Use of Nowcasting tools , developed in SAF for the diagnosis of fogs in the South Plateau of the Iberian Peninsula.

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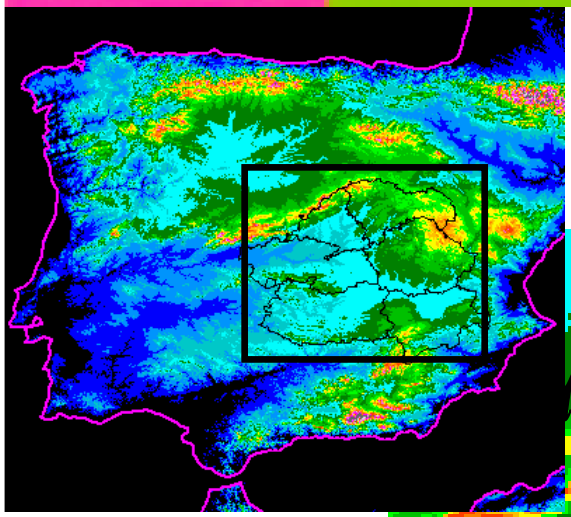
Objective:

To obtain a vision from the SAFNWP products, especially PWBL, of the mechanisms for formation of fog in this region.

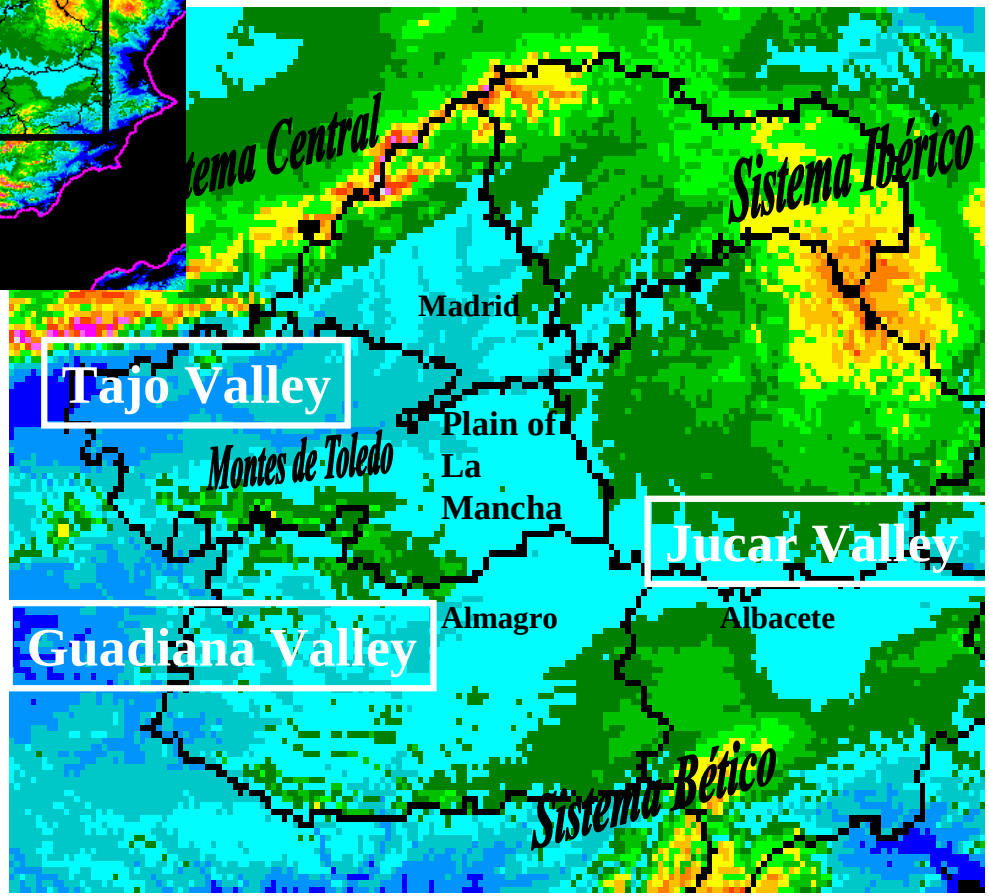
Method:

Daily analyses and diagnoses for the operative regional nowcasting.

Topographic characteristics in the area of study.



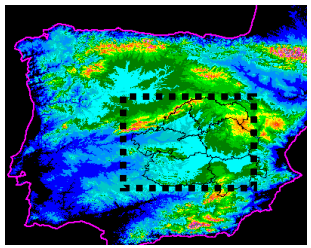
Southern plateau in the Iberian Peninsula



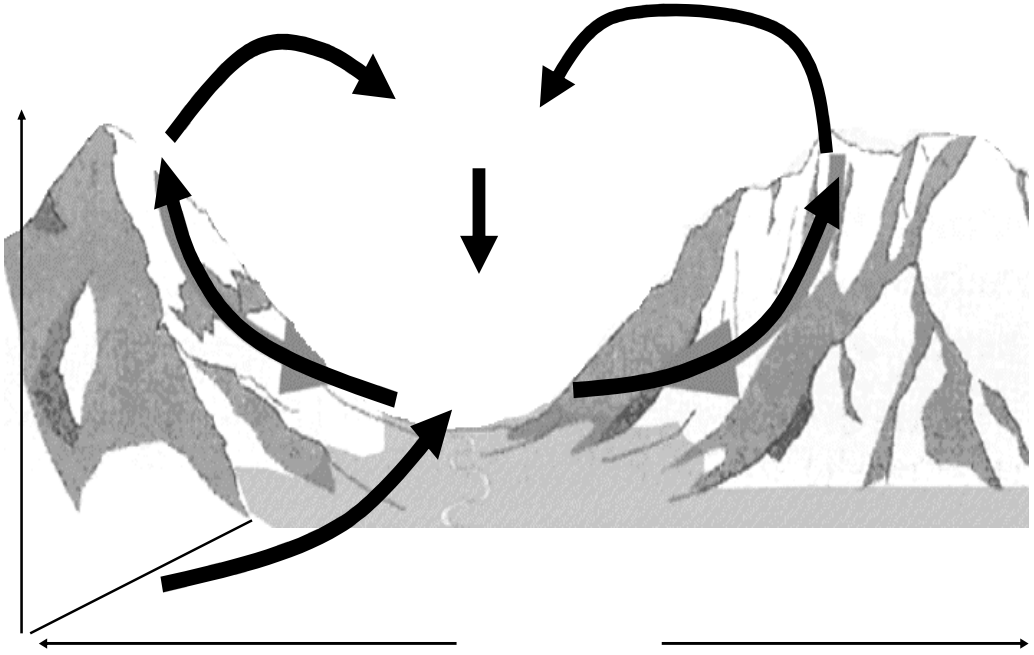
N

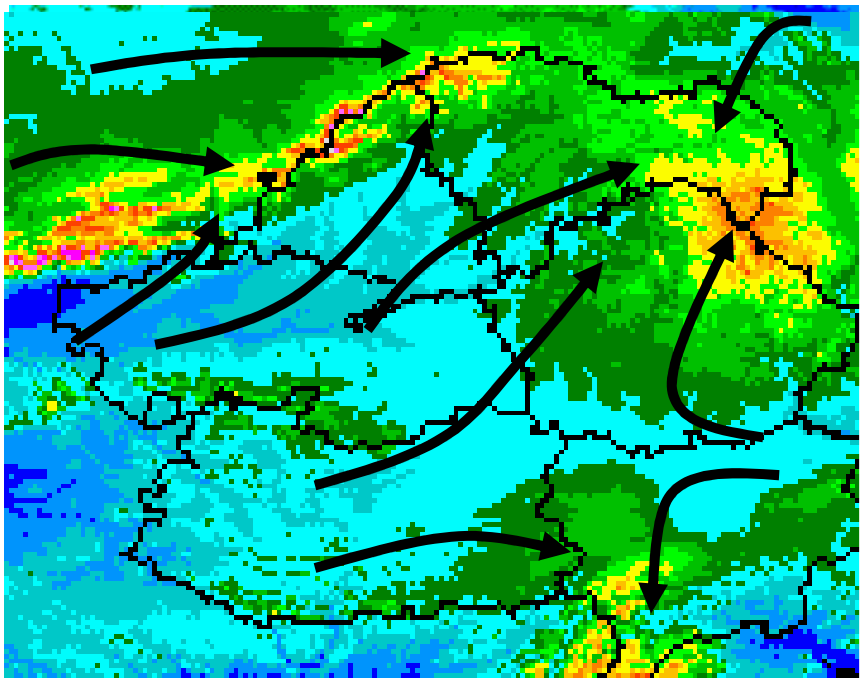
The Region is opened to the Atlantic Ocean (to the west) all surrounded by mountains like an amphitheatre. Two river basins pass from east to west separated by the Mounts of Toledo, the basin of the Tajo river and that of the Guadiana river. Eastward the Jucar river spills to the Mediterranean. In the map the principal geographical accidents and some airports can be distinguished.

Breezes of mountains: Anabatic flow



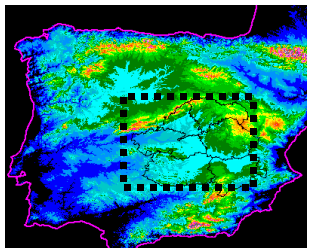
The anabatic is the meso-ß vision of the Thermal Peninsular Low. (Orlanski classification)



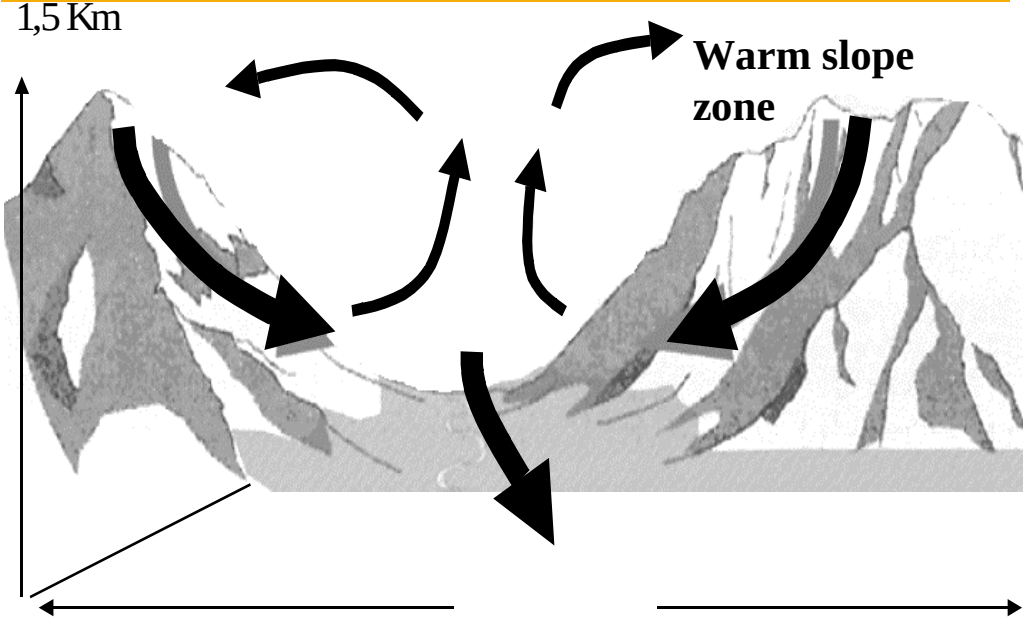


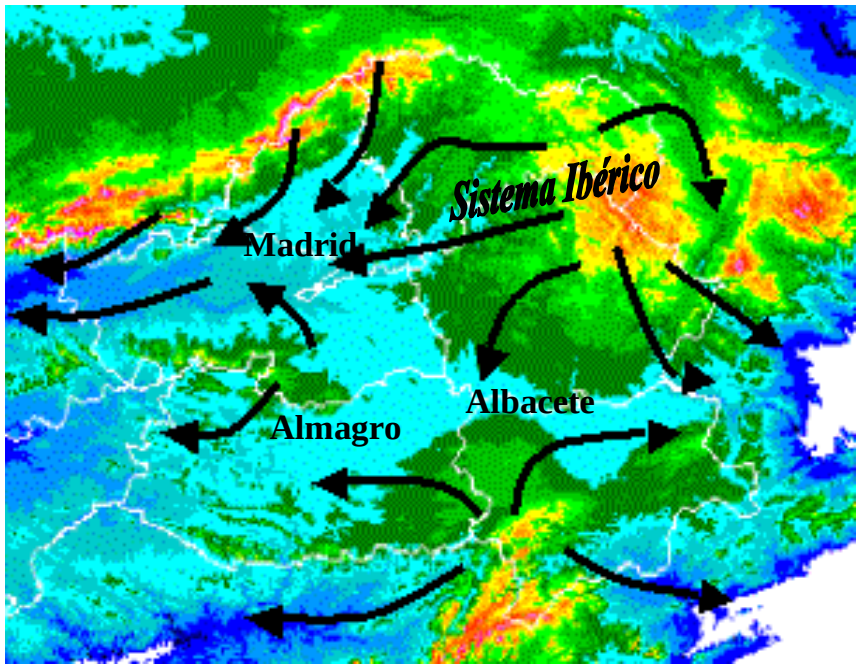
In clear days, a moderate flow (~10 Kts) from the South- West invades the valleys, go up to the mountains.
At the botton of the valley there is a divergence of mass that originates a descendent movement.
In the top of the mountains there is a convergence.

Breezes of mountains: Katabatic flow



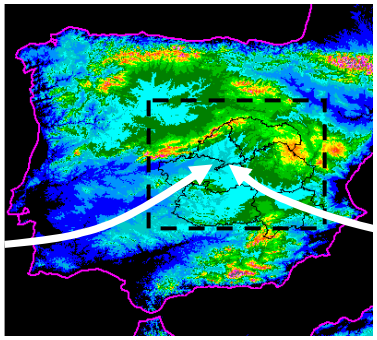
The katabatic is the meso-ß vision of the Autonomous Peninsular Anticyclone. (Orlanski classification)

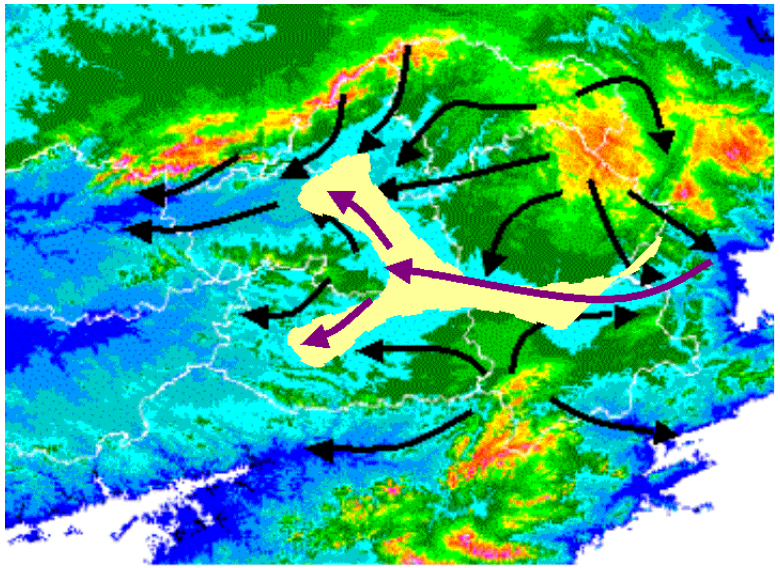




In clear nights, a weak flow (< 5 Kts) from the East invades the valleys, comming from the mountains. At the botton of the valley there is convergence of mass that originates ascent motion. At the top of the mountains there is a returned descendent warm flow.

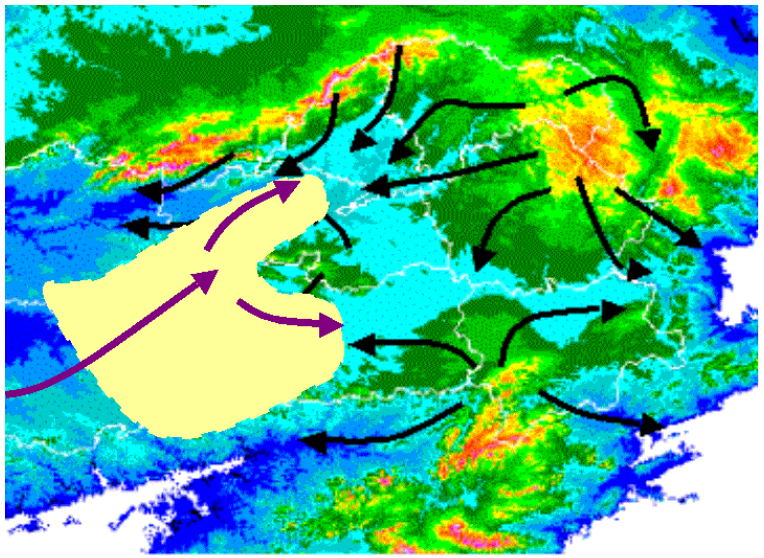
Conceptual model of fog formation in the region



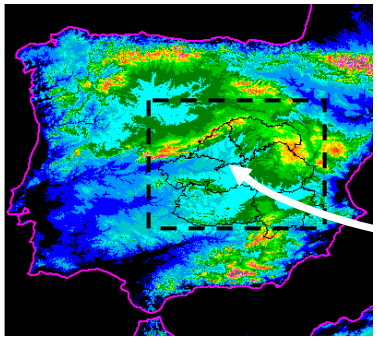


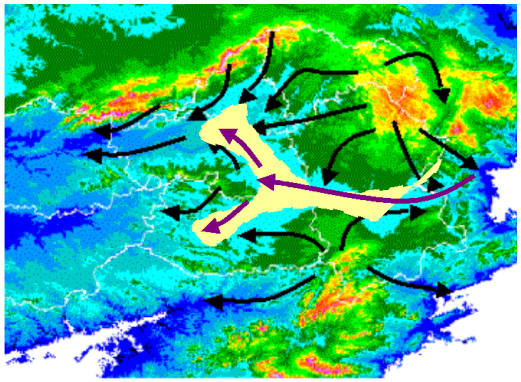
Although fogs of retention in the mountain paths and the generalized fogs (when the warm fronts are passing by) are also possible , the most common fogs obey the scheme in which two mesoscale mechanisms take part: The nights with clear skies and ***katabatics winds*** overflown by ***warm advections*** from the Atlantic or the Mediterranean.

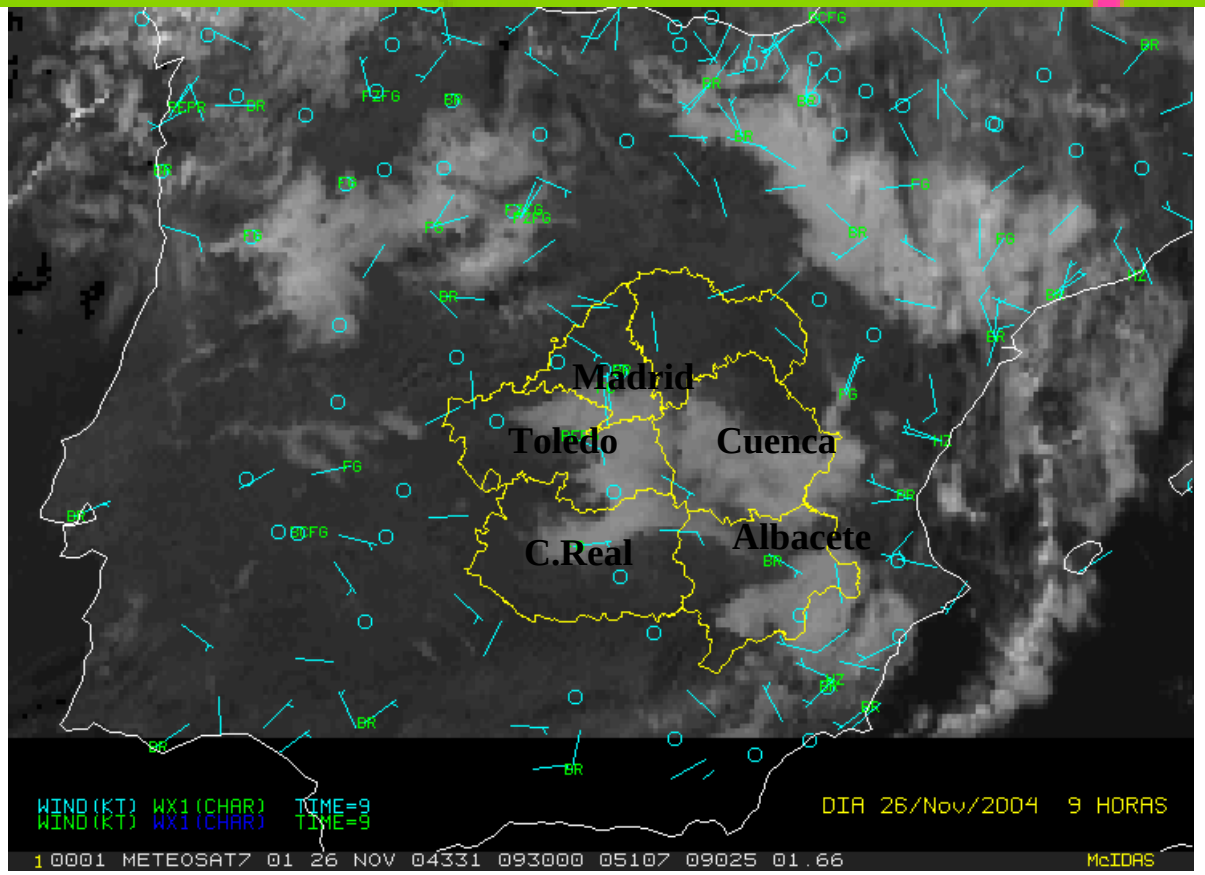
The Mounts of Toledo emerge from the fog molding the banks with the characteristic forms of the Moon in waxing or wanning .



Fogs whit the mediterranean advection

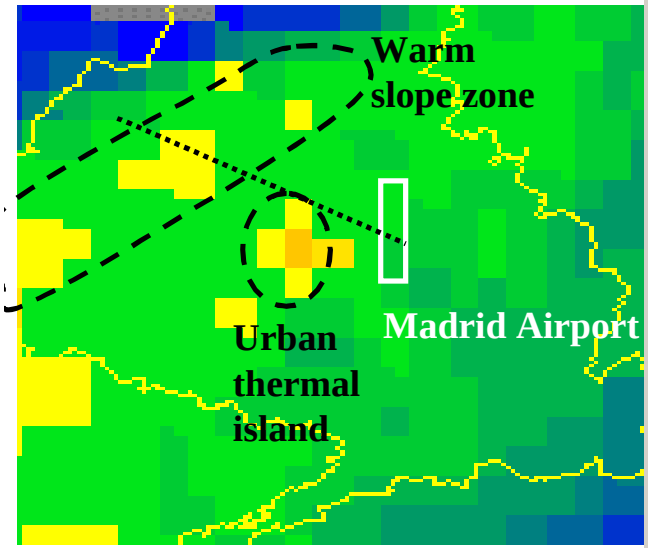


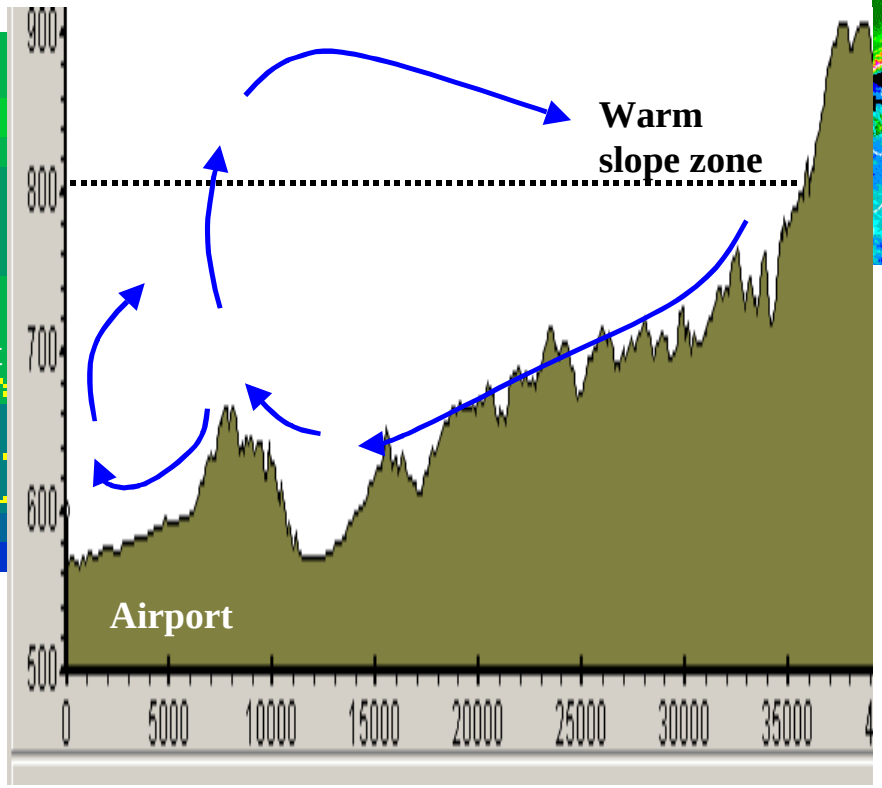


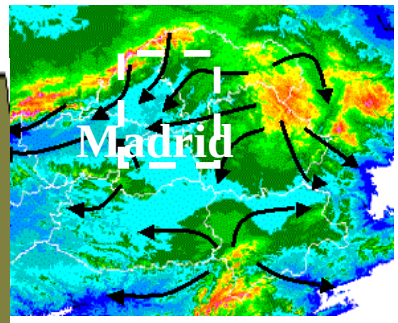


These banks can affect the principal cities in the region, even Madrid.

studies of the katabatic flow before the MSG appearance.





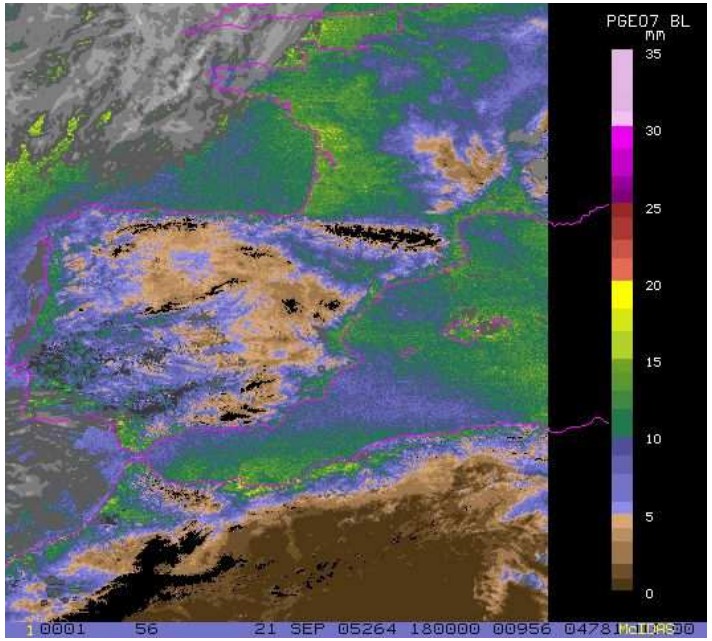


The brightness temperature average at 3:00 during clear nights in January computed from METEOSAT I data (channel 4).

The value of the thermal katabatic horizontal advections and the flow height can be deduced from conventional wind climatologies and from images of satellite climatologies in clear nights.

The product "precipitable water in the boundary layer"

In principle, any product called "precipitable water in the boundary layer in the clear days" looks interesting for any forecaster that faces the prediction of fogs

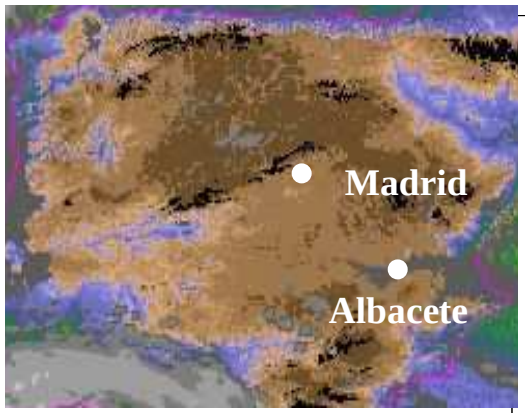


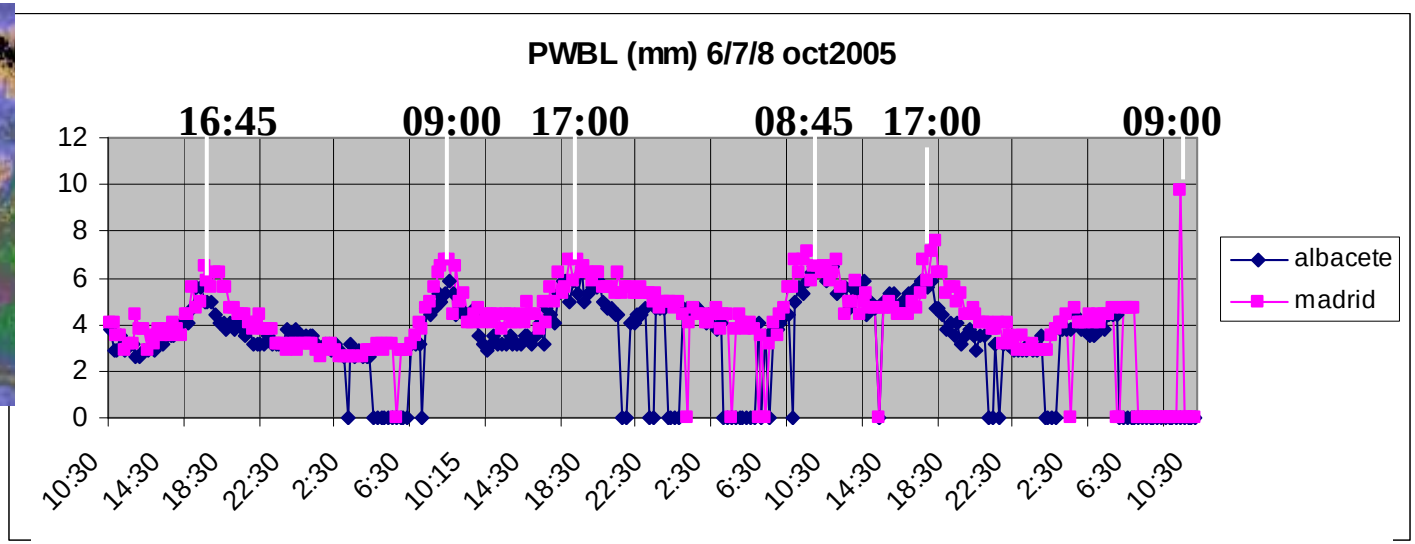
The central aim of the LPW is therefore to provide information on the water vapor contained in a vertical column of unit cross-section area in three layers in the troposphere:

- Boundary Layer (BL): 1013hPa-840 hPa
- Middle Layer (ML): 840hPa-437hPa
- High Layer (HL): <437hPa

R13.4 μm	R12.0 μm	R10.8μm	R9.7μm	R8.7μm	R7.3μm	R6.2μm
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	Mandatory

Behavior of the PWBL in the clear days.

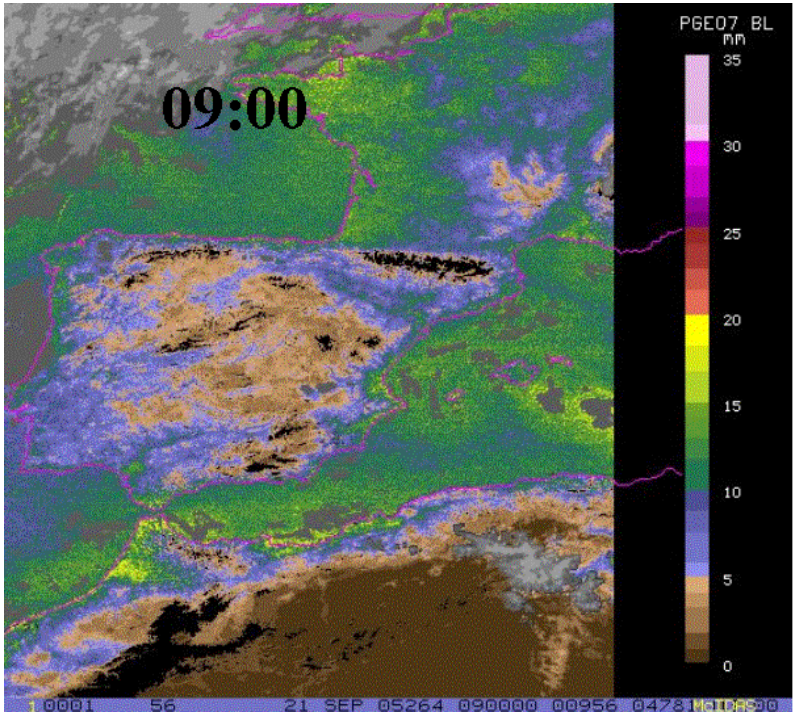




Evolution of the PWBL in Albacete and Madrid for 3 clear days.

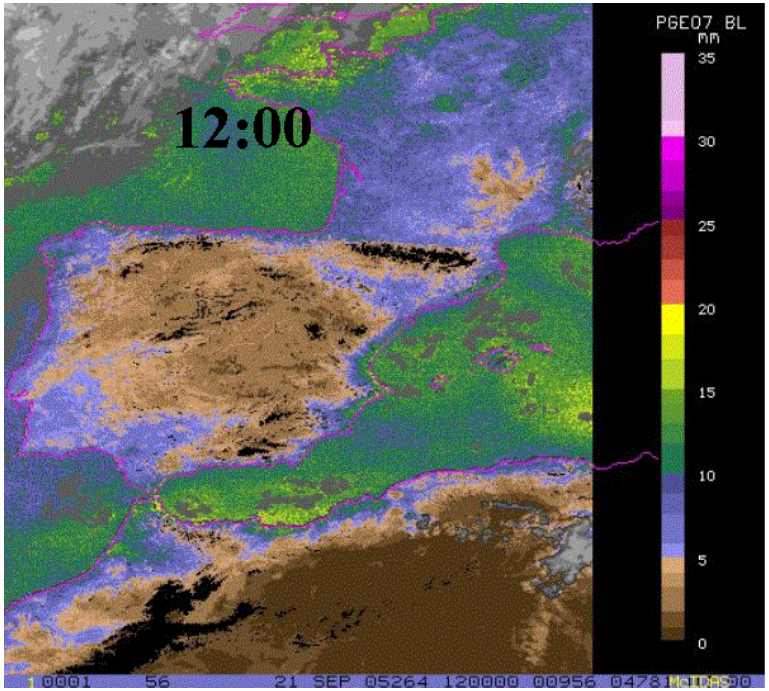
A daily oscillation is observed. There are a maxima around 5 p.m. and 9 a.m. and minima around noon and in the dawn.

Behavior of the PWBL in the clear days.

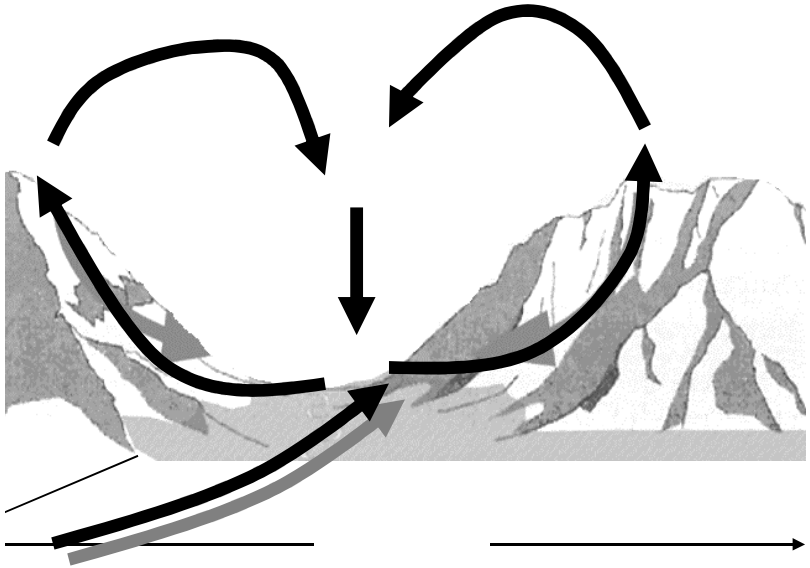


During daytime, there can be evaporation (really not too much in this season and in this region). The turbulent mixing distributes the water vapour in all the atmosphere. It results in a decrease of low-level precipitable water by noon

Behavior of the PWBL in the clear days.

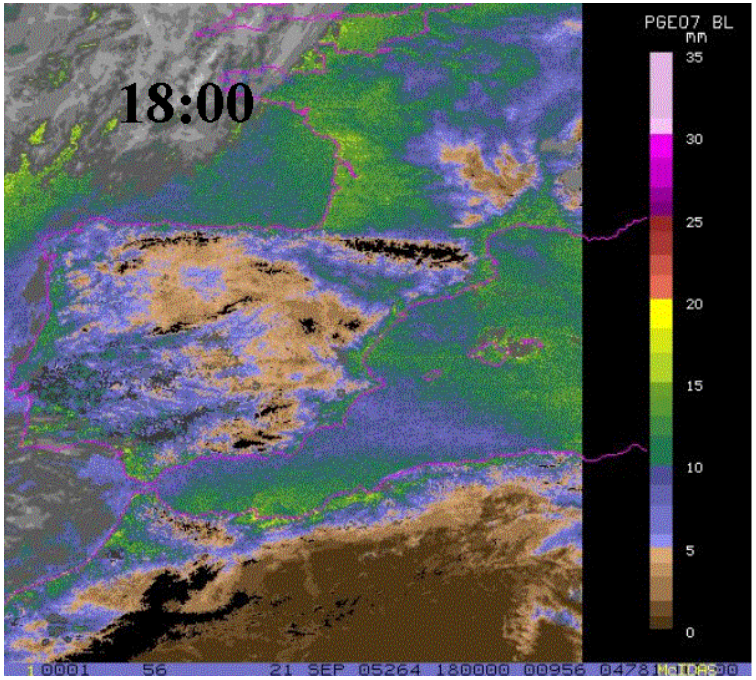


Conceptual model of the anabatic cell

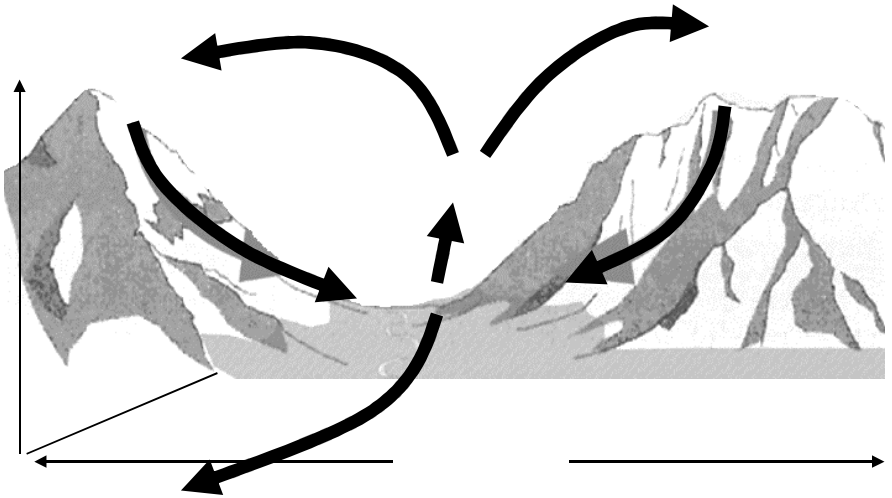


At noon, when the anabatic flow develops, there is a downward motion over the valleys that retains the humidity at low levels. It results in an increase of low-level water vapour during the evening, until sunset.

Behavior of the PWBL in the clear days.



Conceptual model of katabatic cell



When the anabatic flow stops, the ground inversion begins, and immediately the katabatic flow. A rapid desiccation is observed. The katabatic advects a dry air from the mountains. During the night, the katabatic flow continues but it does not dry the air any more. Only the precipitation or exchanges with the soil can change slowly the precipitable water in the affected levels.

Detección of favorable meteorological situations to the formation of fog

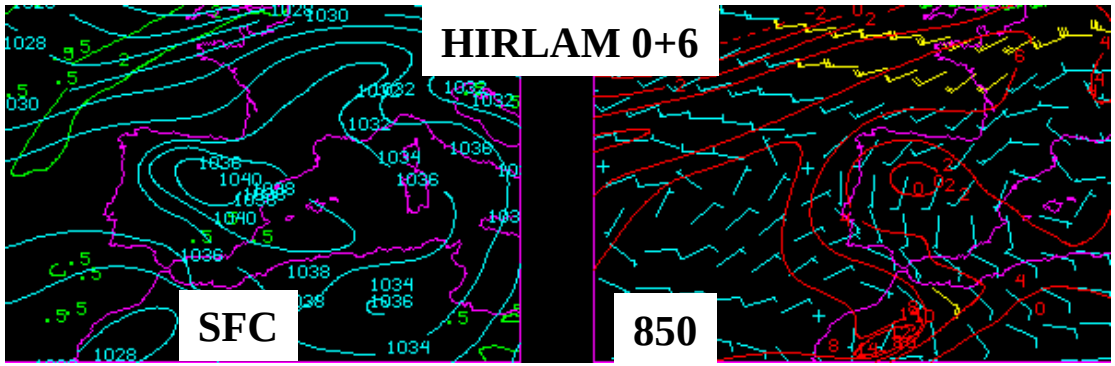
The clear nights with ***katabatics winds*** overflown by ***warm advections***

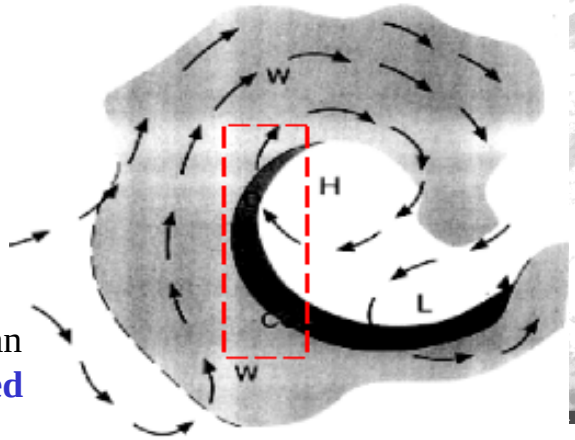
NWP

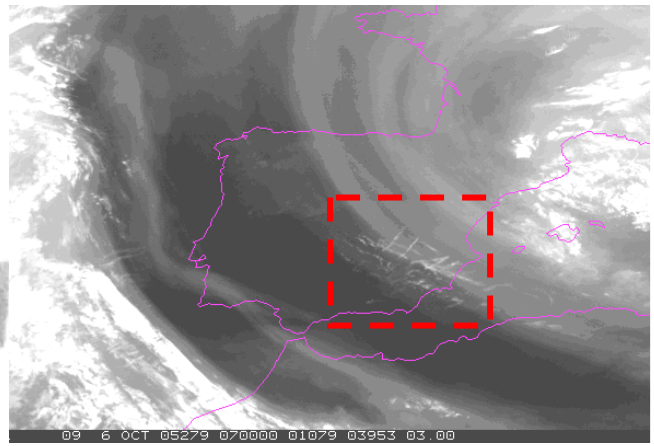
In the surface Autonomous Peninsular Anticyclon overflown by one warm dorsal from the South

Teledetection

border of **divergent** and **subsident** air masses.

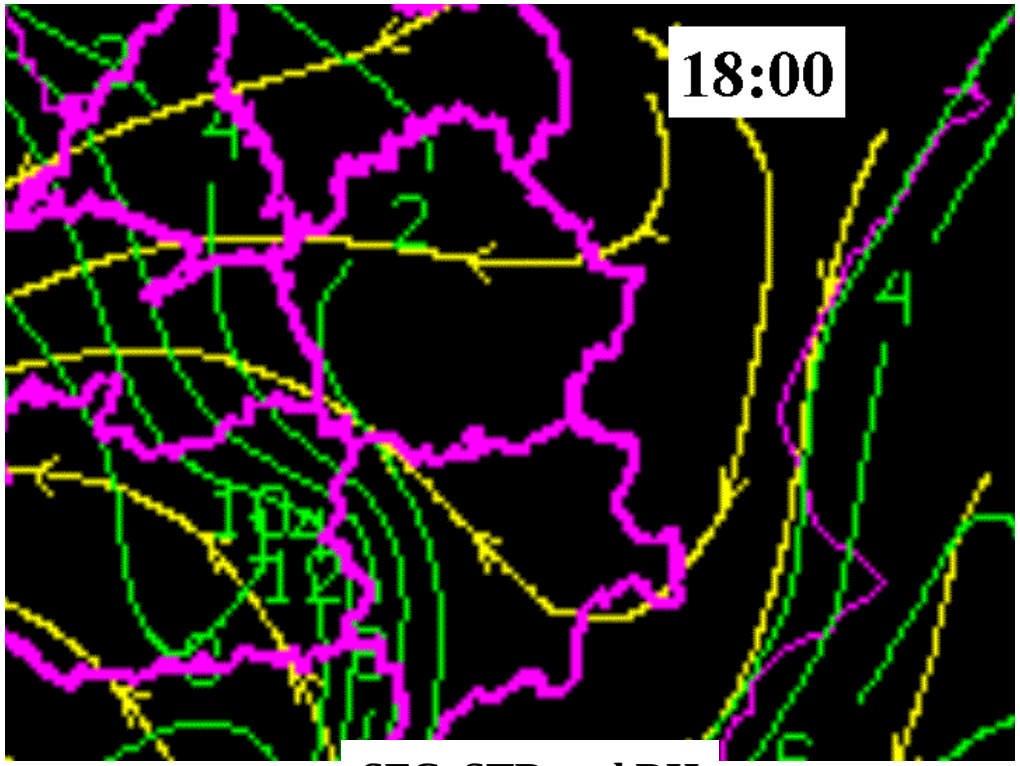






The analysis of the water vapour images can help to locate these zones. **It is recomended to use conceptual models of image**.

Fogs whit the mediterranean advection

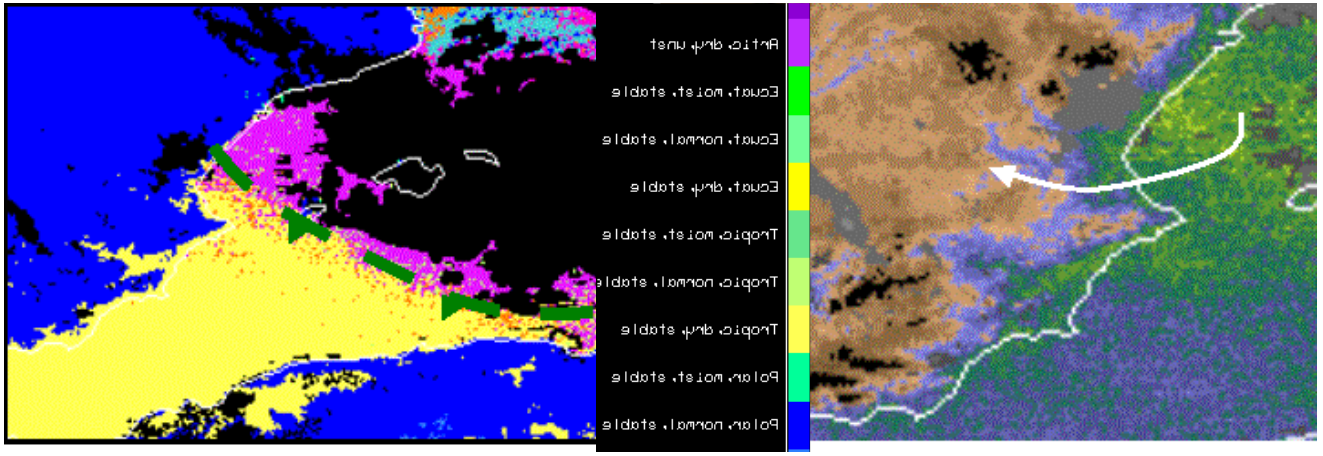


SFC, STR and RH

All these mechanisms lead to same consequence: **increased thermal and humidity contrast** in a zone in which the vertical ascending movements are kept out.

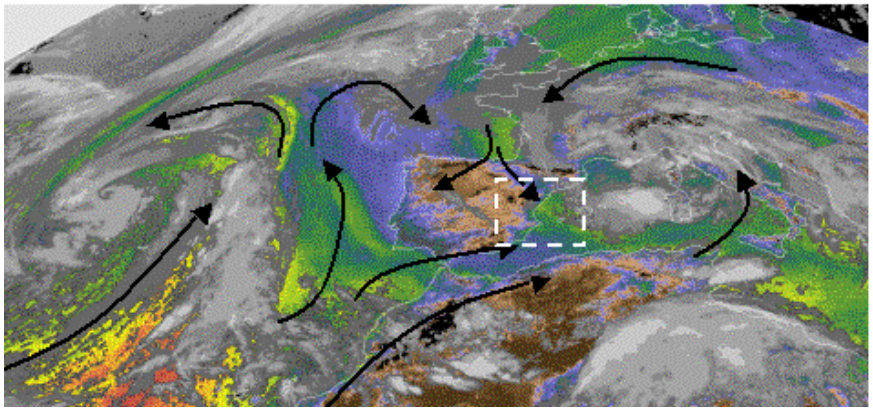
Use of Nowcasting tools , developed in SAF for the diagnosis of fogs in the South Plateau of the Iberian Peninsula.

October 6, 2005



Clear skies with development of katabatic flows and a advection of a humid mass from the East.

18:00

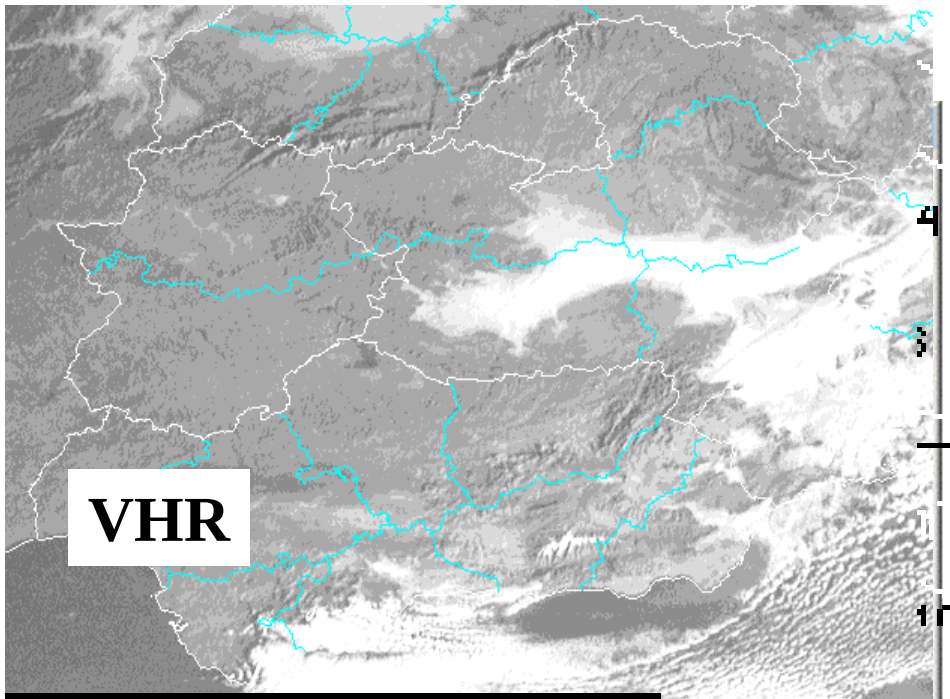


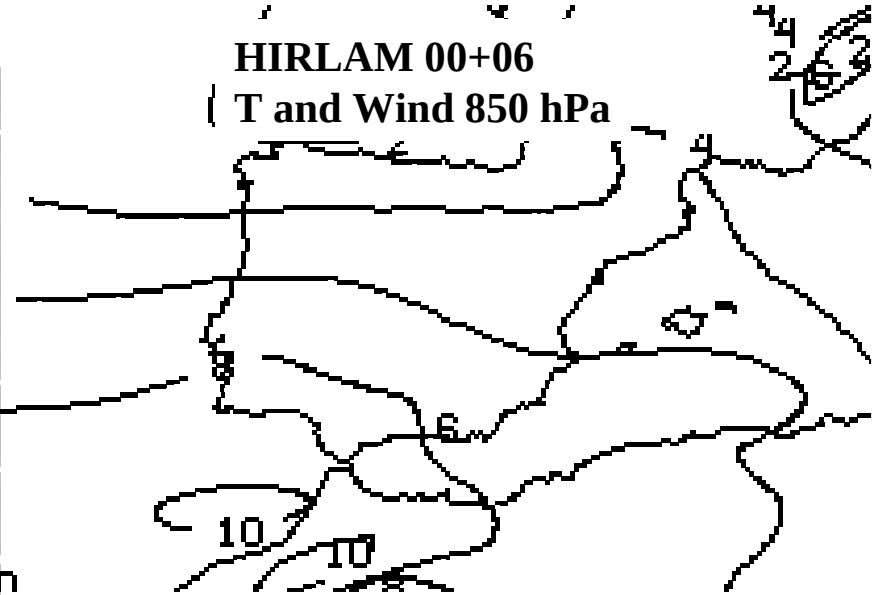
The area of study is in the border of two subsidents masses.

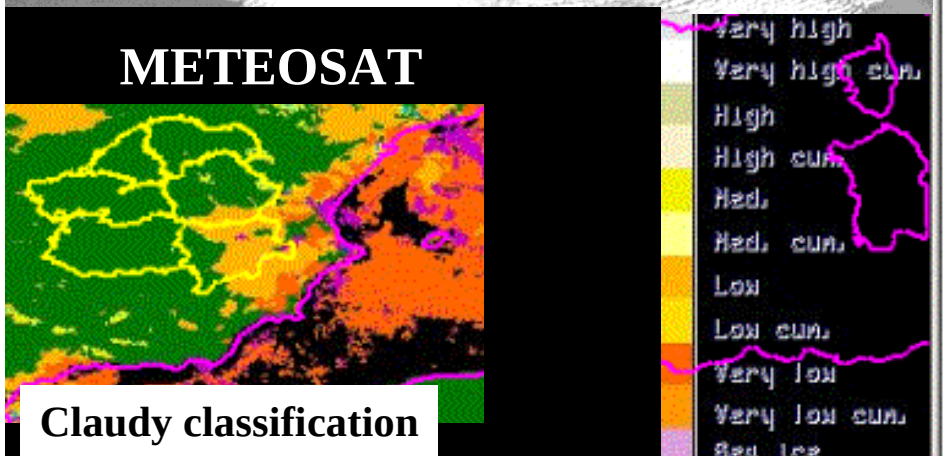
Synoptic evolution with a diagnosis of the relative flows.

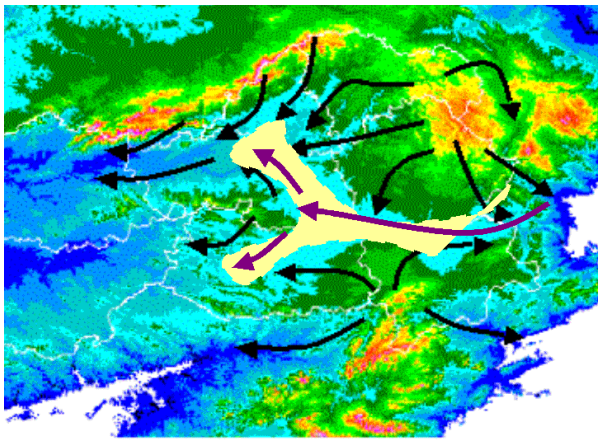
Use of Nowcasting tools , developed in SAF for the diagnosis of fogs in the South Plateau of the Iberian Peninsula.

January 17,2005





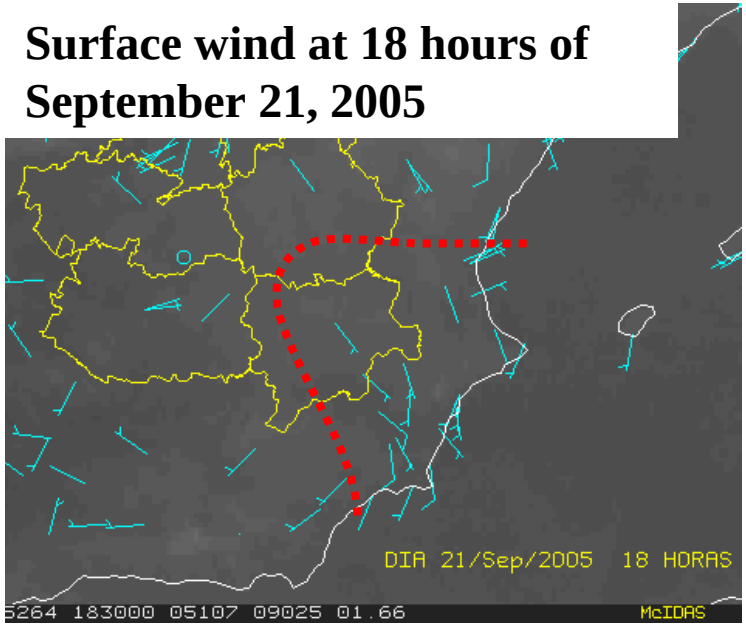




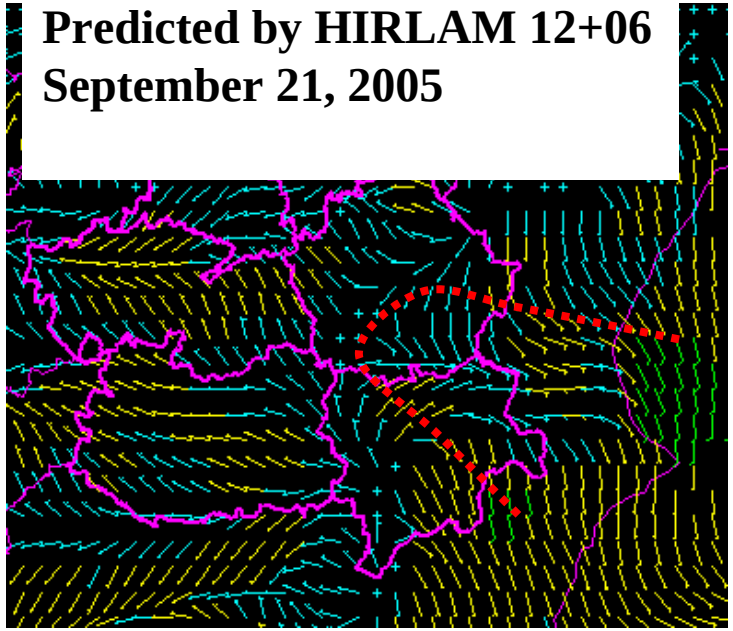
Use of Nowcasting tools , developed in SAF for the diagnosis of fogs in the South Plateau of the Iberian Peninsula.

September 22, 2005.

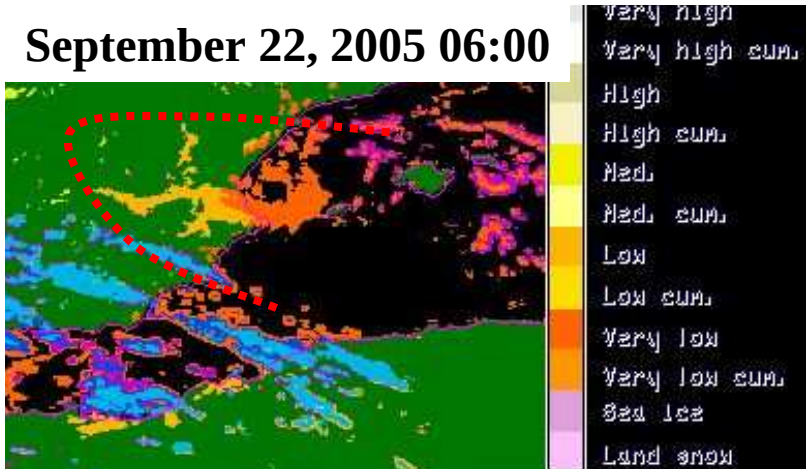
Surface wind at 18 hours of September 21, 2005



Predicted by HIRLAM 12+06 September 21, 2005



September 22, 2005 06:00

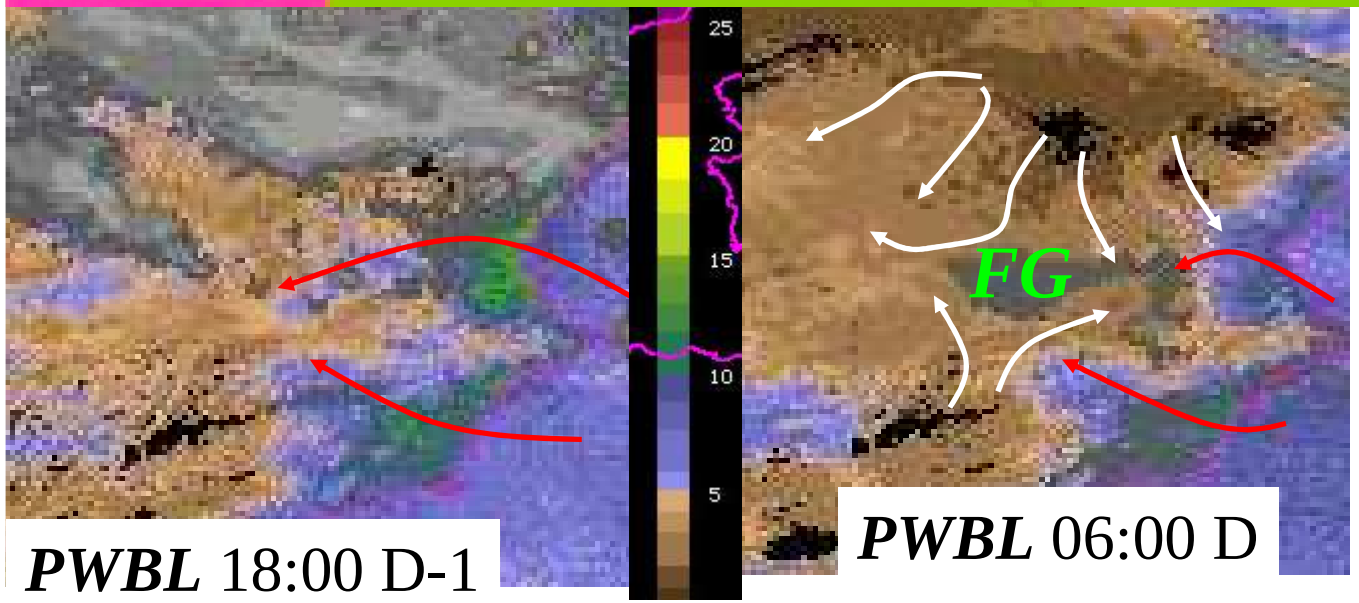


It is common that the winds in the previous evening are of a maritime origin, and so one rule of prediction would be the following:

" The bank of fog in the morning will go up to where the maritime wind penetrates in the region the previous evening"

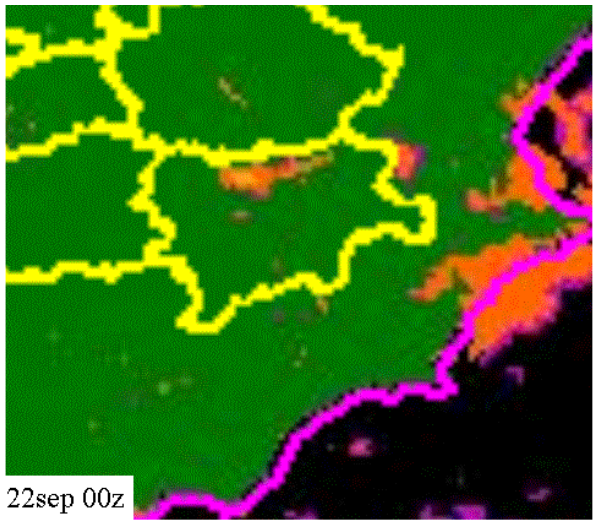
Use of Nowcasting tools , developed in SAF for the diagnosis of fogs in the South Plateau of the Iberian Peninsula.

September 22, 2004.



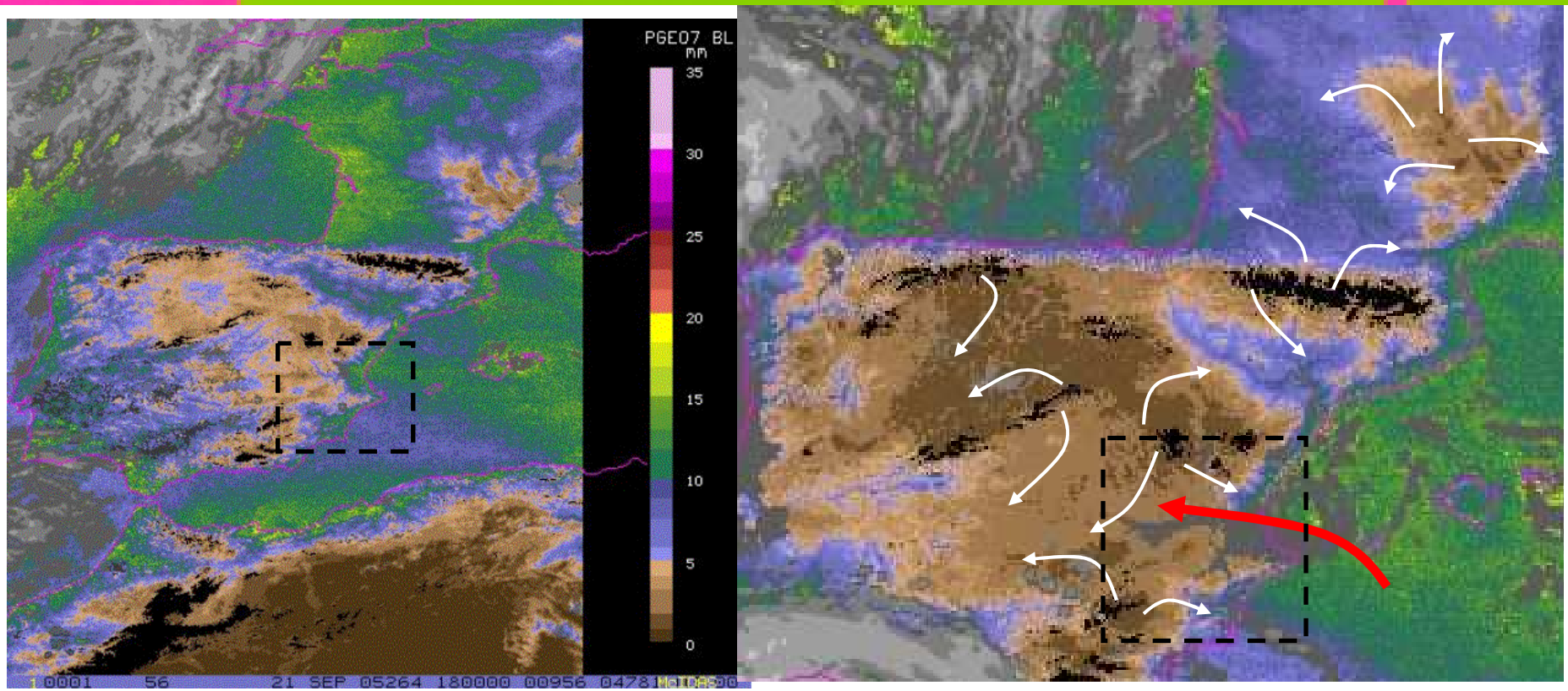
PWBL 18:00 D-1

PWBL 06:00 D



" The bank of fog in the morning will go up to where the maritime wind penetrated in the region the previous evening"

September 22, 2005.



PWBL evolution (every 3 hours from the 18)

The white arrows indicate the katabatic, and red one the humid advection. In the zone indicated with a square, the humidity continues entering during the night by the Jucar Valleys . The humidity gradient increases in that zone.

Principal problems and future projects

The daily oscillation in stability conditions might be caused by some thermal channel. It would be desirable to analyze the contributions from every channel to this oscillation.

The temporary resolution of the radiosondage information (12 a.m. and 00 a.m.) is not appropiate to detect the phenomenon. At these hours we might be in two similar minimum values, giving the impression that there is no daily variation.

A climatology of PWBL values would help us to understand the phenomenum and to confirm the proposed process. At the moment, it is only a subjective vision. These climatologies should be hourly. The moment of maximum or minimun can change throughout the year.

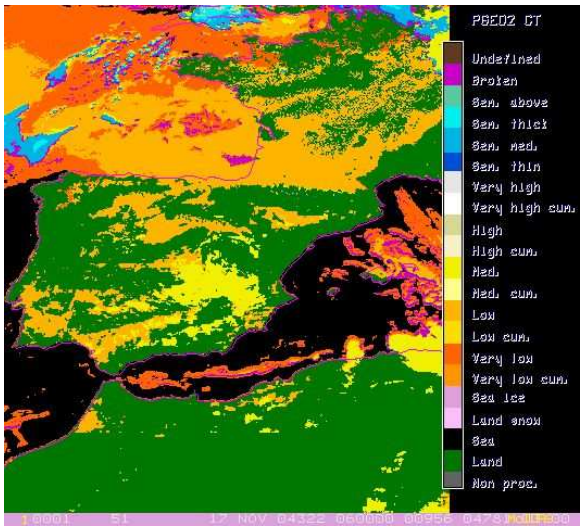
Principal problems and future projects

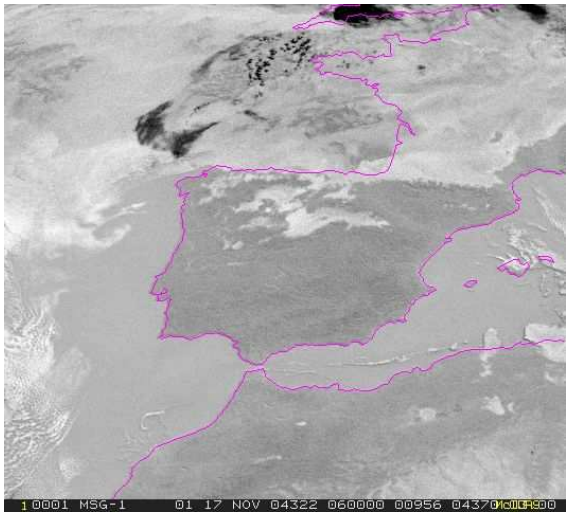
The conceptual model should be applied independently to each valley, due to the influence of the different highs of the valleys.

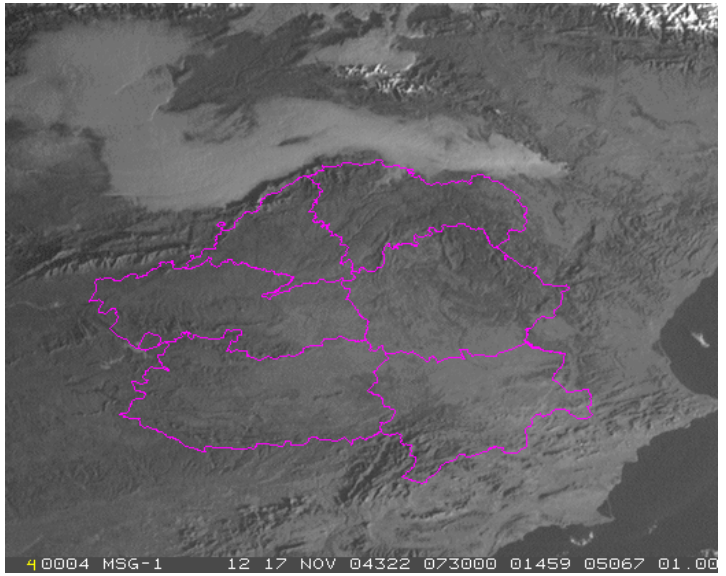
We could to do that by taking the PWBL climatology from an average clear days as a reference. The difference between the present day and the average clear day can be calculated in order to highlight the phenomenum.

Some trails have been done with data from a whole month. The results look promising.

Principal problems and future projects



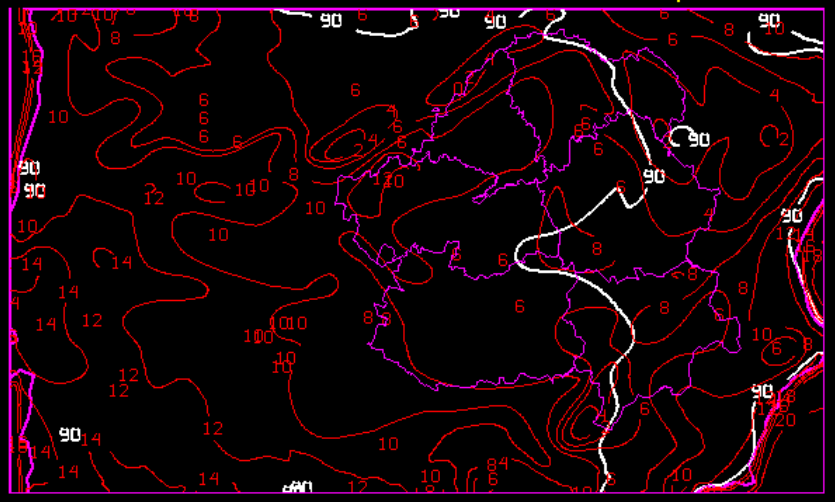




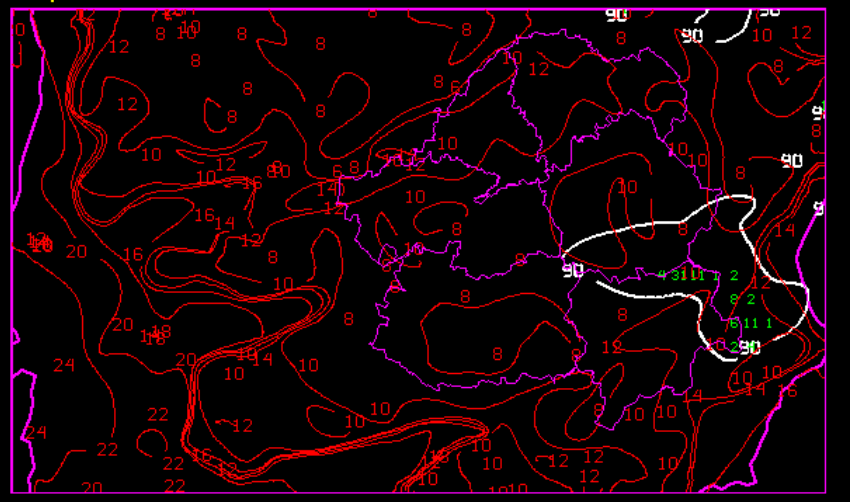
The problem whith the Cloudy Mask.

There is a case in which the **Cloudy Mask** gives sign of clouds that does not exist.

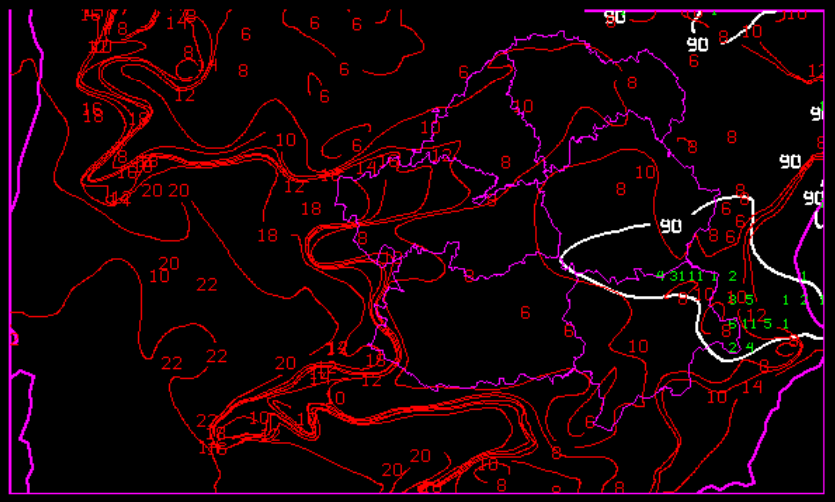
Modelo Hirlam res 0.05 Hora pasada 12 Previsto para H+18



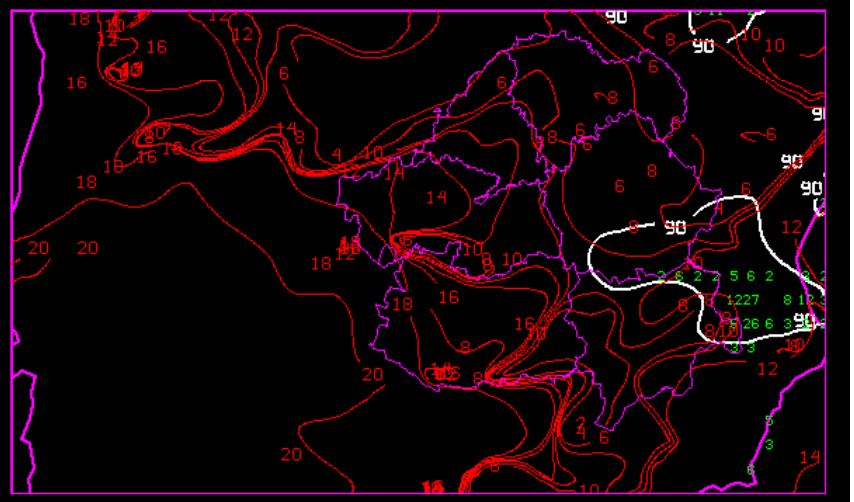
T (C) SFC M TIME 12Z DAY 2005278 VALID 2005279/06Z
RH (%) SFC M TIME 12Z DAY 2005278 VALID 2005279/06Z



T (C) 975 MB TIME 12Z DAY 2005278 VALID 2005279/06Z
RH (%) 975 MB TIME 12Z DAY 2005278 VALID 2005279/06Z

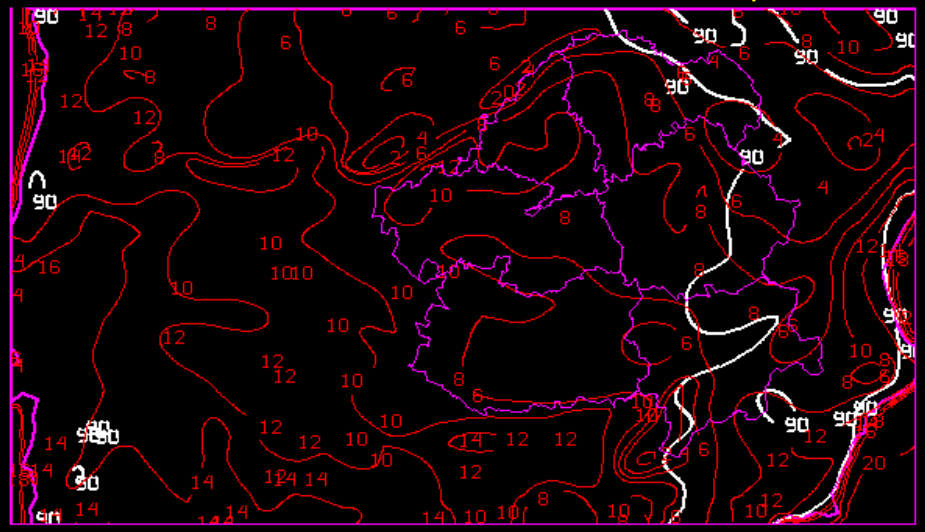


T (C) 950 MB TIME 12Z DAY 2005278 VALID 2005279/06Z
RH (%) 950 MB TIME 12Z DAY 2005278 VALID 2005279/06Z

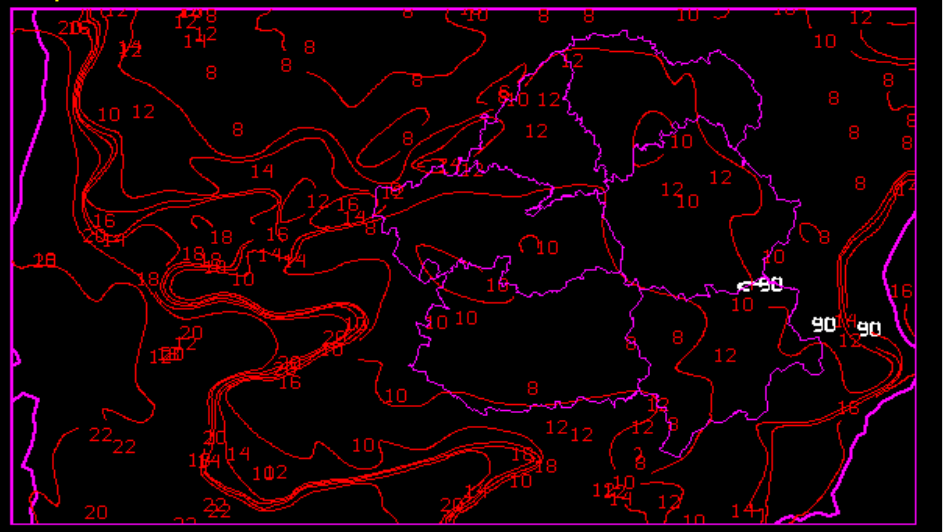


T (C) 925 MB TIME 12Z DAY 2005278 VALID 2005279/06Z
RH (%) 925 MB TIME 12Z DAY 2005278 VALID 2005279/06Z

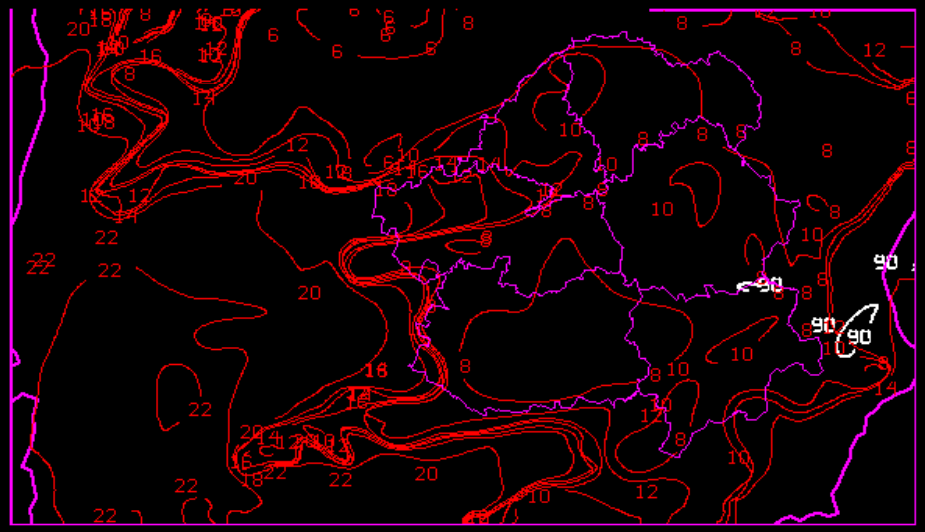
Modelo Hirlam res 0.05 Hora pasada 18 Previsto para H+9



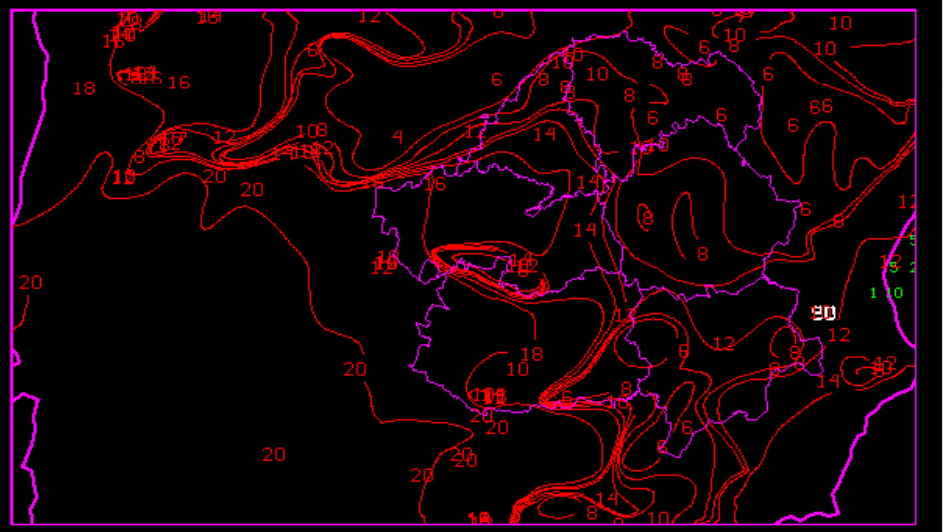
T (C) SFC M TIME 18Z DAY 2005278 VALID 2005279/03Z
RH (%) SFC M TIME 18Z DAY 2005278 VALID 2005279/03Z



T (C) 975 MB TIME 18Z DAY 2005278 VALID 2005279/03Z
RH (%) 975 MB TIME 18Z DAY 2005278 VALID 2005279/03Z



T (C) 950 MB TIME 18Z DAY 2005278 VALID 2005279/03Z
RH (%) 950 MB TIME 18Z DAY 2005278 VALID 2005279/03Z



T (C) 925 MB TIME 18Z DAY 2005278 VALID 2005279/03Z
RH (%) 925 MB TIME 18Z DAY 2005278 VALID 2005279/03Z