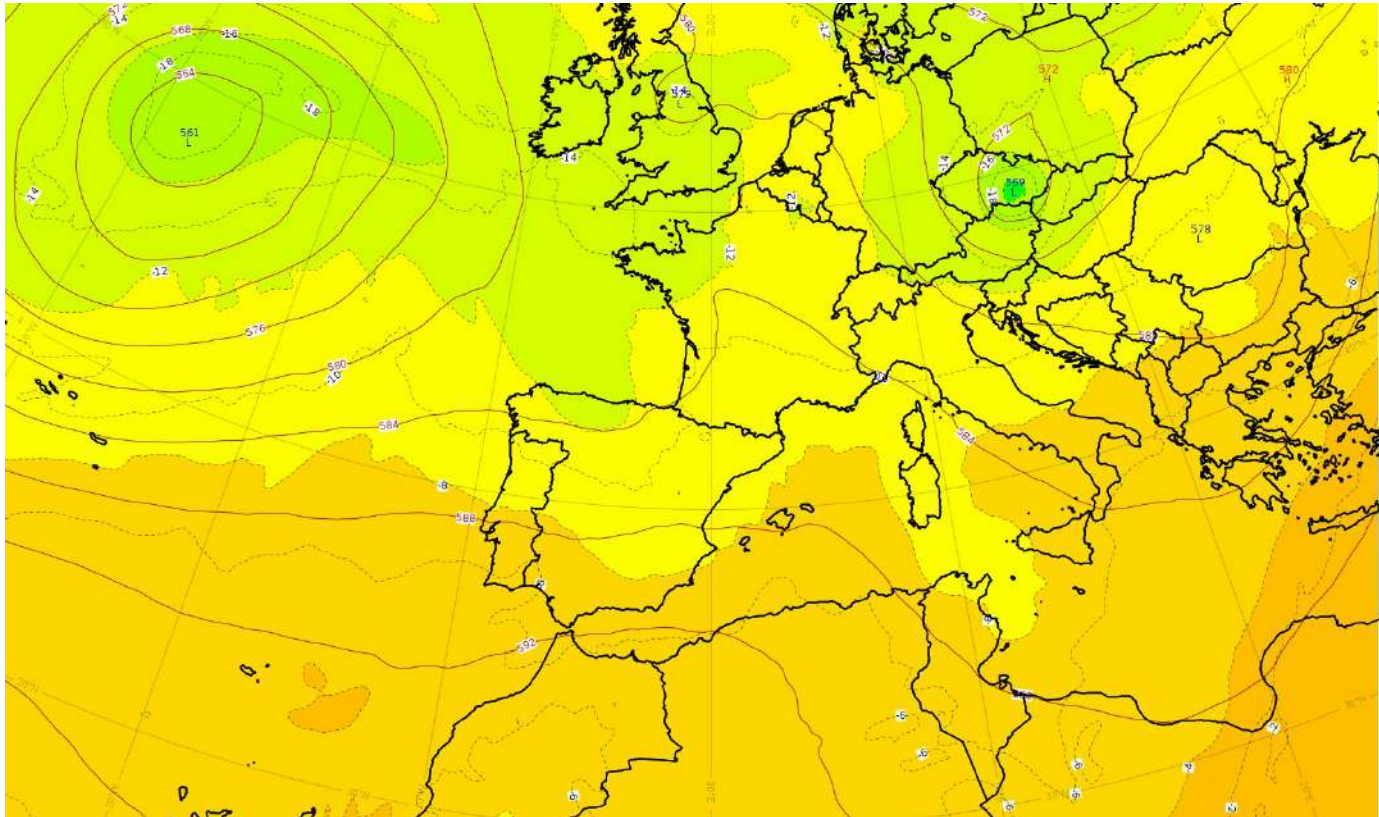
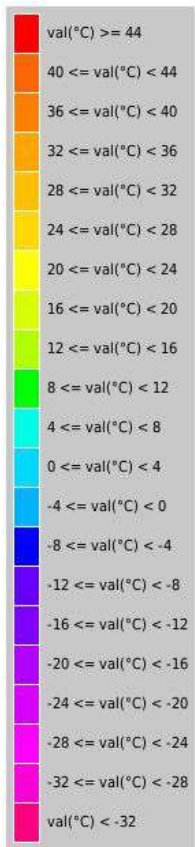
# Synoptic conditions

Color composite at 05:40 UTC

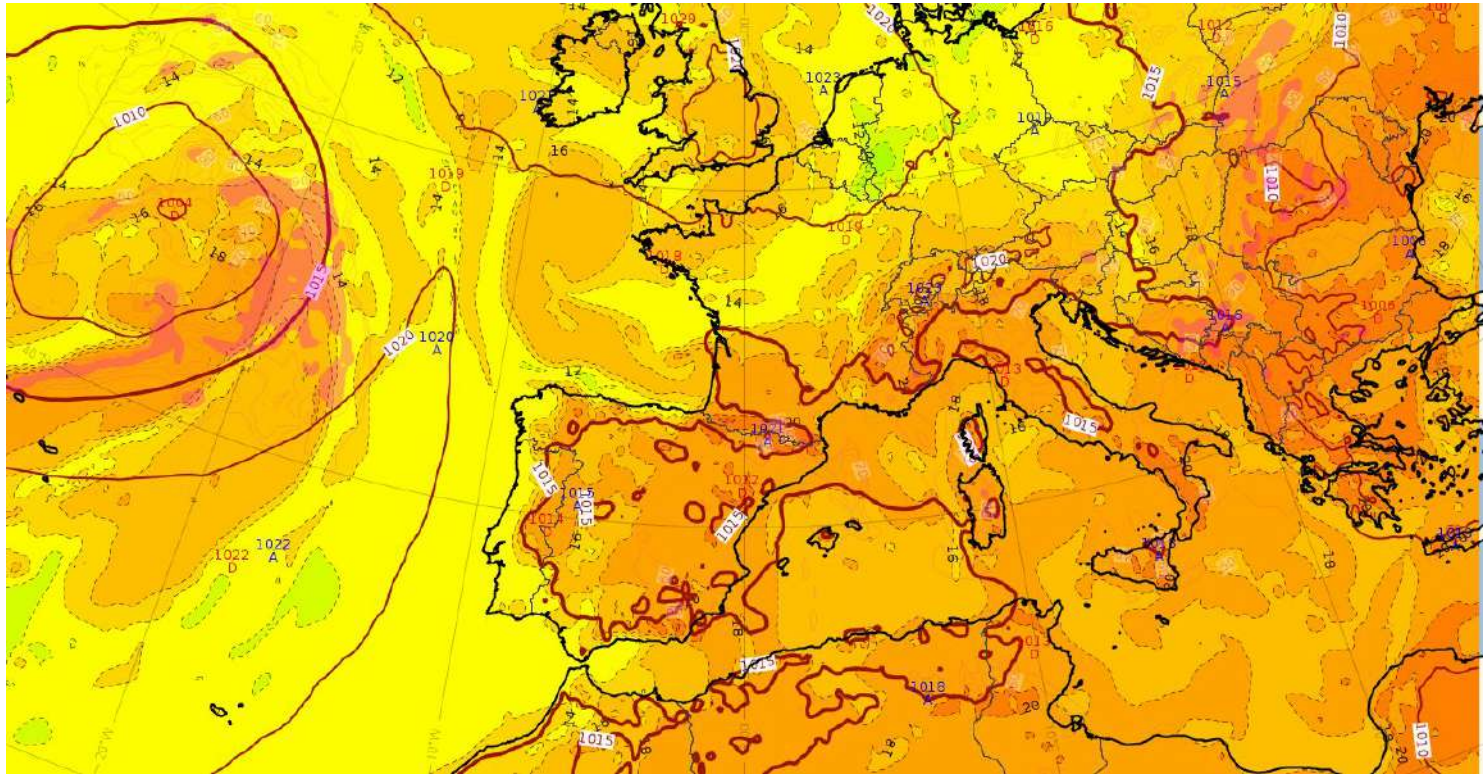
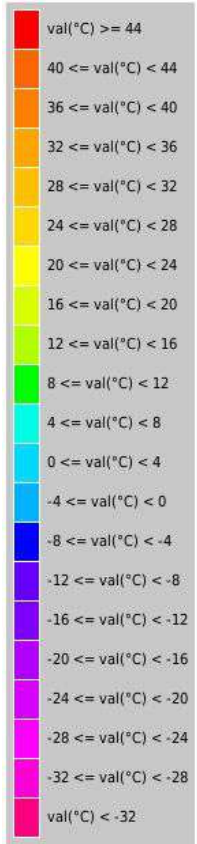


20/07

# Geopotential height + Temperature at 500 hPa at 12 UTC (Arpege 0.1 Run 0 UTC 19/07 for 20/07)



# Wet bulb 850 hPa + SLP at 12 UTC (Arpege 0.1 Run 00 UTC 19/07 for 20/07)

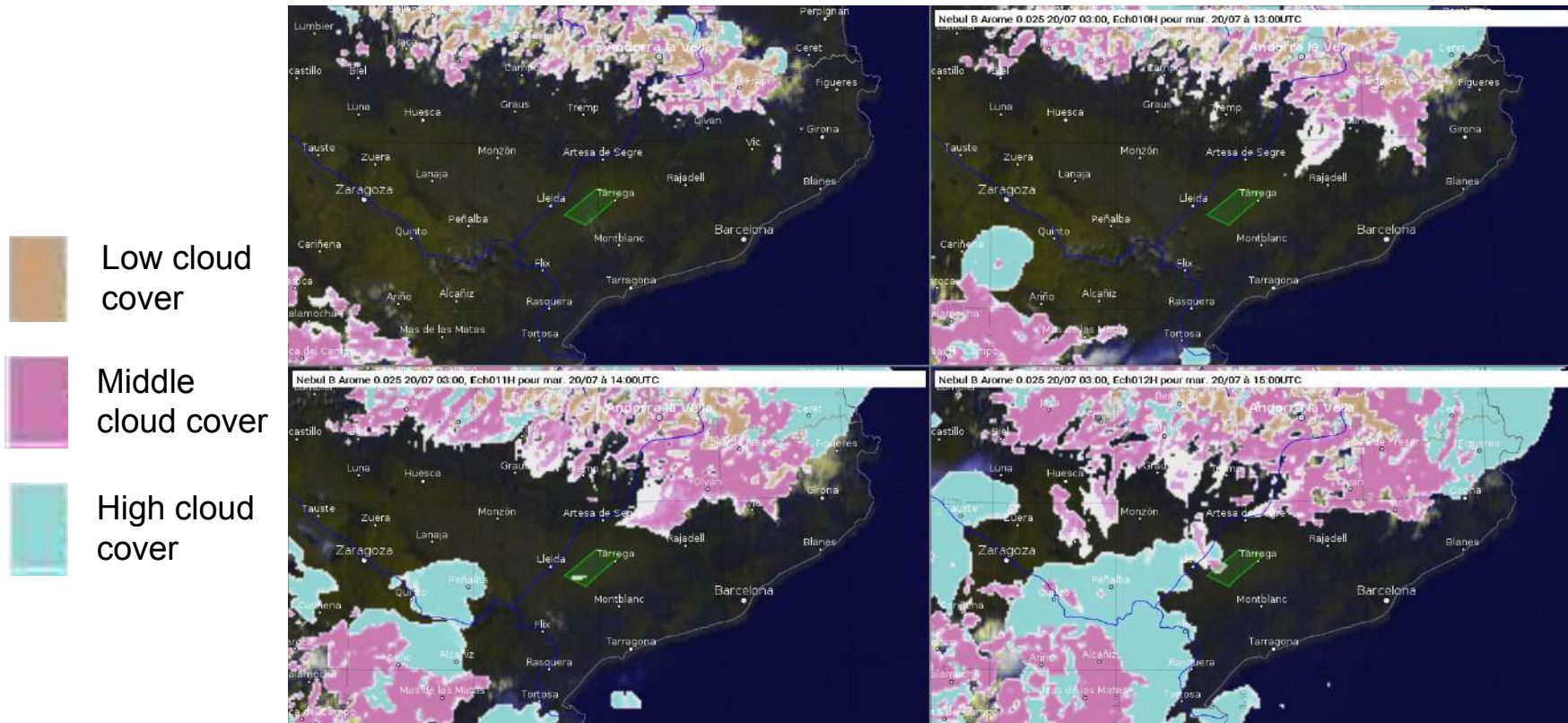


Conditions remain anticyclonic from the surface to 500 hpa.

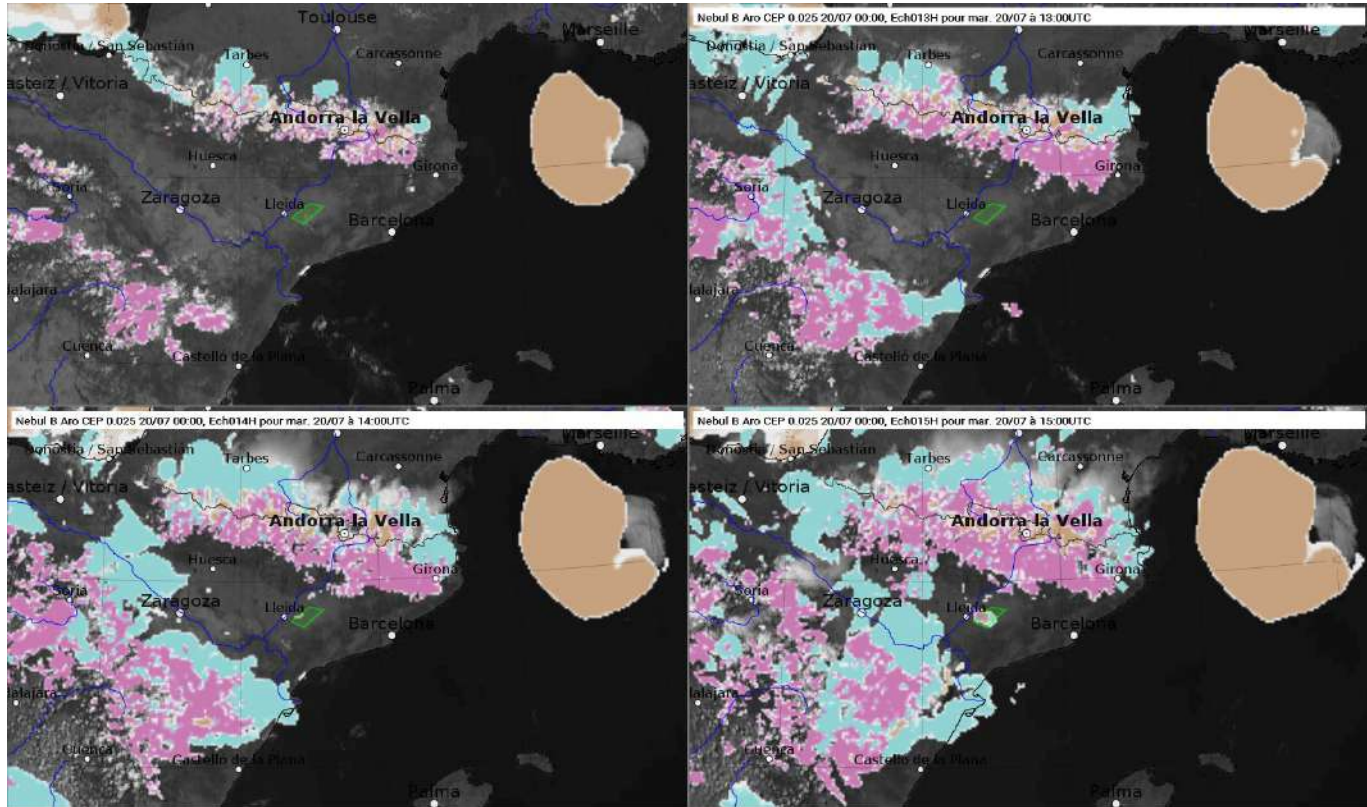
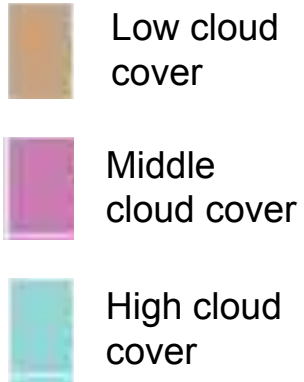
# Cloud Cover



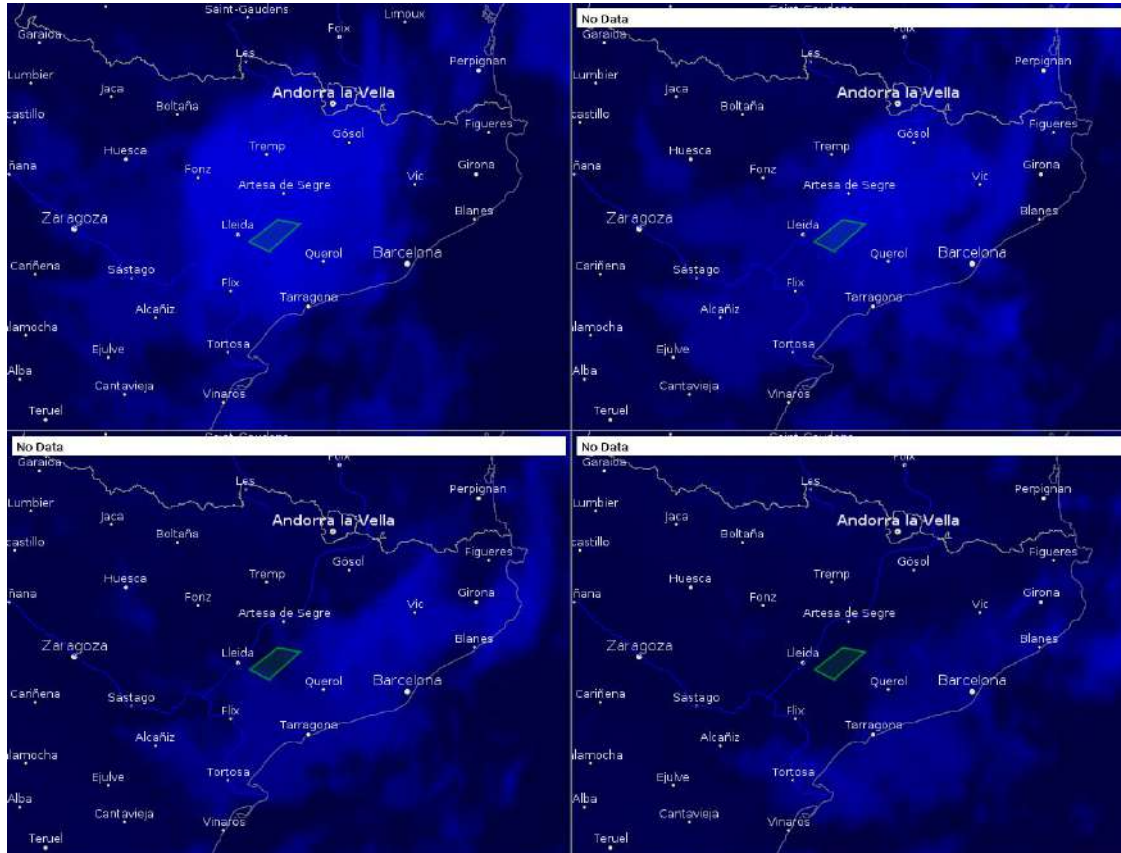
# HR\_VIS observation + Cloud cover from the modele at 12 to 15 UTC (arome run 03UTC)



# HR\_VIS observation + Cloud cover from the modele at 12 to 15 UTC (AROIFS run 00UTC)

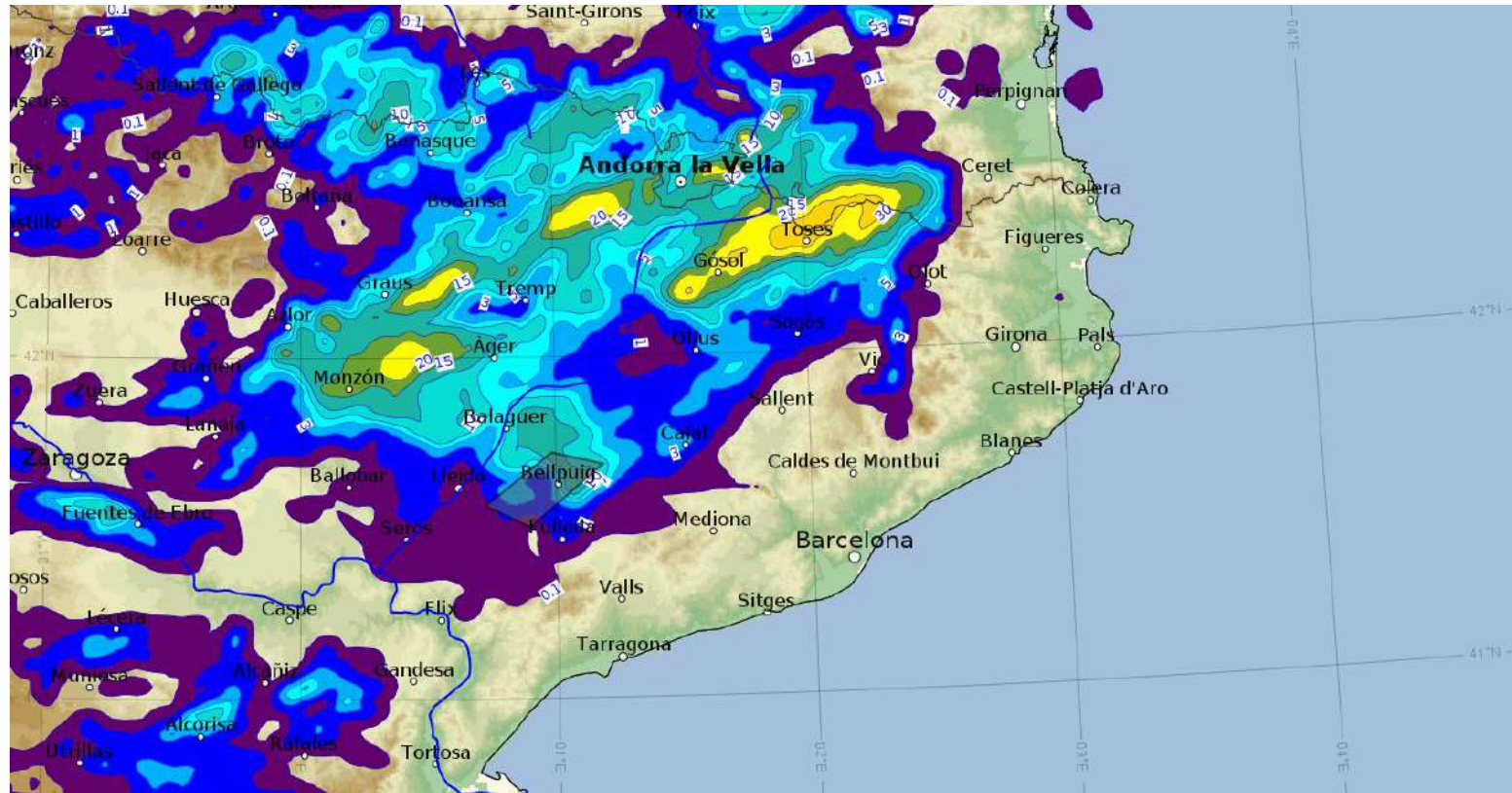
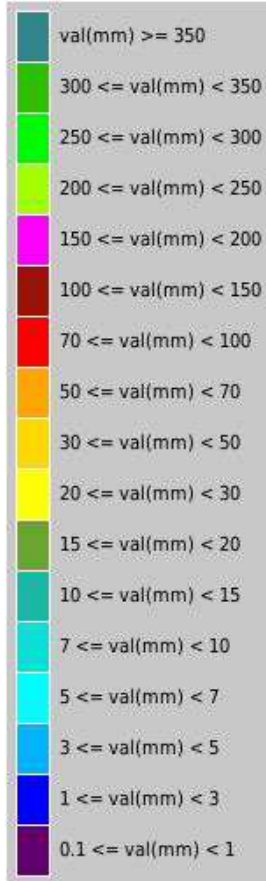


# HR\_VIS observation 23 to 02 UTC

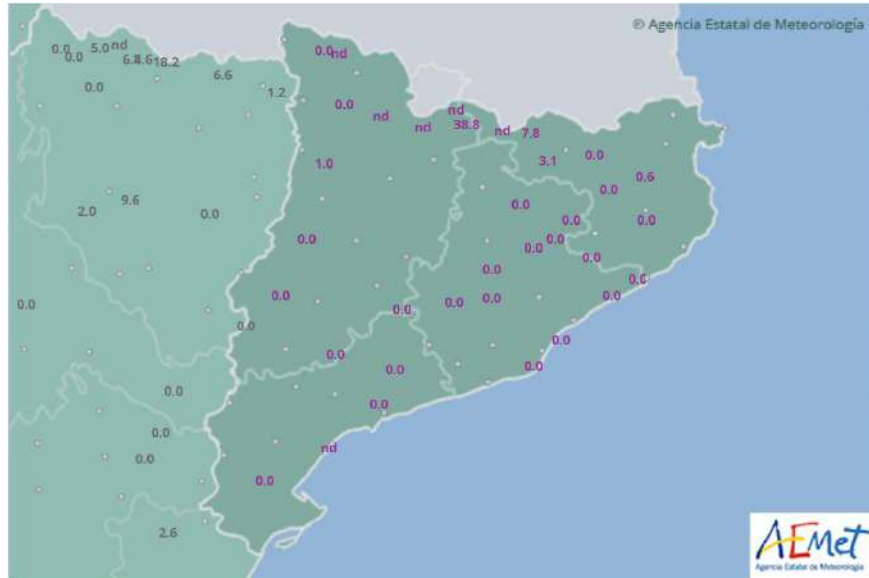


# Rainfall

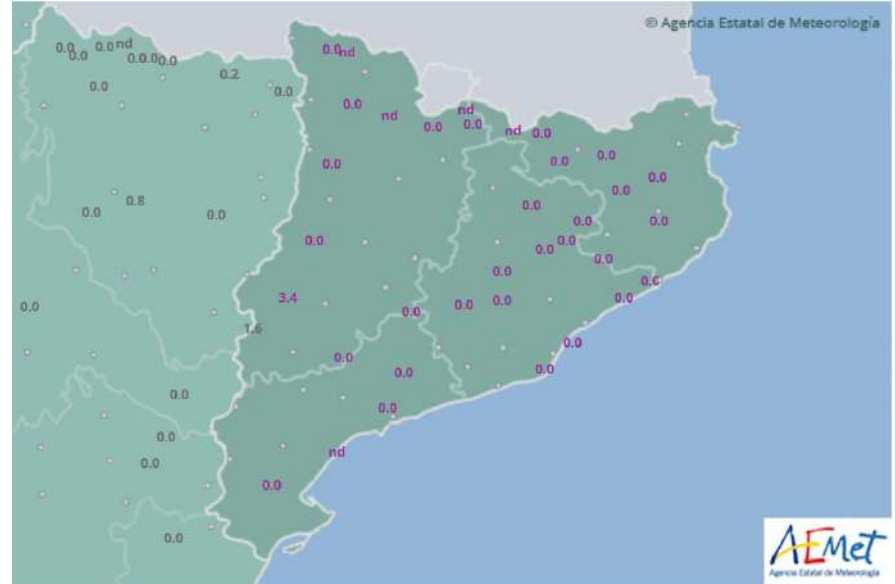
# Total rainfall in 24h (Arome 03h UTC 19/07 for 20/07)



# Observation - aemet - rainfall



Day time



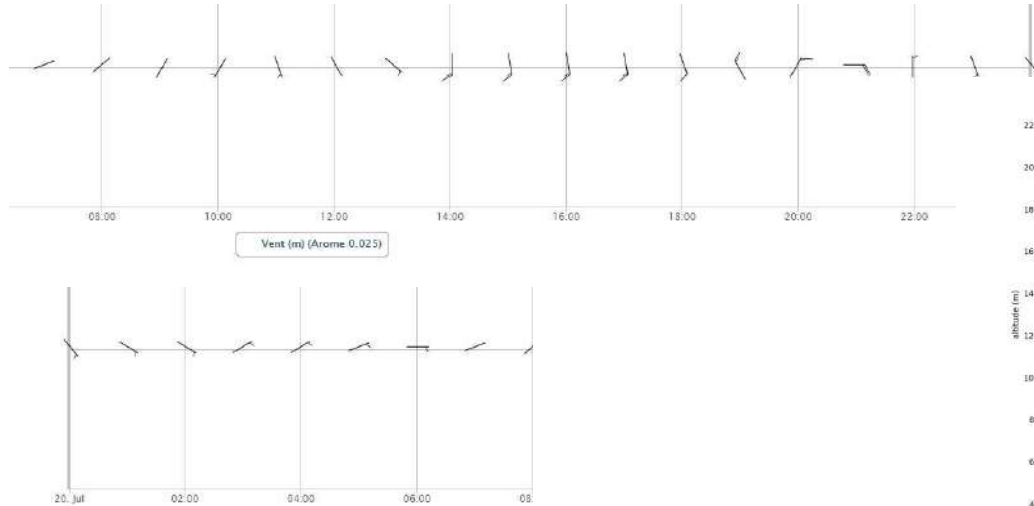
Night time (22-23 UTC)

It rained on the 21st between 00 and 02 local time. 3.4 mm of rain were observed in Lleida. It didn't rain over the area on the 20th. However some clouds that developed during the day brought some rain over the Pyrenees on the 20th.

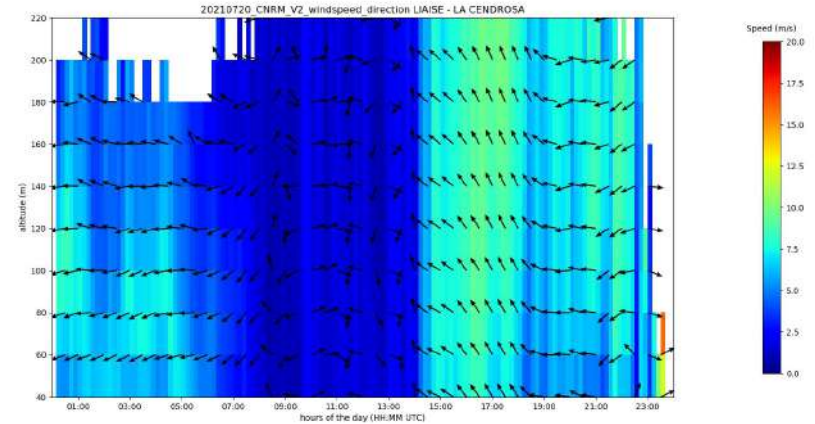
Wind



# Wind at 10 m Arome Run 03 UTC 19/07 for 20/07 and Obs



Wind at 10 m Arome Run 03 UTC

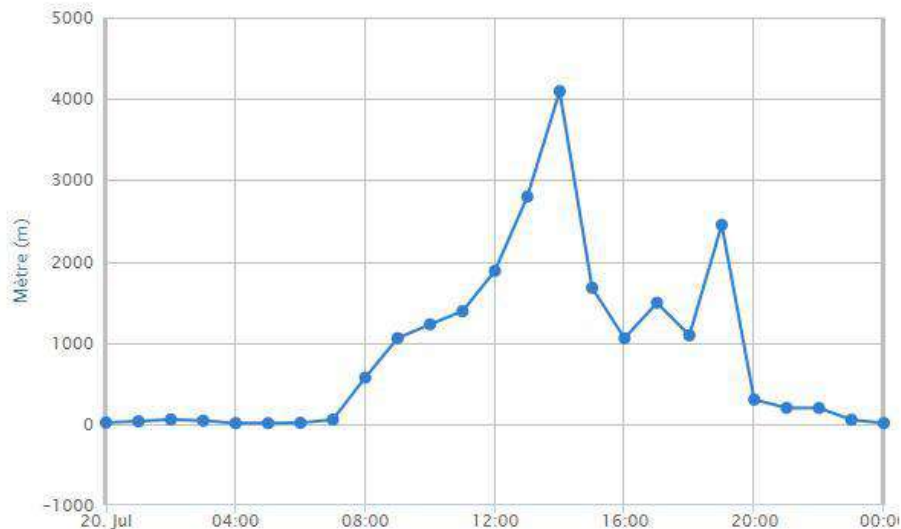


Observations - La Cendrosa -  
Wind profiler Lidar Windcube

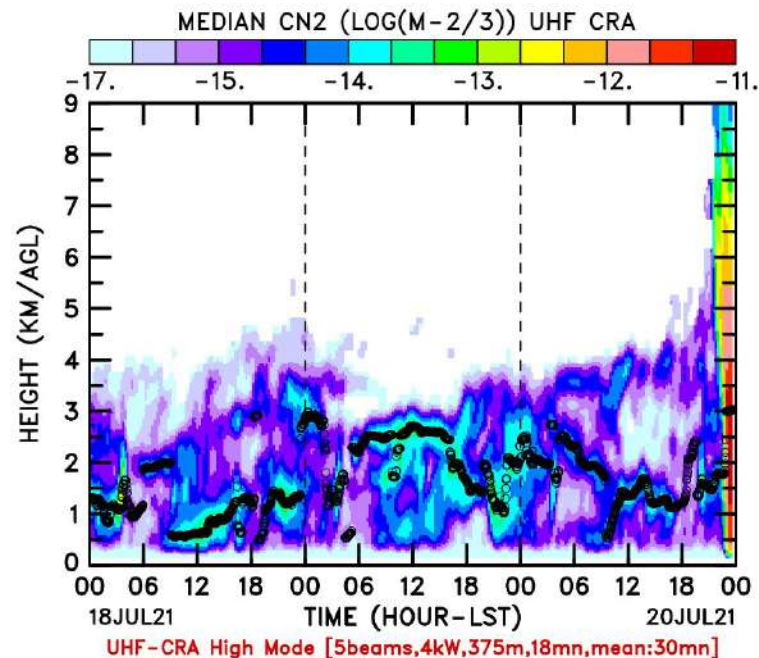
The model well predicted the arrival of the sea breeze at 14 UTC. East winds prevailed in the early morning.

# Planetary Boundary Layer

# Atmospheric boundary layer thickness (Arome run 3 UTC) in Mollerussa and Obs



## Atmospheric boundary layer thickness (Arome run 3 UTC 19/07 for 20/07) in Mollerussa



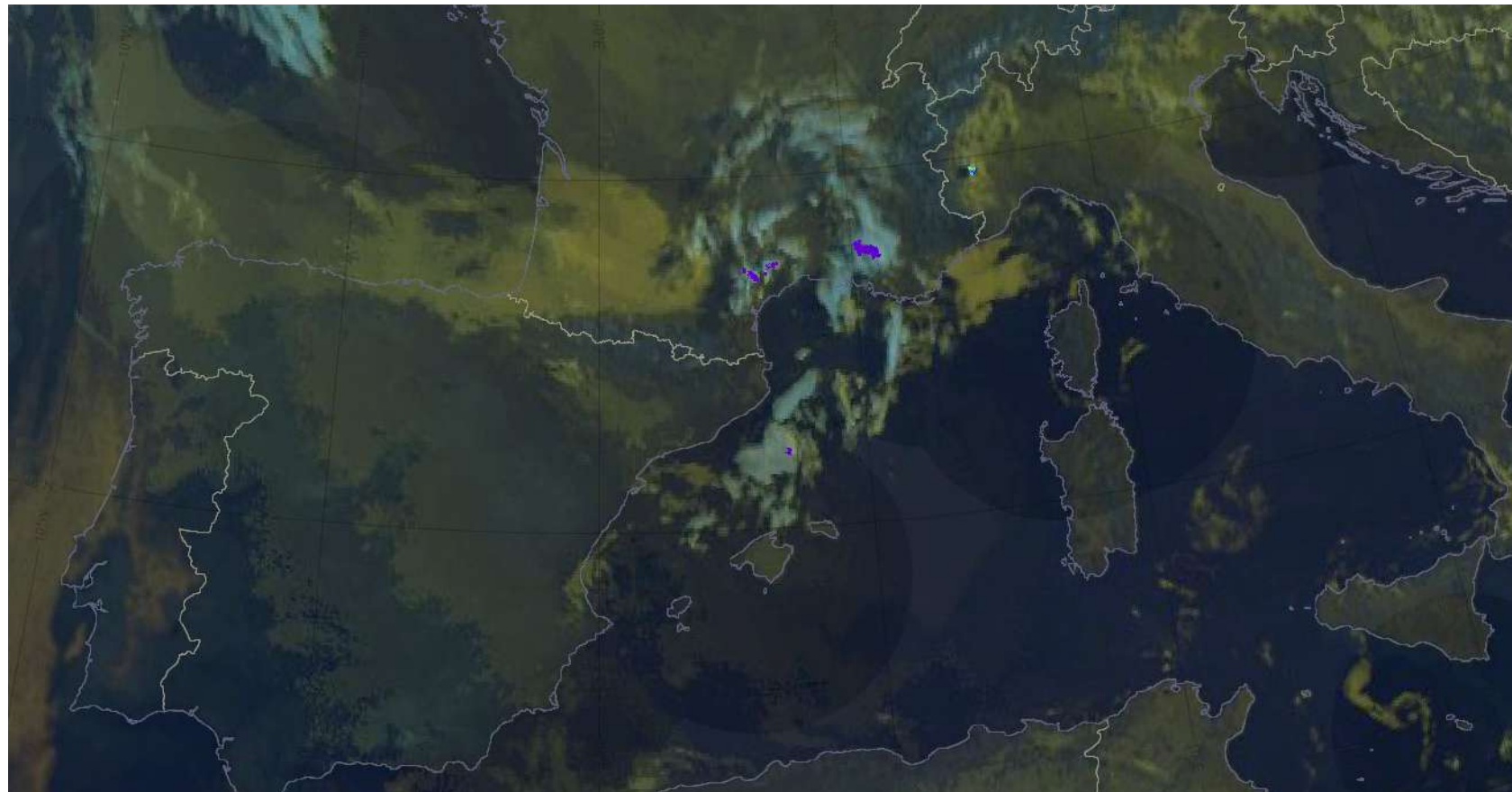
Observations - Els plan  
ReflectivityZI

The model overestimated the height of the planetary boundary layer. According to the model, it was predicted to reach 4000m. The observations didn't match the prediction.

21/07/2021

# Synoptic conditions

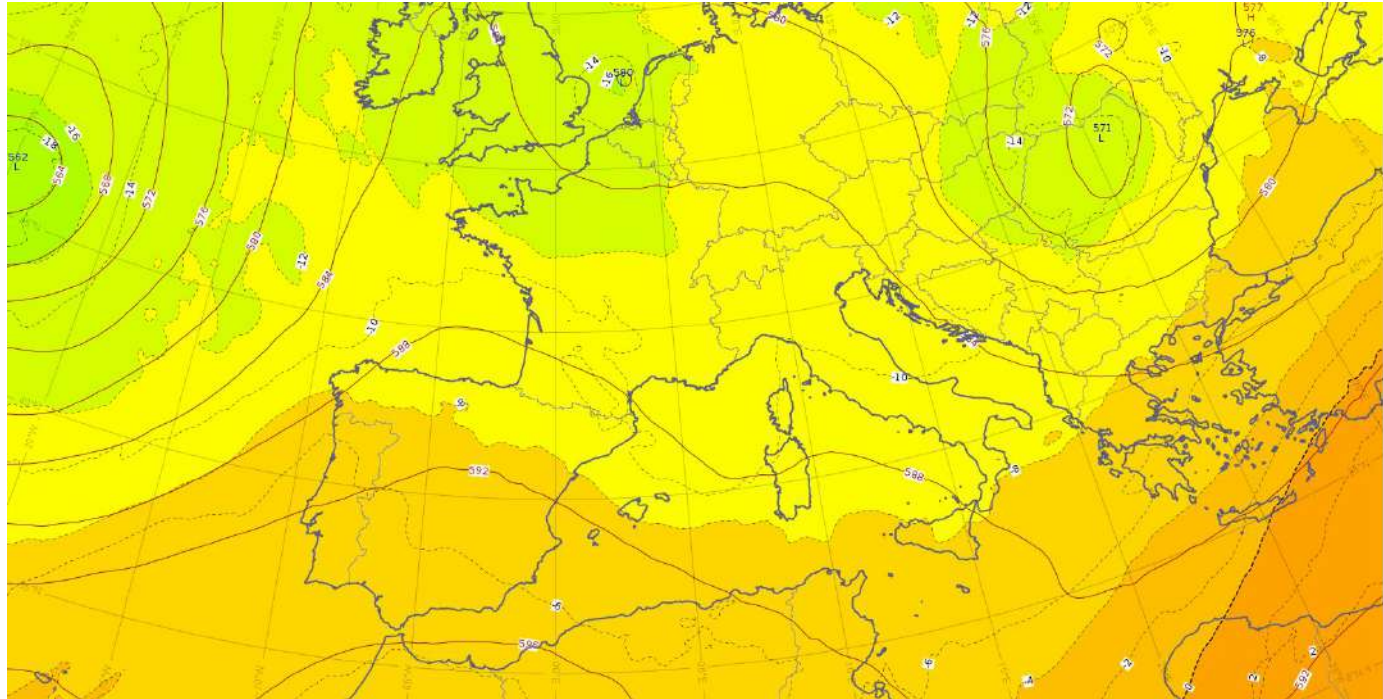
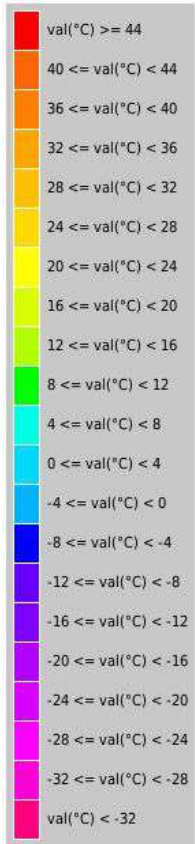
Color composite at 05:45 UTC



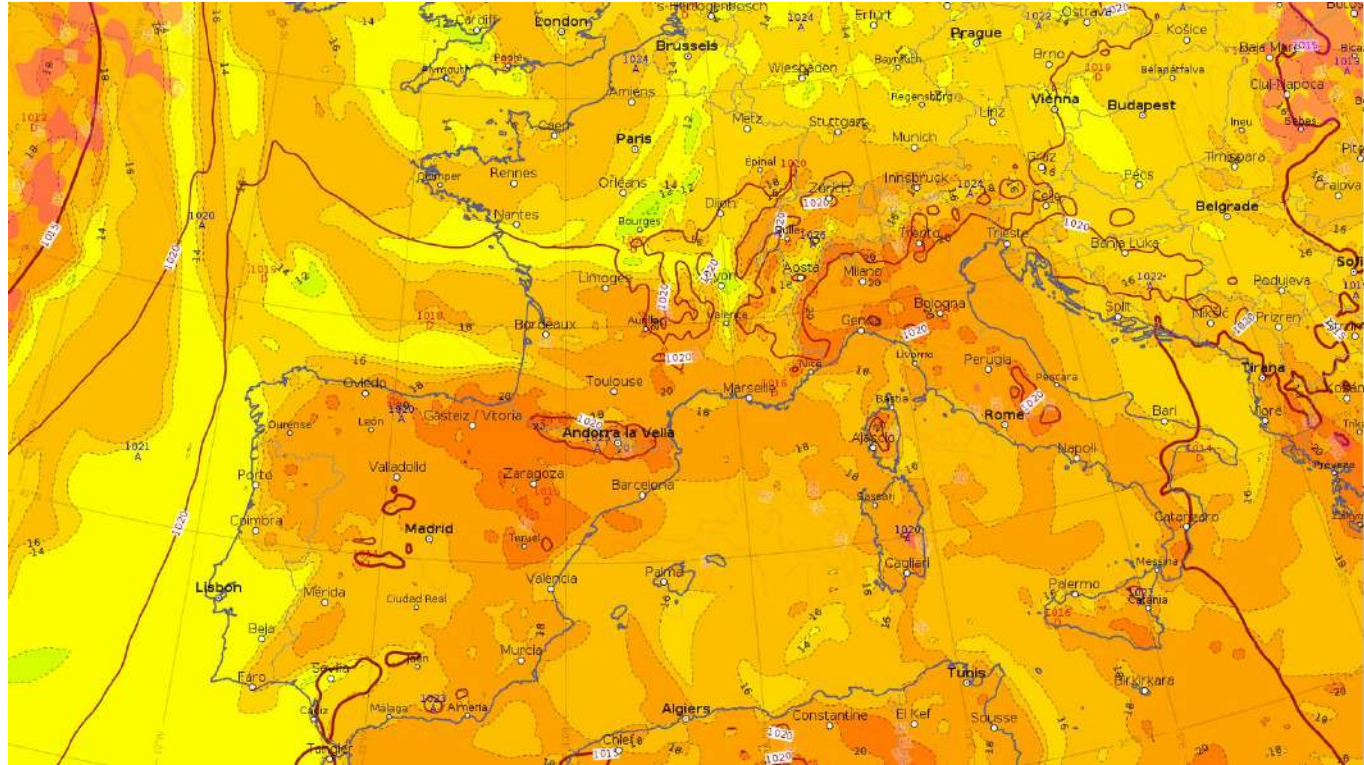
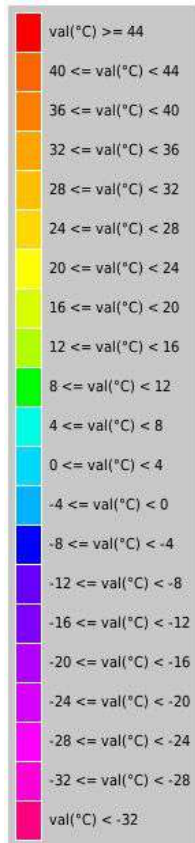
21/07



# Geopotential height + Temperature at 500 hPa at 12 UTC (Arpege 0.1 Run 0 UTC 20/07 for 21/07)



# Wet bulb 850 hPa + SLP at 12 UTC (Arpege 0.1 Run 00 UTC 20/07 for 21/07)

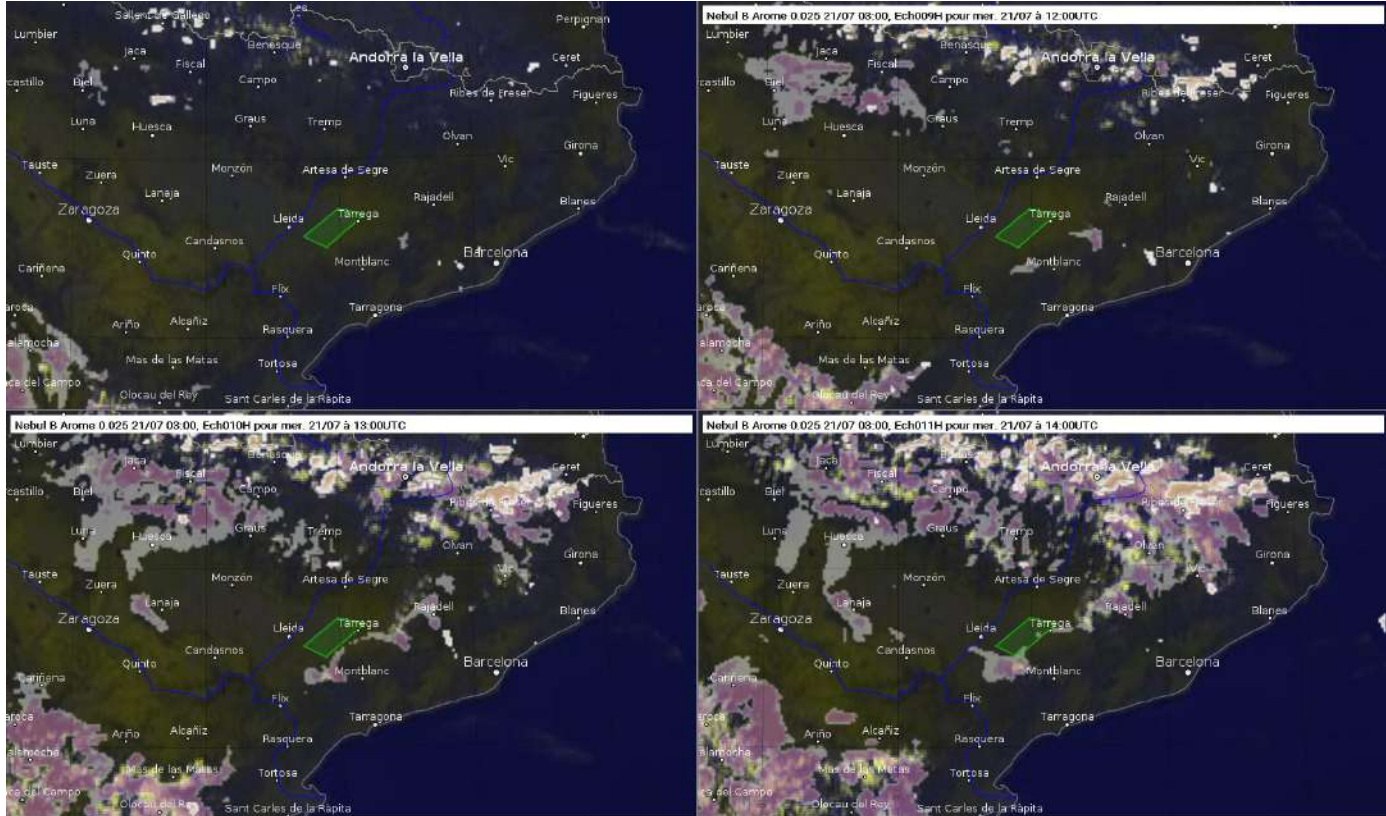


Conditions remain anticyclonic from the surface to 500 hpa.

# Cloud Cover

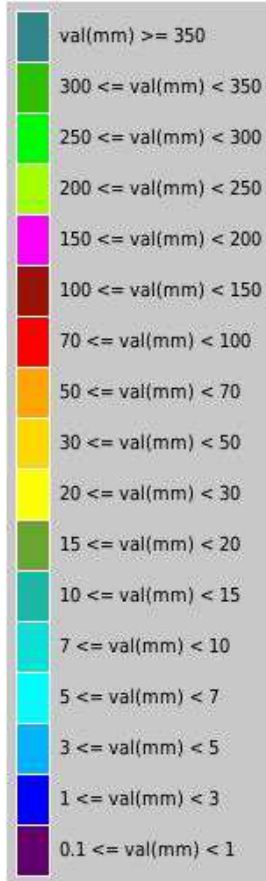
# HR\_VIS observation + Cloud cover from the modele at 12 to 15 UTC (arome run 03UTC)

- Low cloud cover
- Middle cloud cover
- High cloud cover

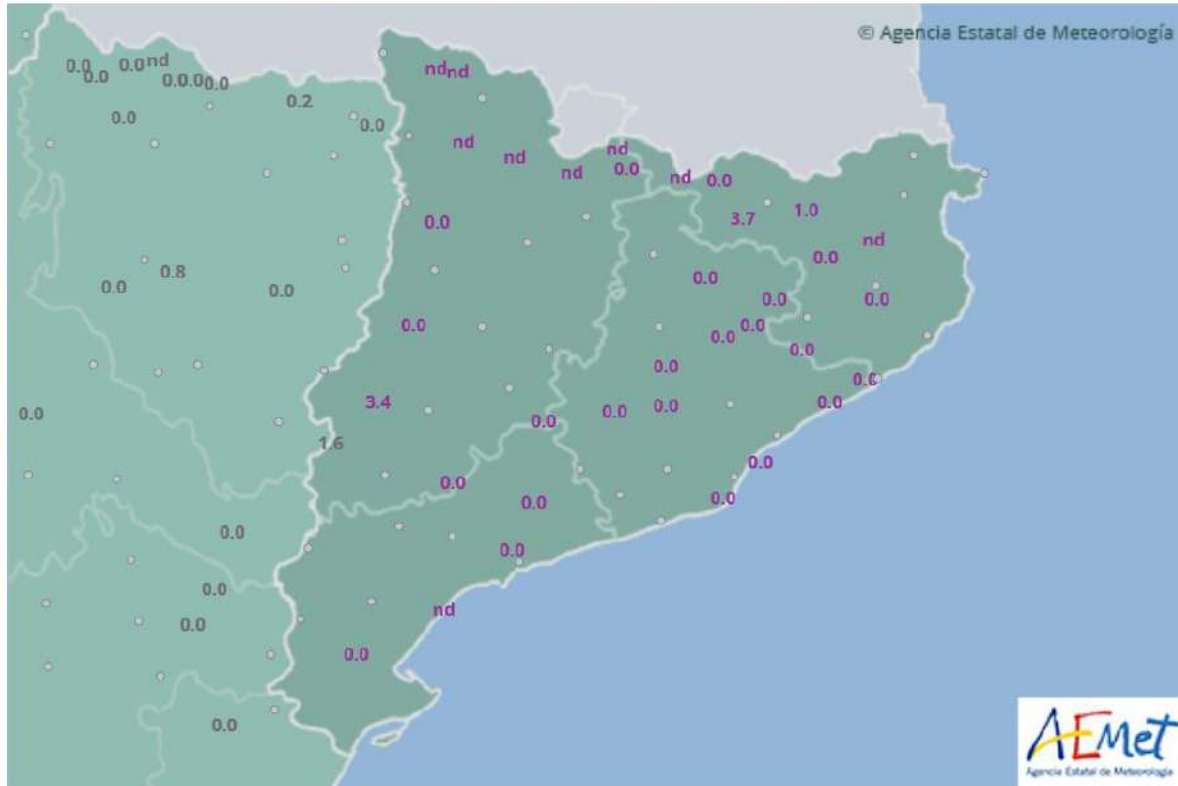


# Rainfall

# Total rainfall in 24h (Arome 03h UTC 20/07 for 21/07)

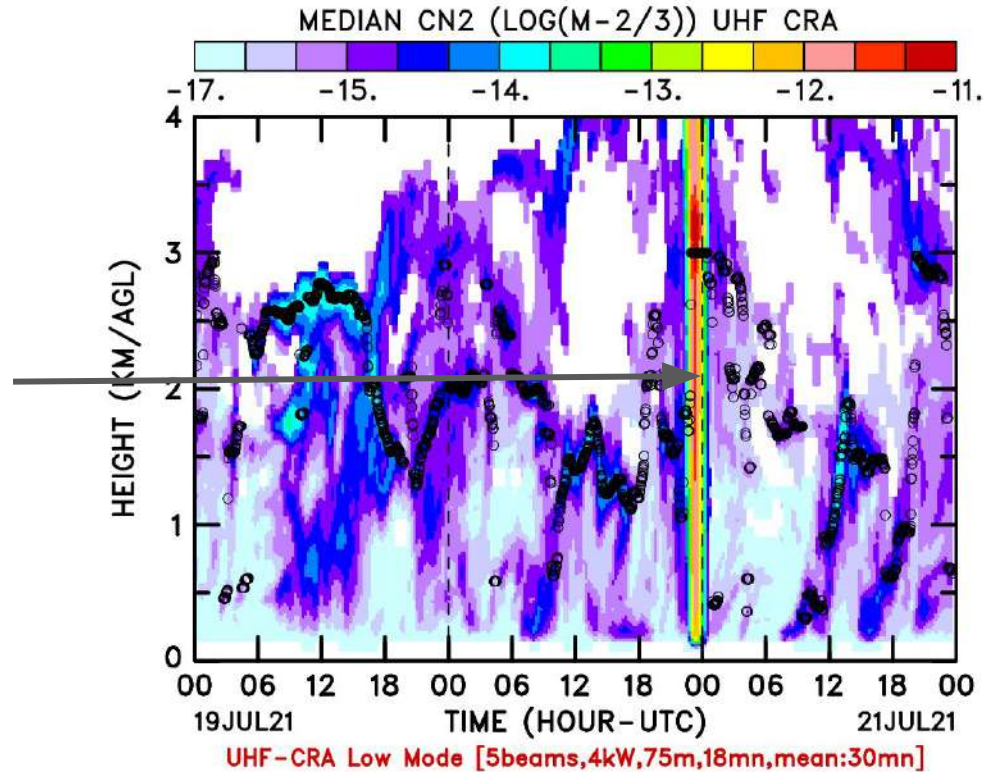


# Observation - aemet - rainfall



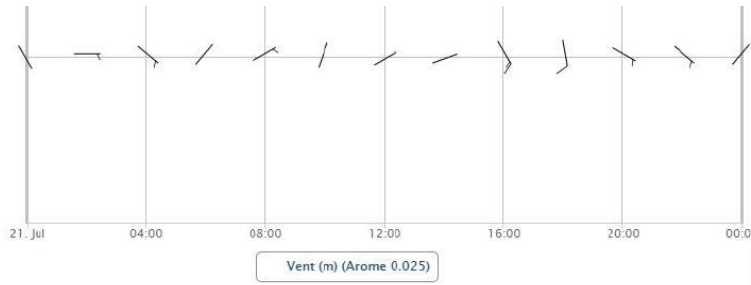


It rained on the 21st between 00 and 02 local time. 3.4 mm of rain were observed in Lleida.

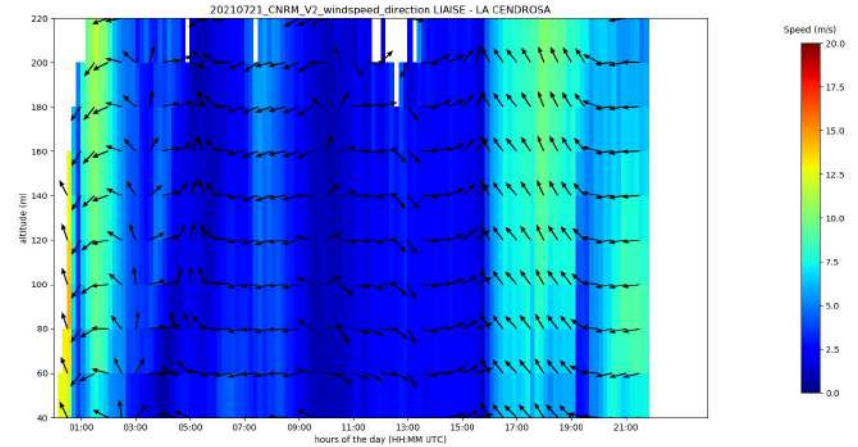


Wind

# Wind at 10 m Arome Run 03 UTC 20/07 for 21/07 and Obs



Wind at 10 m Arome Run 03 UTC

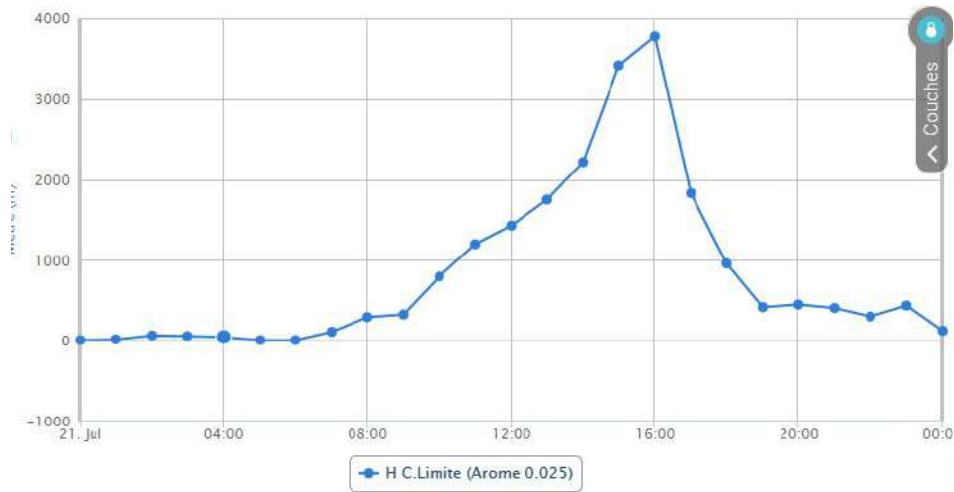


Observations - La Cendrosa -  
Wind profiler Lidar Windcube

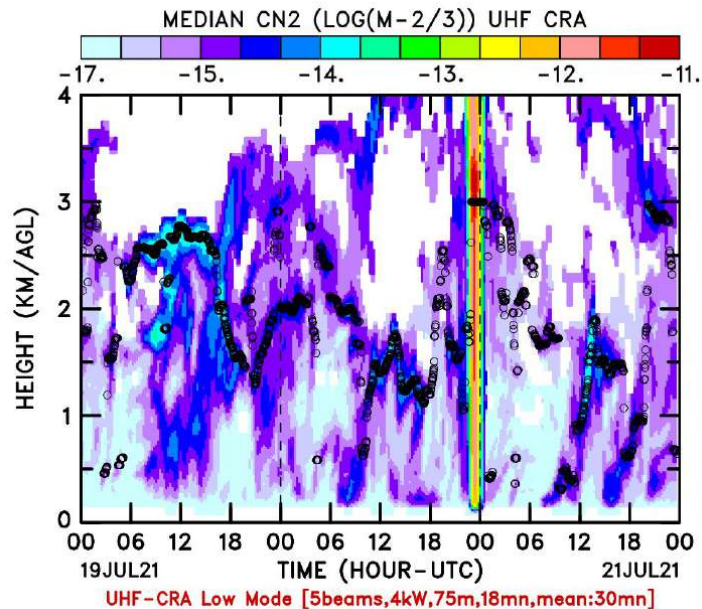
The model well predicted the arrival of the sea breeze at 16 UTC. The weak westerly flow dominated before the arrival of the sea breeze.

# Planetary Boundary Layer

# Atmospheric boundary layer thickness (Arome run 3 UTC) in Mollerussa and Obs



# Atmospheric boundary layer thickness (Arome run 3 UTC 20/07 for 21/07) in Mollerussa



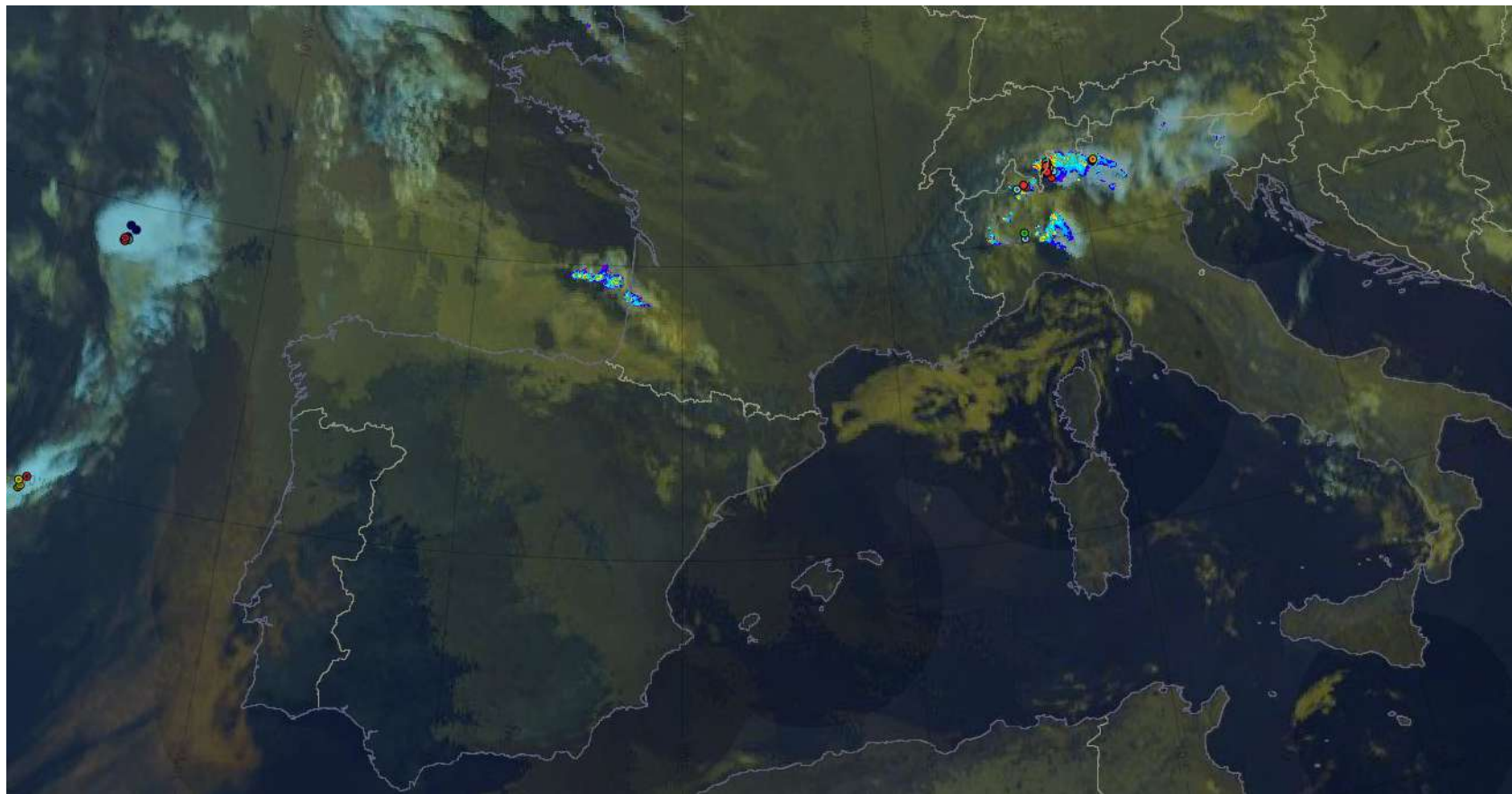
Observations - Els plan  
ReflectivityZI

The model overestimated the height of the planetary boundary layer as it was the case the day before.

22/07/2021

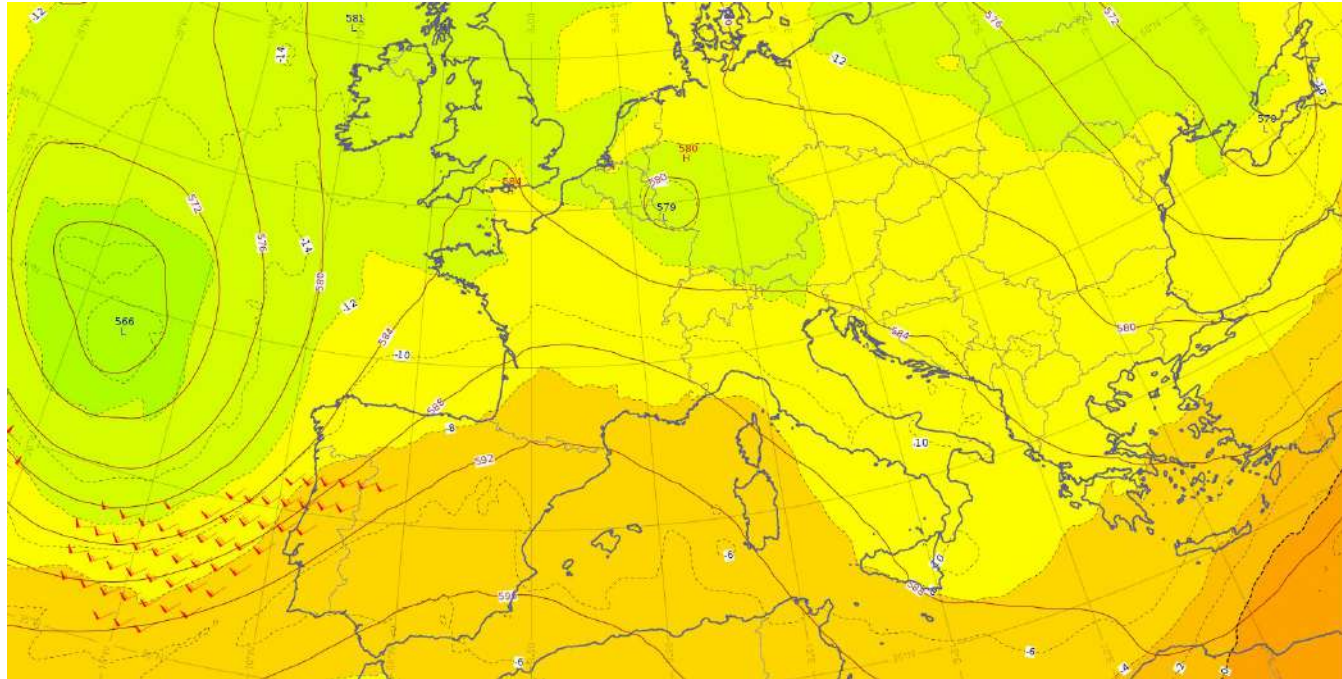
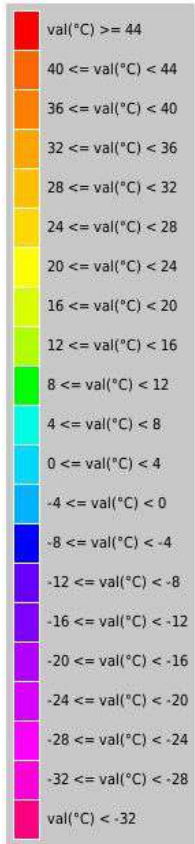


Color composite at 05:45 UTC

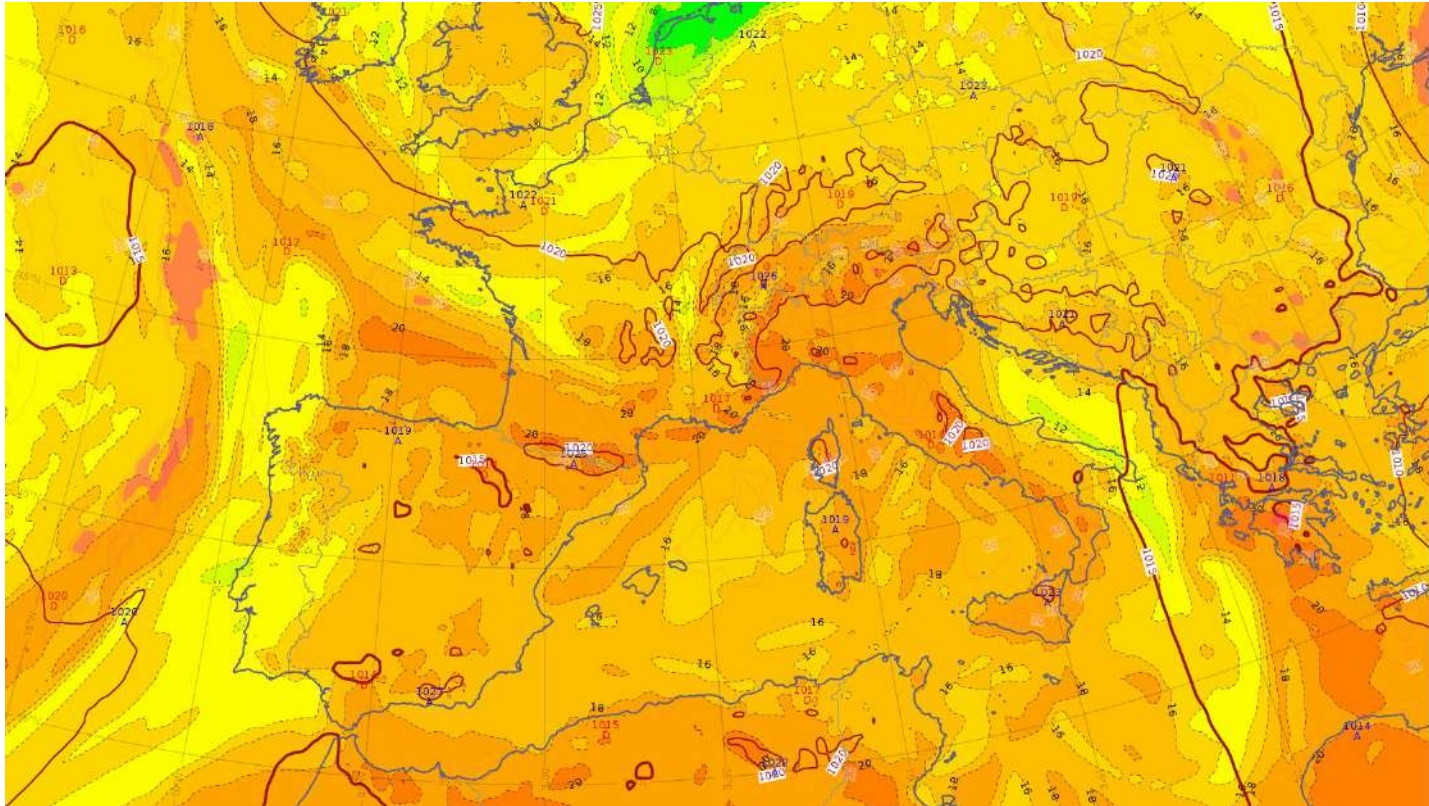
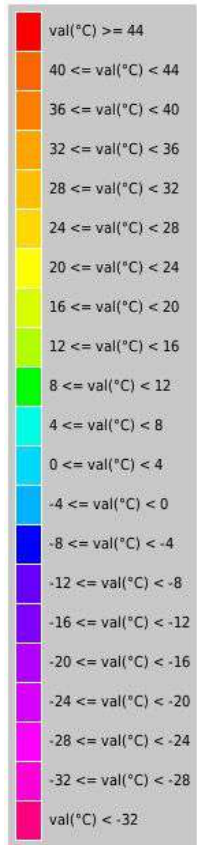


22/07

# Geopotential height + Temperature at 500 hPa at 12 UTC (Arpege 0.1 Run 0 UTC 22/07)



# Wet bulb potential temperature at 850 hPa + SLP at 12 UTC (Arpege 0.1 Run 00 UTC)

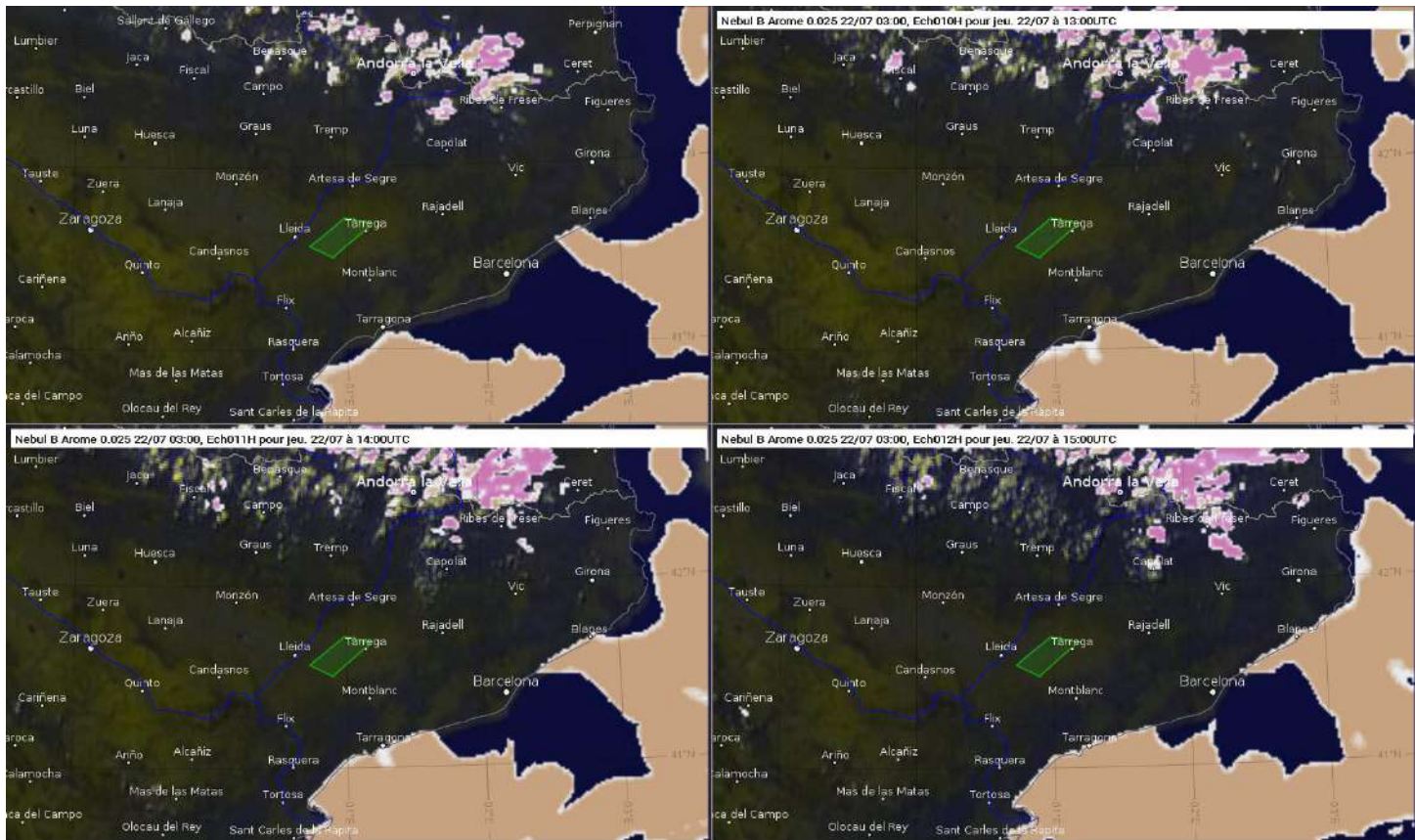


Conditions remain anticyclonic from the surface to 500 hpa.

# Cloud Cover

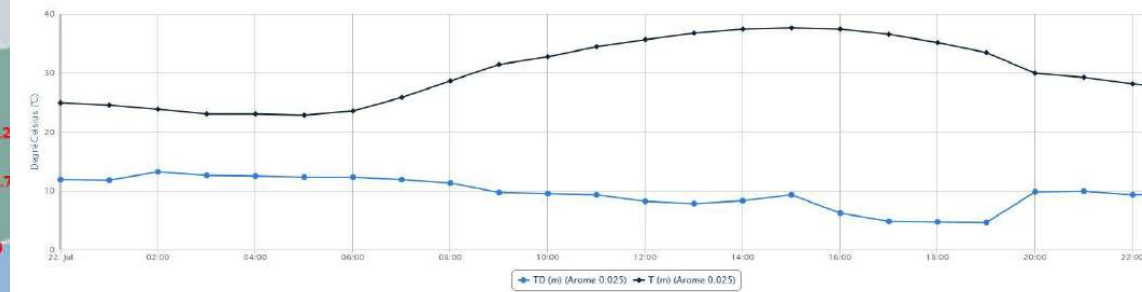
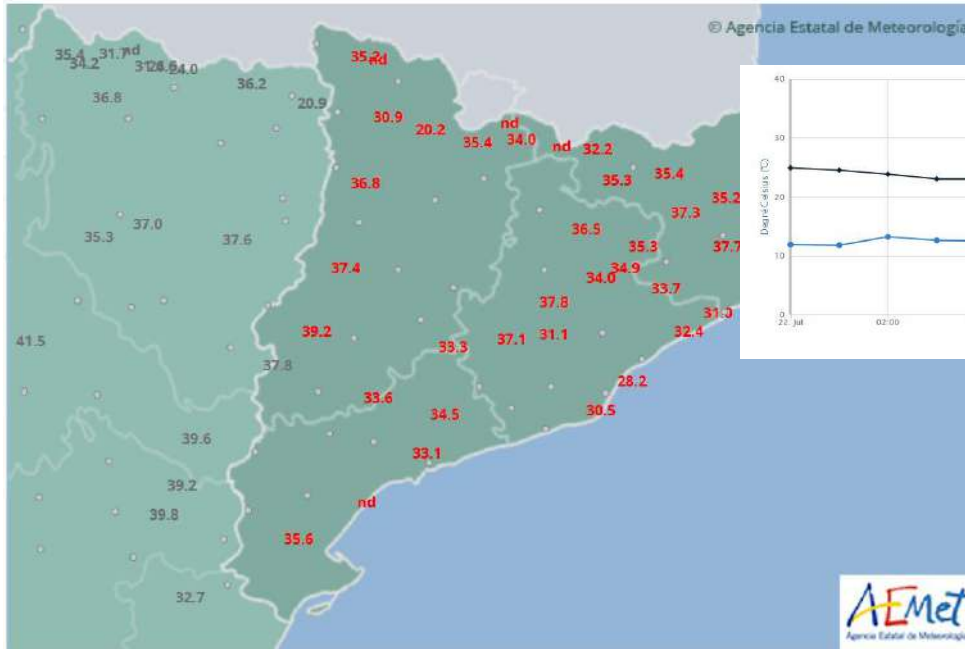
# HR\_VIS observation + Cloud cover from the modele at 12 to 15 UTC (arome run 03UTC)

- Low cloud cover
- Middle cloud cover
- High cloud cover



# Temperature

# Observations - aemet - maximum temperature



Arome (Run 3h UTC 21/07 for 22/07) - Temperature and dew point - Mollerussa

Observations



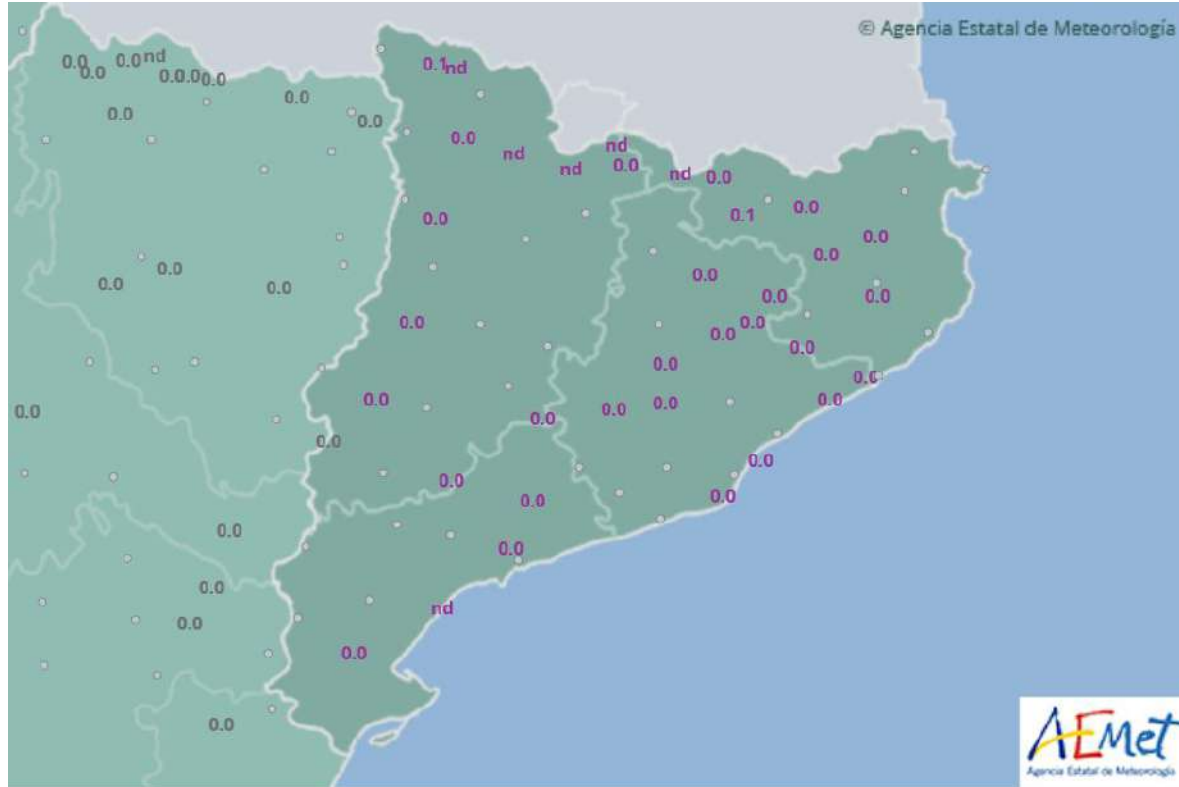
The prediction matched well the observations.

# Rainfall

# Total rainfall in 24h (Arome 03h UTC 21/07 for 22/07)



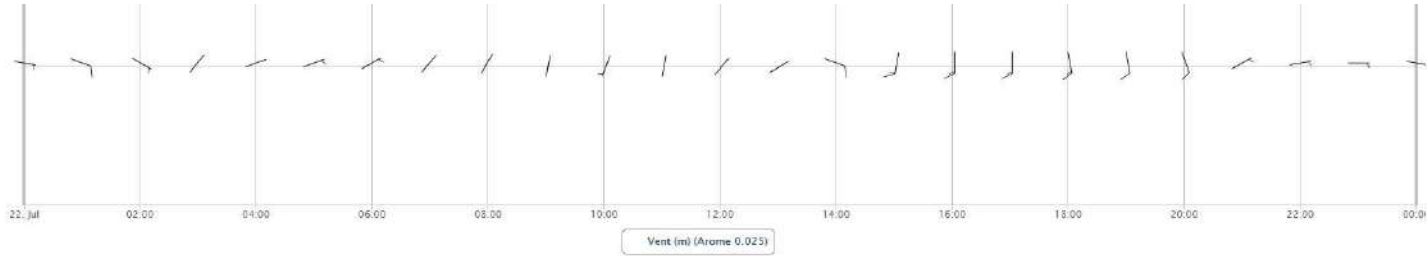
# Observation - aemet - rainfall



No rain was observed as expected.

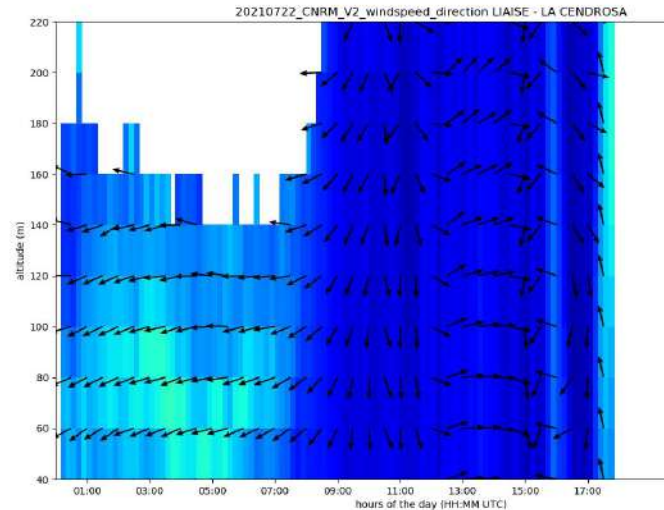
Wind

# Wind at 10 m Arome Run 03 UTC 21/07 for 22/07 and Obs



## Wind at 10 m Arome Run 03 UTC

Observations - La Cendrosa -  
Wind profiler Lidar Windcube

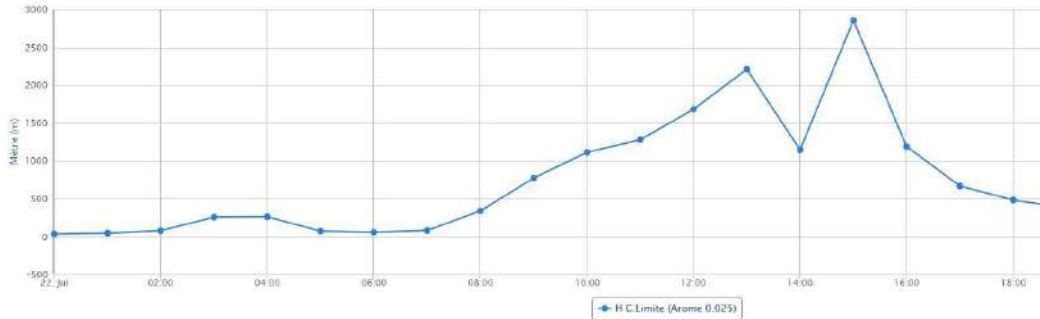


The north wind was not predicted by the model. The sea breeze arrived at 17 UTC contrary to the prediction.

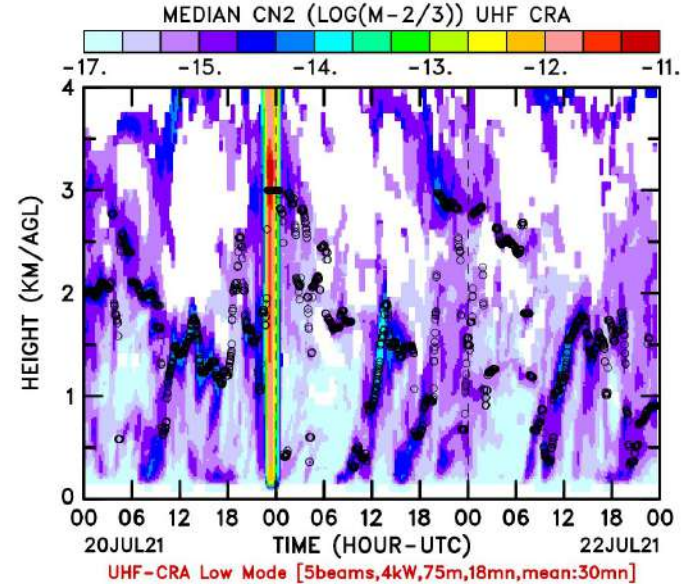


# Planetary Boundary Layer

# Atmospheric boundary layer thickness (Arome run 3 UTC) in Mollerussa and Obs



## Atmospheric boundary layer thickness (Arome run 3 UTC 21/07 for 22/07) in Mollerussa



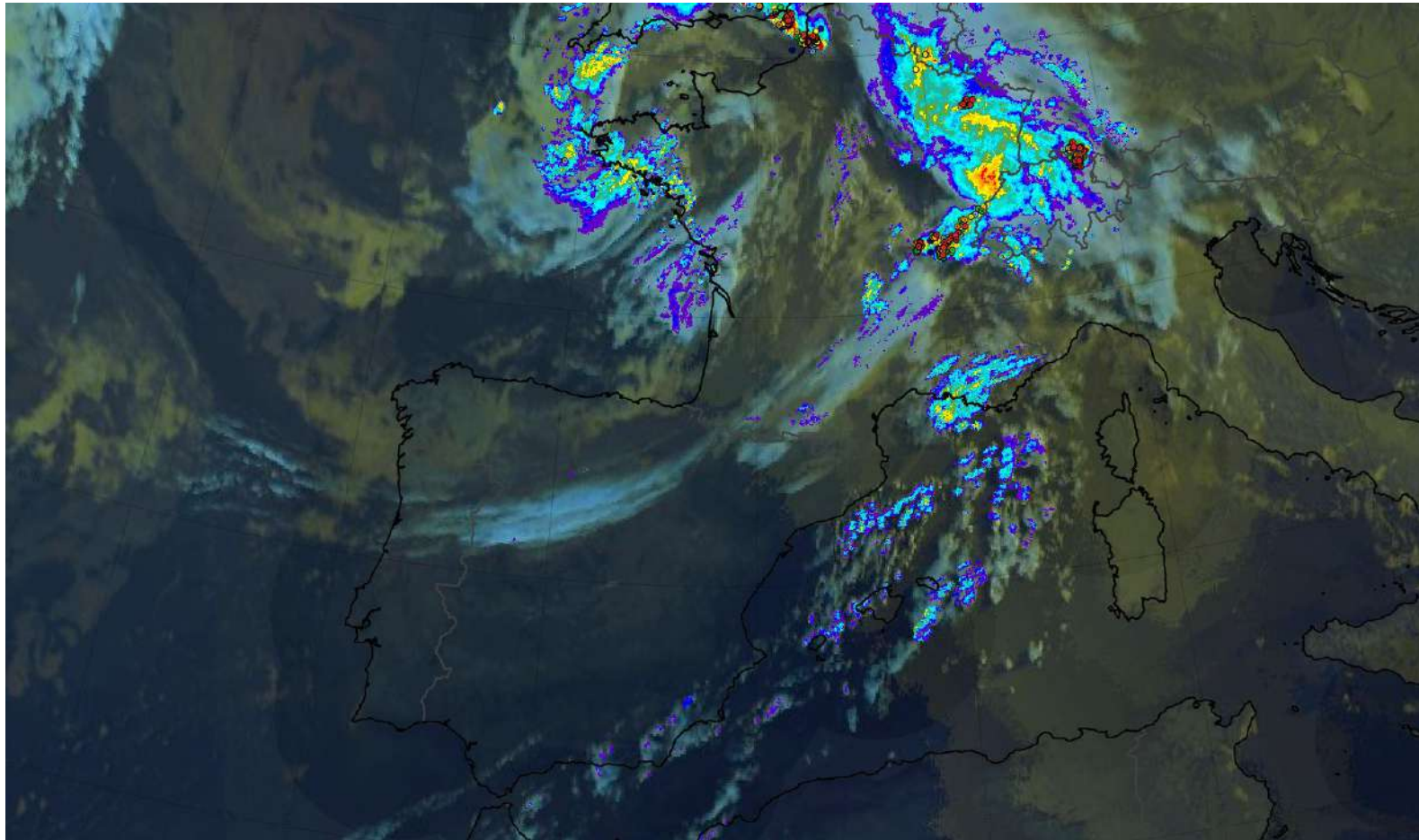
Observations - Els plan  
ReflectivityZI

The height of the planetary boundary layer was overestimated by the model.

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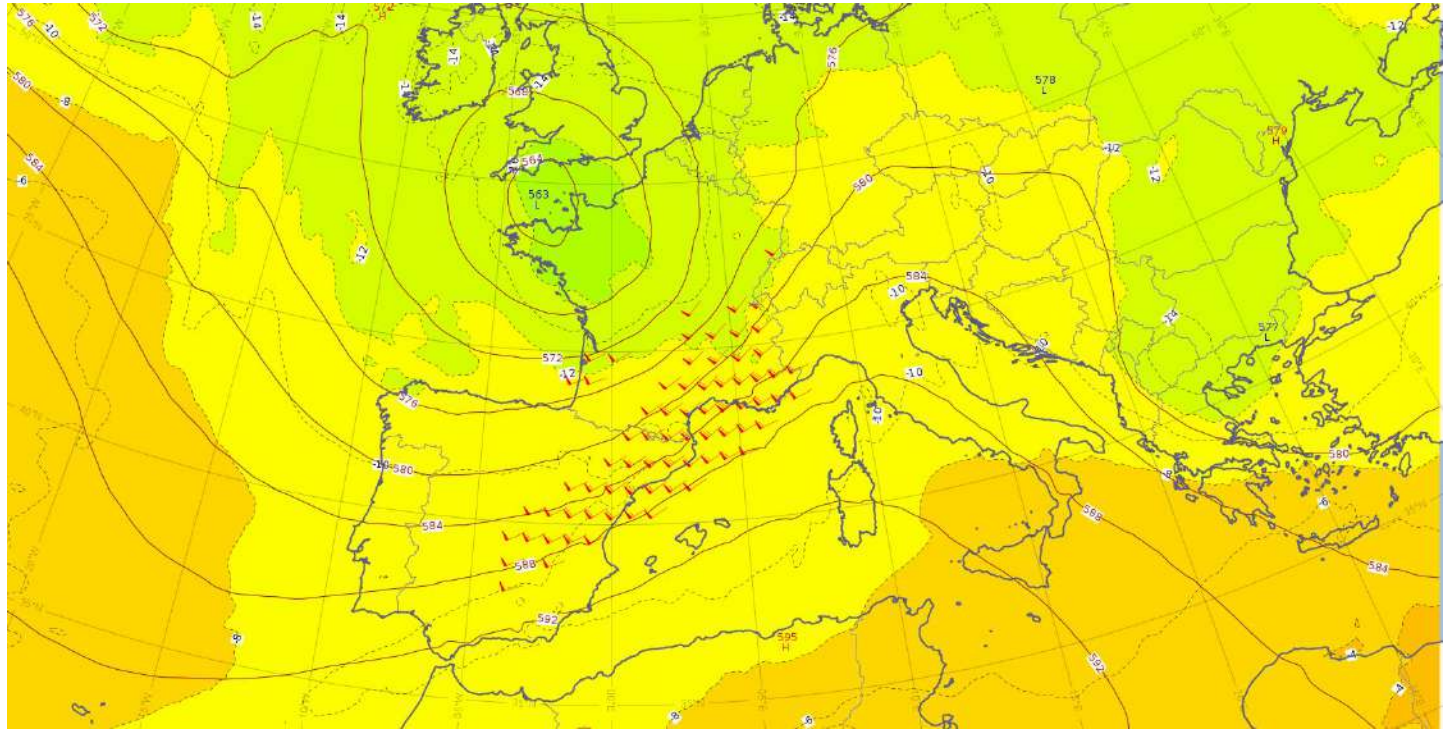
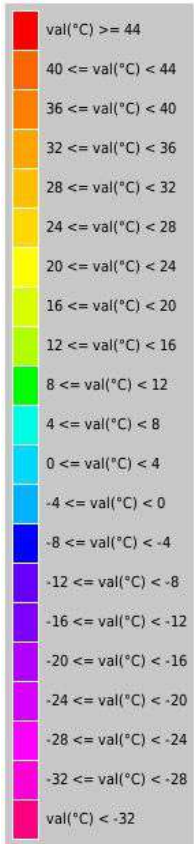
# Synoptic conditions

Color composite at 05:00 UTC

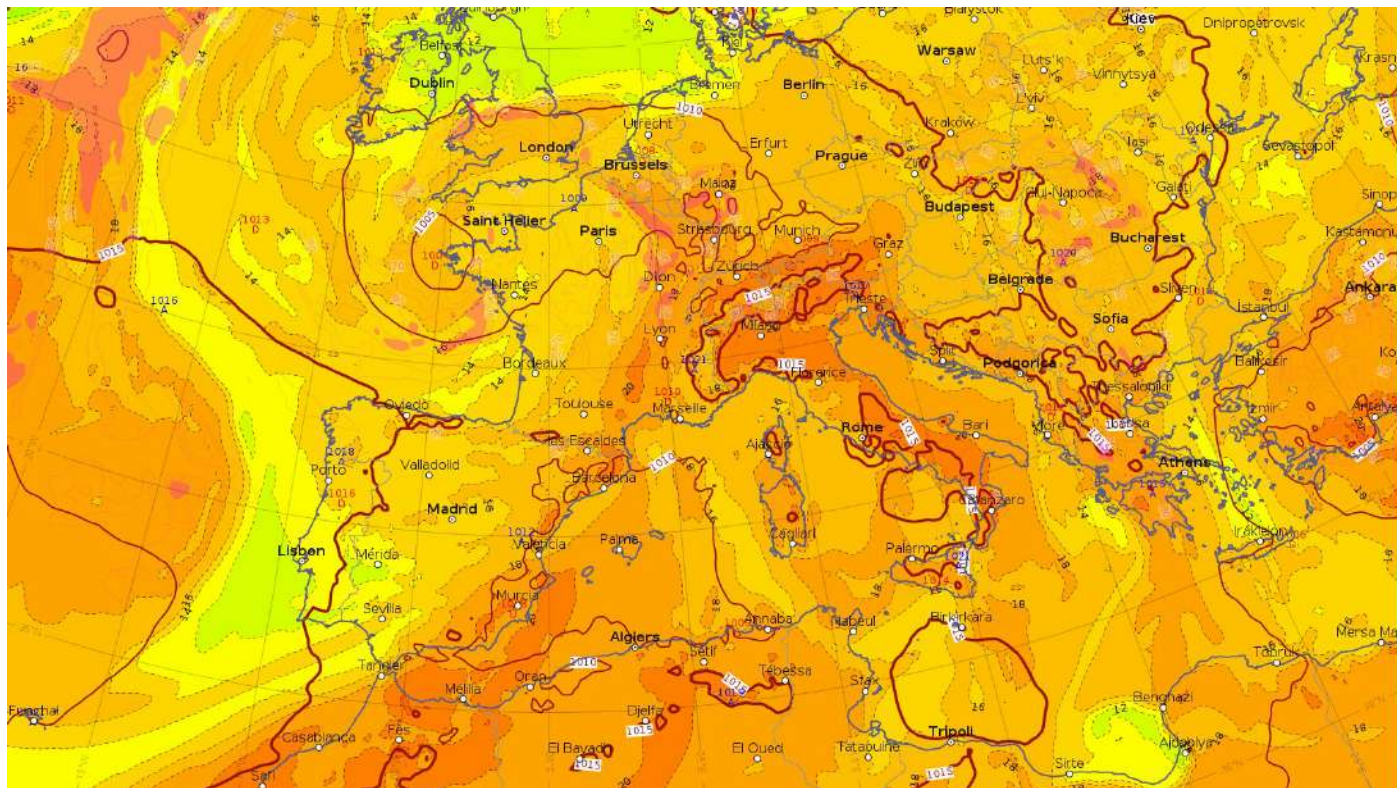
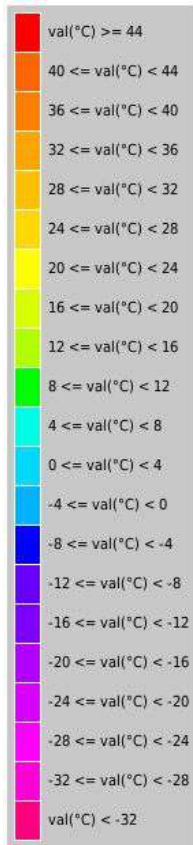


24/07

# Geopotential height + Temperature at 500 hPa at 12 UTC (Arpege 0.1 Run 0 UTC)



# Wet bulb 850 hPa + SLP at 12 UTC (Arpege 0.1 Run 00 UTC)

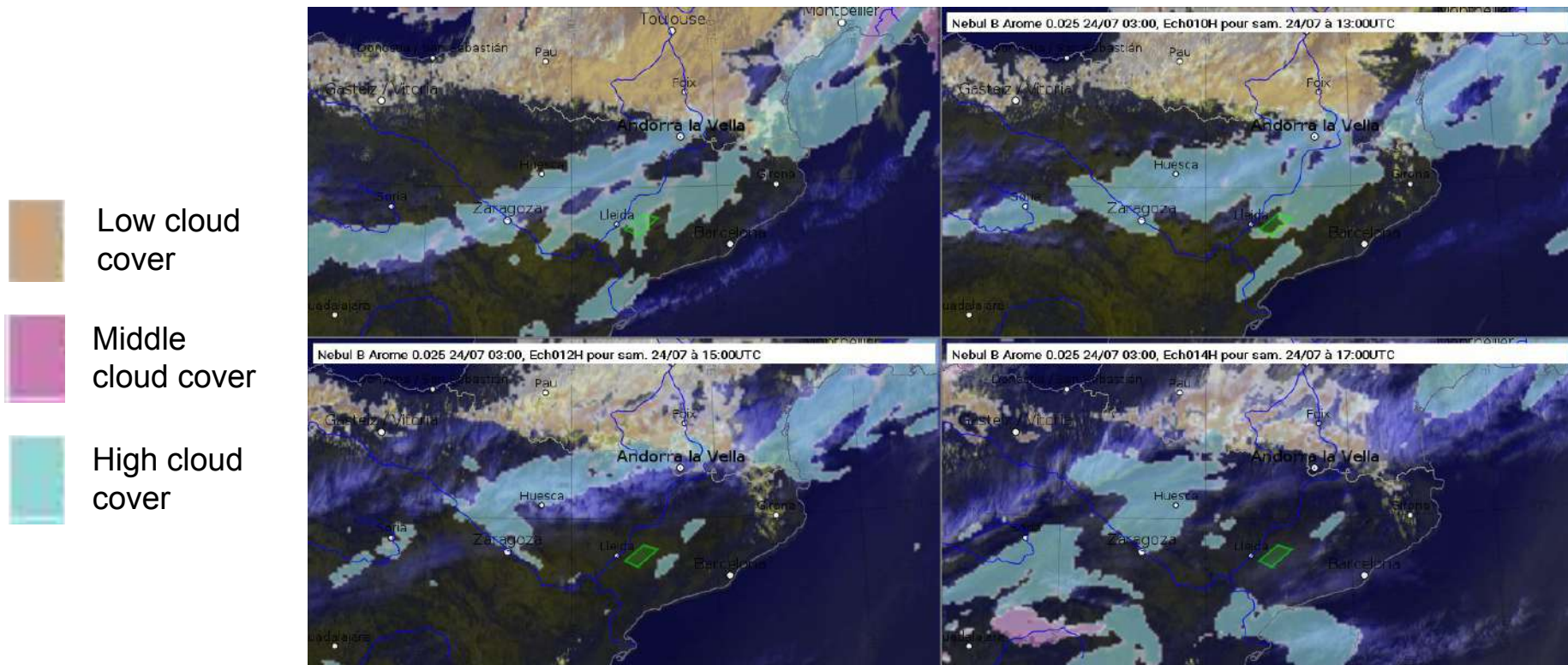




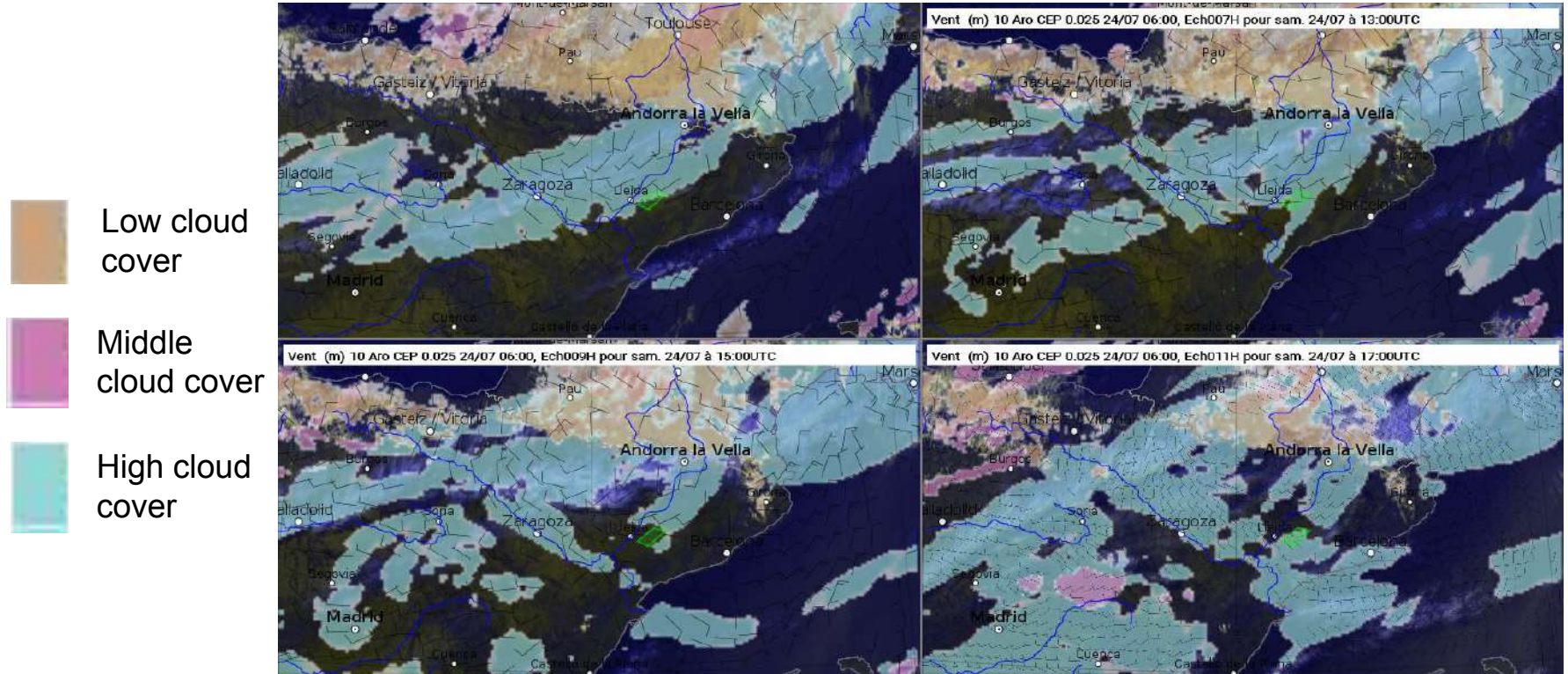
Cyclonic conditions at 500 hpa. Anticyclonic conditions close to the surface.

# Cloud Cover

# HR\_VIS observation + Cloud cover from the modele at 11 to 14 UTC (arome run 03UTC)



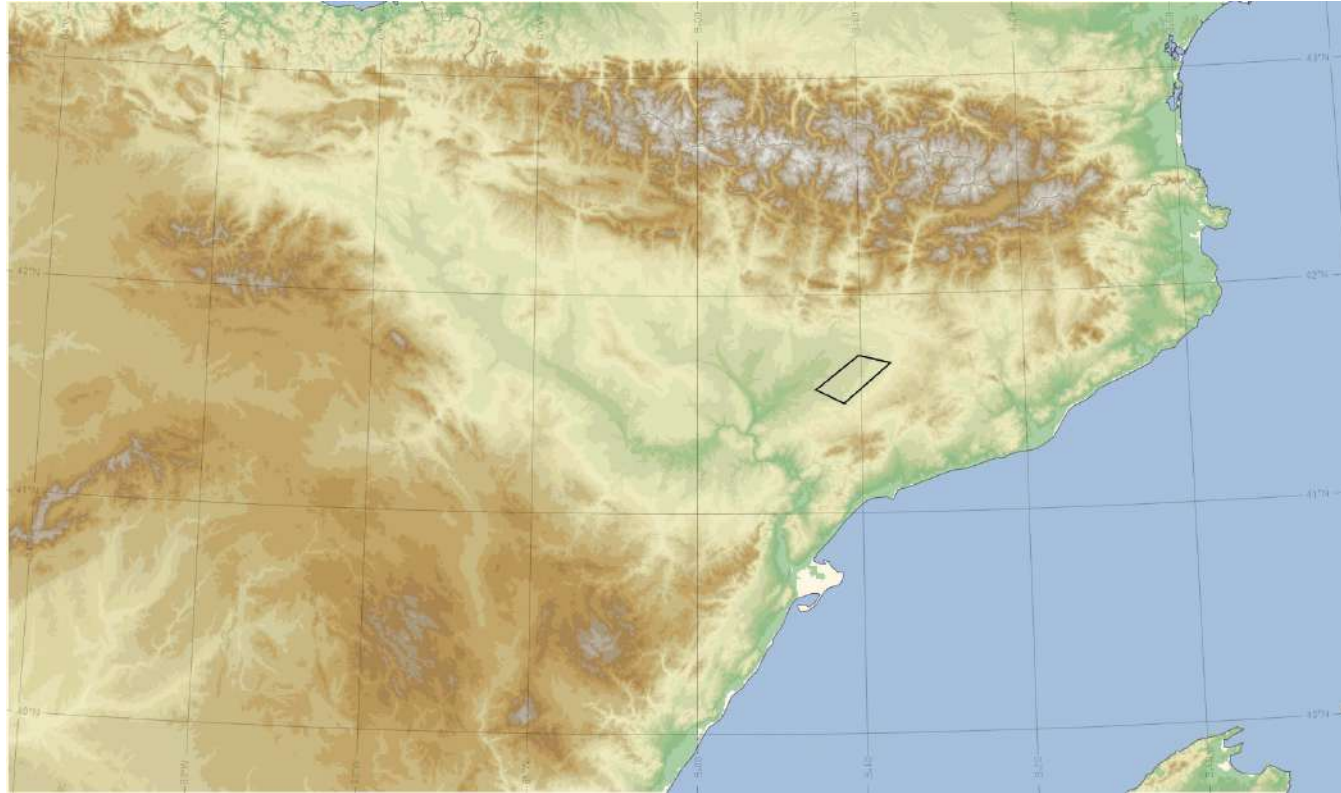
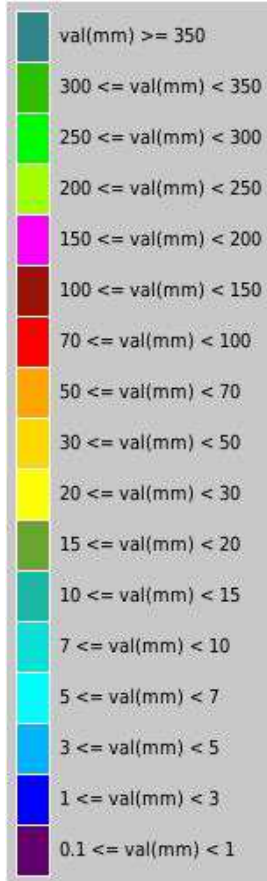
# HR\_VIS observation + Cloud cover from the modele at 11 to 14 UTC (arome IFS run 03UTC)



There were high-level clouds across the area.

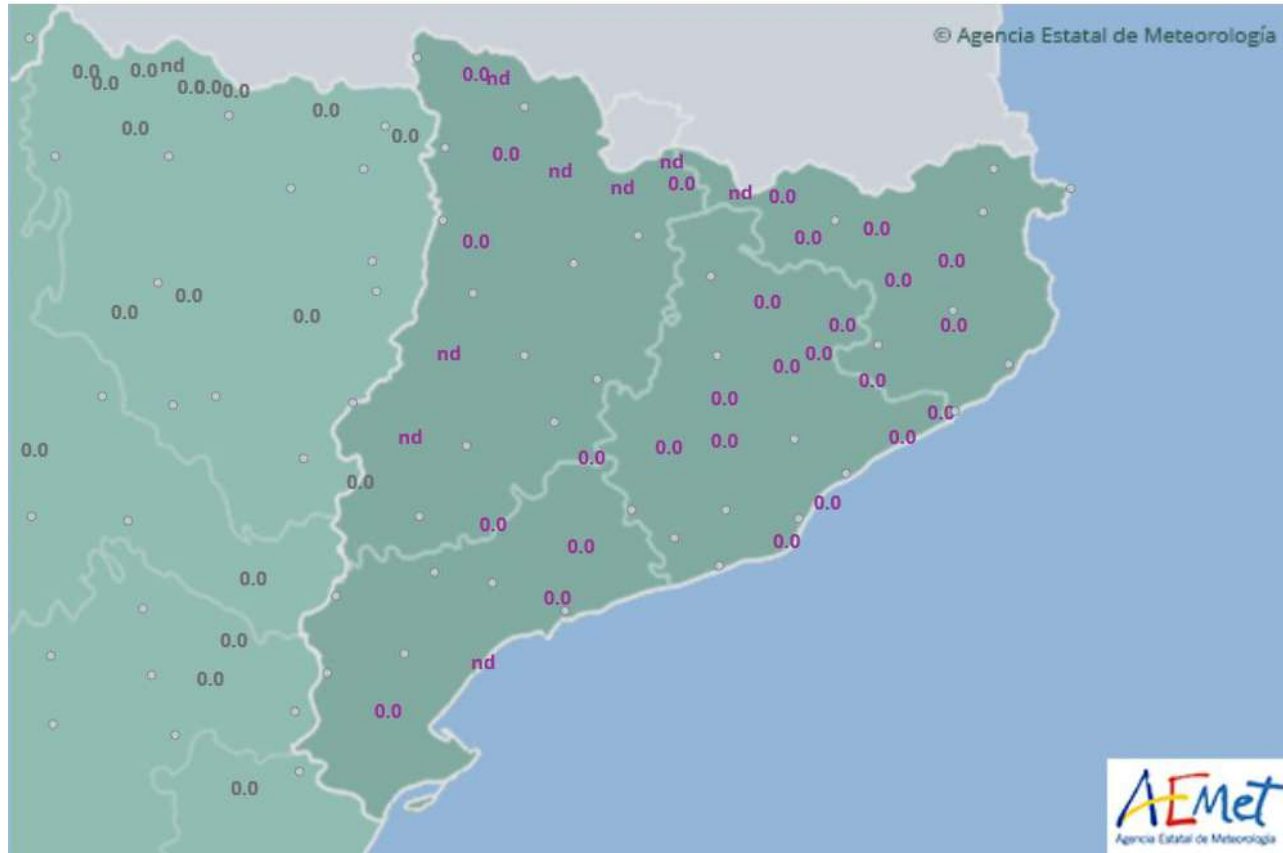
# Rainfall

# Total rainfall in 24h (Arome 03h UTC)



24/07

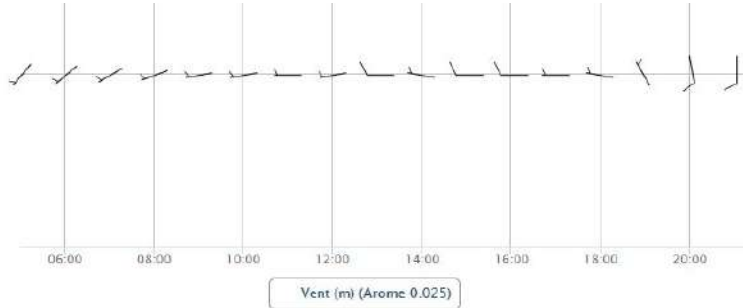
# Observation - aemet - rainfall





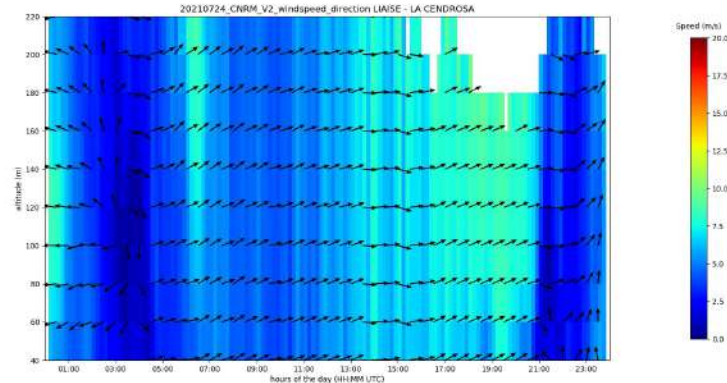
Wind

# Wind at 10 m Arome Run 03 UTC 23/07 for 24/07 and Obs



## Wind at 10 m Arome Run 03 UTC

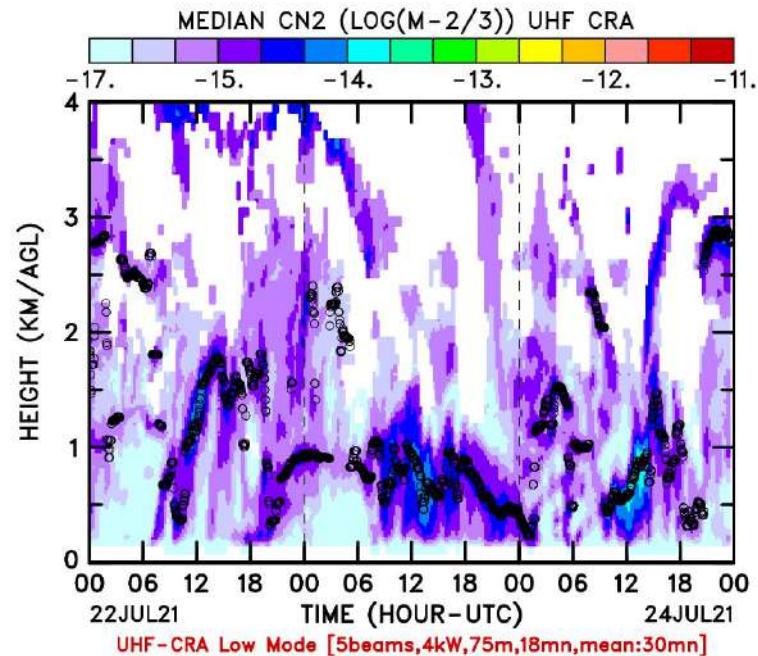
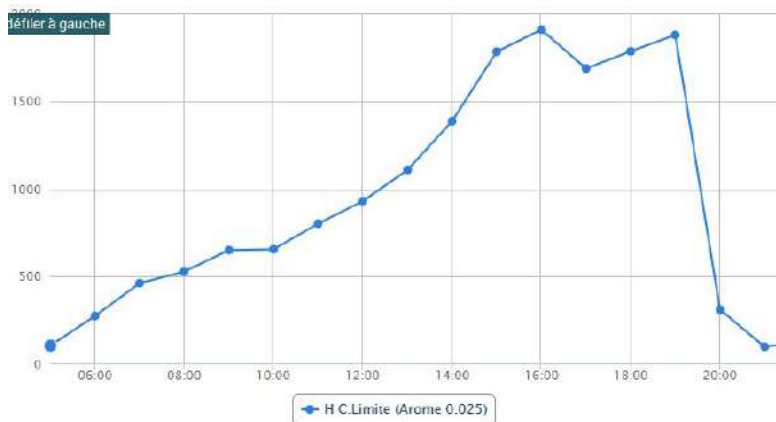
Observations - La Cendrosa -  
Wind profiler Lidar Windcube



Moderate westerly winds were present during the whole day.

# Planetary Boundary Layer

# Atmospheric boundary layer thickness (Arome run 3 UTC) in Mollerussa and Obs



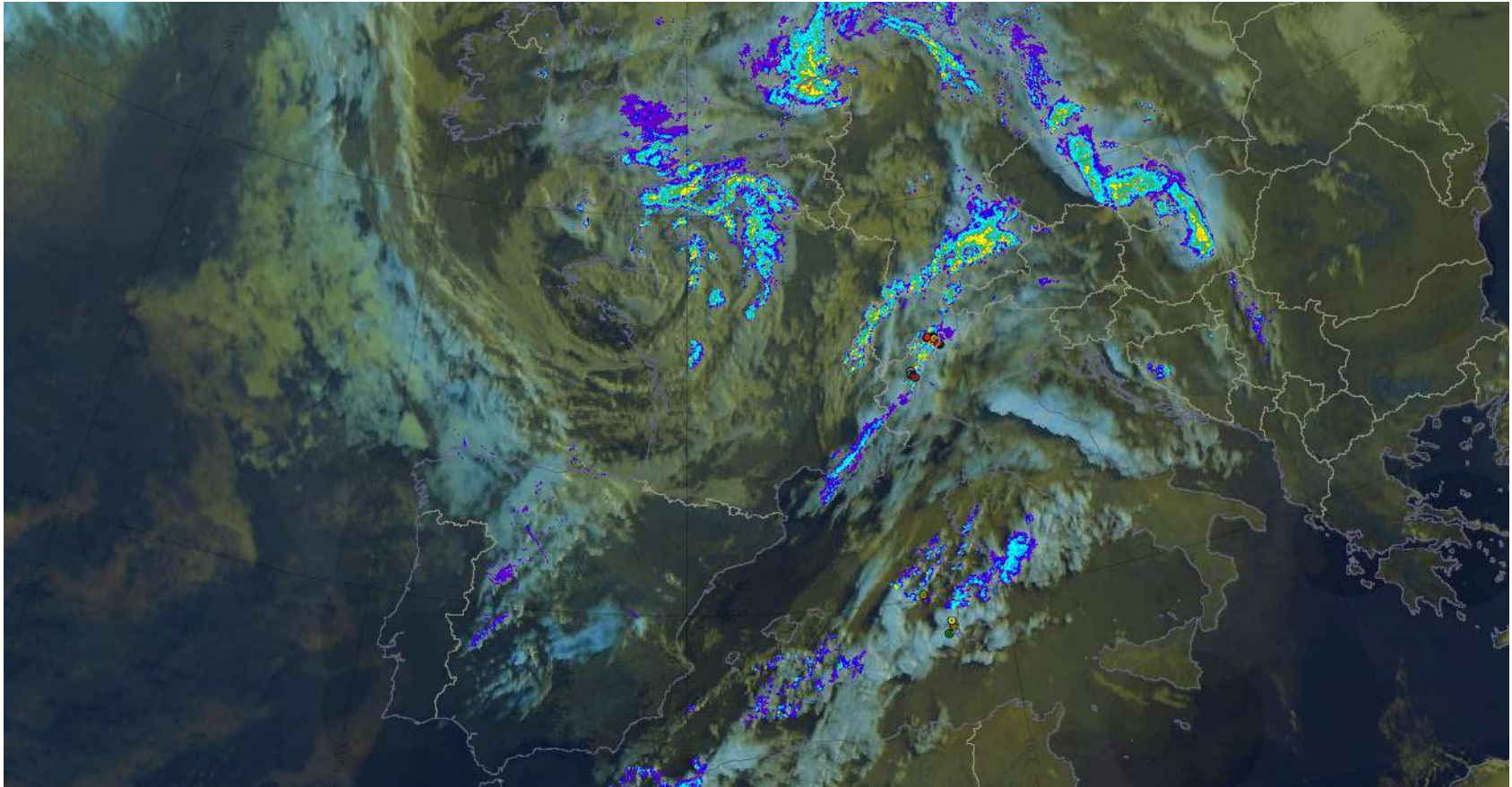
Atmospheric boundary layer thickness (Arome run 3 UTC 23/07 for 24/07) in Mollerussa

Observations - Els plan  
ReflectivityZI

25/07/2021

# Synoptic conditions

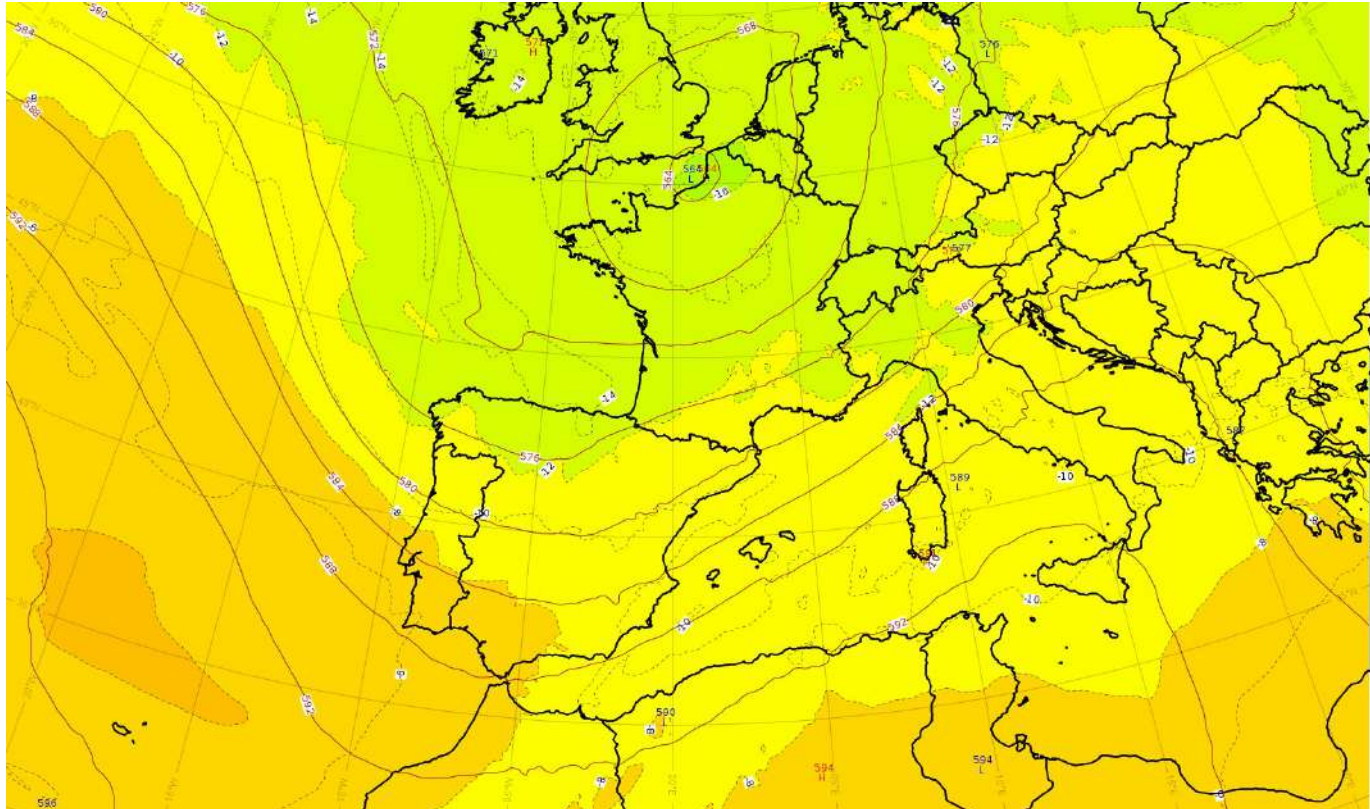
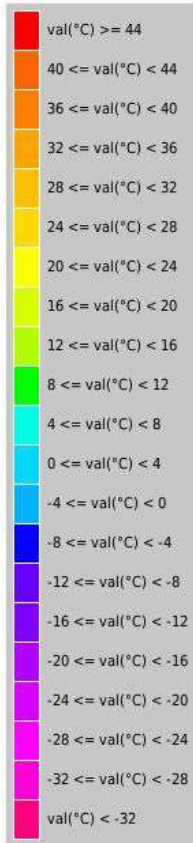
Color composite at 05:35 UTC



25/07



# Geopotential height + Temperature at 500 hPa at 12 UTC (Arpege 0.1 Run 0 UTC 24/07 for 25/07)



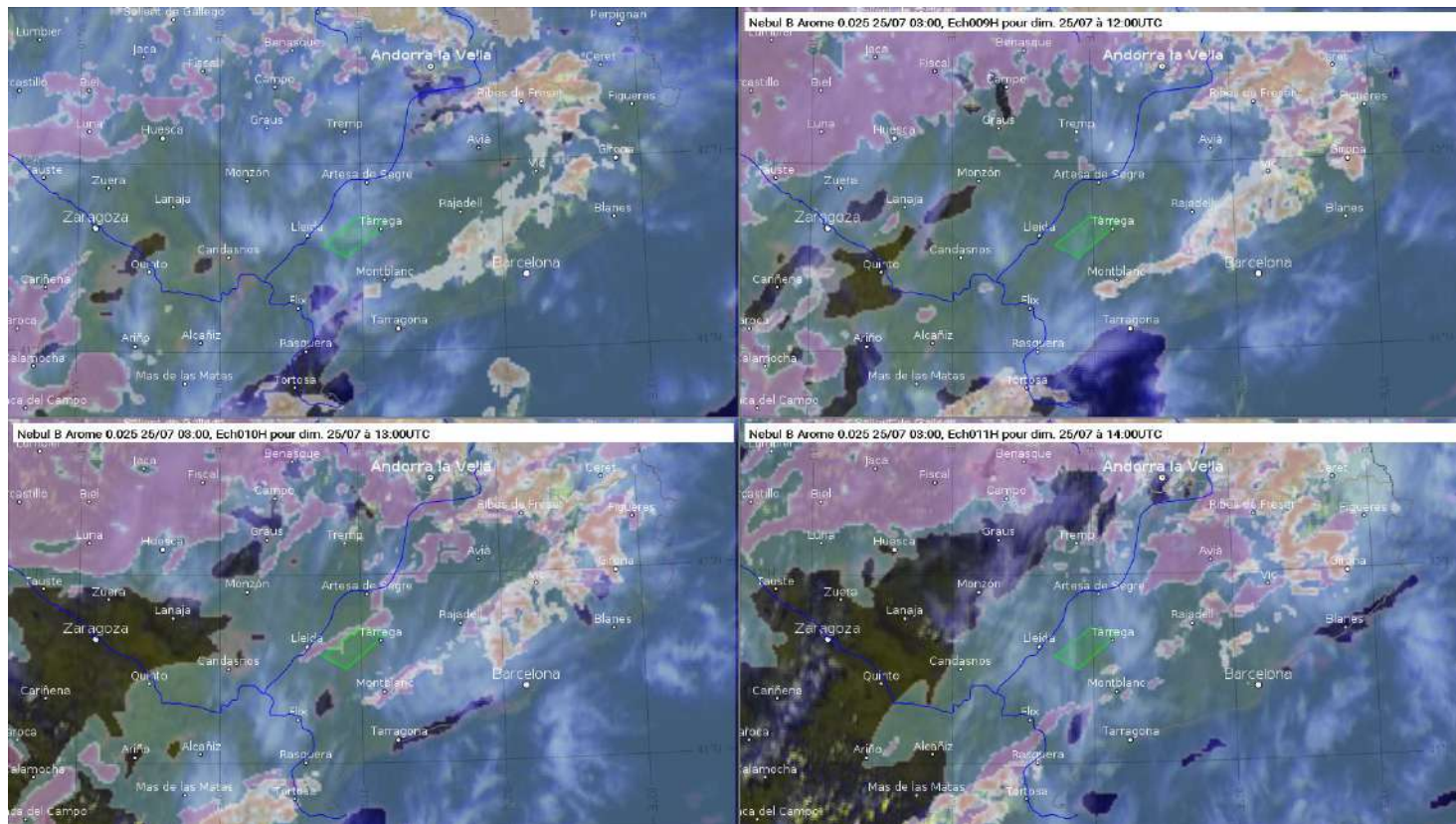
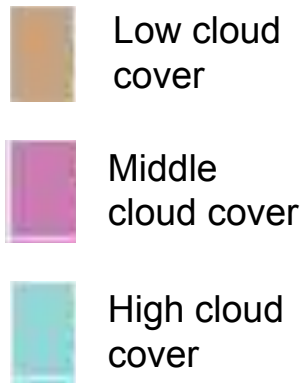
25/07



Cyclonic conditions at 500 hpa. Anticyclonic conditions close to the surface.

# Cloud Cover

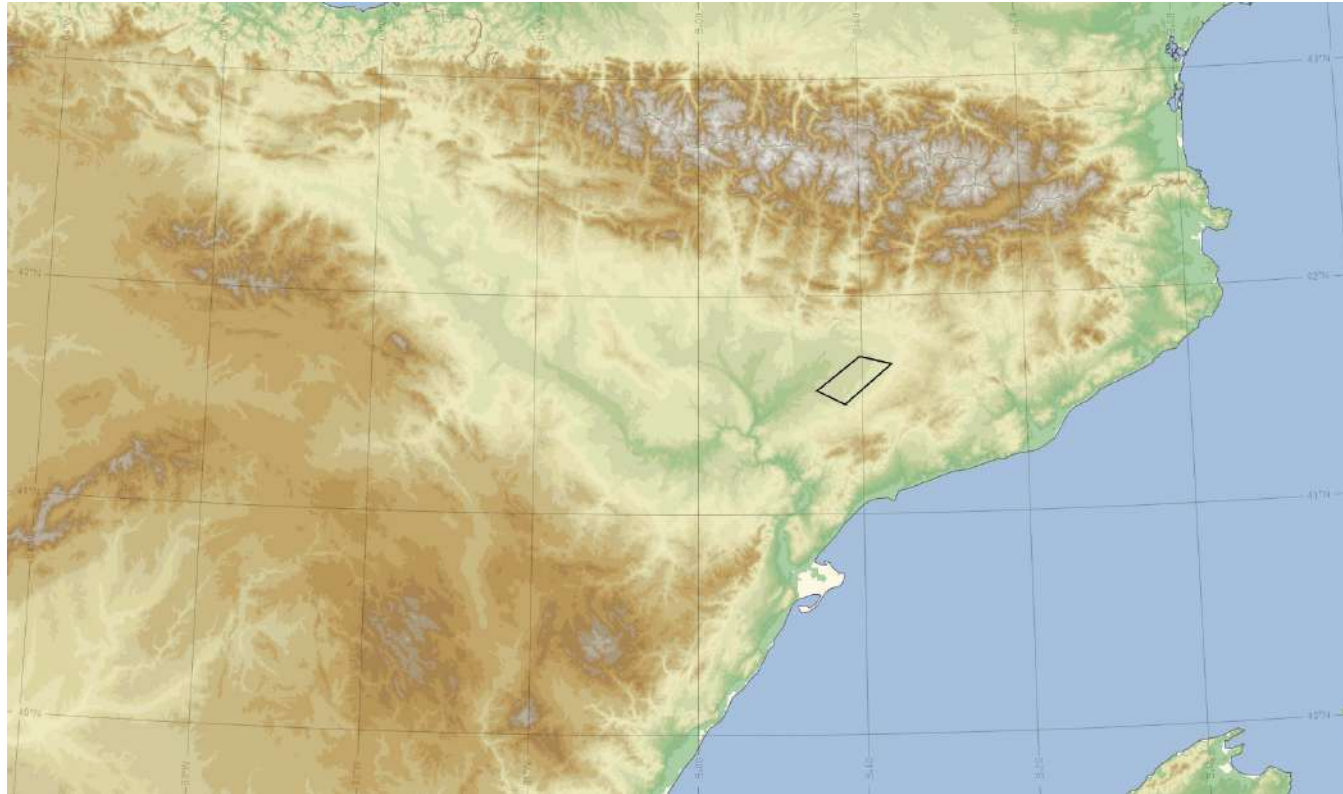
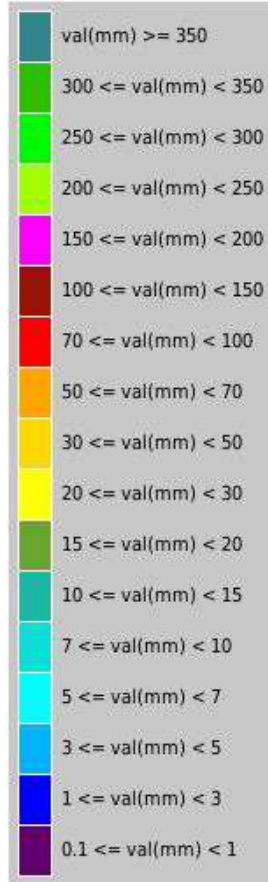
# HR\_VIS observation + Cloud cover from the modele at 11 to 14 UTC (arome run 03UTC)



There were high-level clouds across the area.

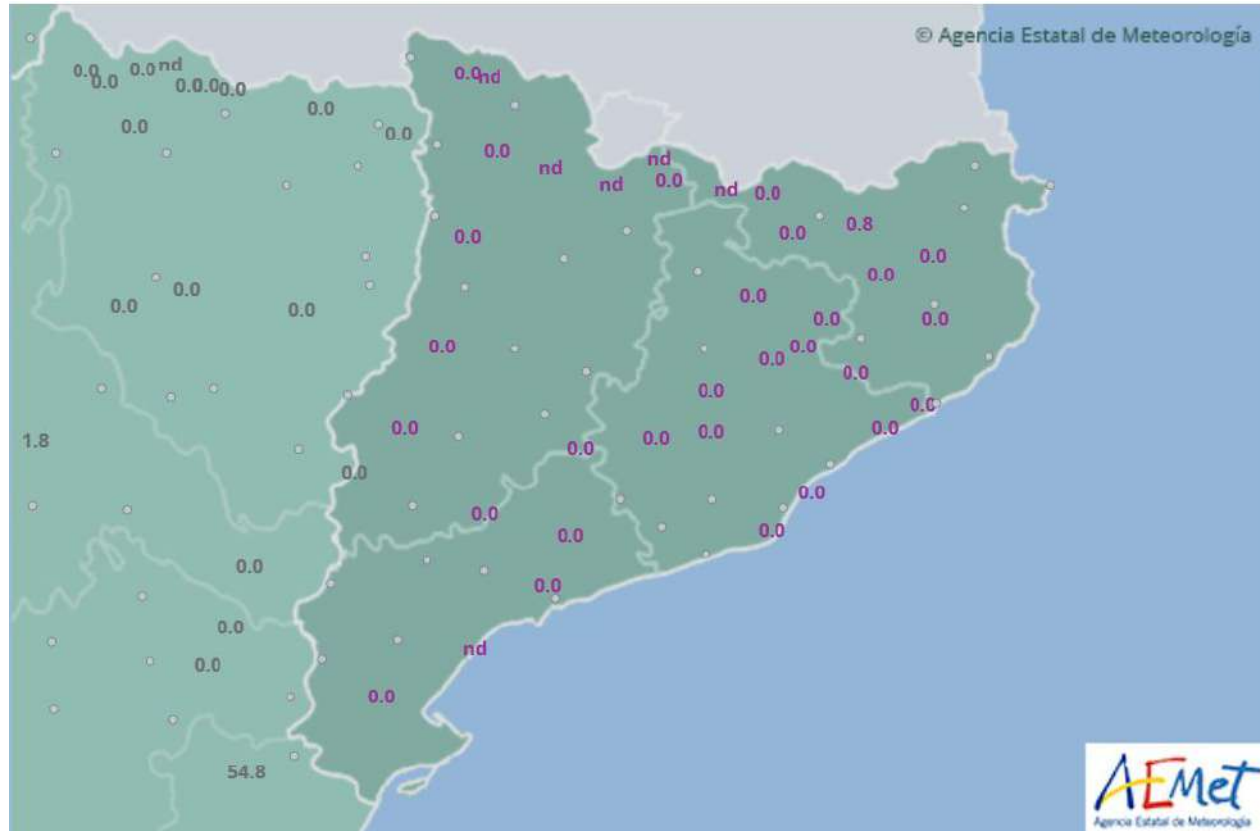
# Rainfall

# Total rainfall in 24h (Arome 03h UTC)





# Observation - aemet - rainfall



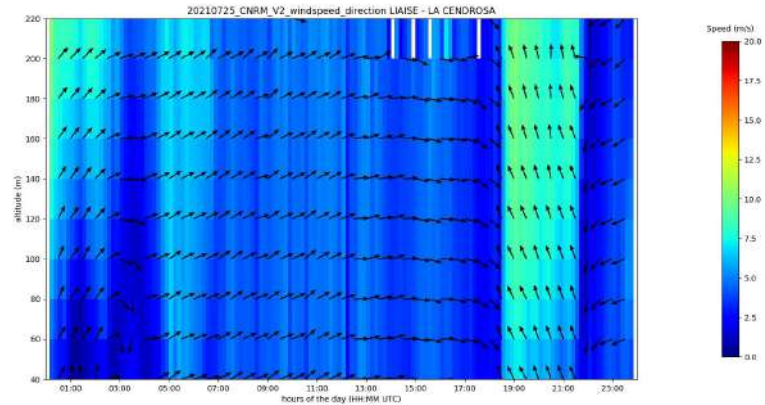
Wind

# Wind at 10 m Arome Run 03 UTC 24/07 for 25/07 and Obs



## Wind at 10 m Arome Run 03 UTC

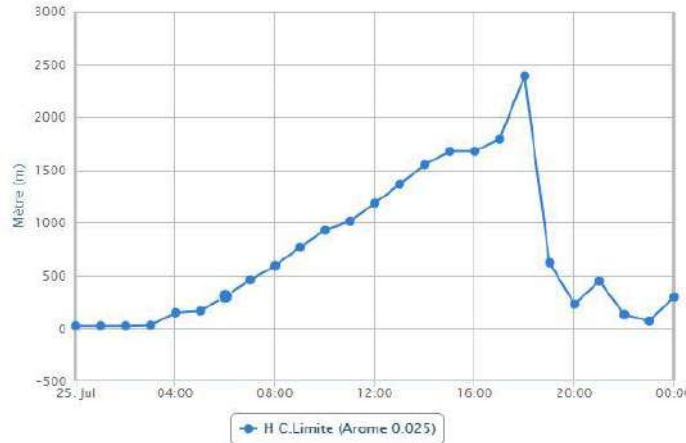
Observations - La Cendrosa -  
Wind profiler Lidar Windcube



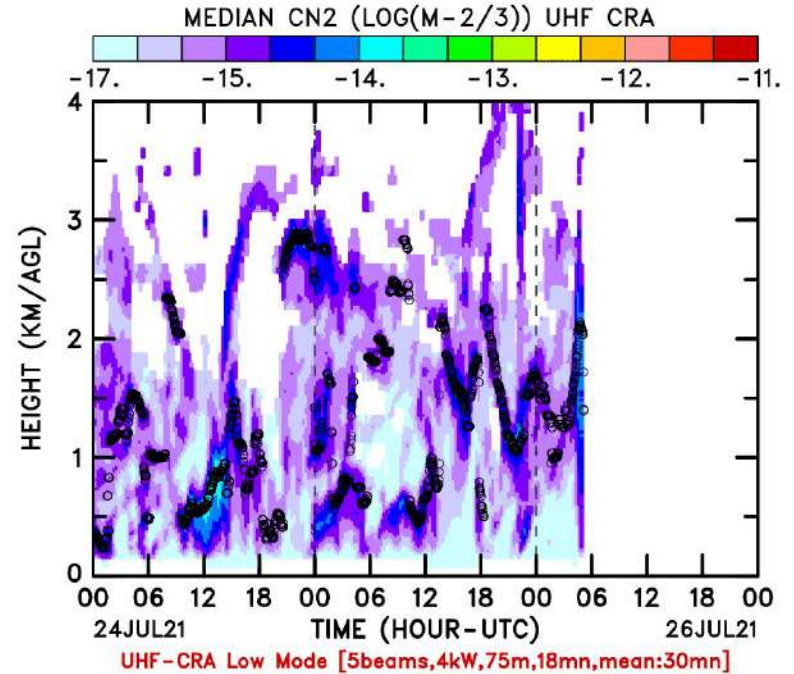
Weak westerly winds until the arrival of the sea breeze at 18 UTC.

# Planetary Boundary Layer

# Atmospheric boundary layer thickness (Arome run 3 UTC) in Mollerussa and Obs



Atmospheric boundary layer thickness (Arome run 3 UTC 24/07 for 25/07) in Mollerussa



Observations - Els plan  
ReflectivityZI

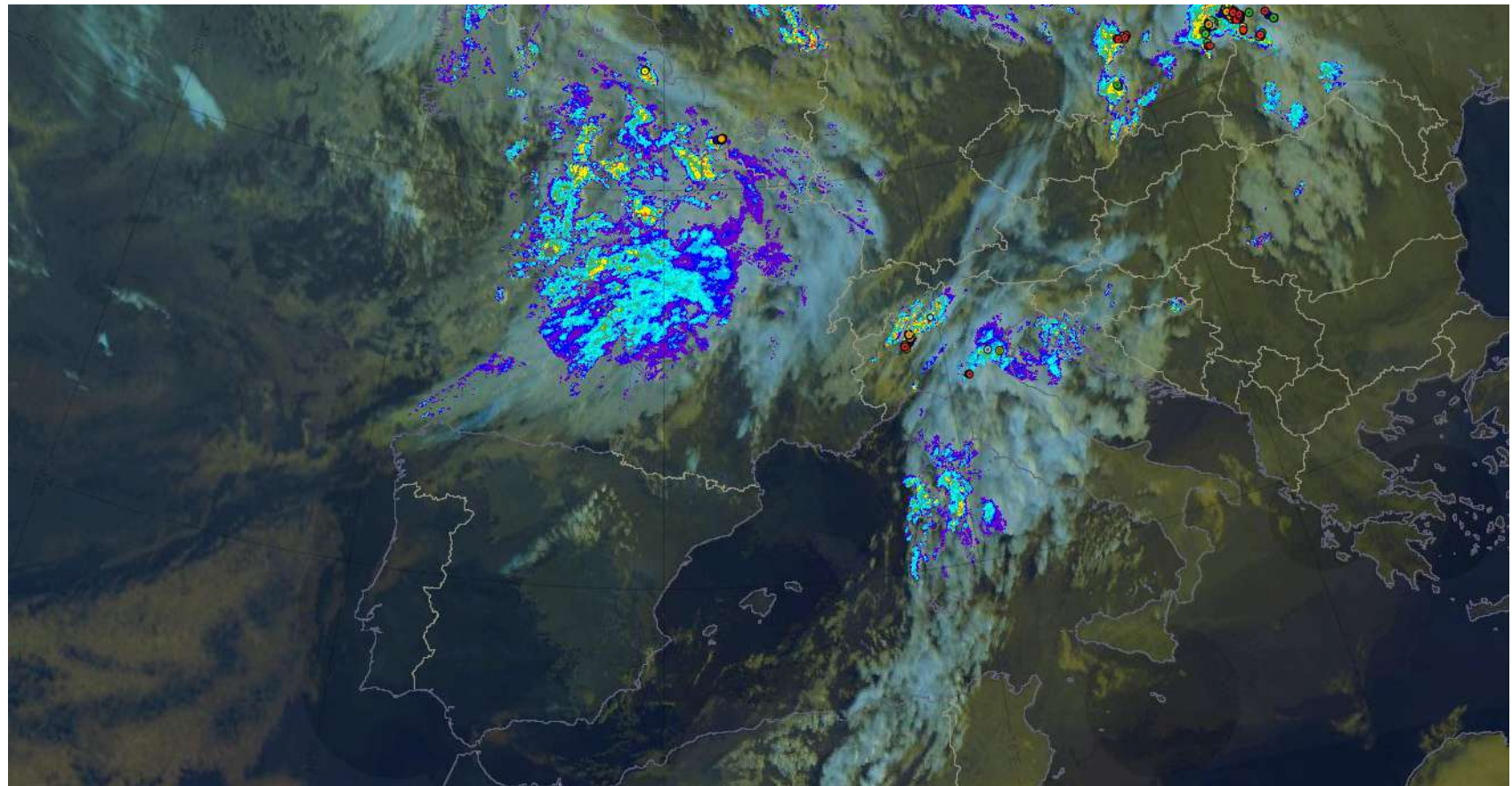
PBL collapsed with the arrival of the sea breeze at 18 UTC.

27/07/2021



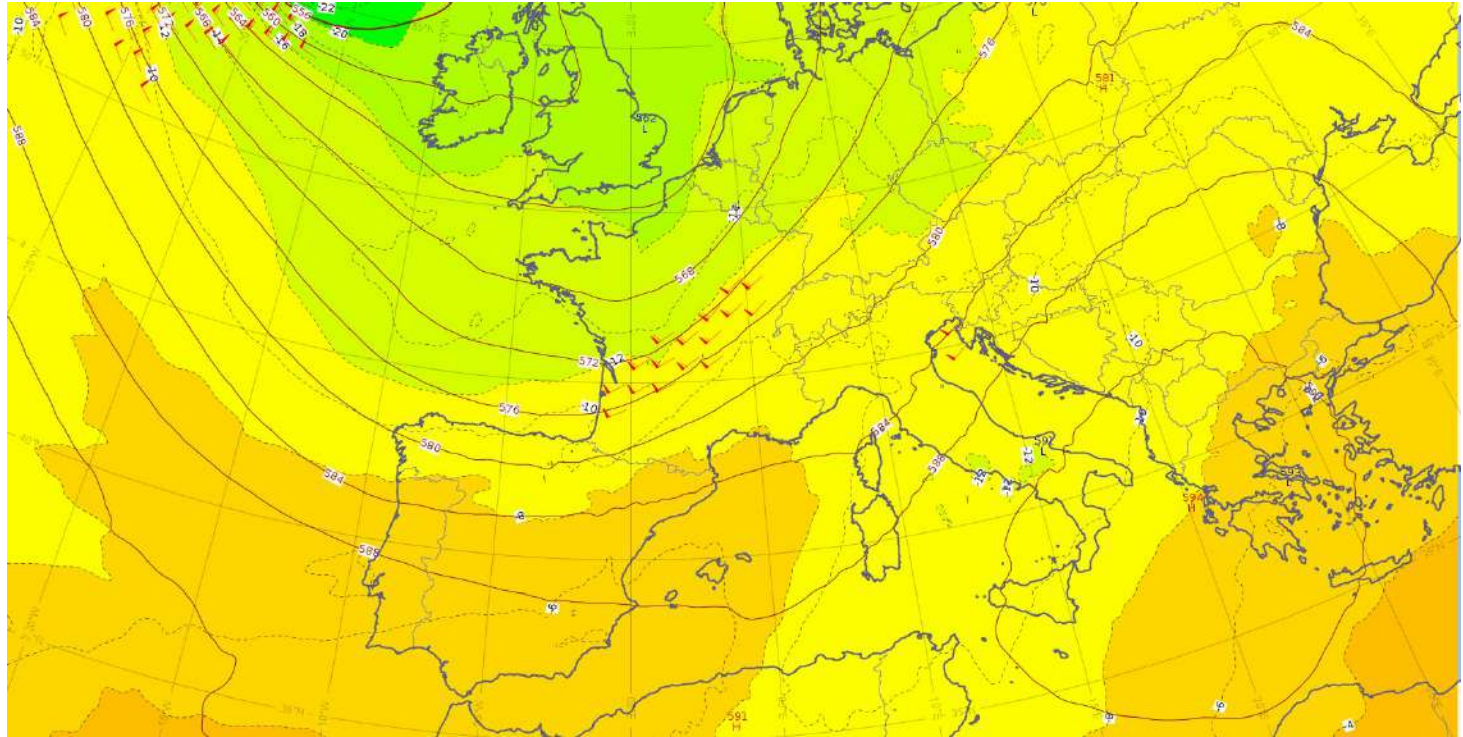
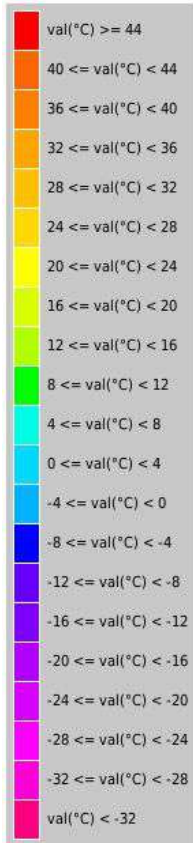
# Synoptic conditions

Color composite at 05:45 UTC

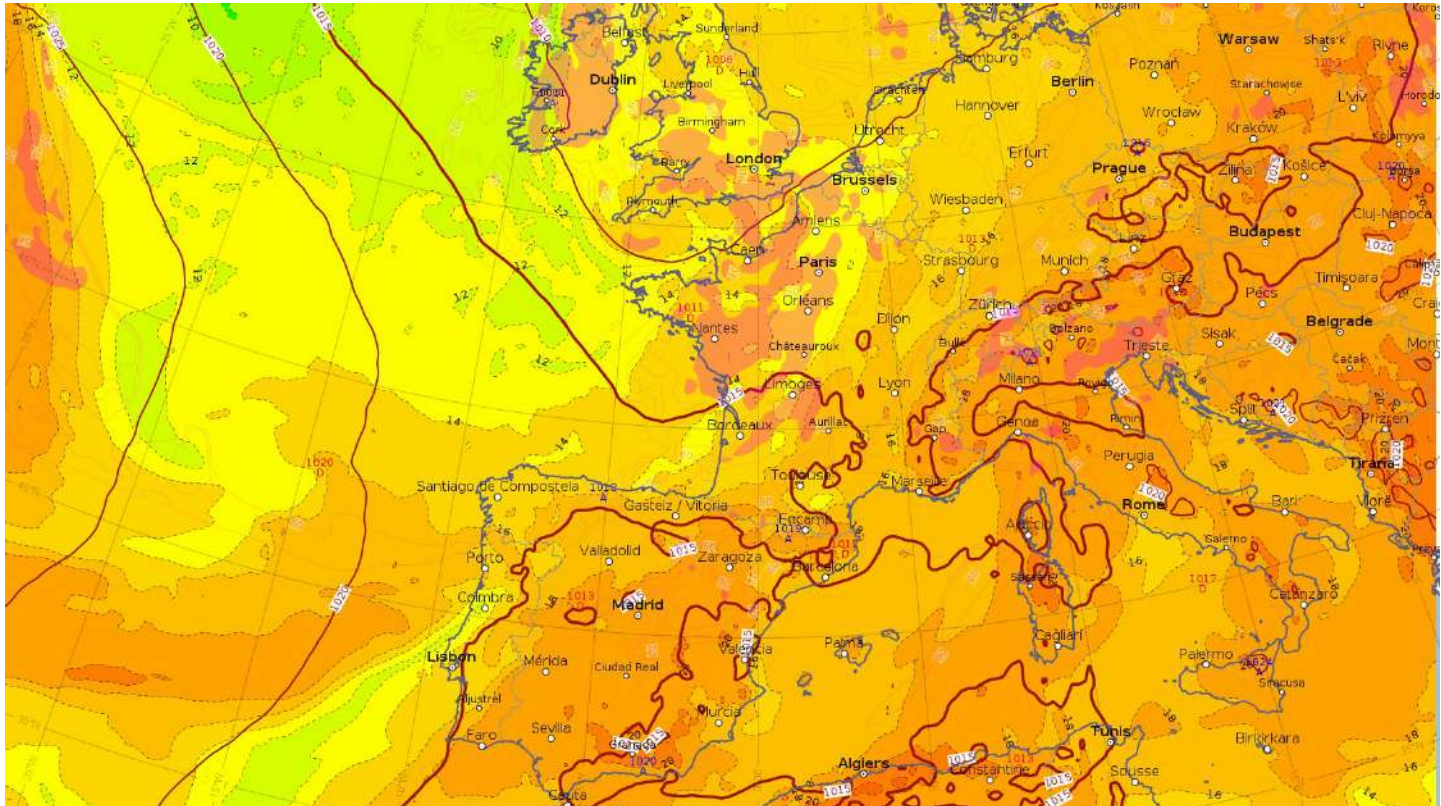
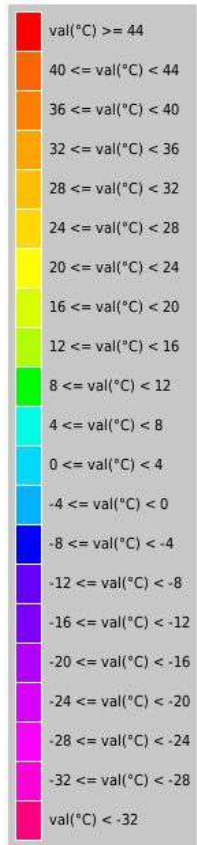


27/07

# Geopotential height + Temperature at 500 hPa at 12 UTC (Arpege 0.1 Run 0 UTC)



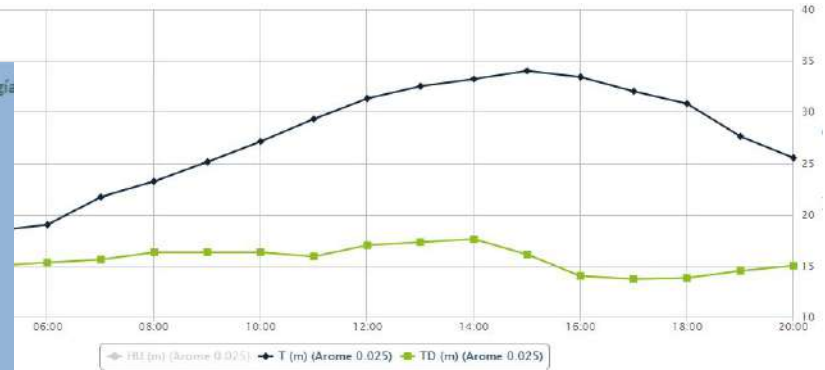
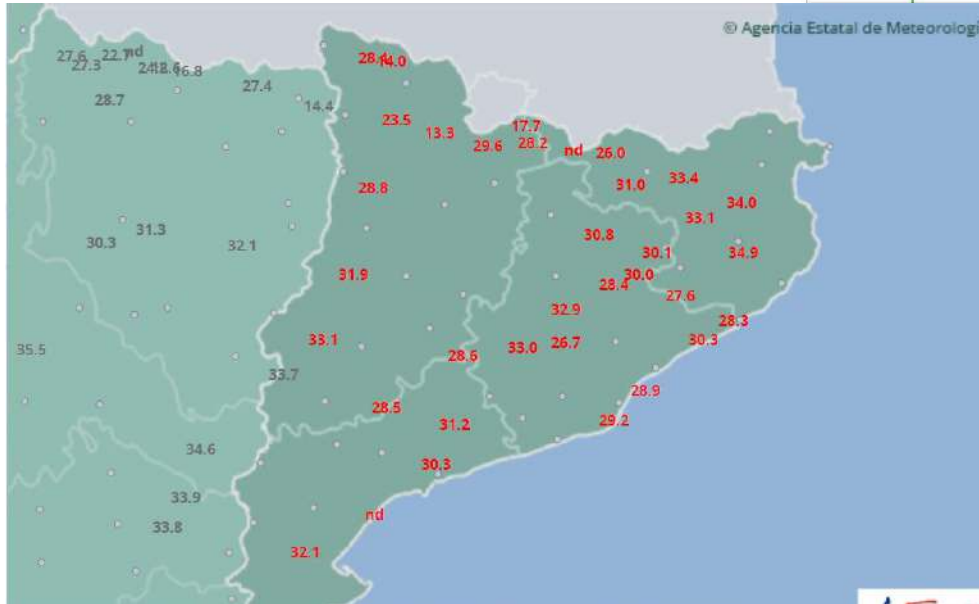
# Wet bulb potential temperature at 850 hPa + SLP + HU at 12 UTC (Arpege 0.1 Run 00 UTC)



Conditions remain anticyclonic close to the the surface. Cyclonic conditions at 500 hpa.

Temperature

# Observations - aemet - maximum temperature



Arome (Run 3h UTC 26/07 for 27/07) - Temperature and dew point - Mollerussa

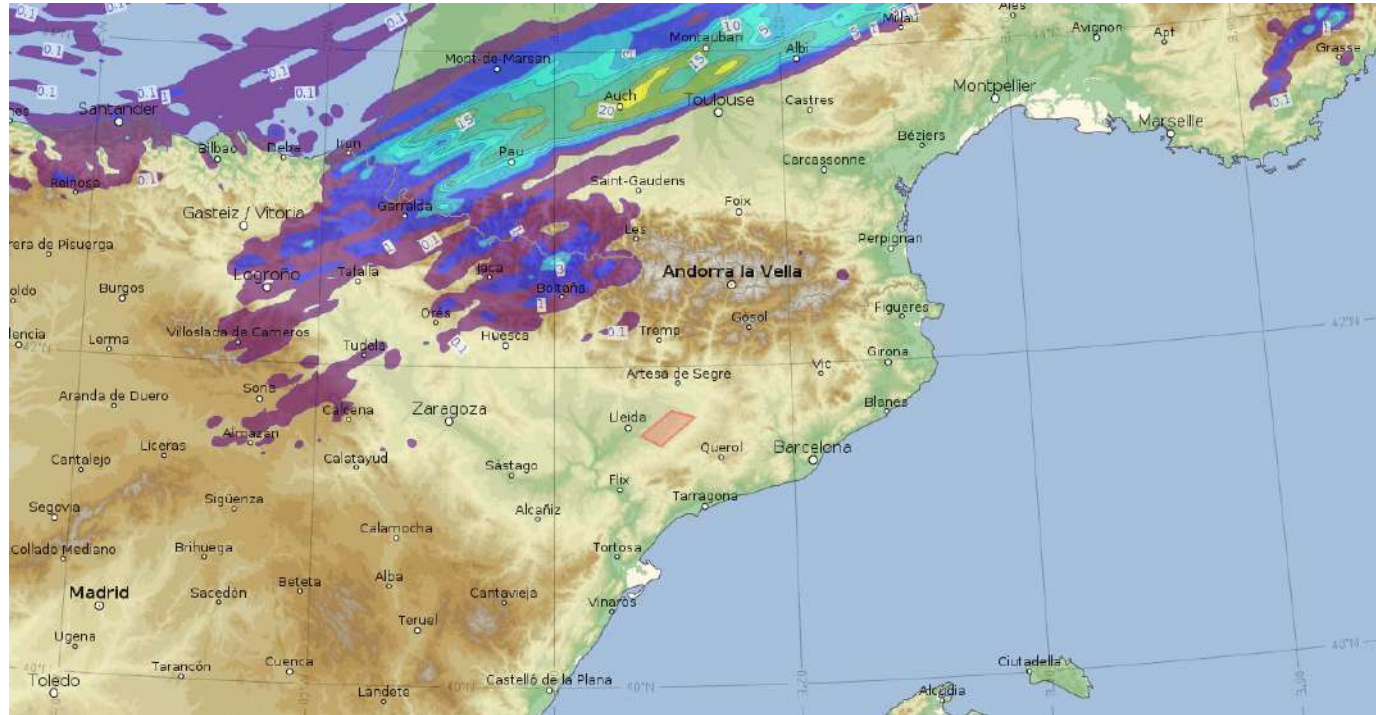
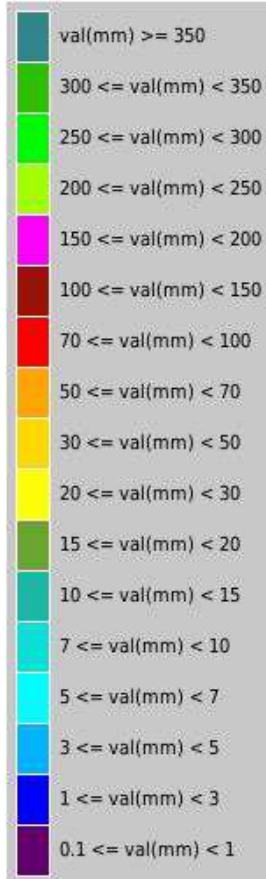
Observations

The prediction matched the observations.

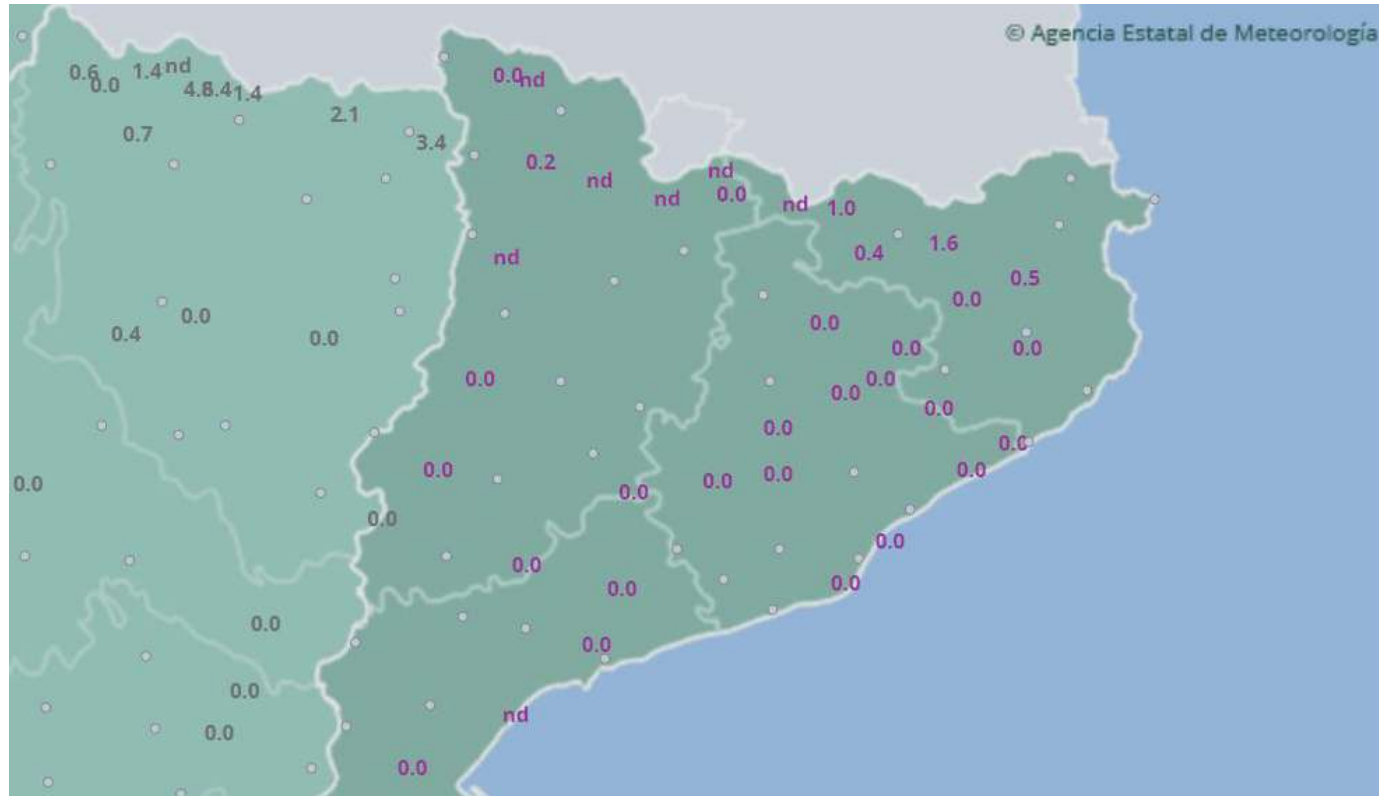


# Rainfall

# Total rainfall in 24h (Arome 03h UTC 26/07)



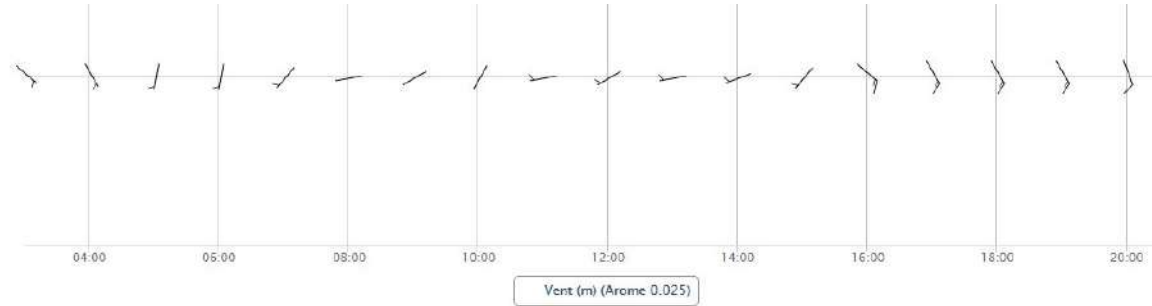
# Observation - aemet - rainfall



In overall, total rainfall was well predicted by the model.

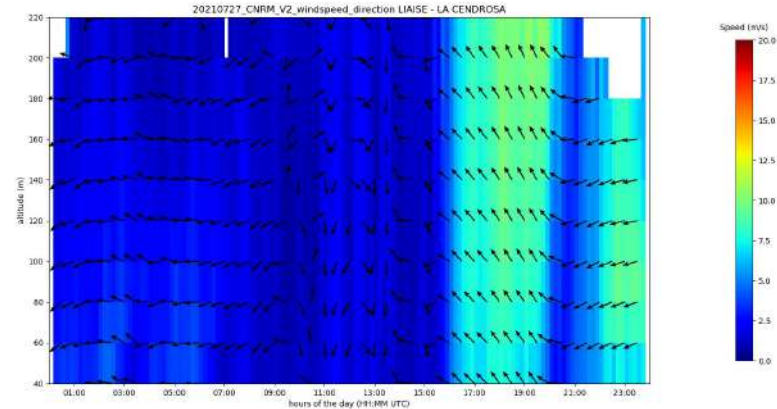
Wind

# Wind at 10 m Arome Run 03 UTC 26/07 for 27/07 and Obs



## Wind at 10 m Arome Run 03 UTC

Observations - La Cendrosa -  
Wind profiler Lidar Windcube

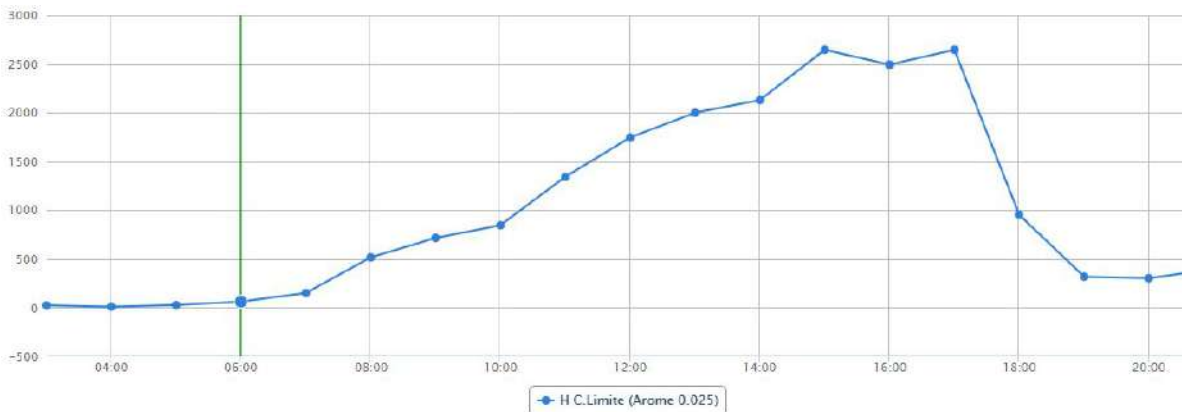


The sea breeze arrived at 16h as expected but the north wind was not predicted by the model.

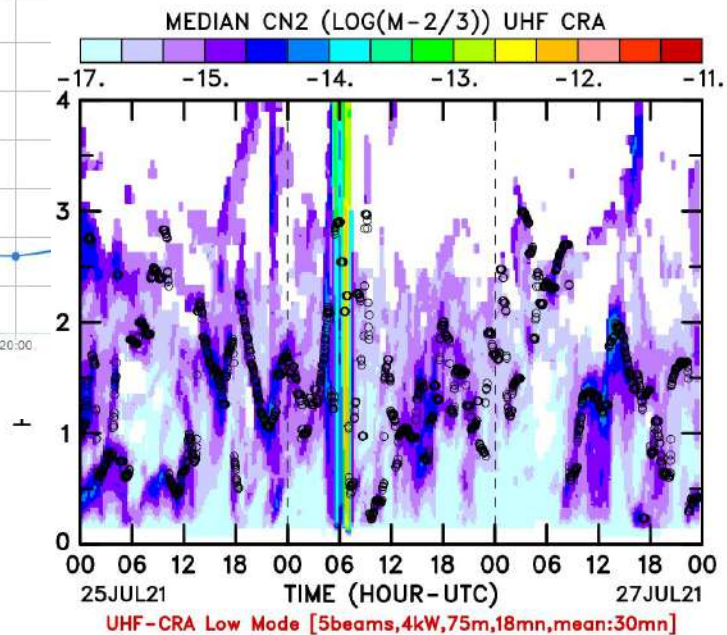
# Planetary Boundary Layer



# Atmospheric boundary layer thickness (Arome run 3 UTC) in Mollerussa and Obs



Atmospheric boundary layer thickness (Arome run 3 UTC 26/07 for 27/07) in Mollerussa



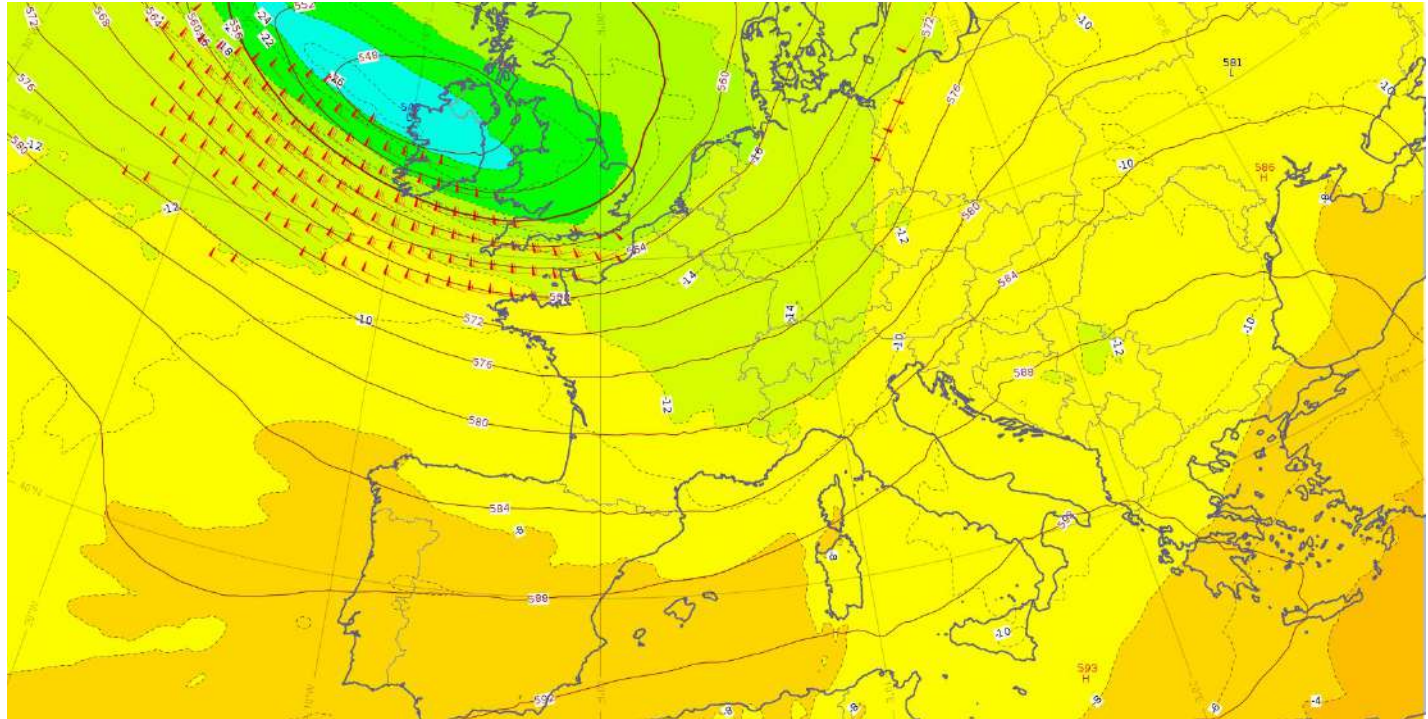
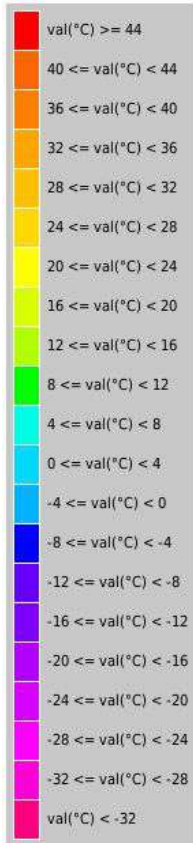
Observations - Els plan  
ReflectivityZI

27/07

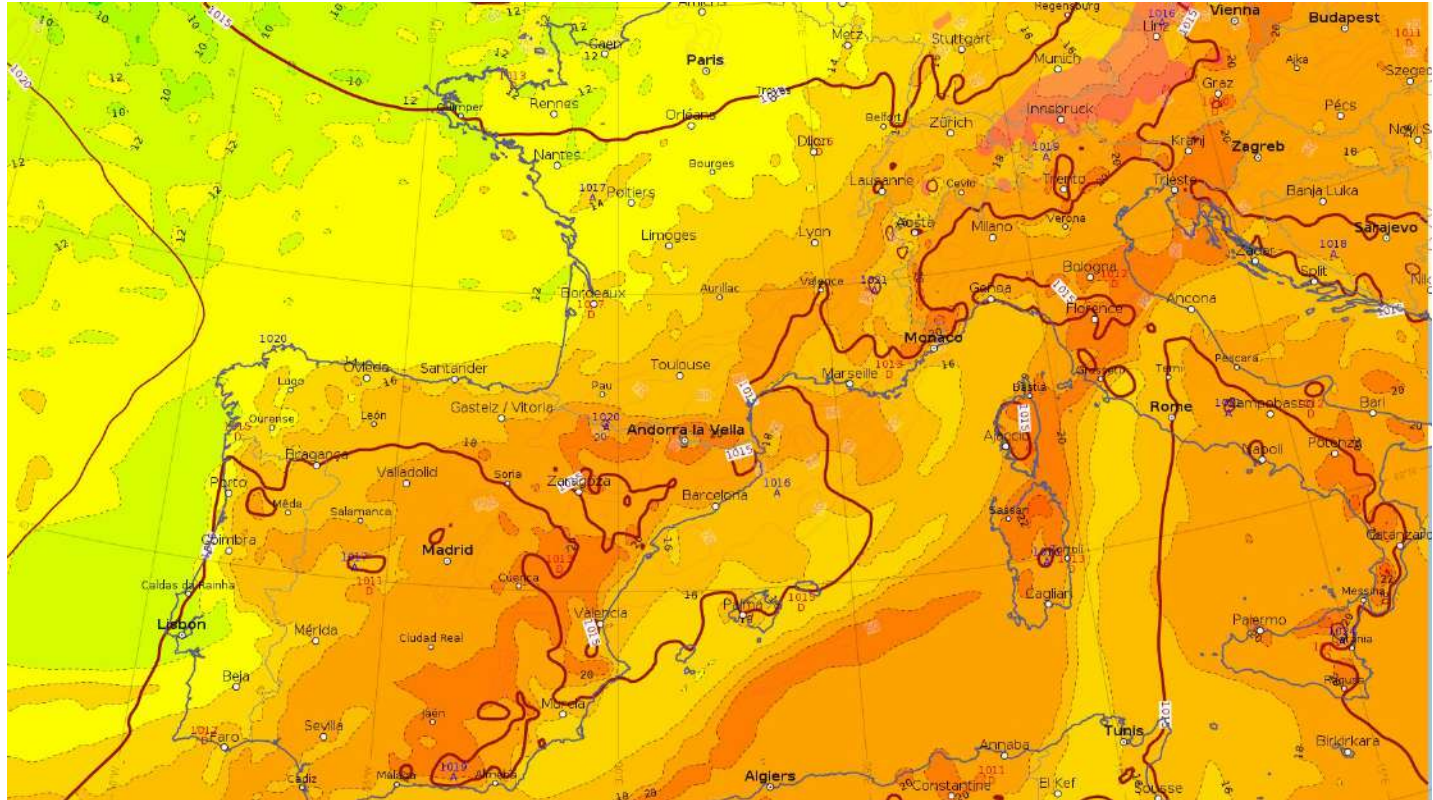
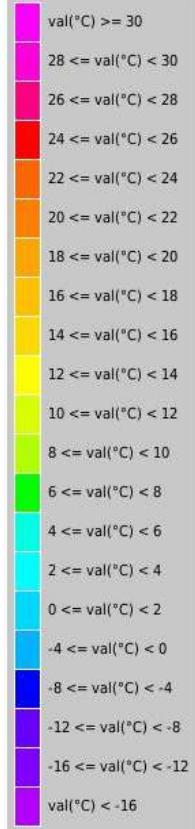
The model overestimated the height of the planetary boundary layer.

28/07/2021

# Geopotential height + Temperature at 500 hPa at 12 UTC (Arpege 0.1 Run 0 UTC 27/07 for 28/07)



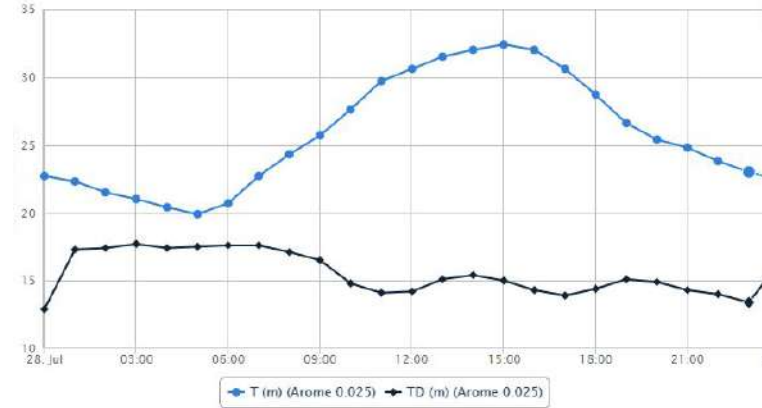
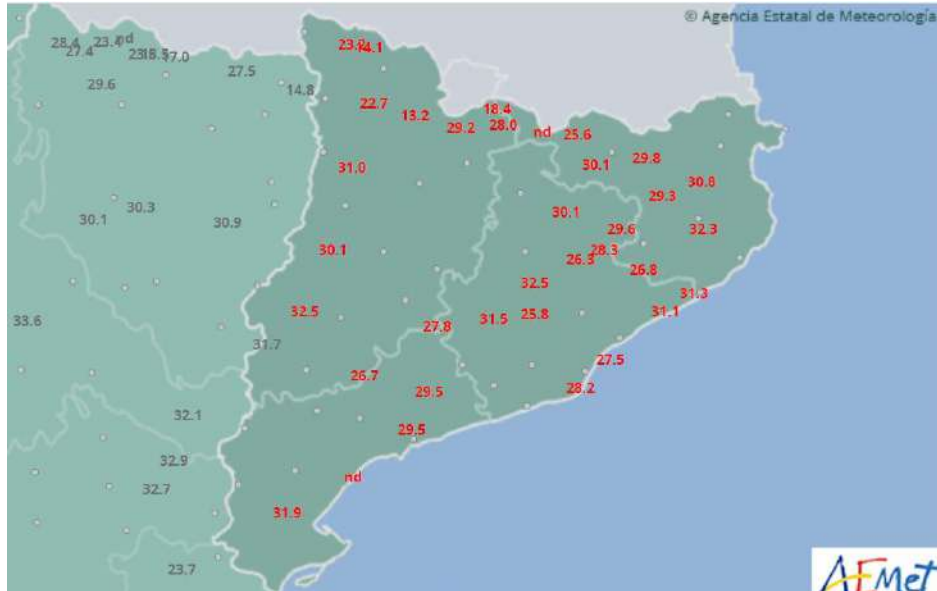
# Wet bulb 850 hPa + SLP at 12 UTC (Arpege 0.1 Run 00 UTC 27/07)



Anticyclonic conditions close to the the surface. Cyclonic conditions at 500 hpa.

Temperature

# Observations - aemet - maximum temperature



Arome (Run 3h UTC 27/07 for 28/07) - Temperature and dew point - Mollerussa

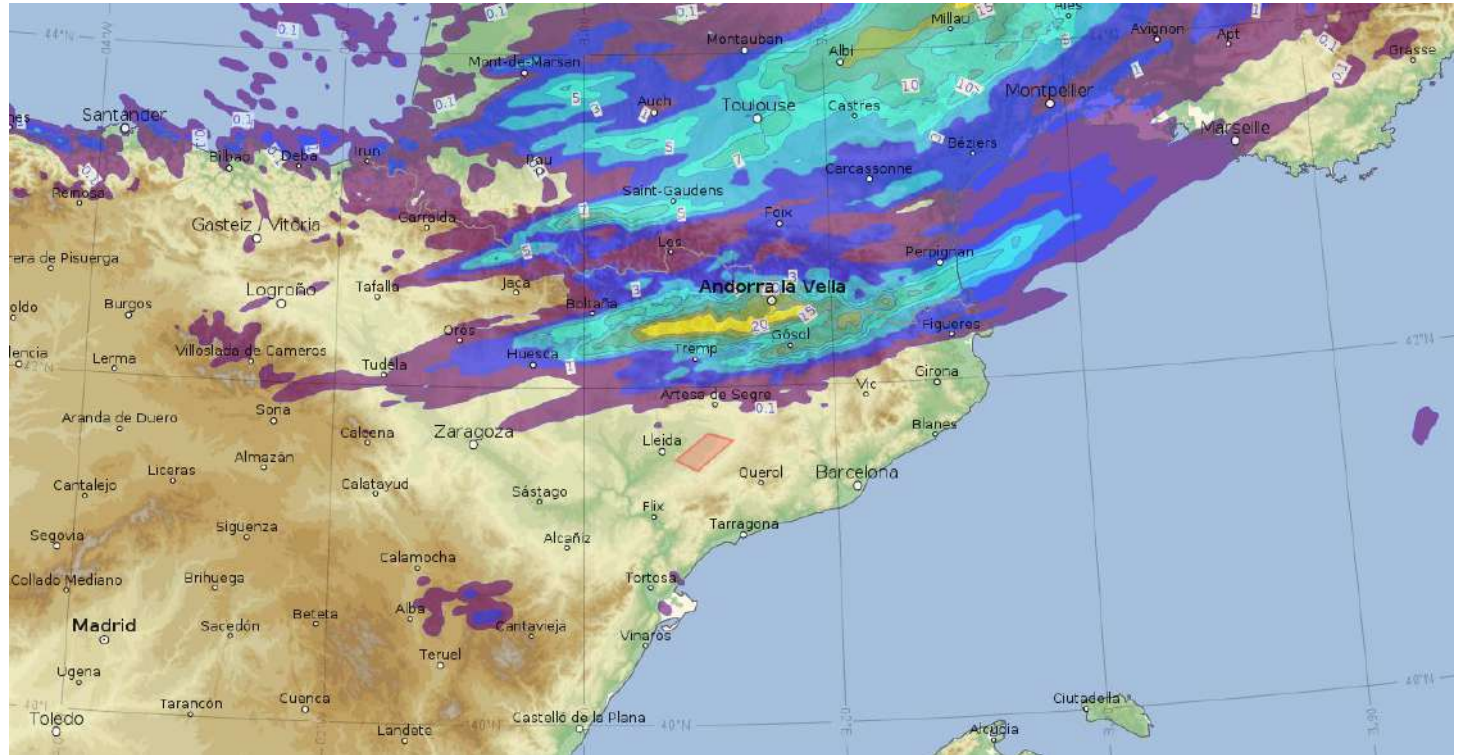
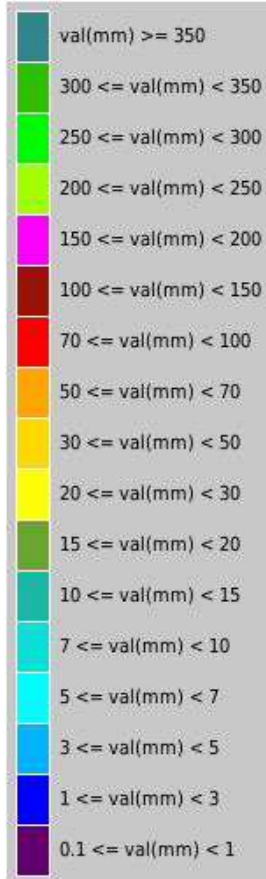
Observations



The temperature increased to 32.5°C at Lleida. The prediction matched the observations.

# Rainfall

# Total rainfall in 24h (Arome 03h UTC 27/07 for 28/07)

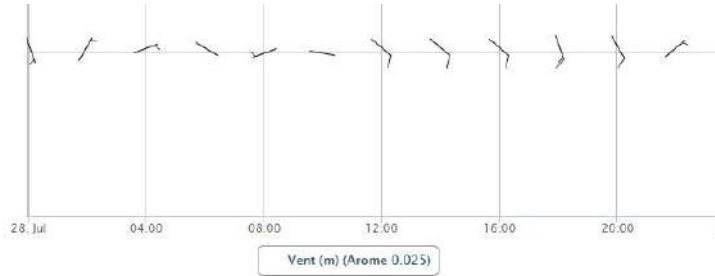




Some rain was observed over the Pyrenees as it was expected by the model.

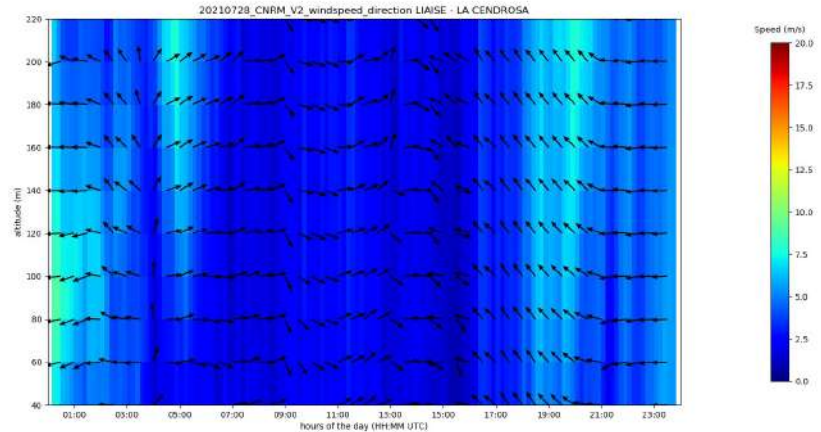
Wind

# Wind at 10 m Arome Run 03 UTC 27/07 for 28/07 and Obs



## Wind at 10 m Arome Run 03 UTC

Observations - La Cendrosa -  
Wind profiler Lidar Windcube

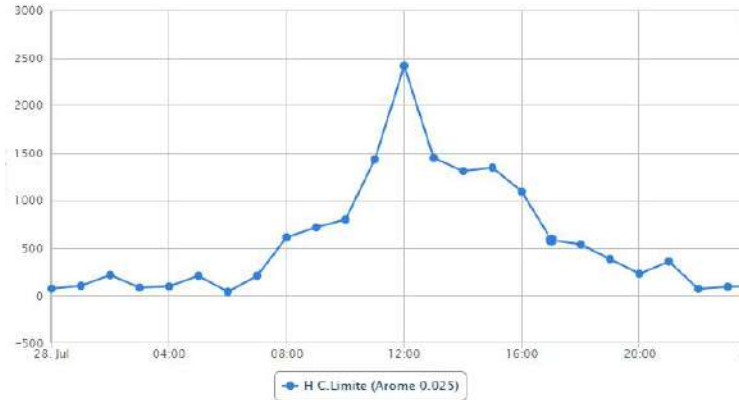


The sea breeze arrived later than expected. The sea breeze was expected to arrive at 12 UTC according to the model but it arrived late in the afternoon at 17 UTC.

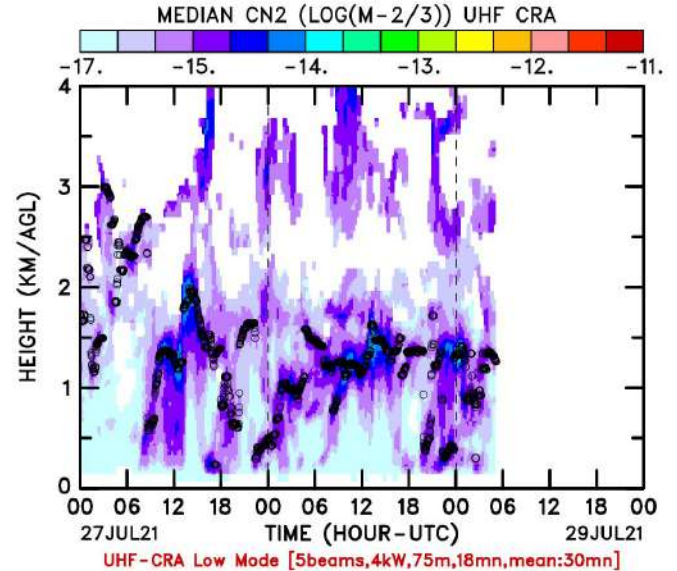


# Planetary Boundary Layer

# Atmospheric boundary layer thickness (Arome run 3 UTC) in Mollerussa and Obs



Atmospheric boundary layer thickness (Arome run 3 UTC 27/07 for 28/07) in Mollerussa



Observations - Els plan  
ReflectivityZI

The model overestimated the height of the planetary boundary layer.