The basin and local contributions of the flow over Lannemezan seen by the MesoNH model

Maria A. Jiménez and Joan Cuxart

Universitat de les Illes Balears
Palma de Mallorca, Spain

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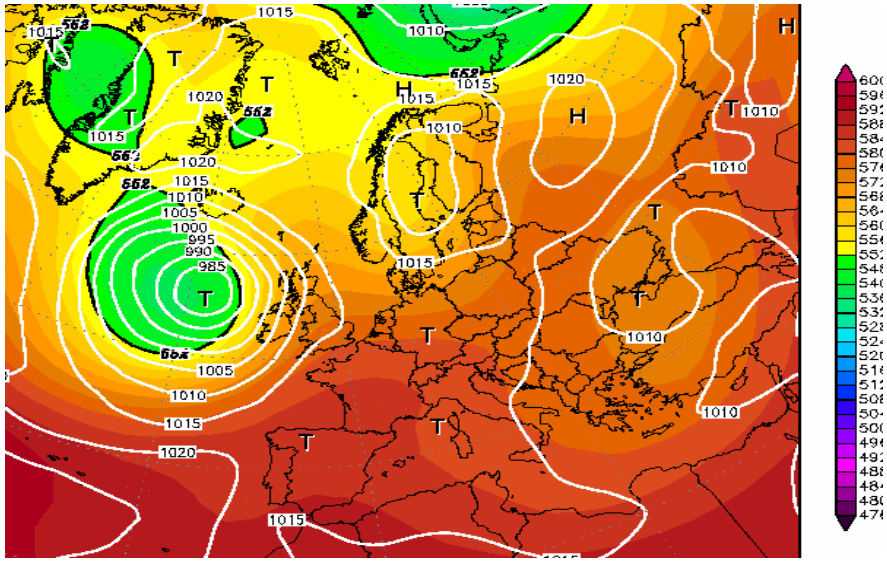
CASE DESCRIPTION

Clear skies and weak synoptical pressure gradient

Starts: 0600 UTC, 30th June 2010

Finishes: 1000 UTC, 1st July 2010

1st July 2010
0000 UTC



- ✓**MesoNH and WRF models**
- ✓**Initial and lateral boundary conditions: ECMWF analyses**
- ✓**Turbulence + Radiation+ Surface schemes**
- ✓**Timestep: 2s** (CFL condition close to the surface)

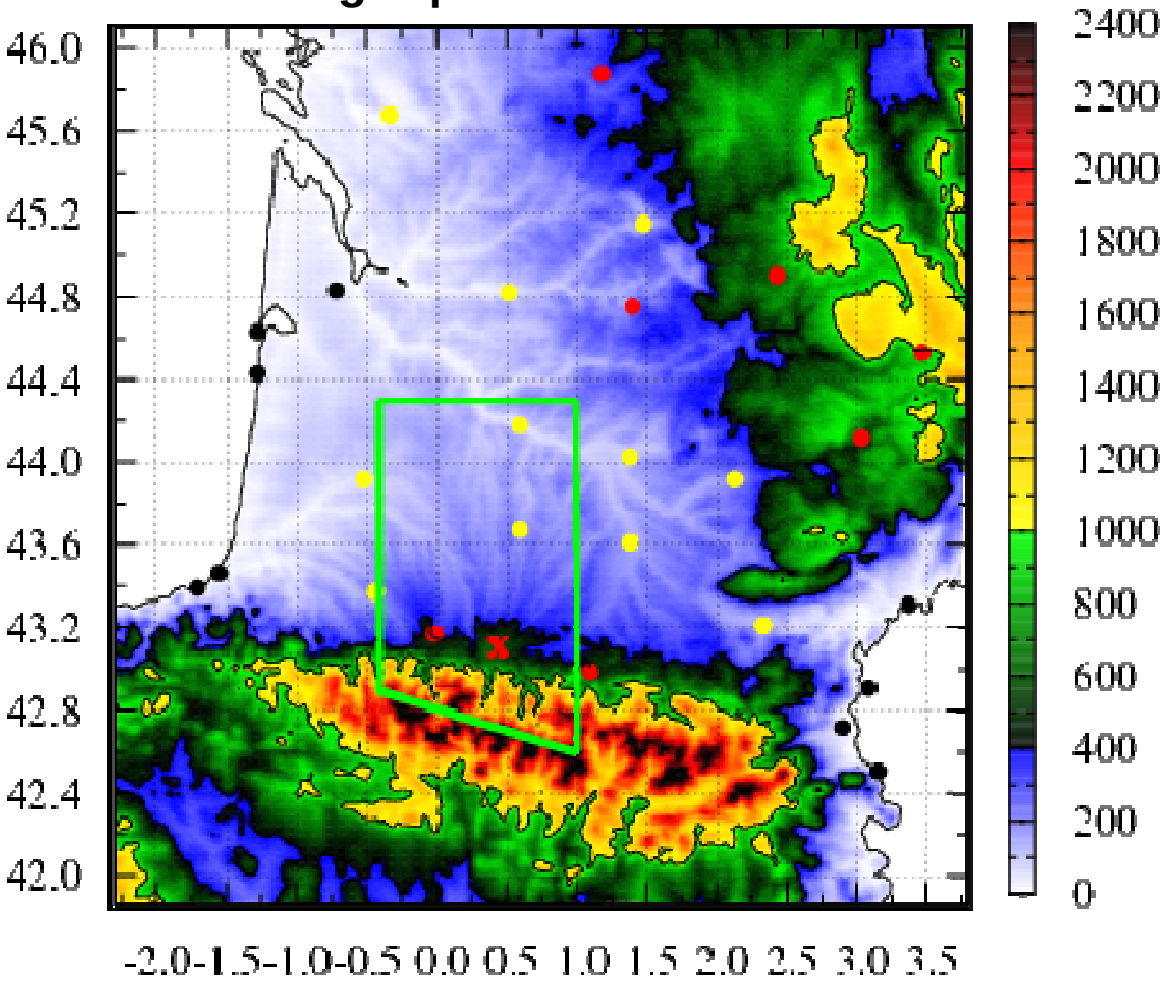
- ✓**Verification**: AWS, observations in Lannemezan, satellite

MODEL SETUP

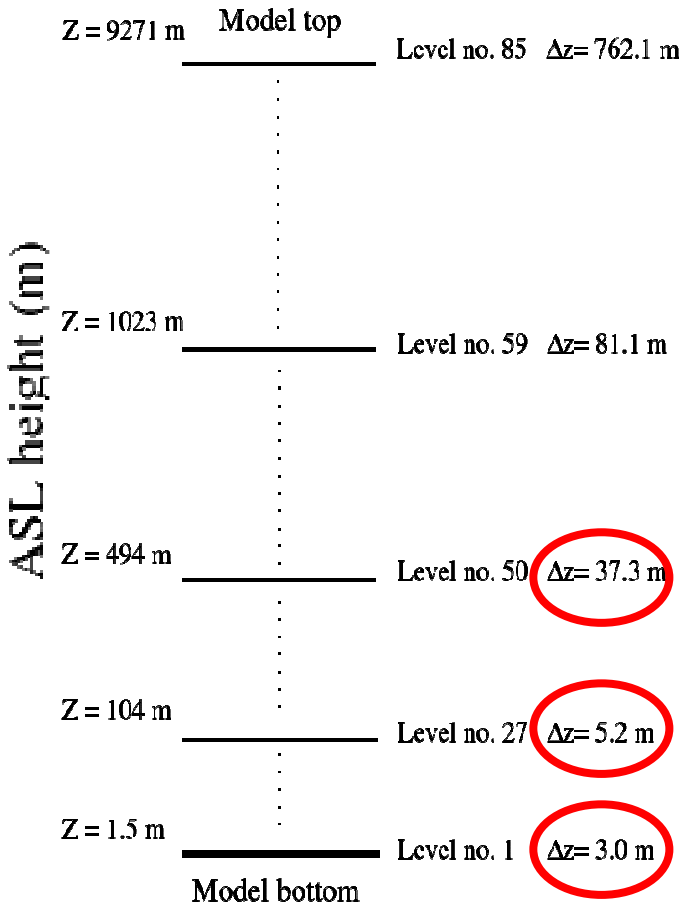
(Jiménez et al., 2012; Jonassen et al., 2012)

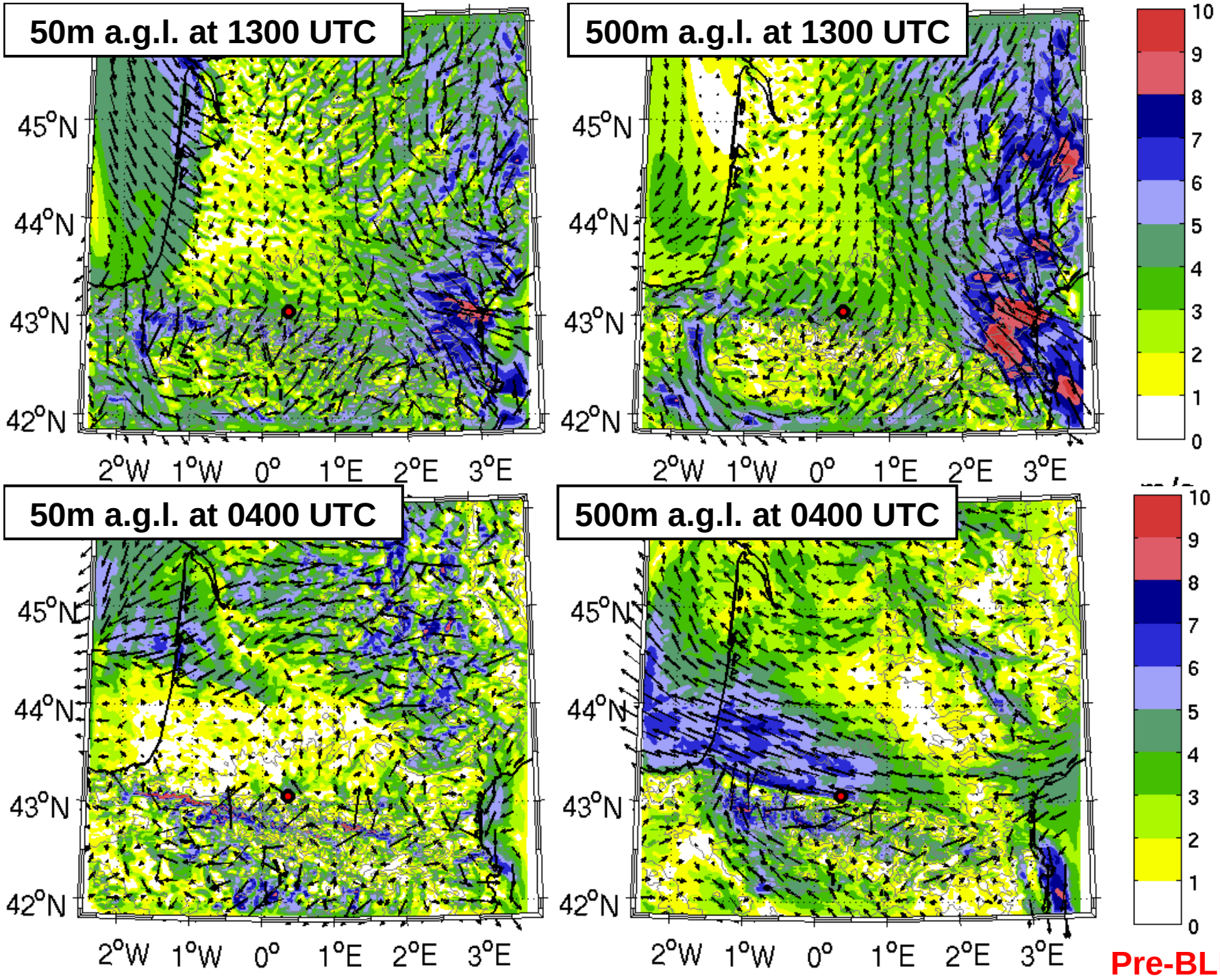
Pre-BLLAST

Horizontal resolution: 2 km x 2 km
250x240 gridpoints



Vertical resolution
85 gridpoints



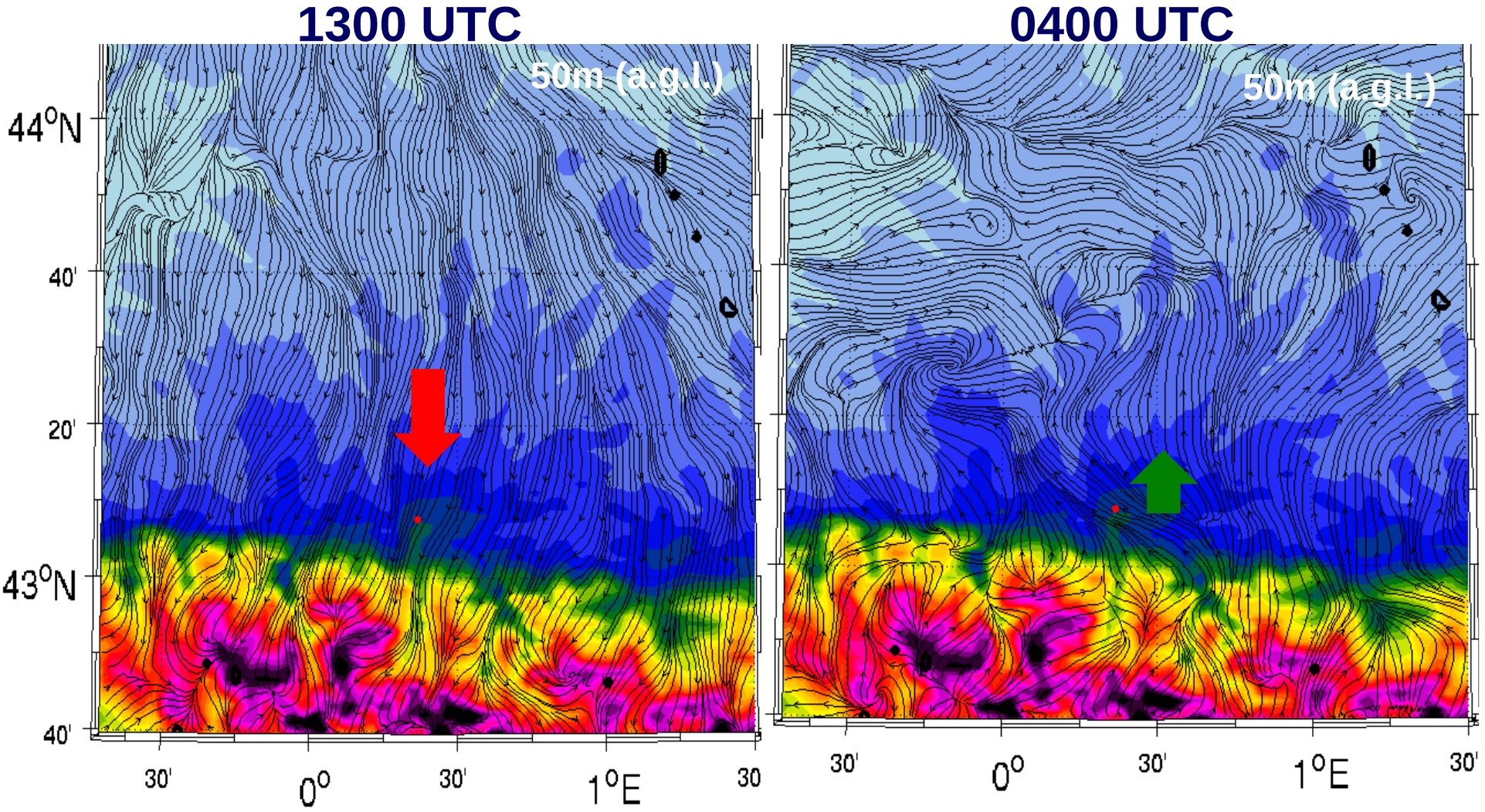

50m a.g.l. at 1300 UTC
500m a.g.l. at 1300 UTC
50m a.g.l. at 0400 UTC
500m a.g.l. at 0400 UTC
45°N
44°N
43°N
42°N
2°W 1°W 0° 1°E 2°E 3°E
10
9
8
7
6
5
4
3
2
1
0
Pre-BLLAST

UPSLOPE/DOWNSLOPE WINDS

Pre-BLLAST

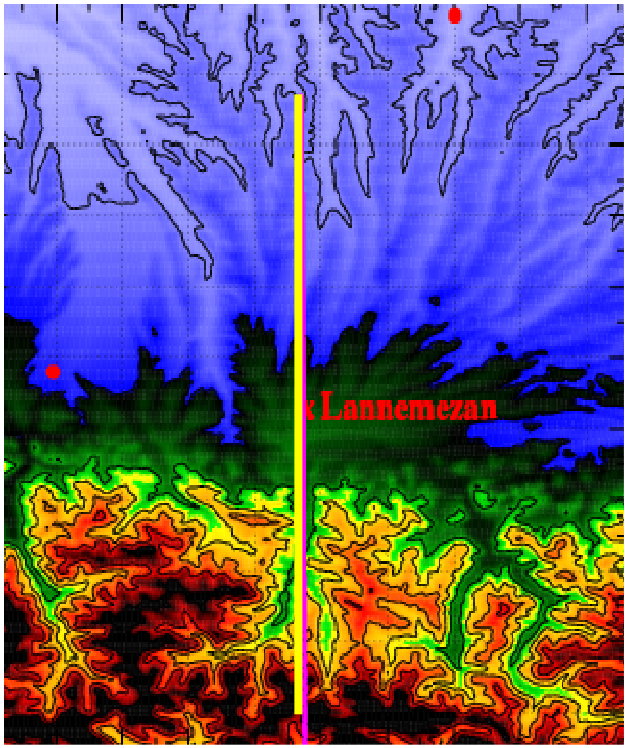
✓**Upslope/downslope flows are generated during day/night, respectively**

✓**The horizontal extension of the downslope flow is largest right before the sunrise and reaches about 120 km.**



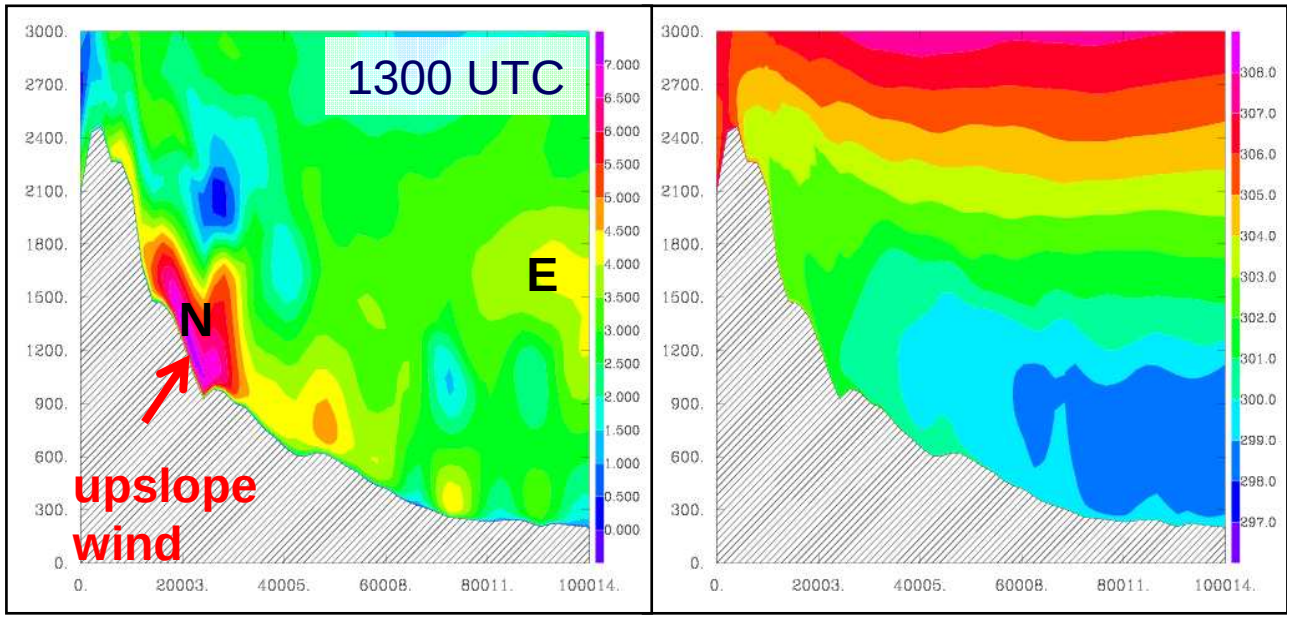
UPSLOPE/DOWNSLOPE WINDS

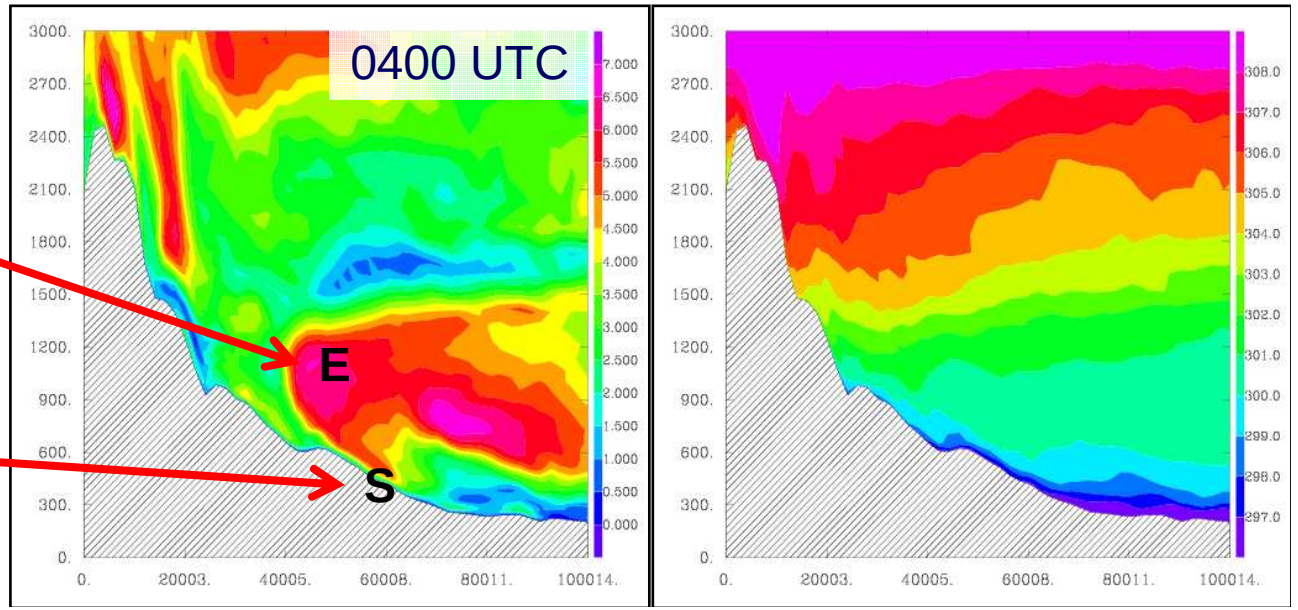
Pre-BLLAST



Wind speed (m/s)

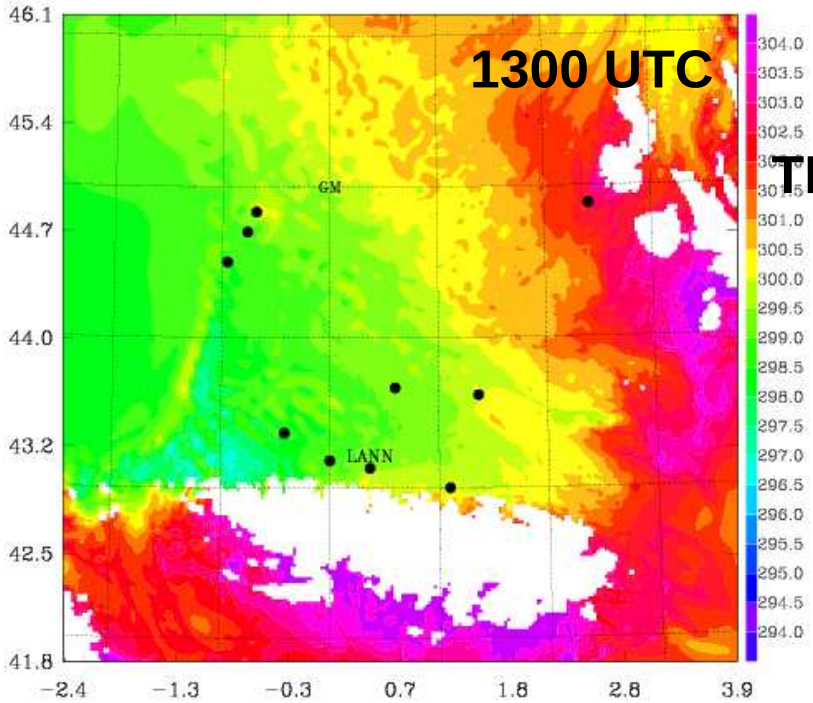
Potential temperature (K)



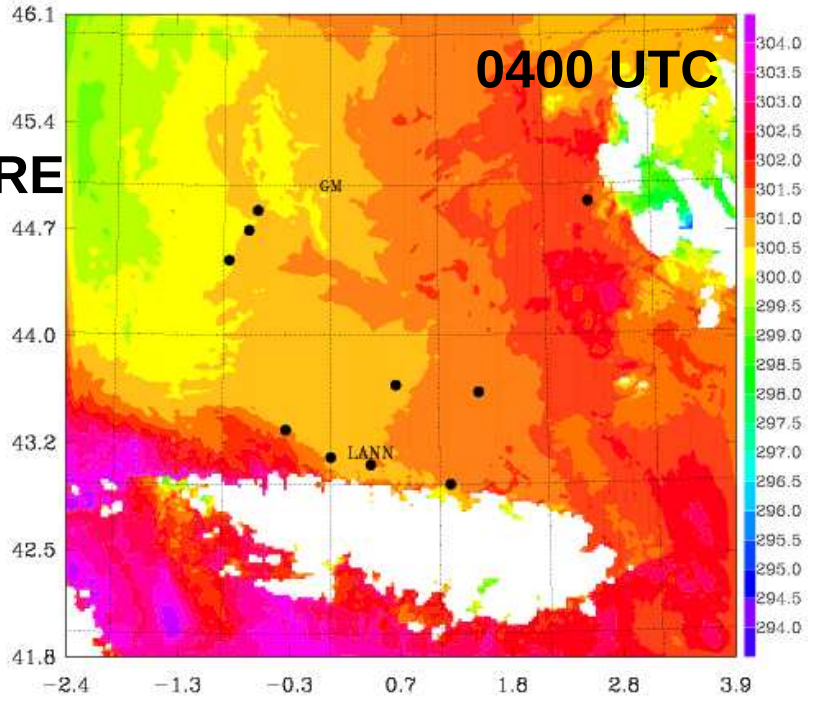


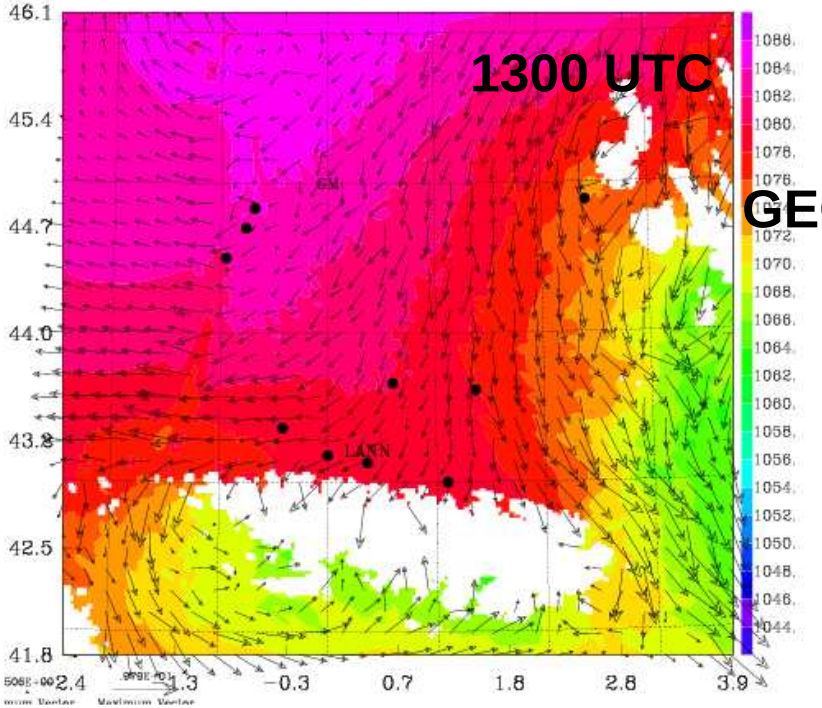
easterly jet

downslope wind

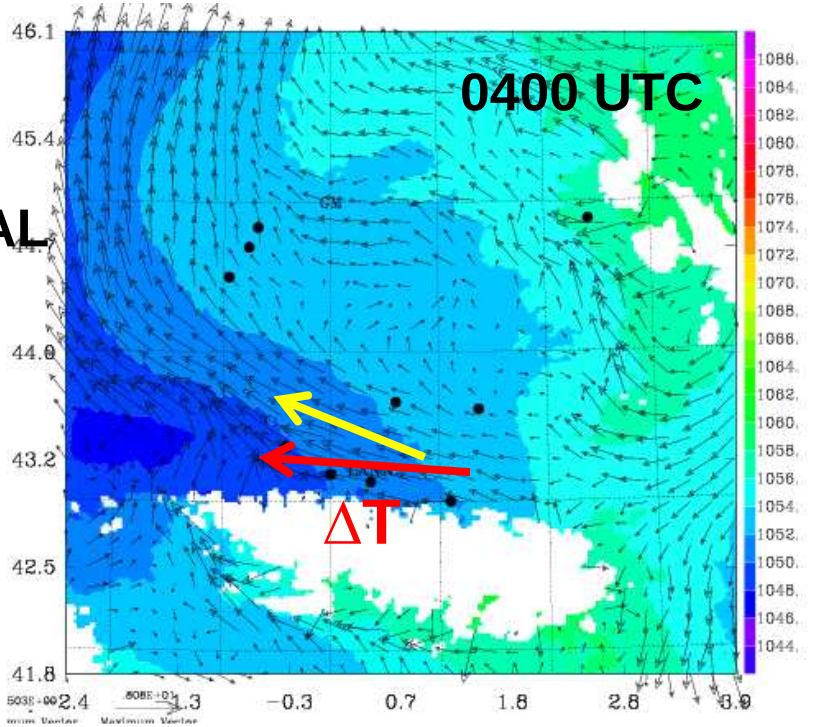


TEMPERATURE at 900 hPa



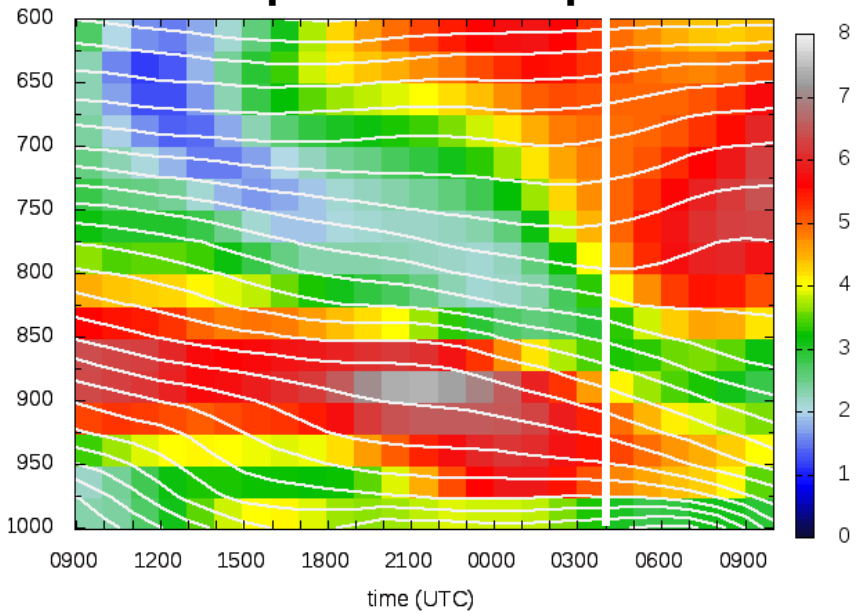


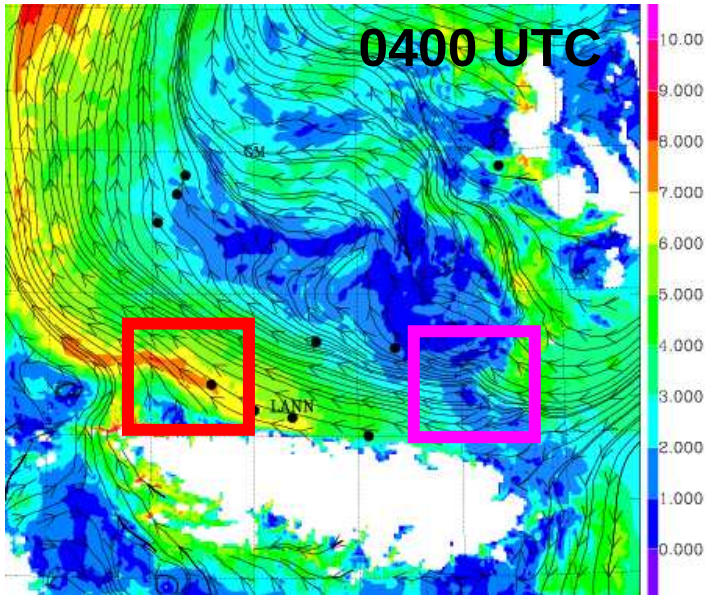
GEOPOTENTIAL HEIGHT AND WIND at 900 hPa



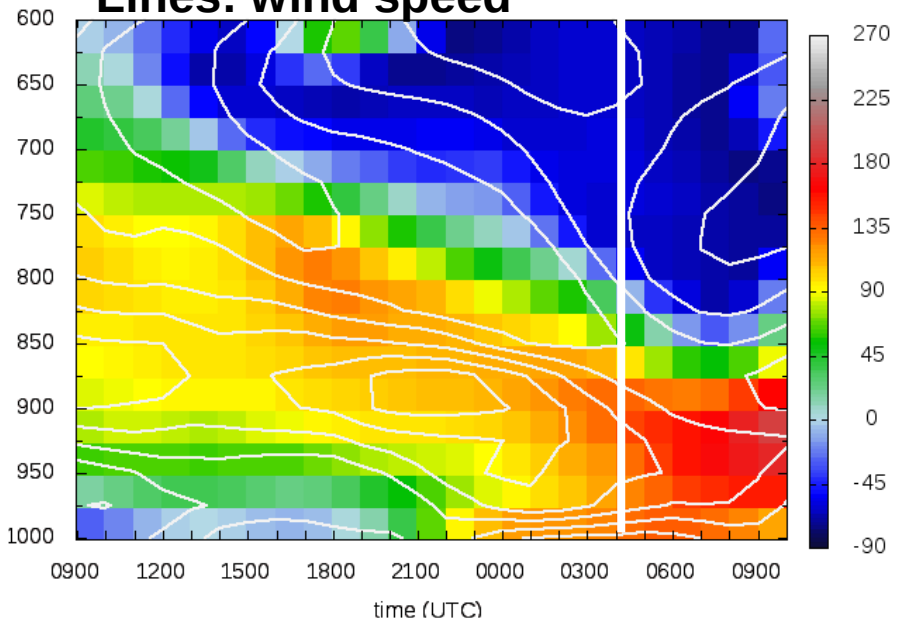
Pre-BLLAST

Averaged wind speed (m/s)
Lines: potential temperature

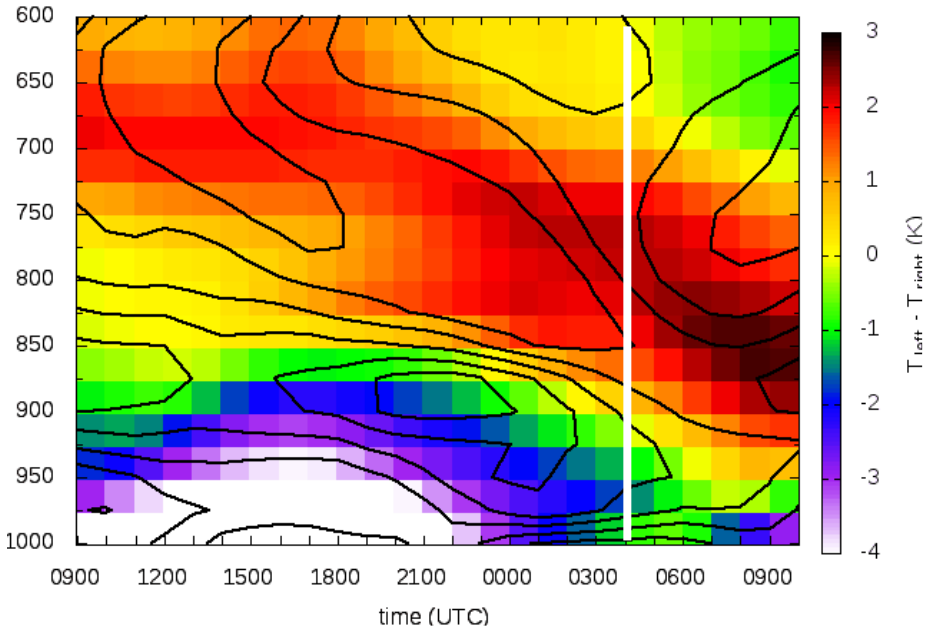




Averaged wind direction (º)
Lines: wind speed

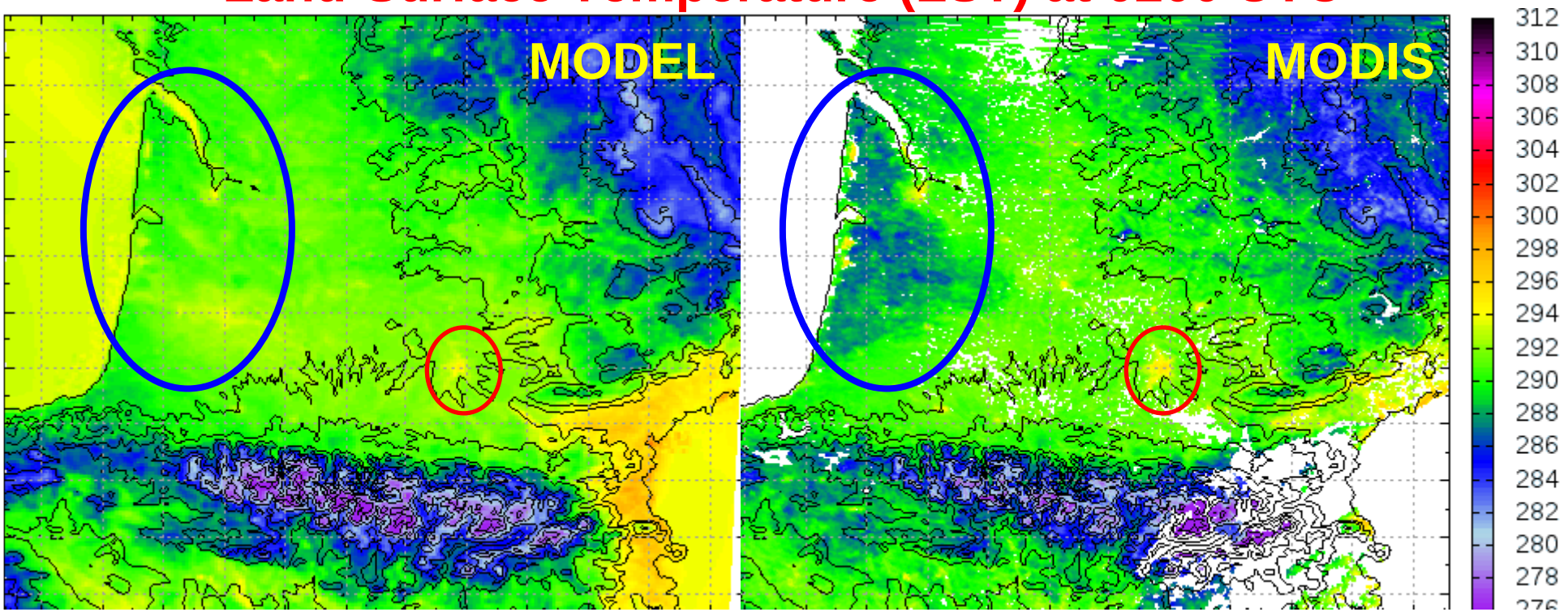


$\langle T_{left} \rangle - \langle T_{right} \rangle$ (K)
Lines: wind speed



Verification using satellite images (Jiménez et al., 2008)

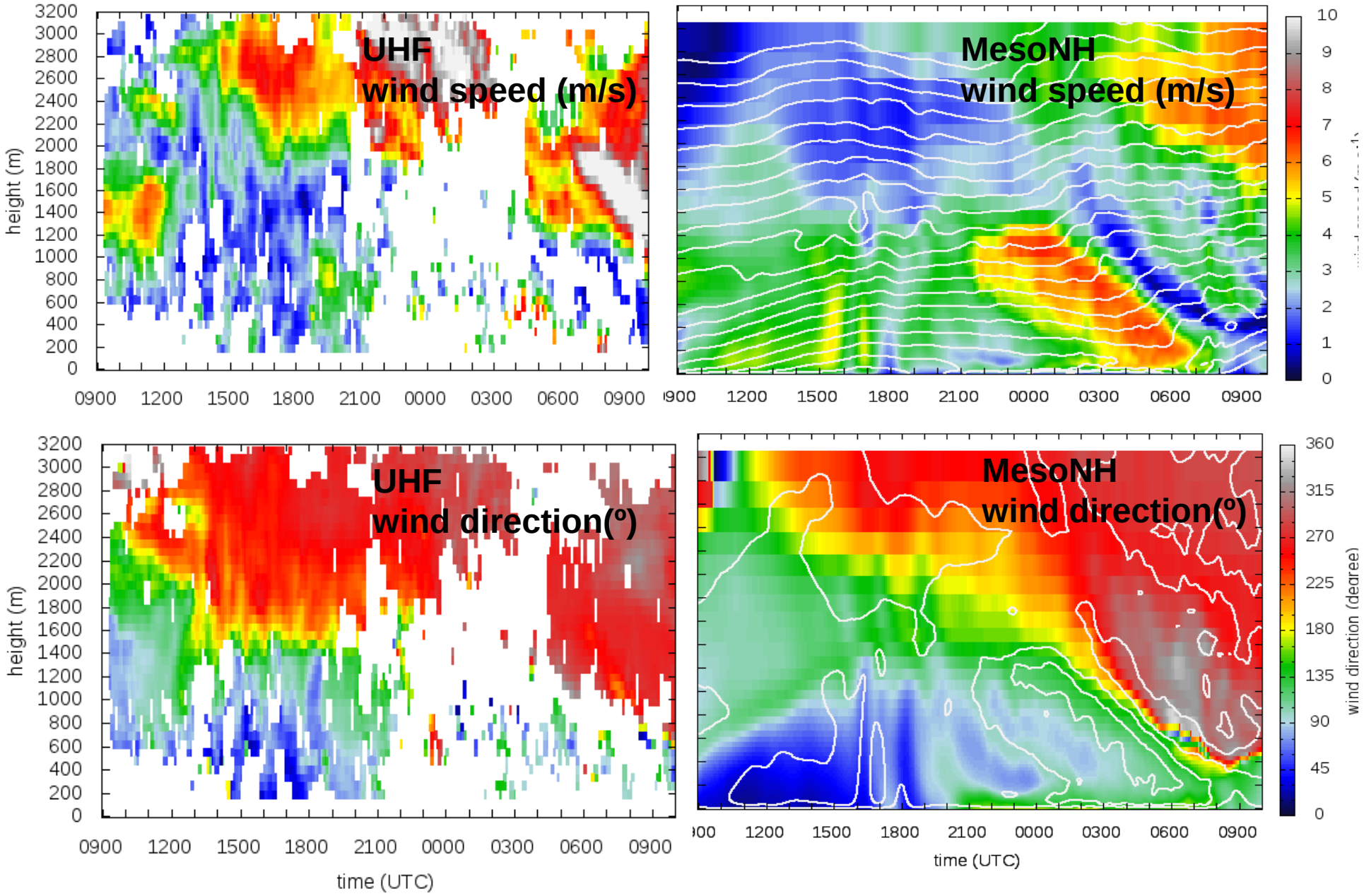
Land-Surface Temperature (LST) at 0200 UTC



✓The model is able to reproduce the main observed patterns

✓Les Landes, strongly vegetated area

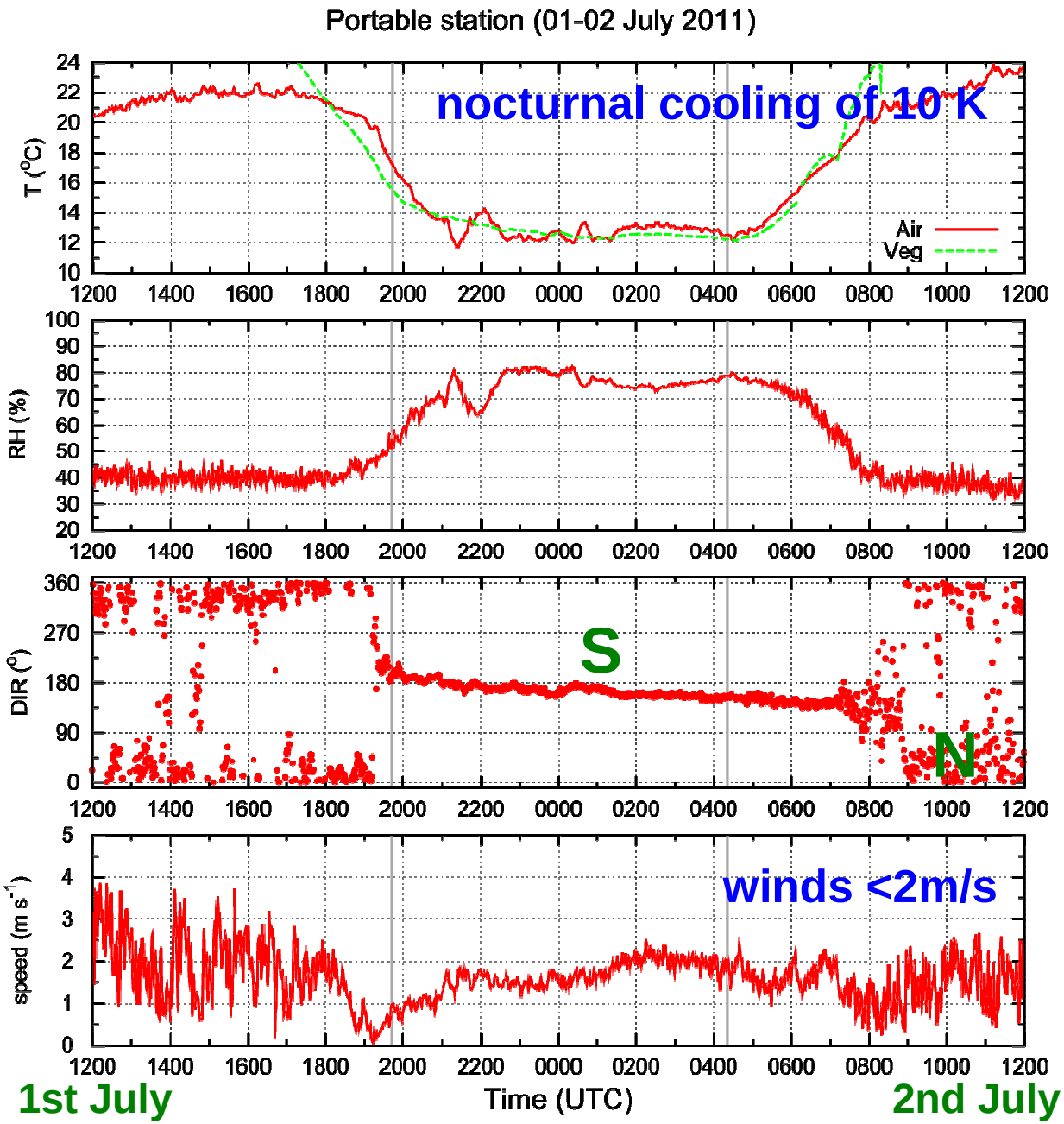
Time series of the vertical profiles in Lannemezan (UHF and MesoNH)



BLLAST intercomparison (D. Pino)

29 June – 3 July 2011

Here the attention is focused from
1st July at 1800 UTC
to 2nd July at 1000 UTC



Similarities pre-BLLAST & BLLAST

✓**The same period of the year (June-July)**

✓**Clear sky night (at least in Lannemezan)**
✓**Weak observed winds in Lannemezan (<2m/s)**

✓**Foothills of the Pyrenees:**
✓**During the day (upslope) and during the night (downslope)**

Differences pre-BLLAST & BLLAST

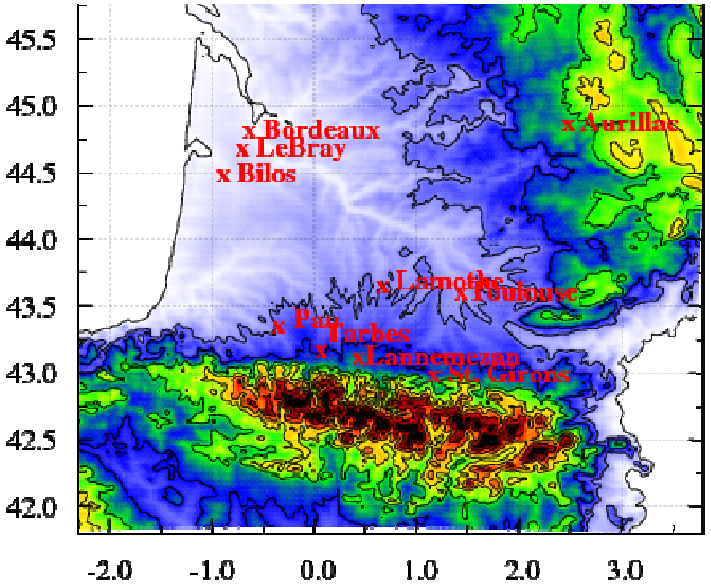
Pre-BLLAST

1)The soil in the run was dryer
2)An easterly jet is formed at 900 hPa (basin+local scales)
3) run: 1 domain (2kmx2km)

BLLAST

1) During the first day of the simulation it rained and the soil was wet (evaporation)
2) No easterly jet is formed, at least at this level (only local scales)
3) run: 3 nested domains (2km,400m,80m)

D1: 2km x 2km (250x240 gridpoints)

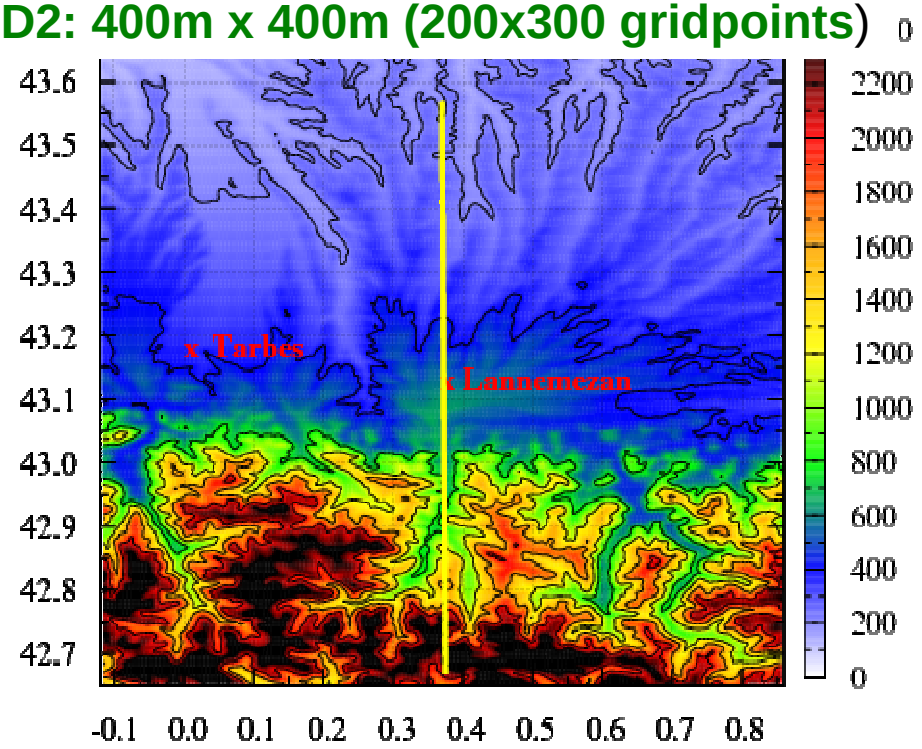


D1: 29 June at 0000 UTC
3 July at 0000 UTC

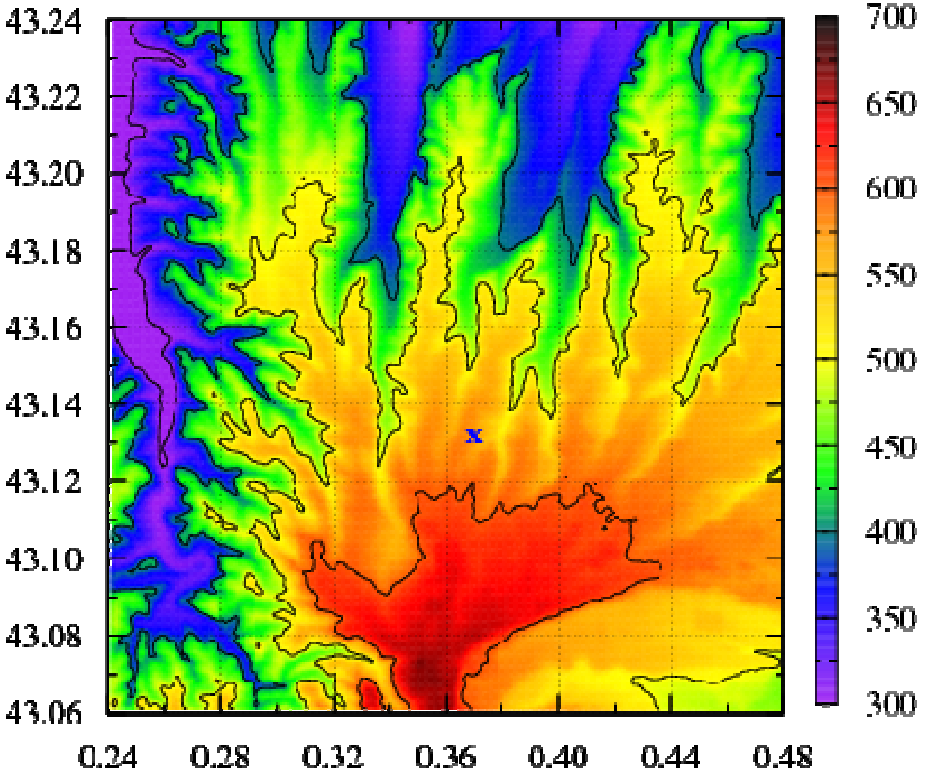
D2: 1 July at 1800 UTC
2 July 1000 UTC

D3: 1 July at 2300 UTC
1 July at 2330 UTC

D2: 400m x 400m (200x300 gridpoints)



D3: 80m x 80m (250x250 gridpoints)

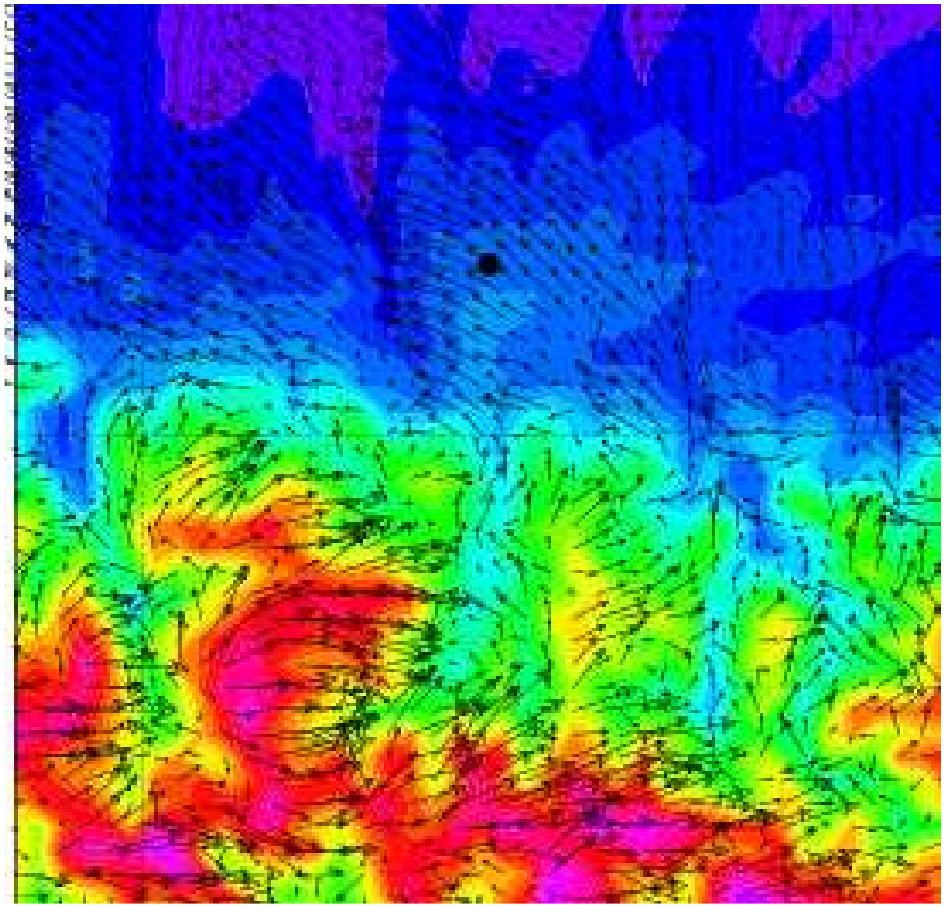


Wind speed at 50 m (a.g.l.) at 2300 UTC, 1st July 2011

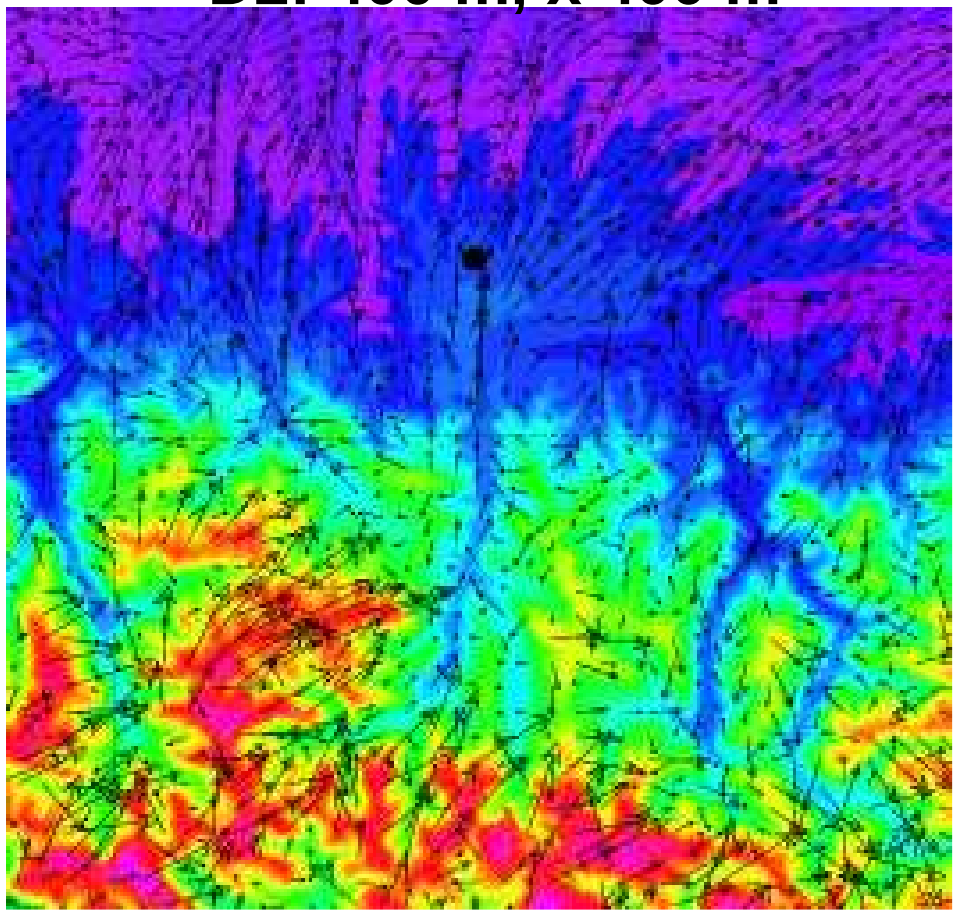
- ✓In D2 the topograhpy is better represented, specially the shape of the slopes of the Aure valley

- ✓Both domains have downslope winds although in D2 it is more evident that it comes from the valley in the S

D1: 2 km x 2 km



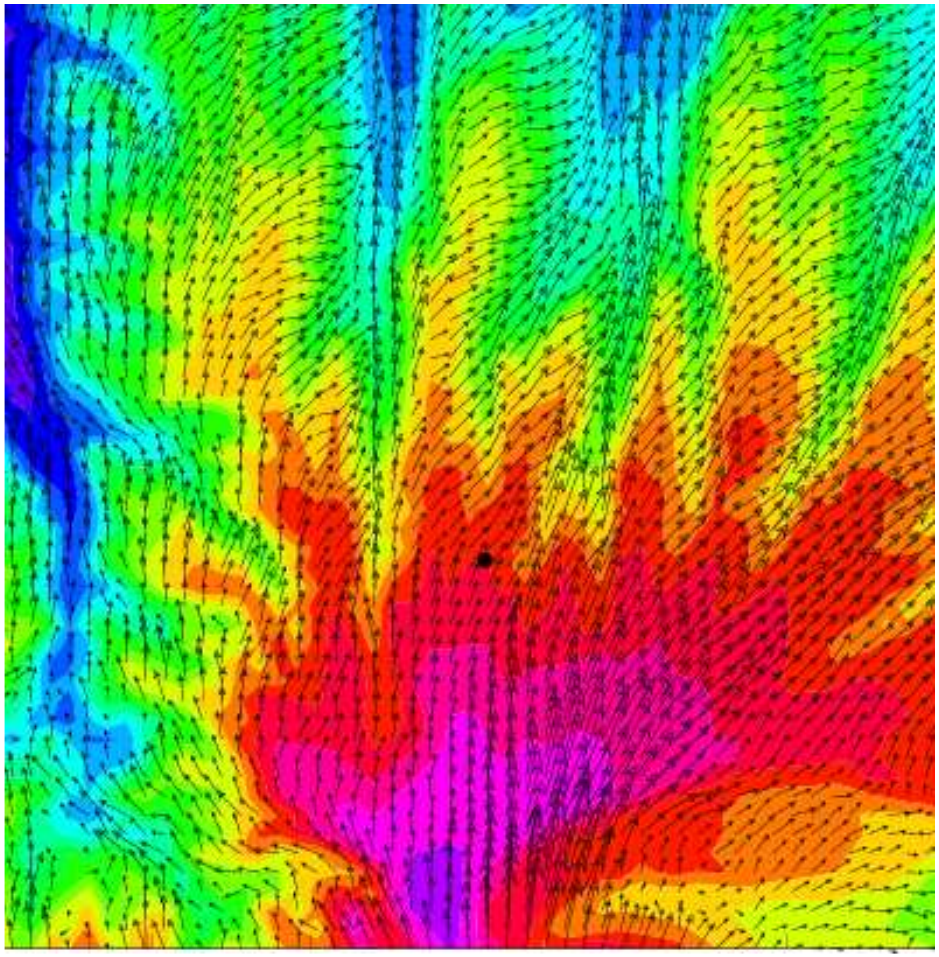
D2: 400 m, x 400 m



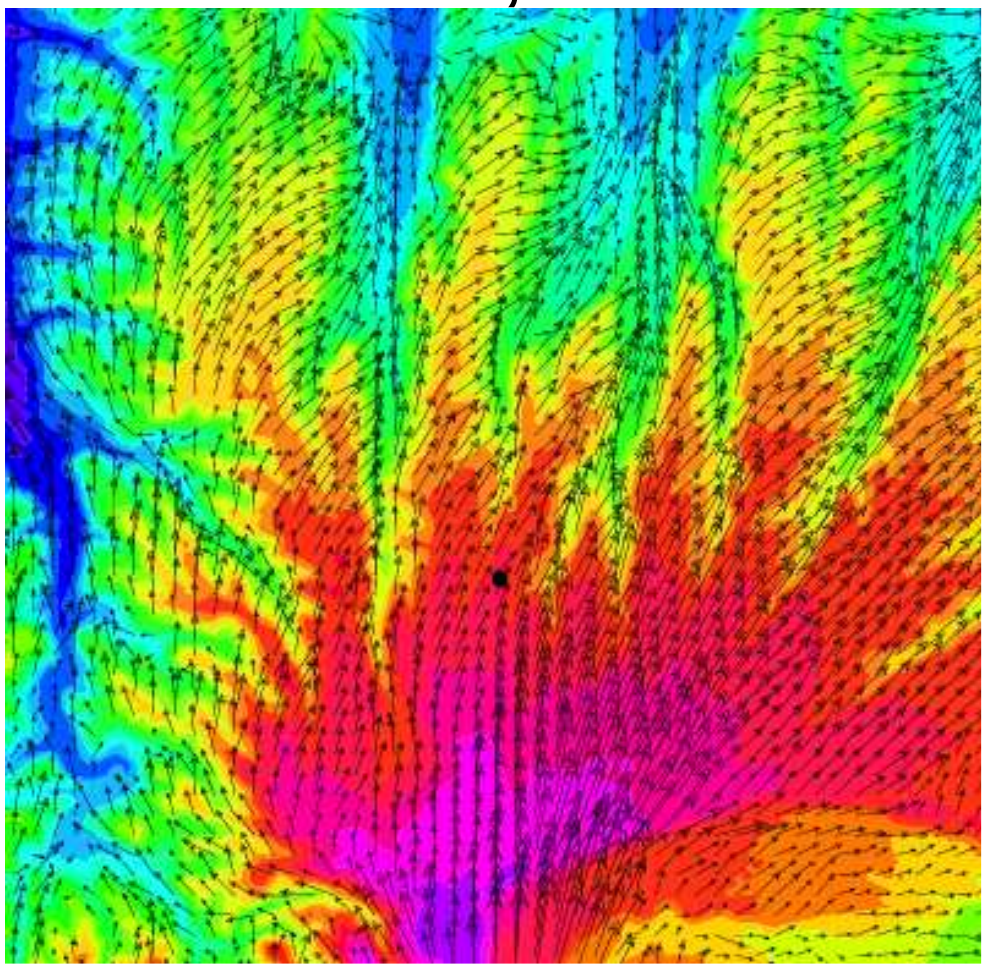
Wind speed at 50 m (a.g.l.) at 2330 UTC, 1st July 2011

In D3 the topography is even more detailed and the flow in D3 adapts to it. There are not big differences between D2 and D3

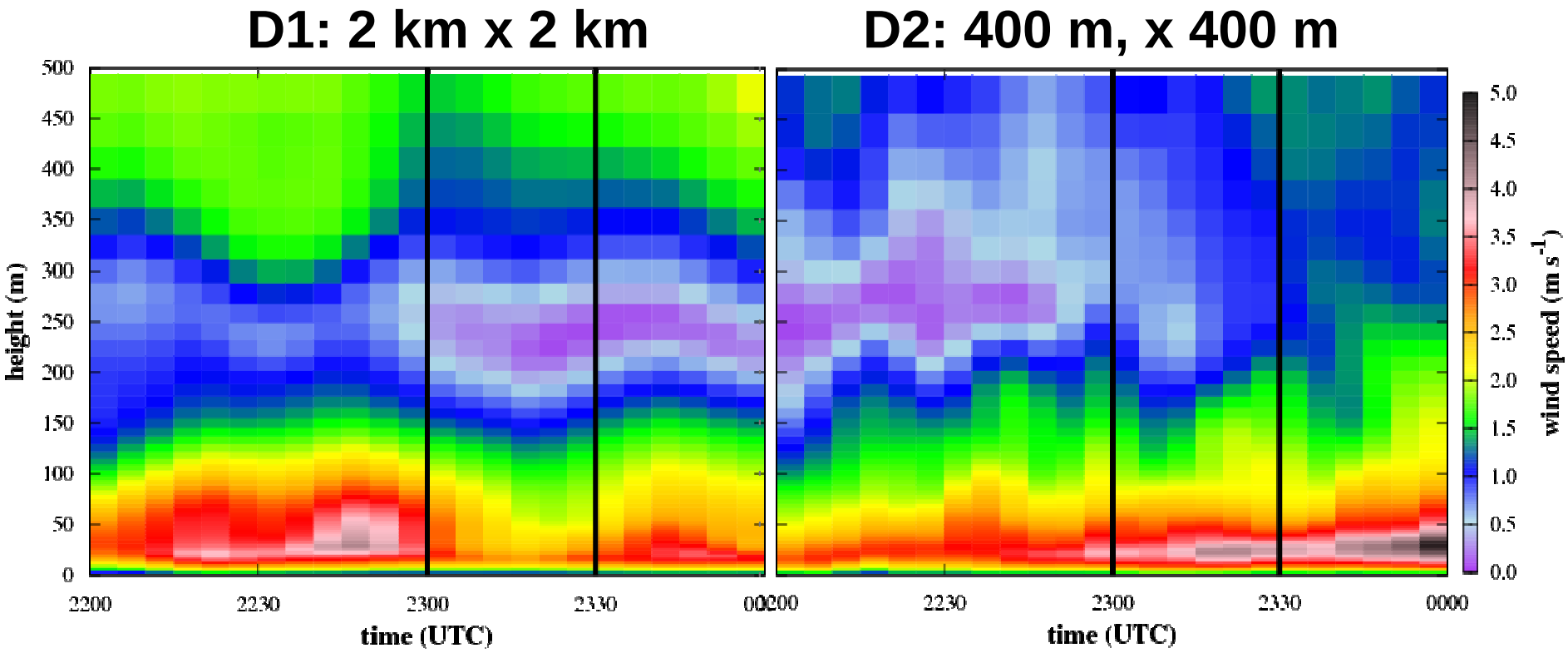
D2: 400 m, x 400 m



D3: 80 m, x 80 m



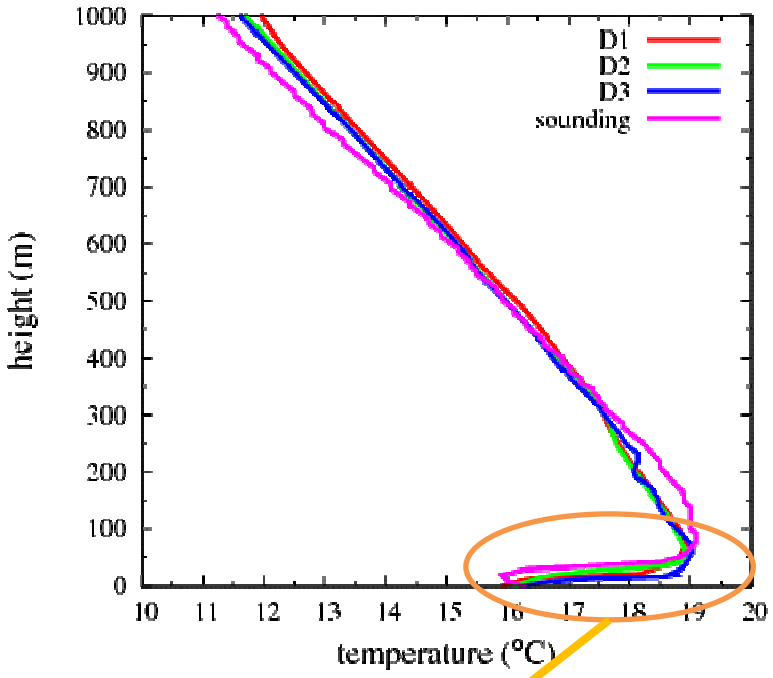
Time evolution of the profiles in Lannemezan

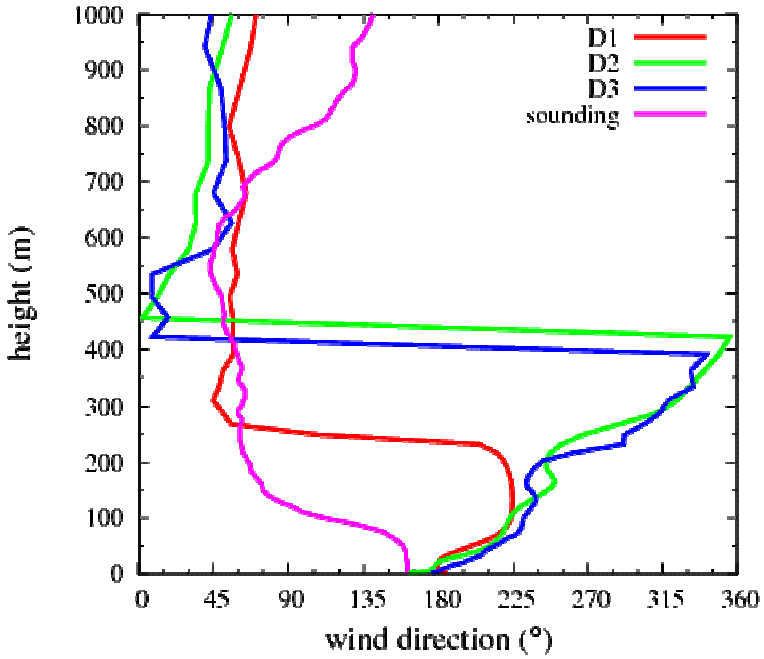


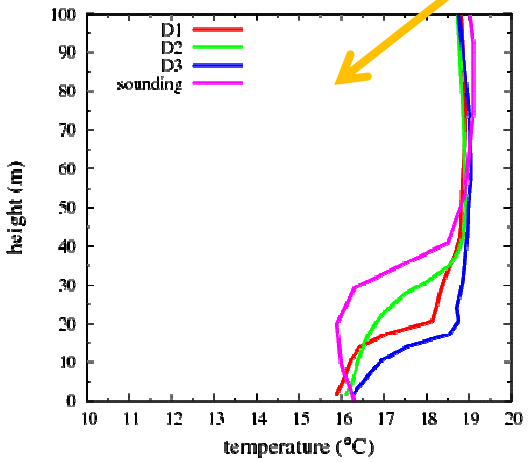
✓In D2 the jet is lower.

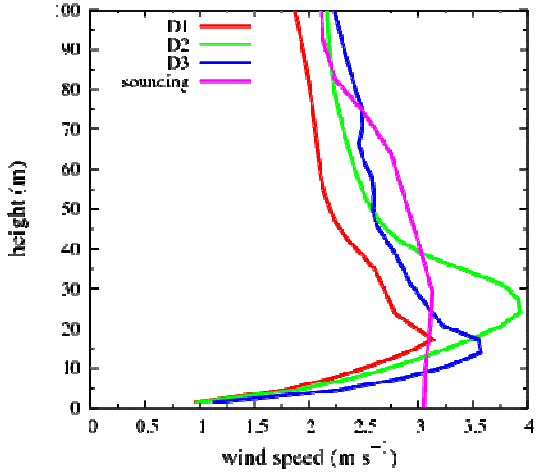
✓Most of the differences between D1 and D2 take place at lower levels, close to the surface

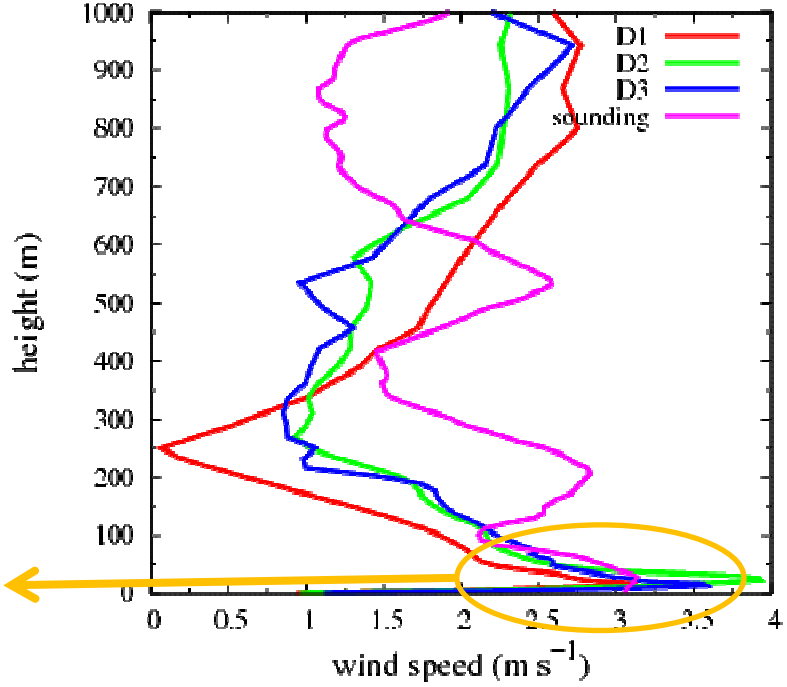
Vertical profiles in Lannemezan at 2330 UTC











Summary

✓Before the BLLAST2011 campaign a mesoscale run was made to understand how the flow is organizing in the Garonne river basin.

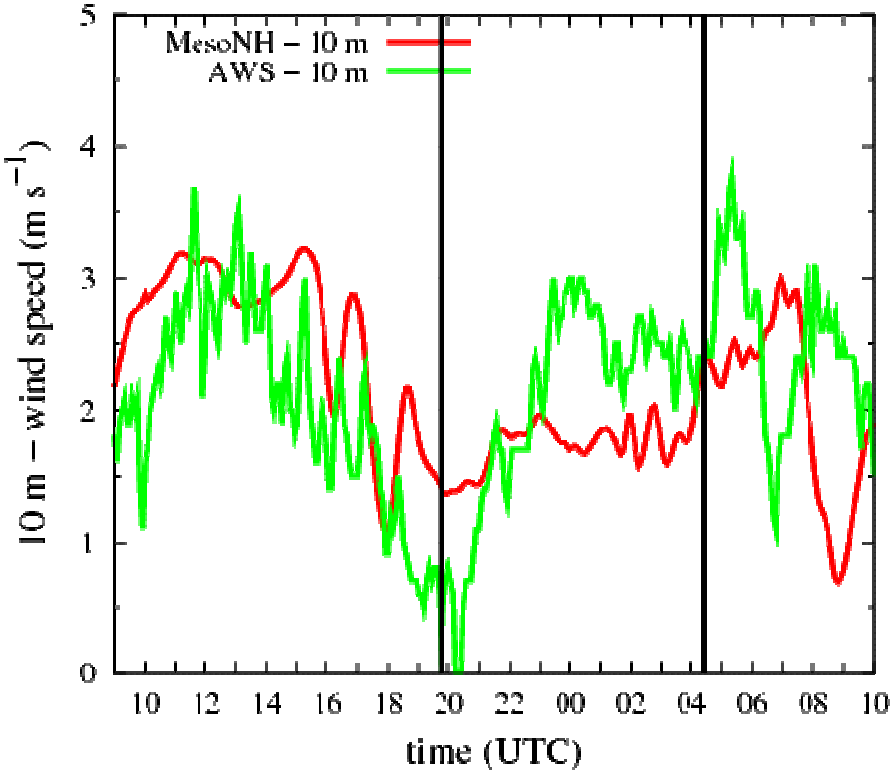
✓Upslope/downslope flows were found at the foothills of the Pyrenees during day/night.

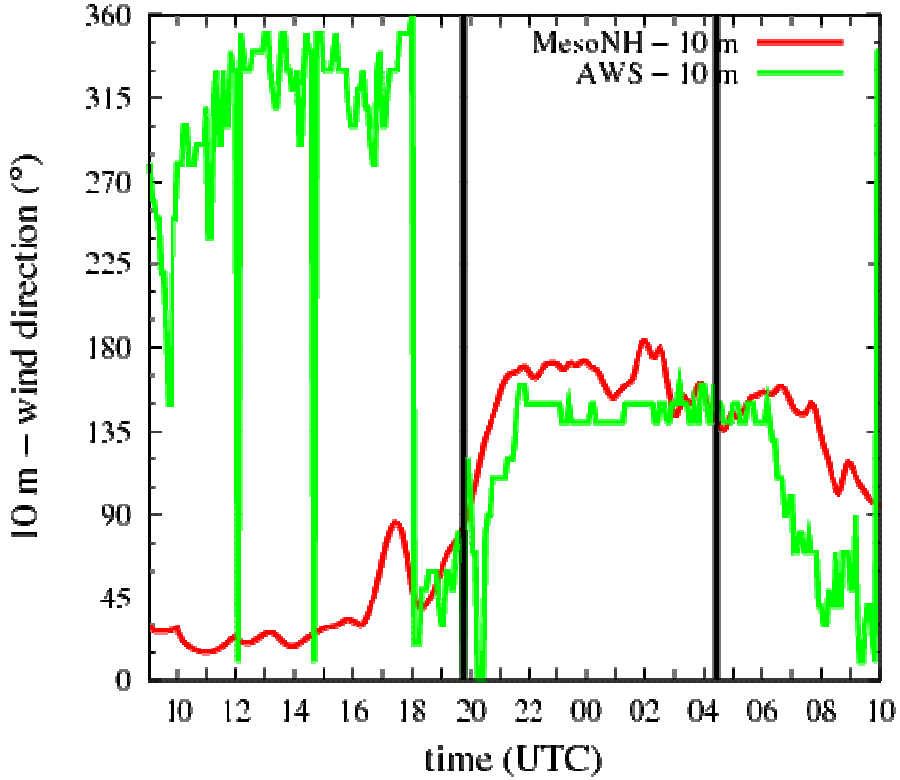
✓Also, an easterly jet was formed during the evening probably related to the baroclinicity of the temperature fields.

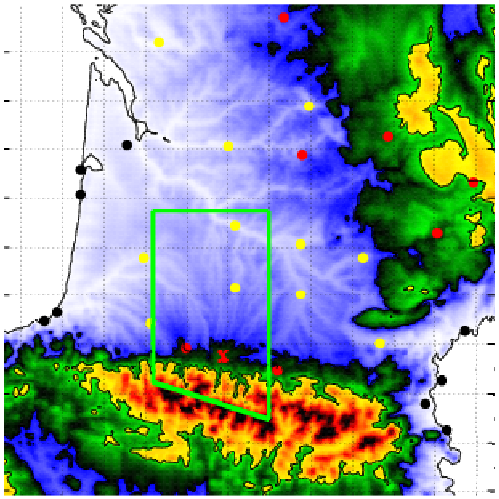
✓After the BLLAST2011 campaign a run is made using 3 nested domains to better reproduce the observed features in Lannemezan.

✓400m x 400m horizontal resolution seems to be the best option to describe the flow in the plateau where Lannemezan is located.

✓Further work is still needed.

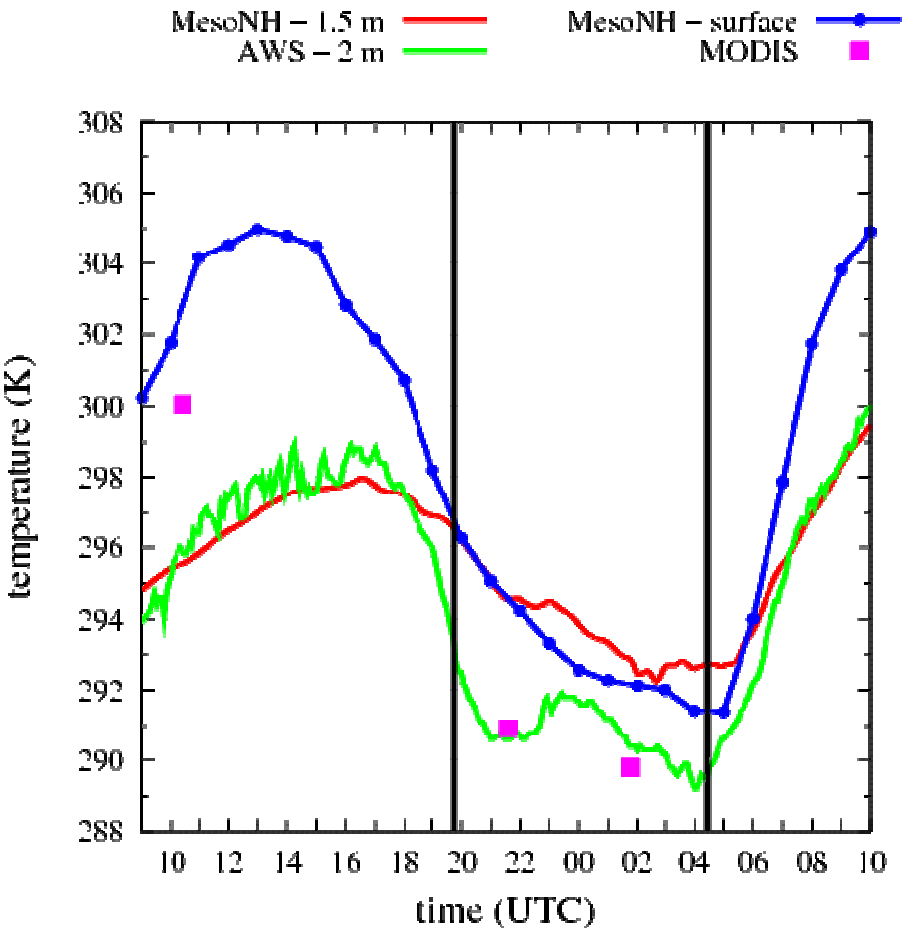


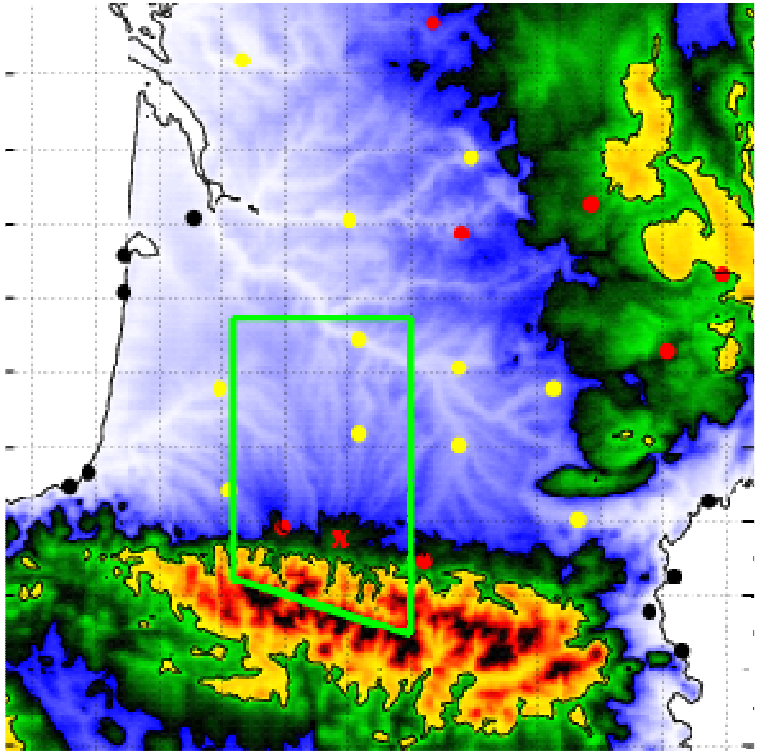


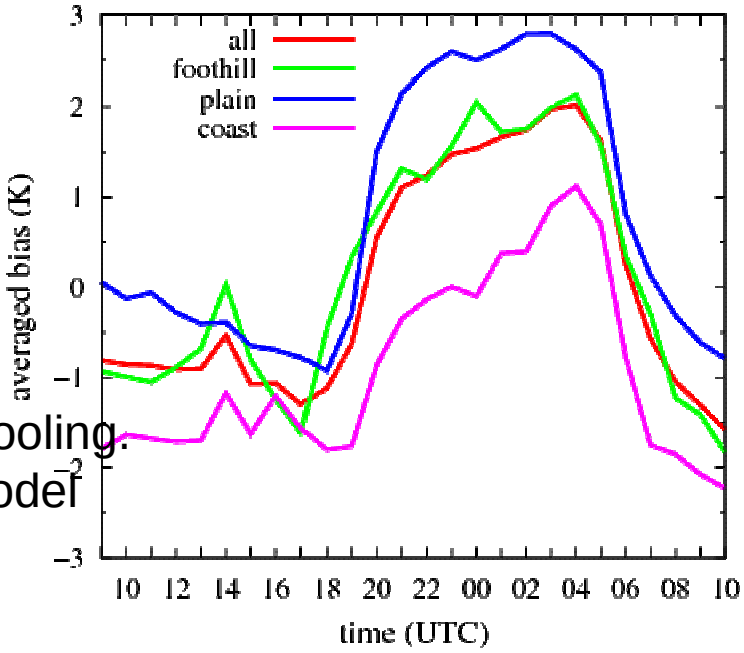


The model reproduces the wind speed and direction
for Lannemezan but also for the rest of AWS in the area

Pre-BLLAST

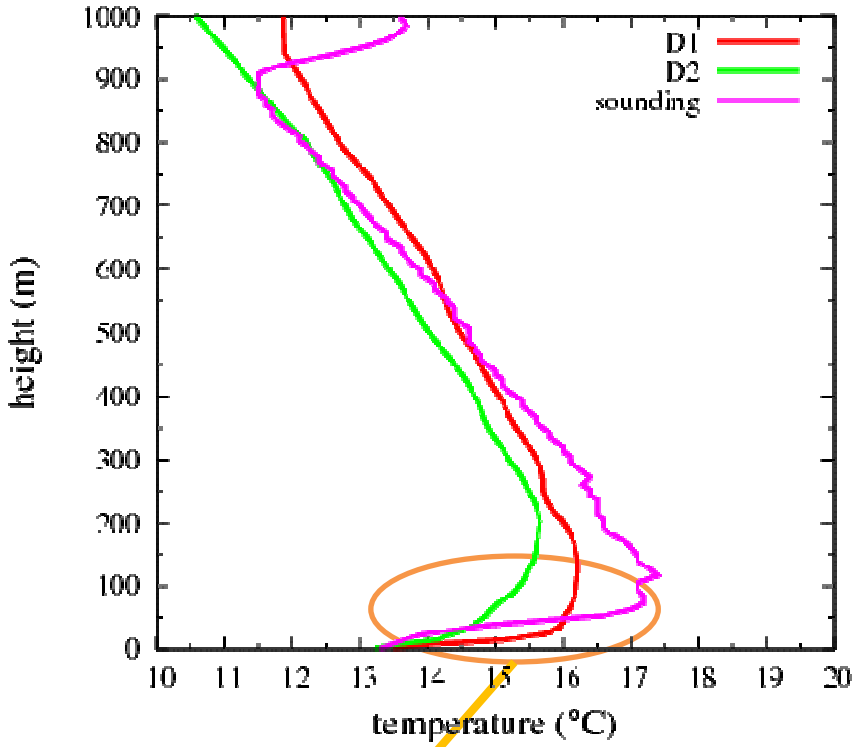


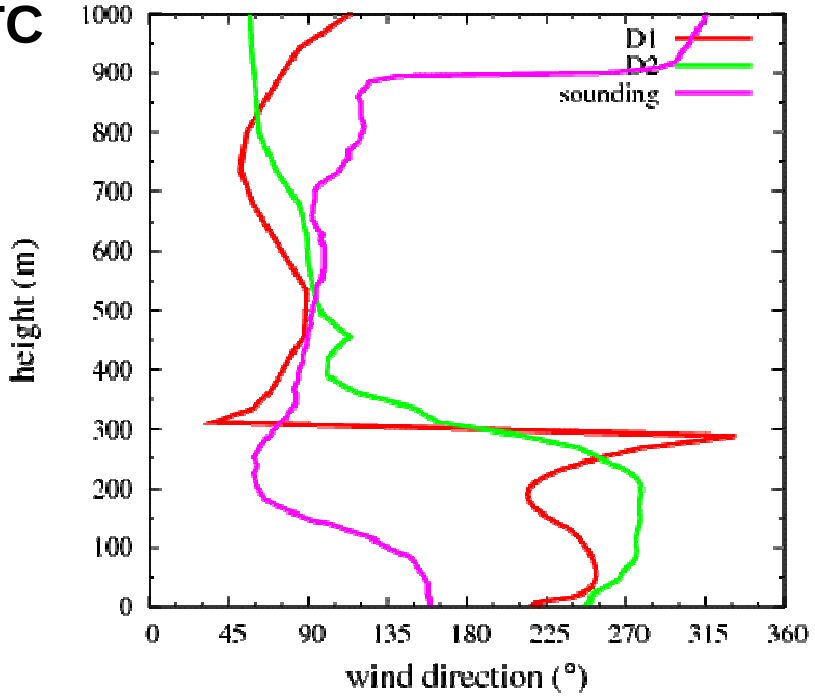


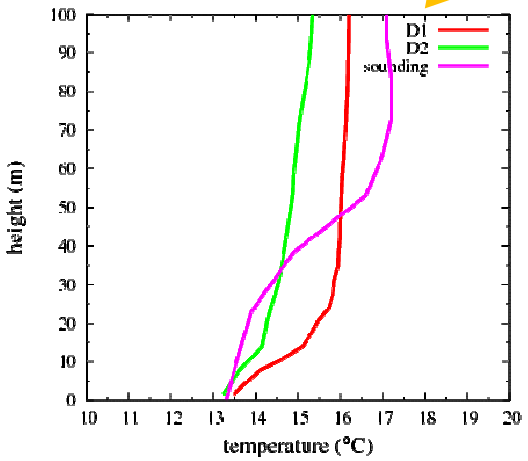


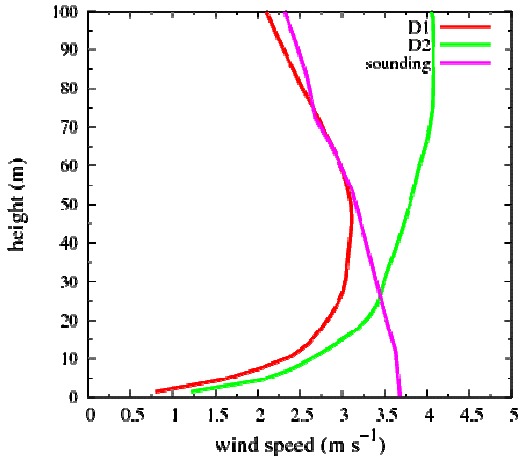
The model is not able to reproduce the nocturnal cooling.
Taking into account all the AWS in the area, the model
is warmer during the night (bias +2K)
and slightly colder during day (bias -1K)

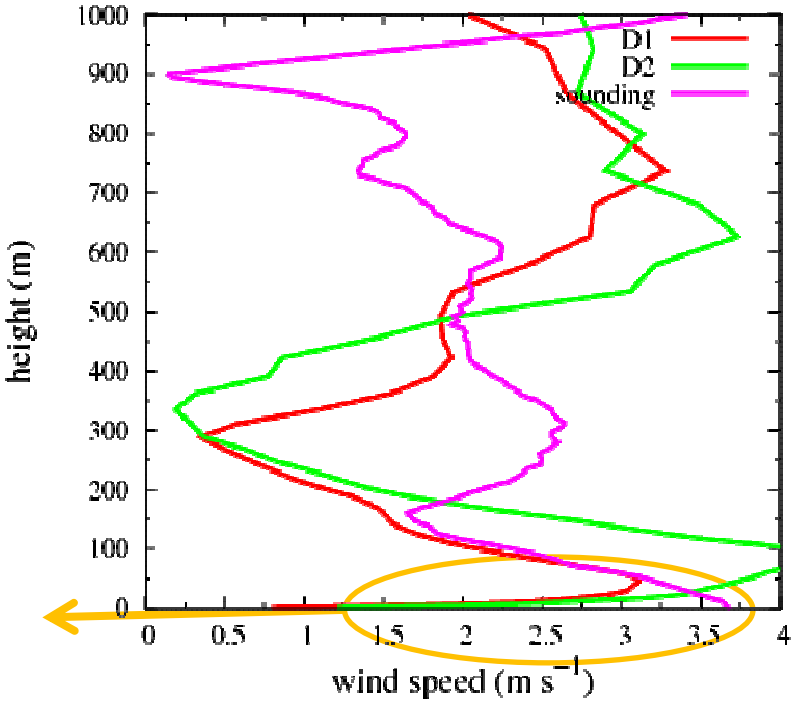
Vertical profiles in Lannemezan at 0500 UTC











Verification, still in progress…

Domain D2