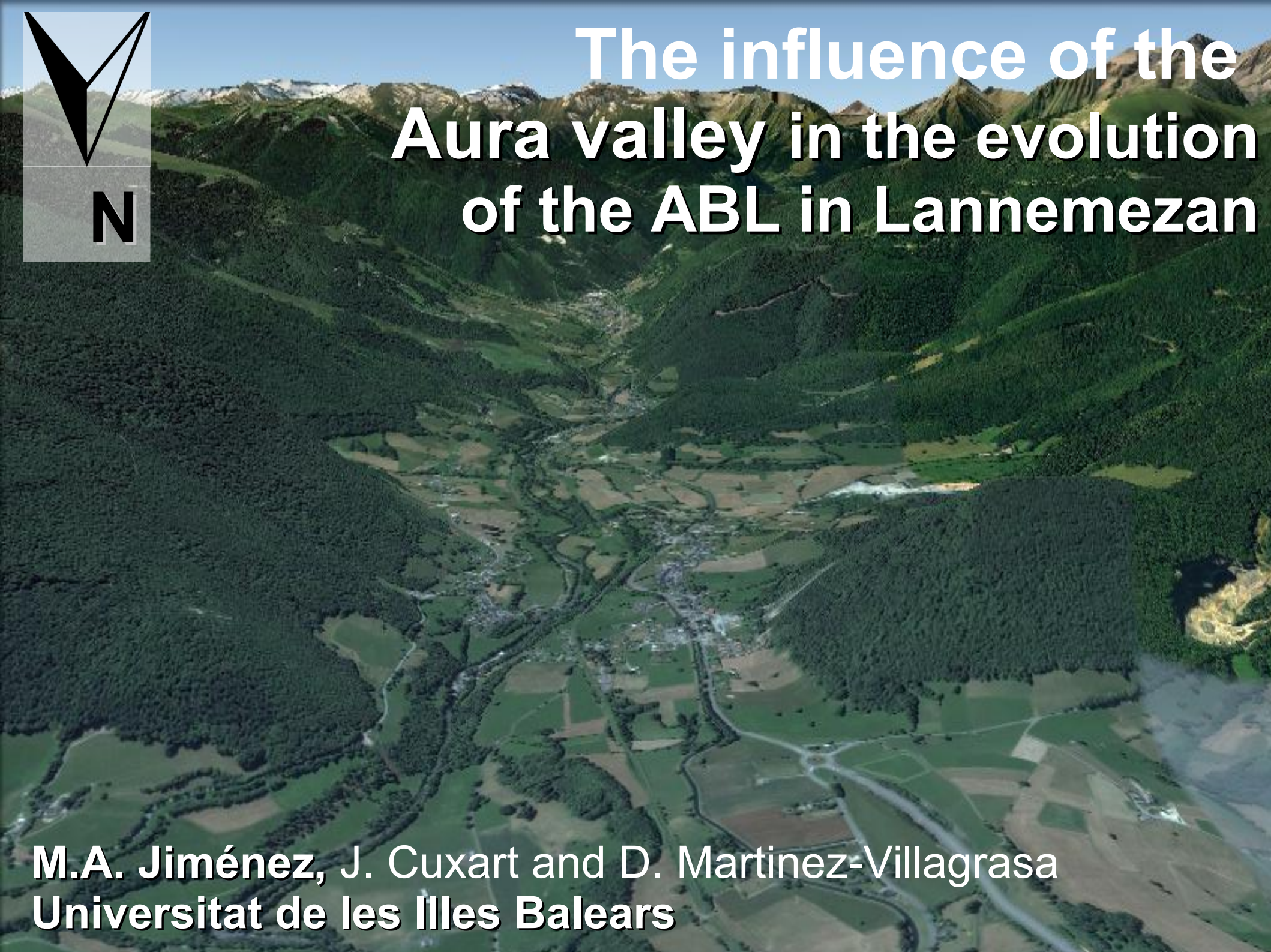
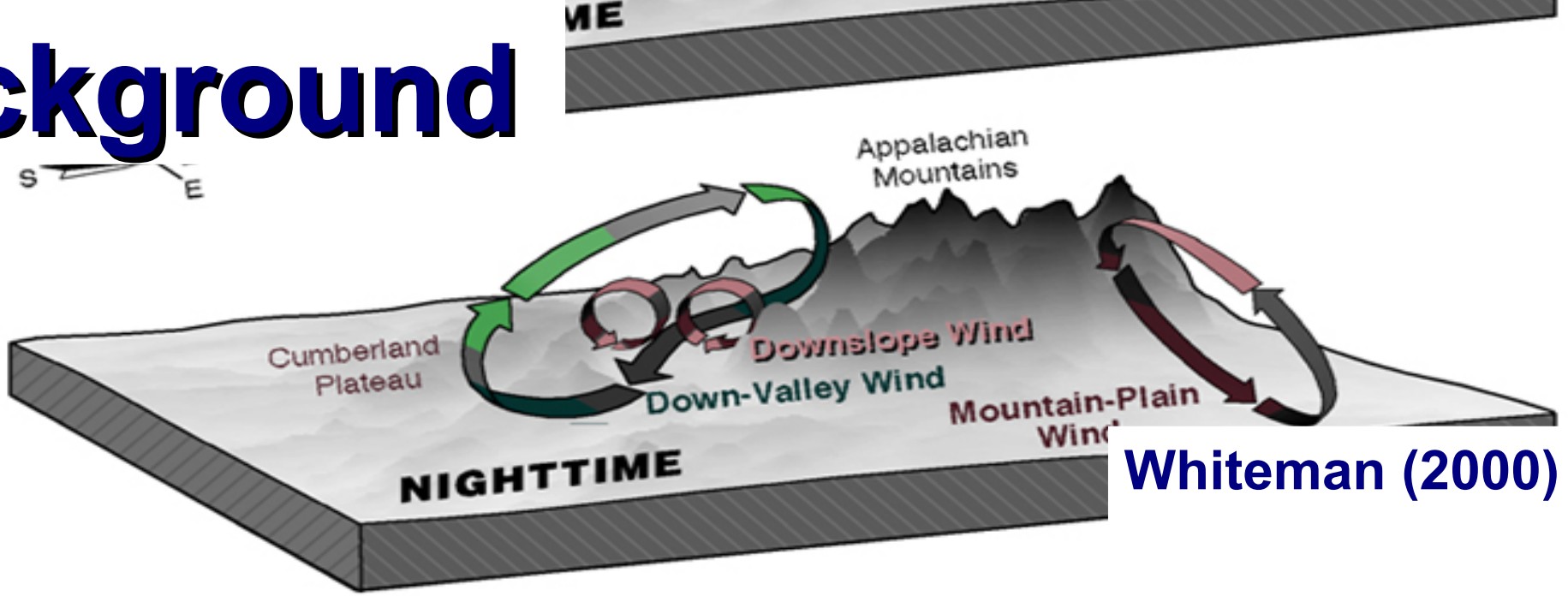


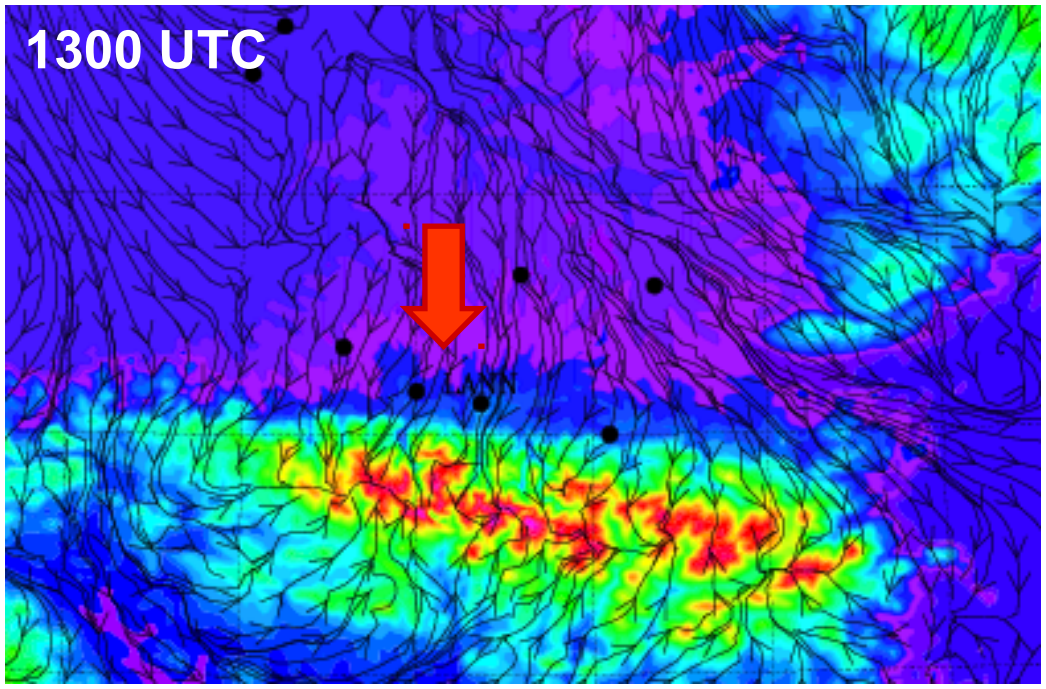
The influence of the Aura valley in the evolution of the ABL in Lannemezan

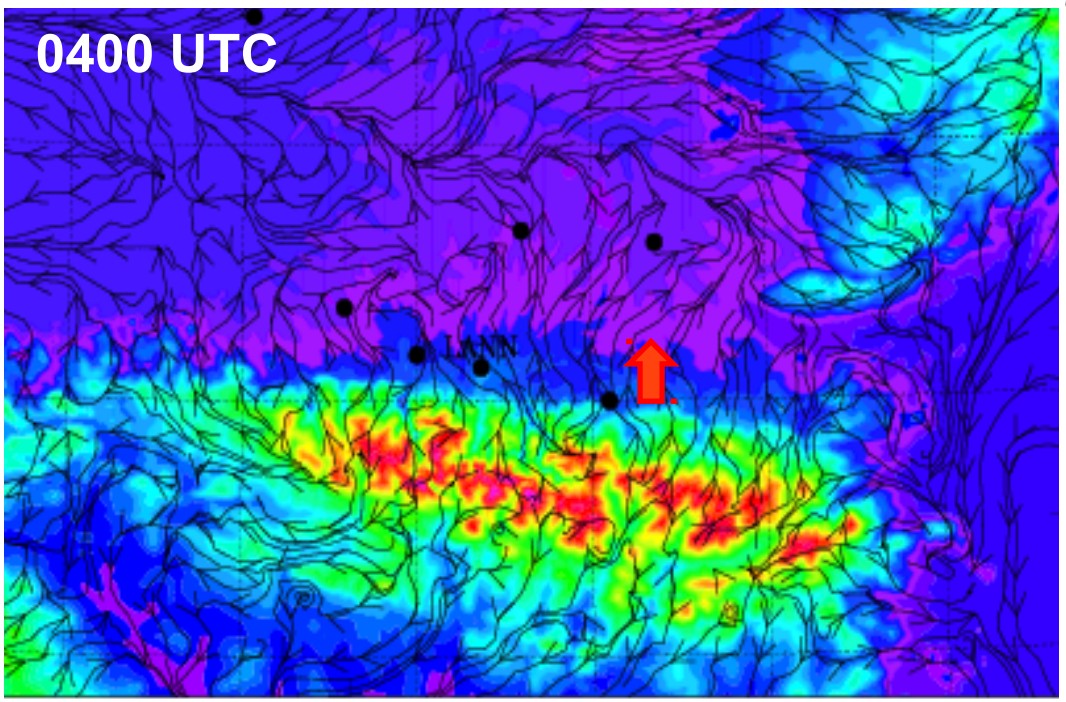
M.A. Jiménez, J. Cuxart and D. Martinez-Villagrasa
Universitat de les Illes Balears

Background



Whiteman (2000)



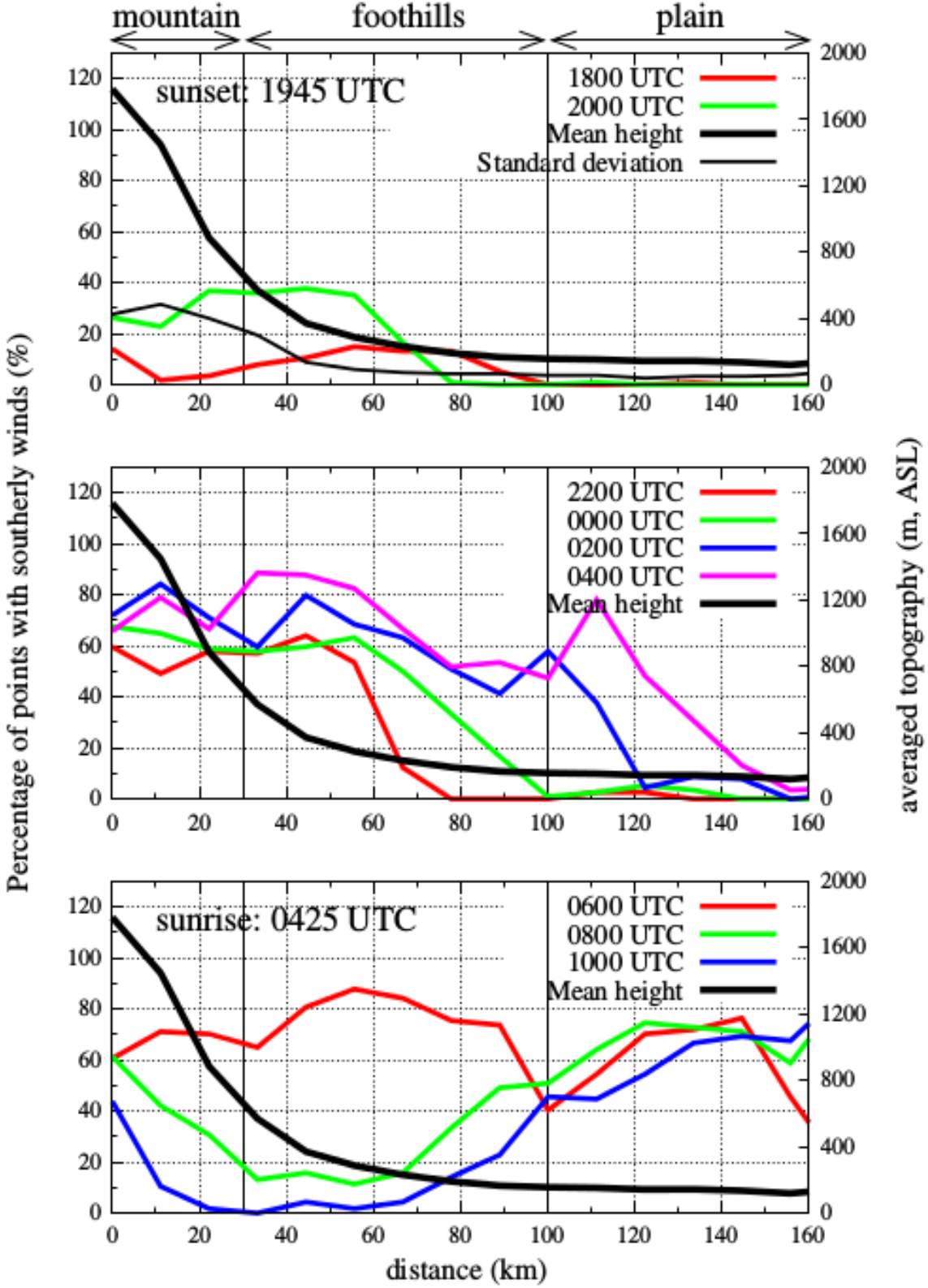


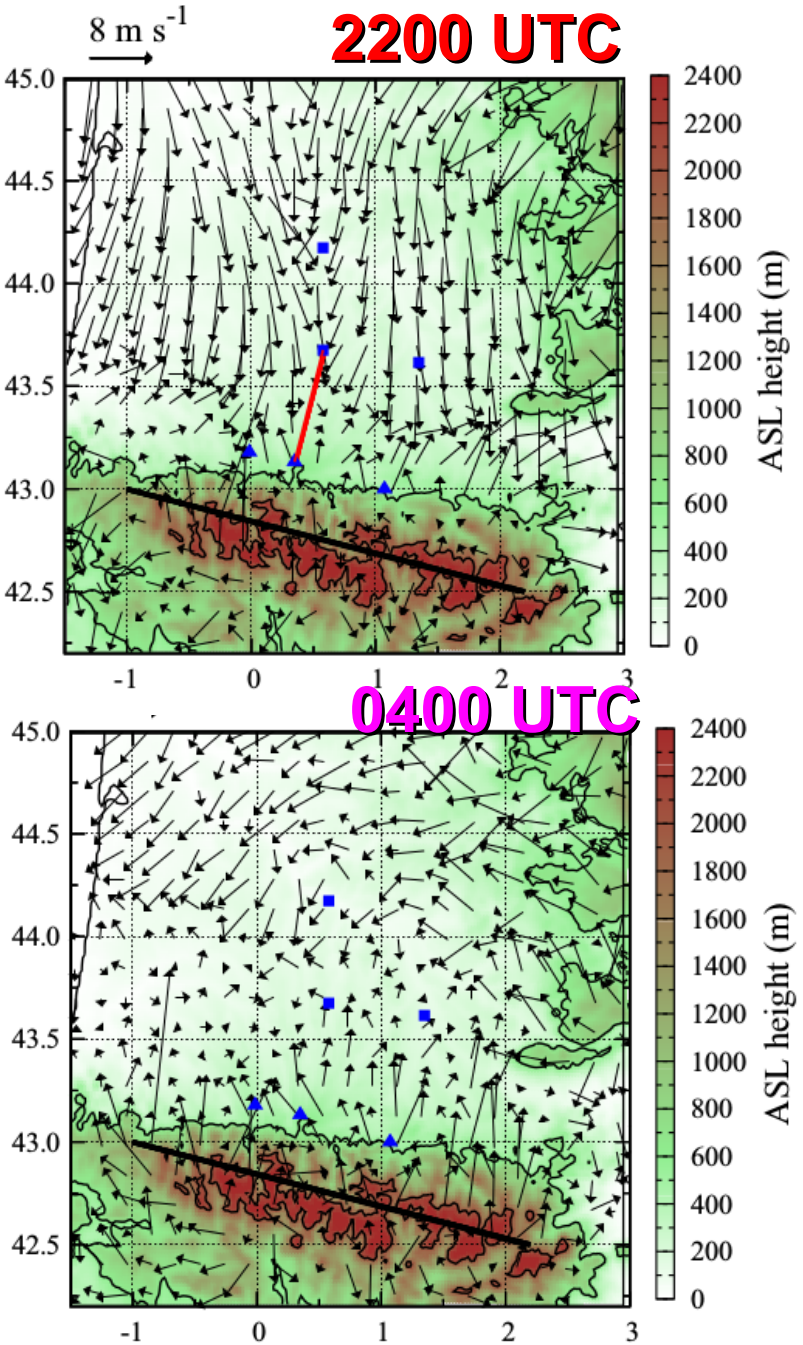
Jiménez and Cuxart (2014, AR)

50m AGL streamlines
(mesoscale simulation at 2km resolution, 1st July 2010)

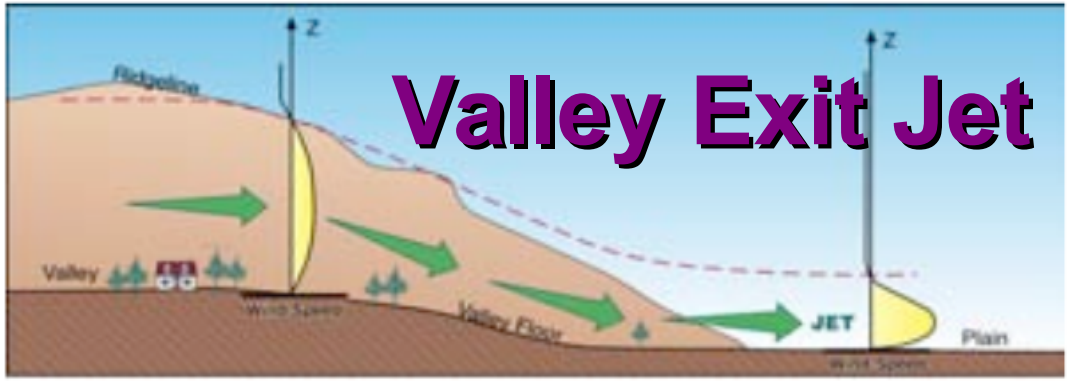
«PRE-BLLAST»

Jiménez and Cuxart (2014, AR)

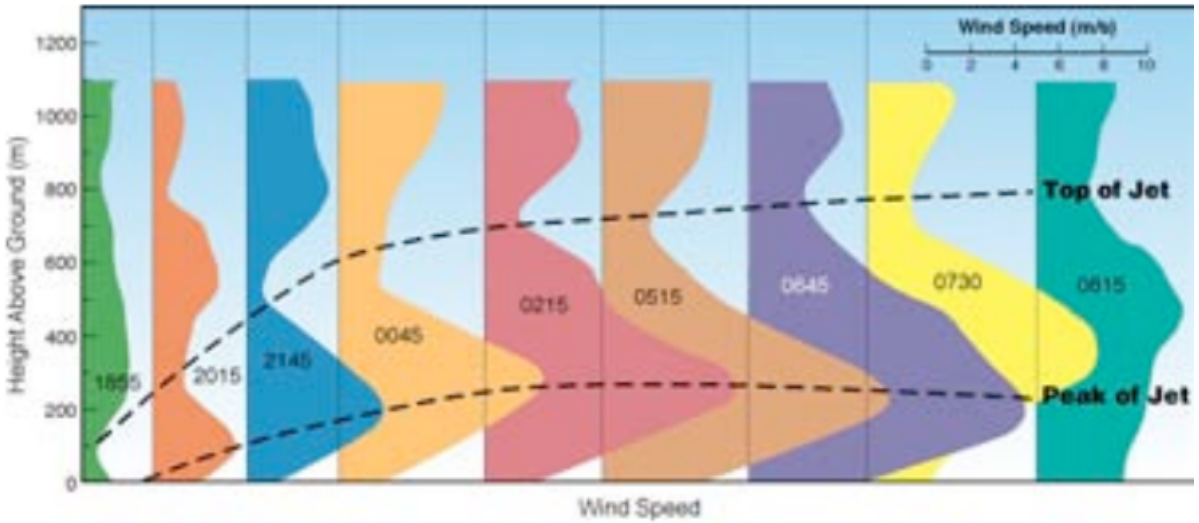


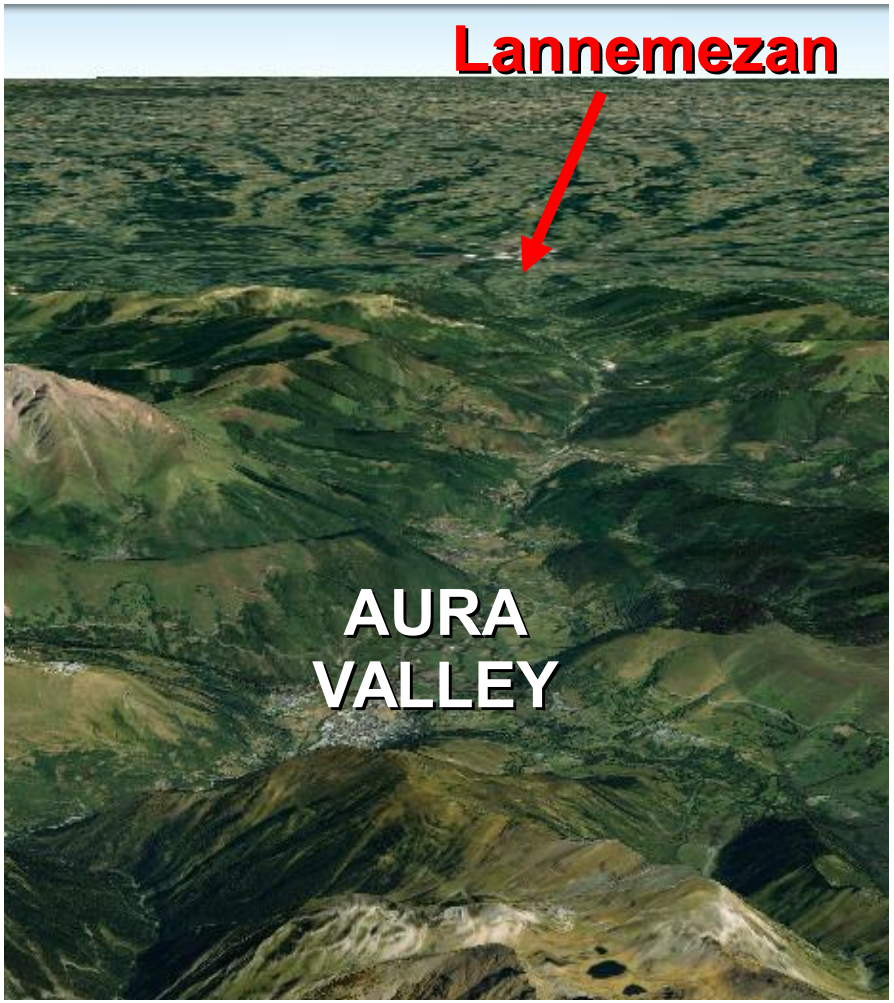


Motivation



Pamperin & Stilke (1985)





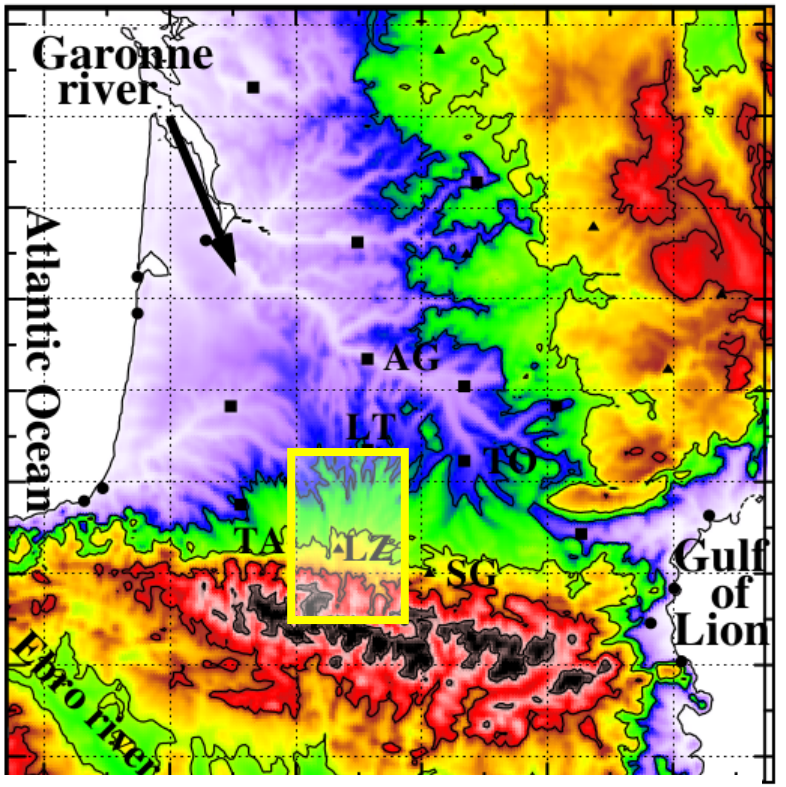
Boundary-**L**ayer **L**ate **A**fternoon and **S**unset **T**urbulence experimental field campaign **(summer 2011)**

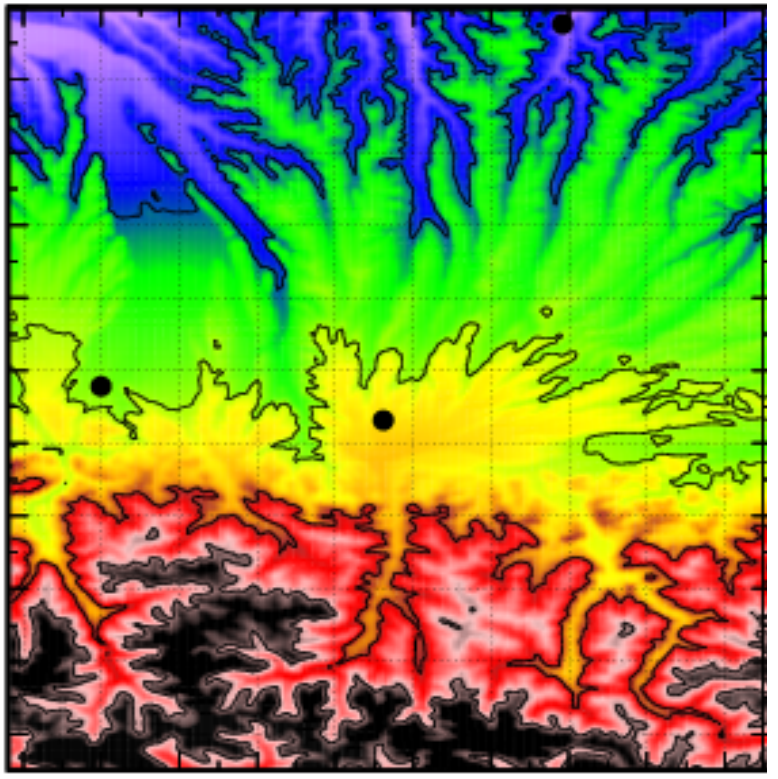
SELECTED IOPs

IOP	Period
1	15-16 June
2	19-20 June
3	**20-21 June**
4	24-25 June
5	**25-26 June**
6	**26-27 June**
7	27-28 June
8	30-1 July
9	**1-2 July**
10	**2-3 July**
11	**5-6 July**

No rain
+
slope winds
+
no clouds
(in Lannemezan)

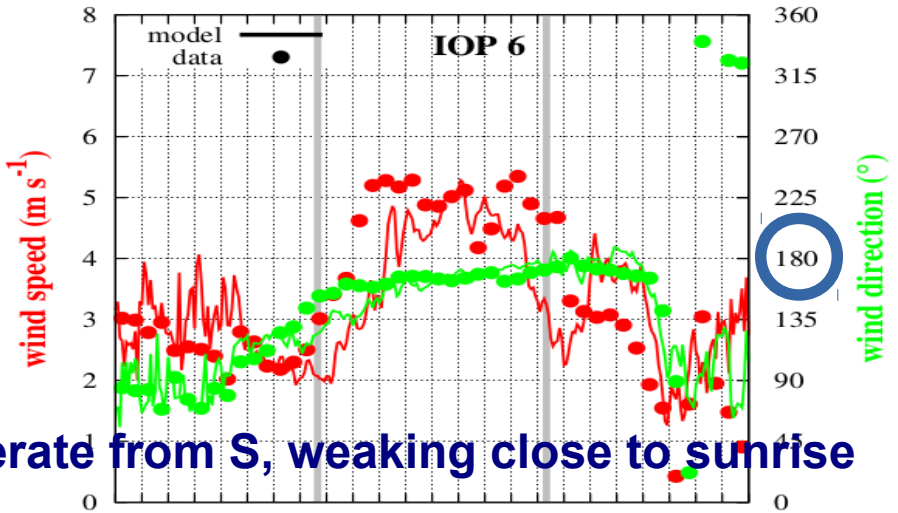
→ **weak LS winds**



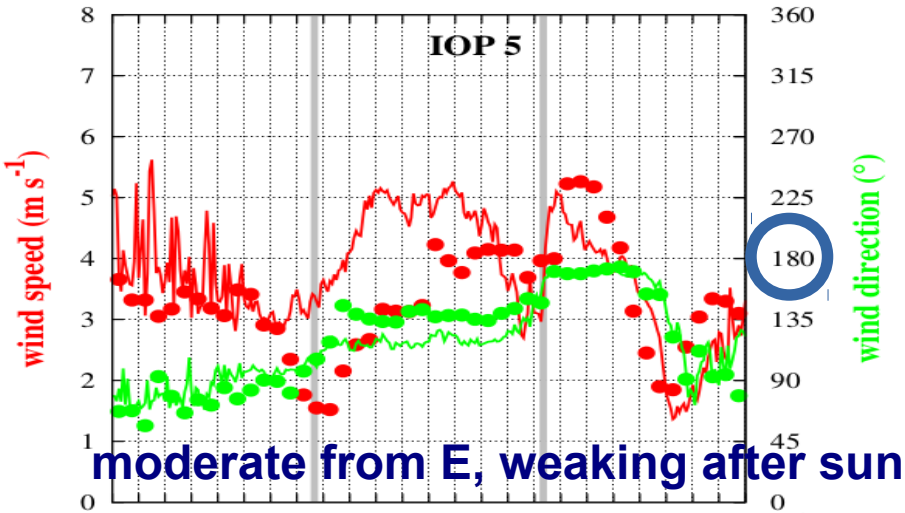


Mesoscale simulation

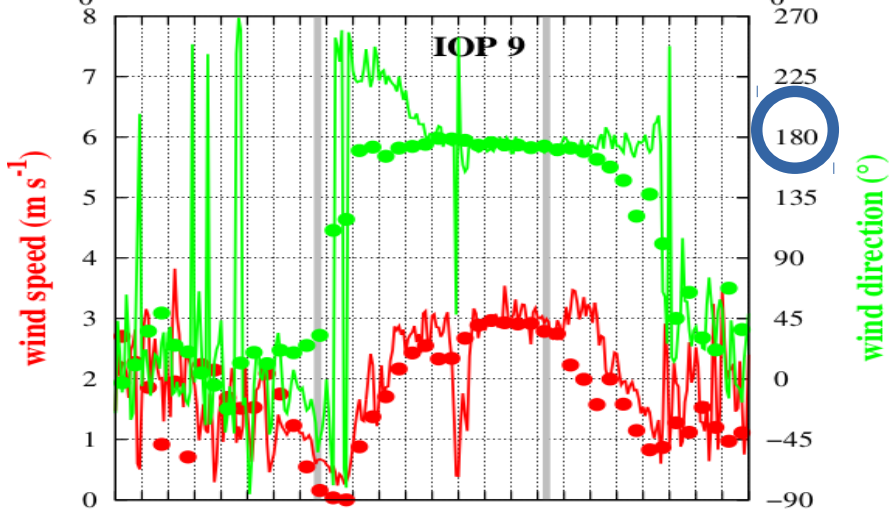
* **2 nested domains** (2km, 400m)
* **Vertical grid** (dz=3m and stretched above, 85 levels up to 9000m agl)
* **Simulated period: 30 hours** (from 0600 UTC until 1200 UTC of the next day)



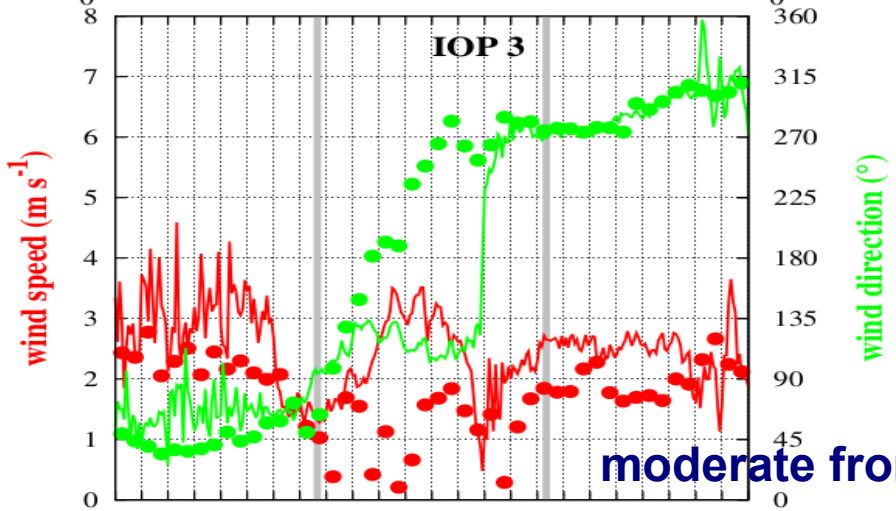
moderate from S, weaking close to sunrise



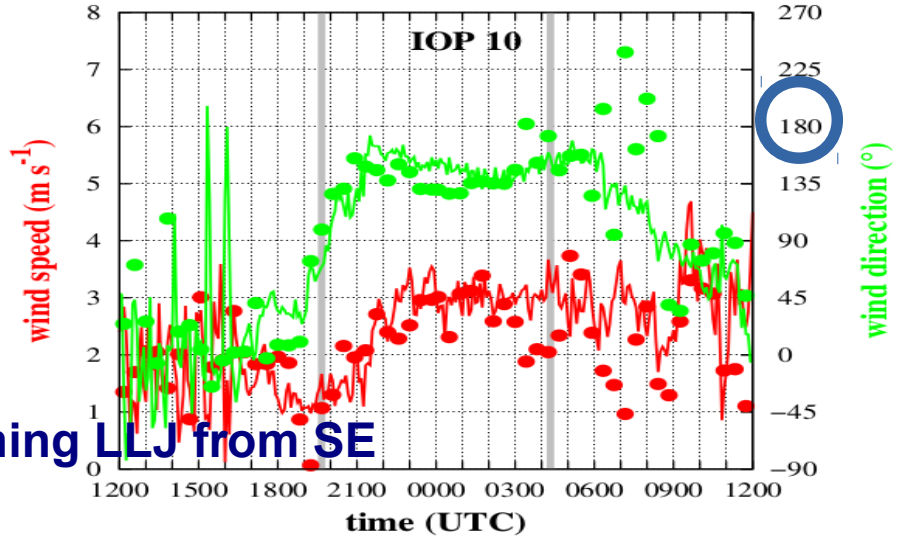
moderate from E, weaking after sunrise



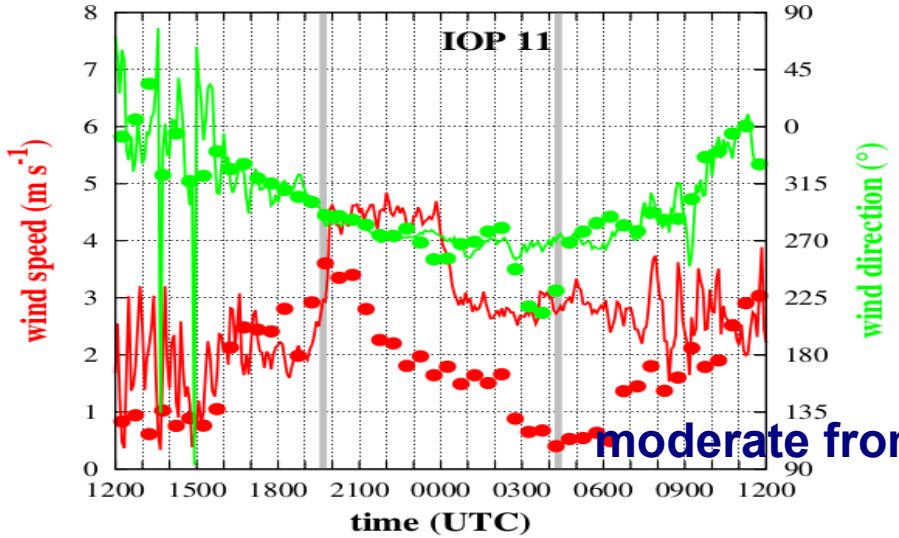
weak



moderate from E



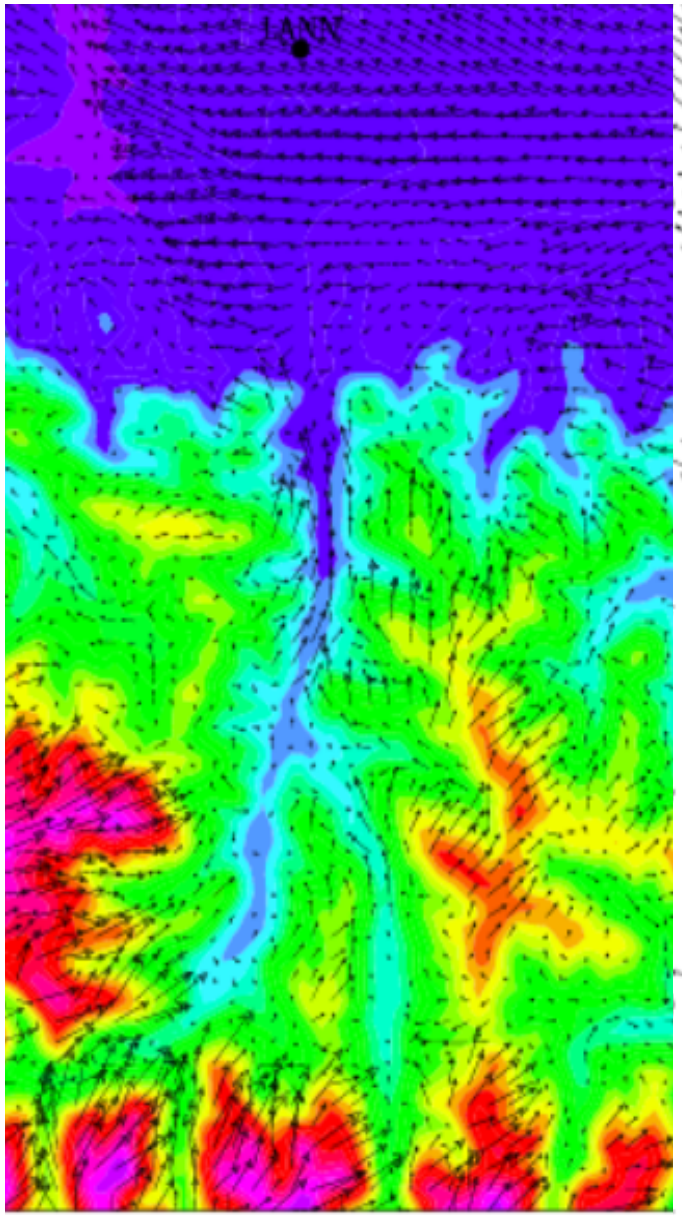
evening LLJ from SE



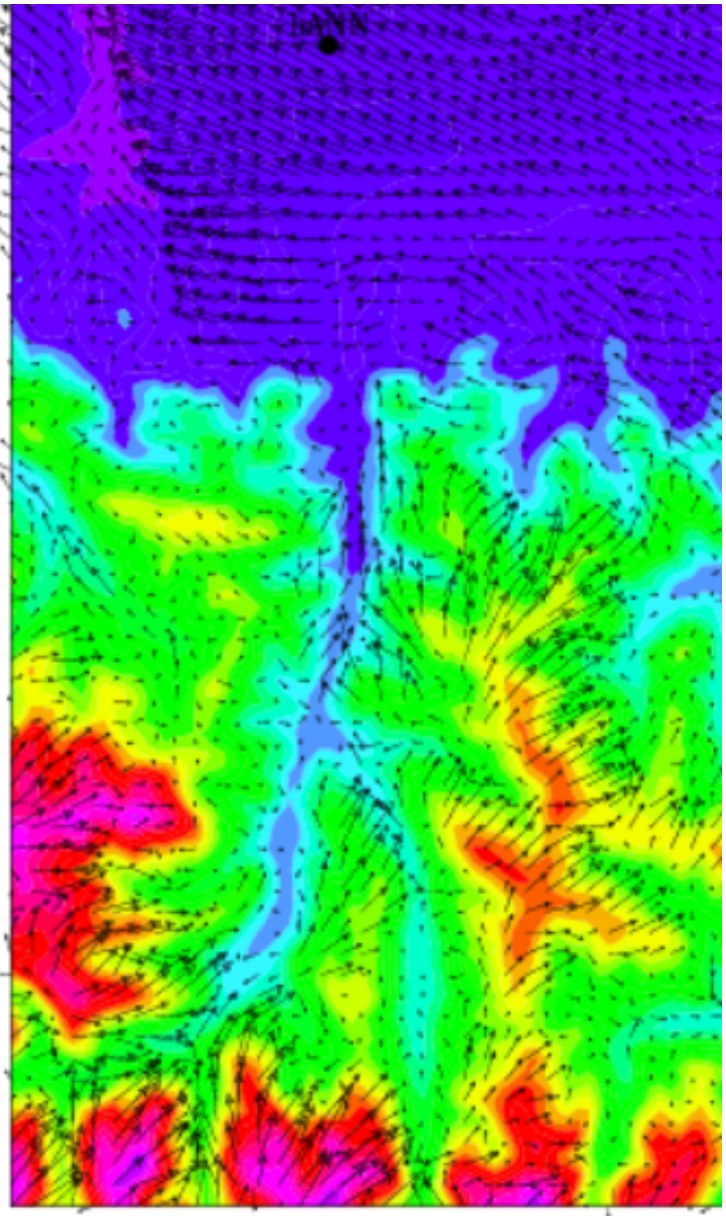
moderate from W

wind vectors at 50m AGL at 0000 UTC

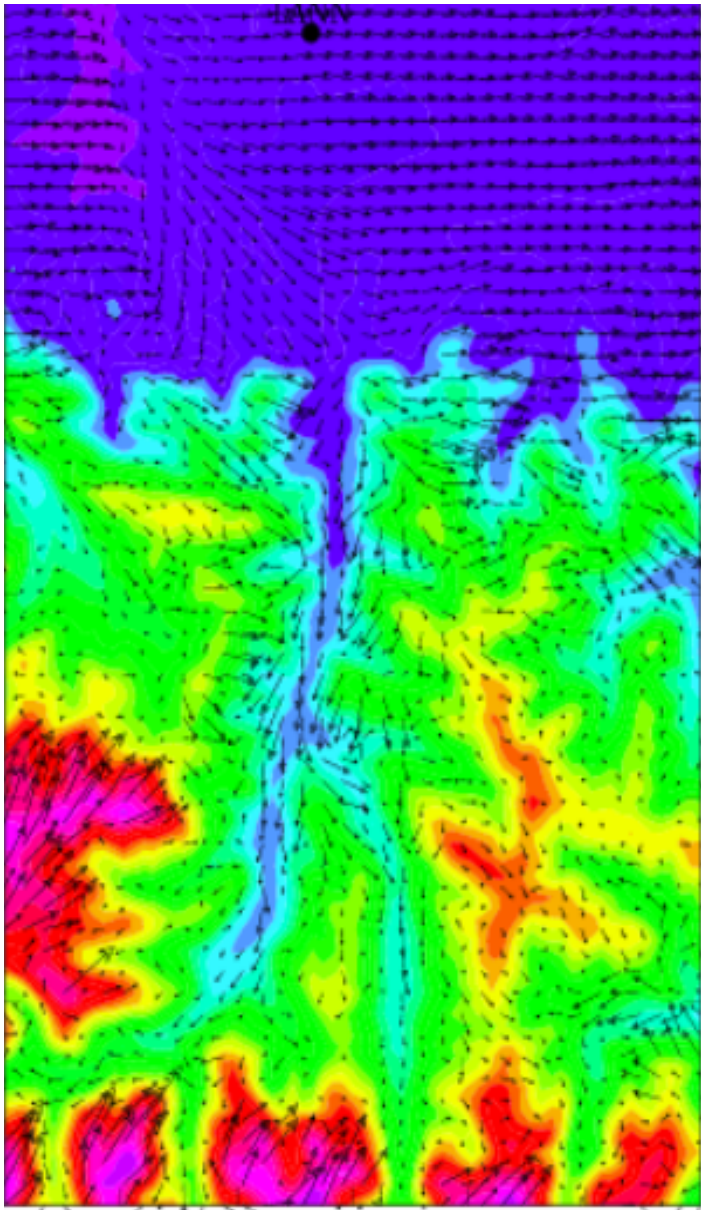
IOP 3



IOP 5

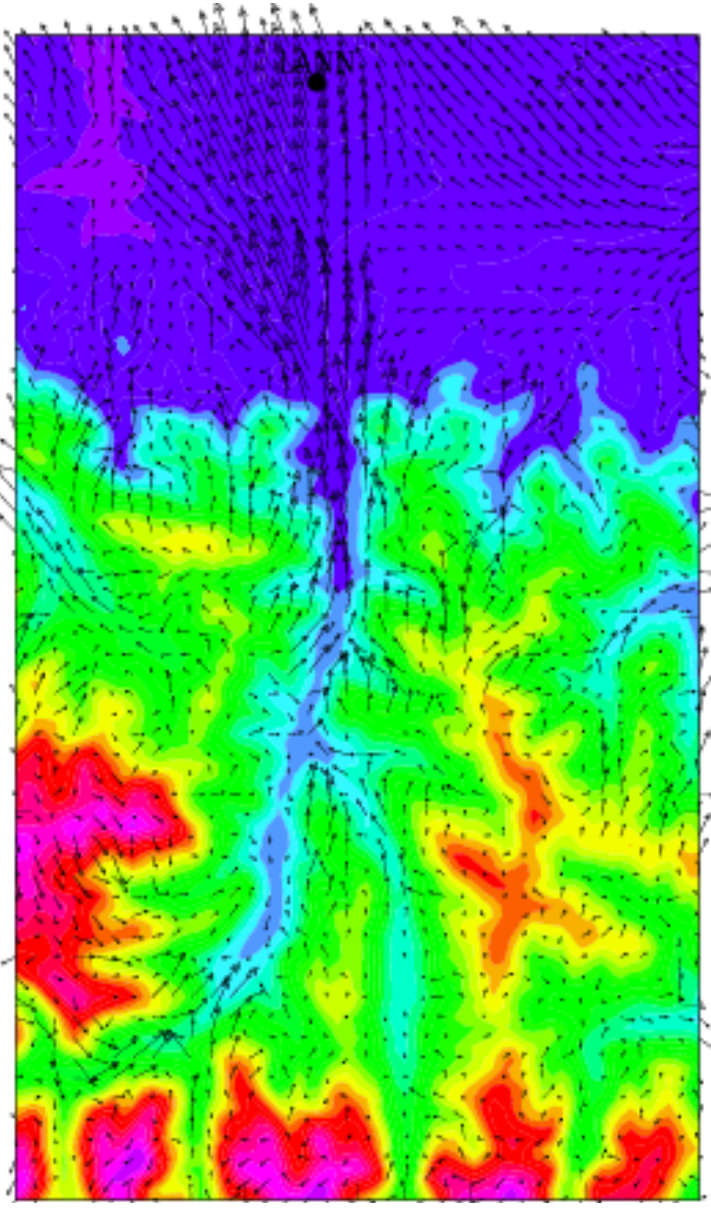


IOP 11

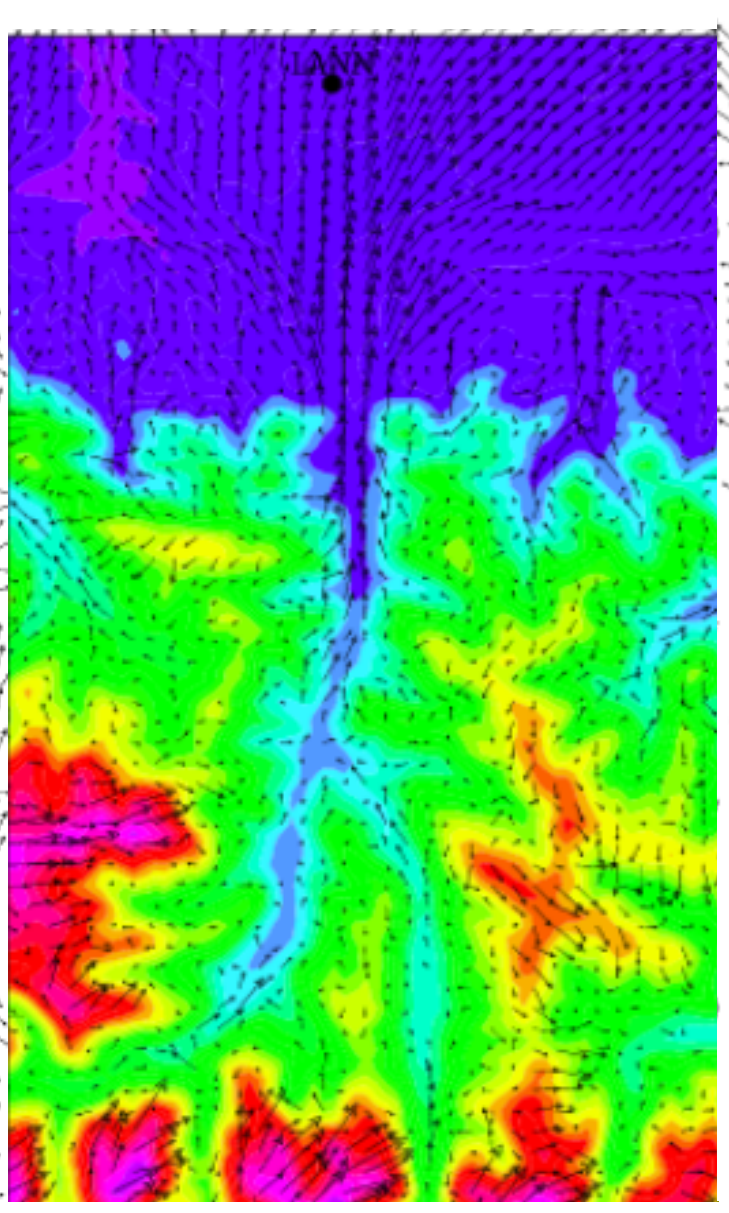


wind vectors at 50m AGL at 0000 UTC

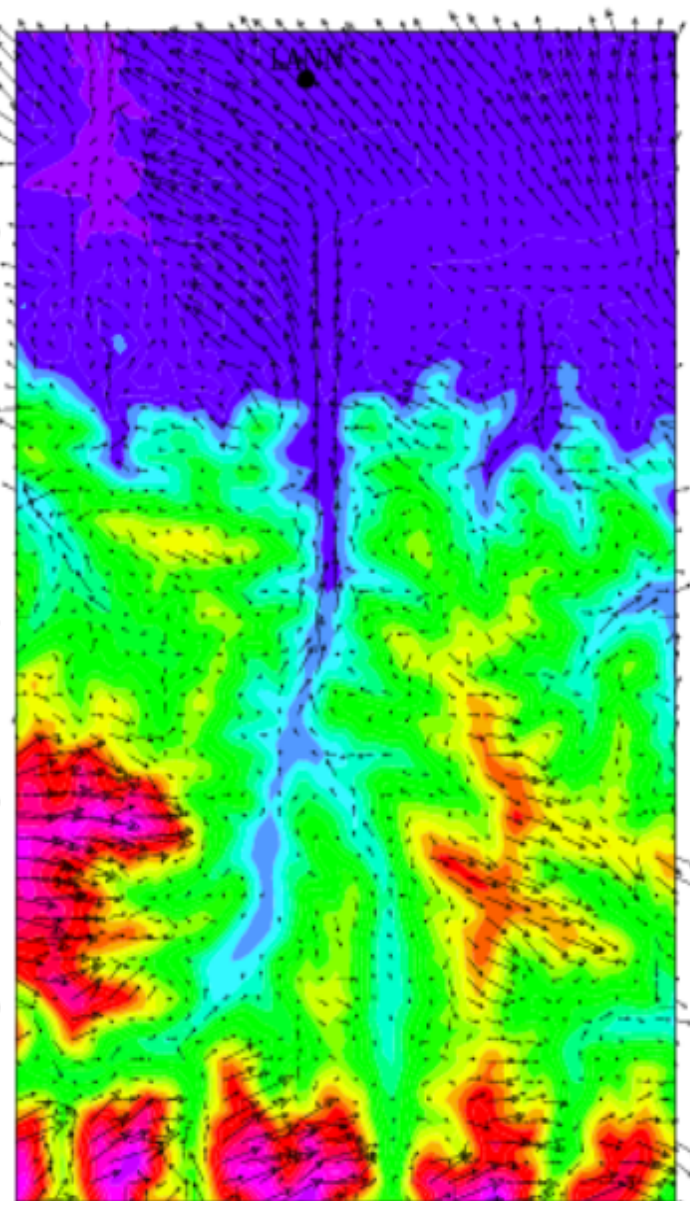
IOP 6



IOP 9



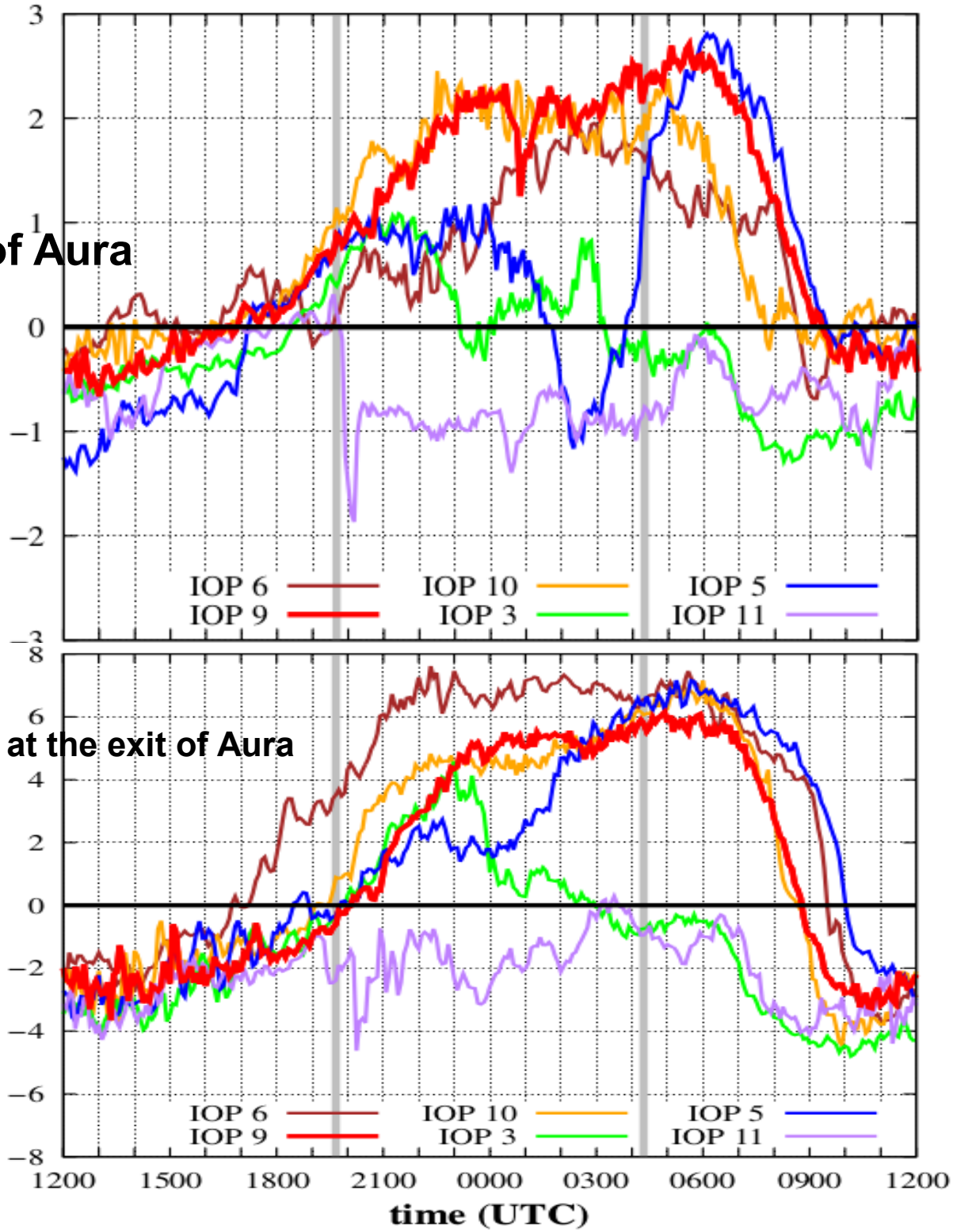
IOP 10

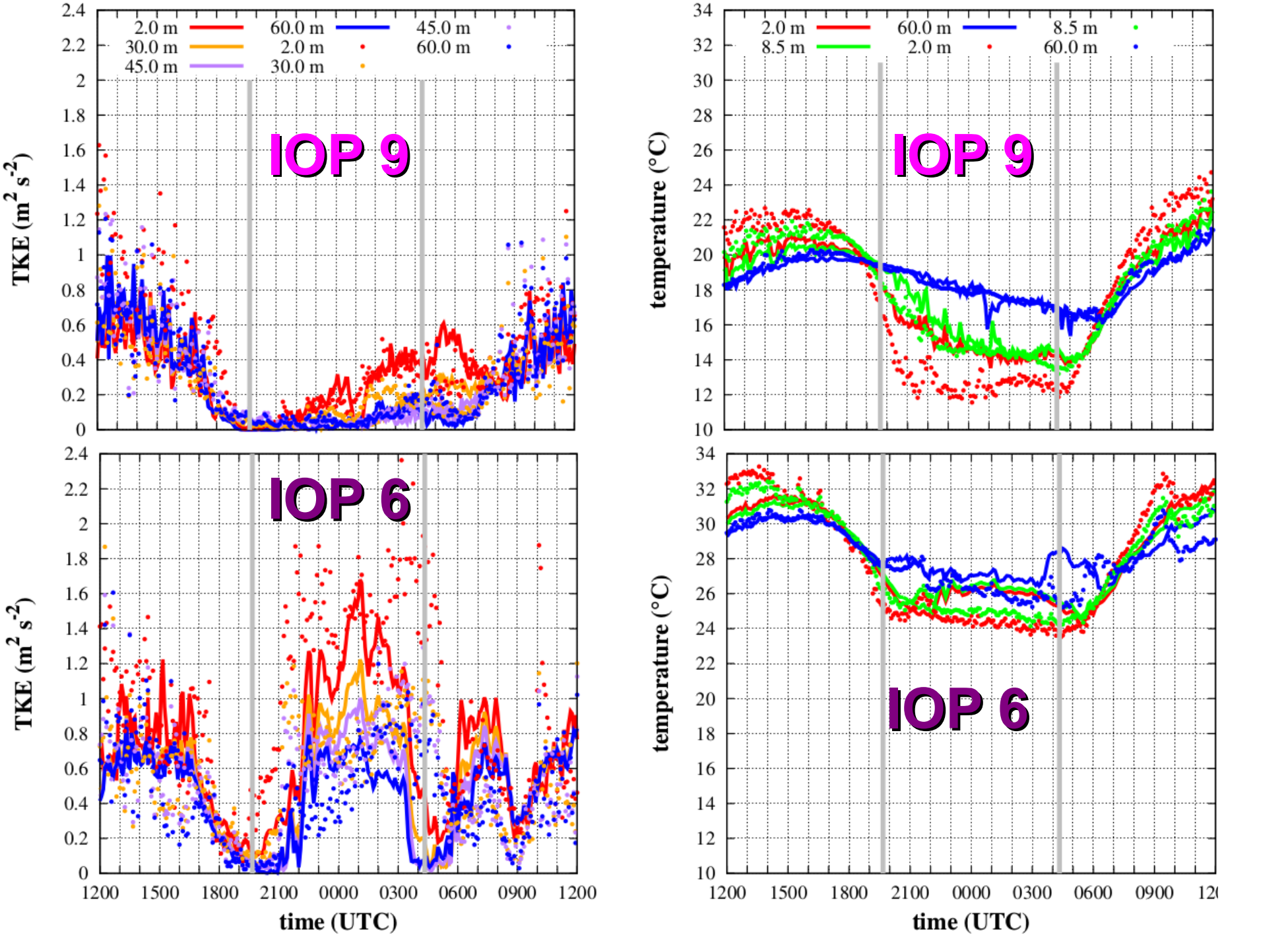


$\langle\theta\rangle_{ABL} = \langle\theta\rangle_{z<1400m\ ASL}$

$\langle\theta\rangle_{Lannemezan} - \langle\theta\rangle_{exit\ of\ Aura}$

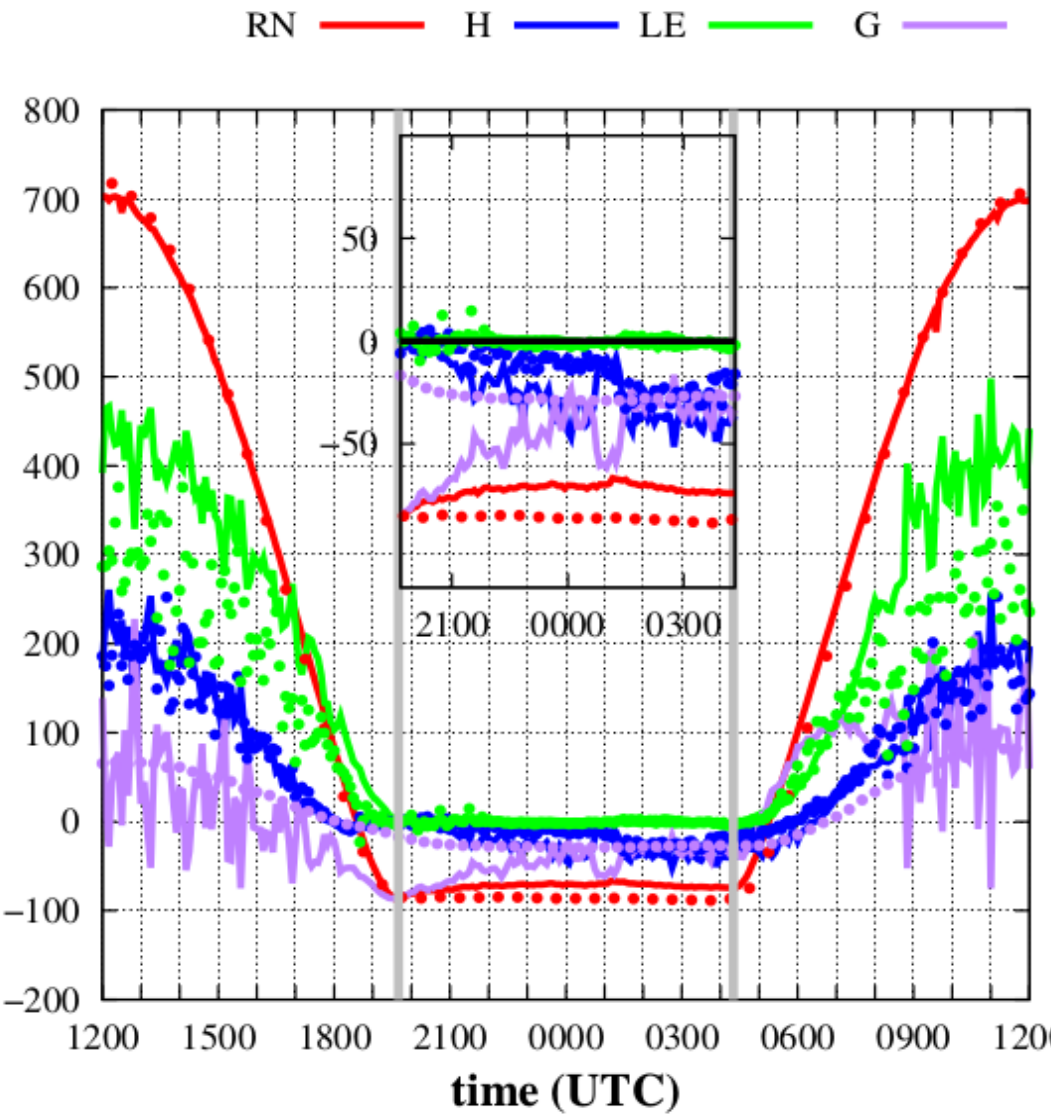
$\langle v\text{-component}\rangle_{z<1400m\ ASL\ at\ the\ exit\ of\ Aura}$



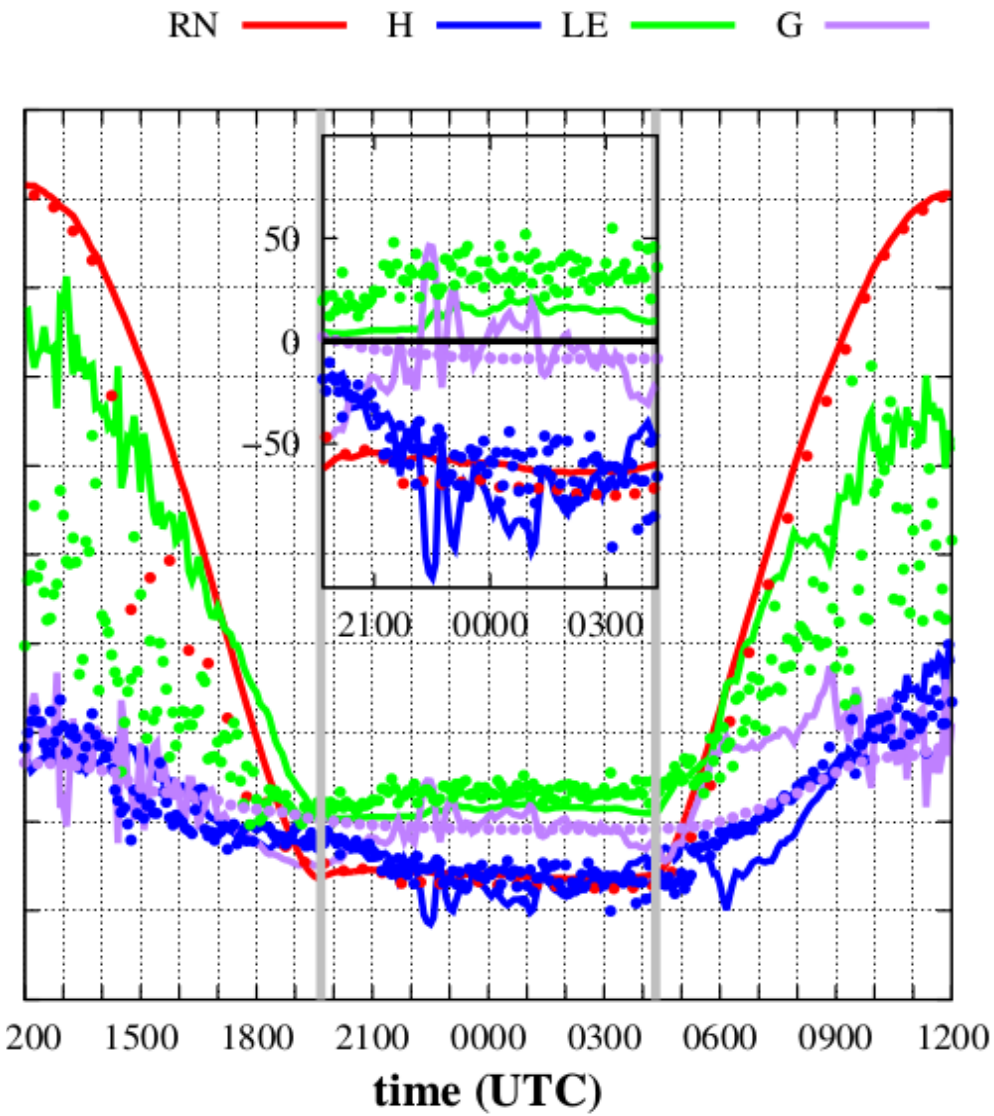

IOP 9
IOP 6
TKE (m² s⁻²)
temperature (°C)
time (UTC)
2.0 m
30.0 m
45.0 m
60.0 m
2.0 m
30.0 m
45.0 m
60.0 m
8.5 m
2.0 m
8.5 m
60.0 m
1200
1500
1800
2100
0000
0300
0600
0900
1200

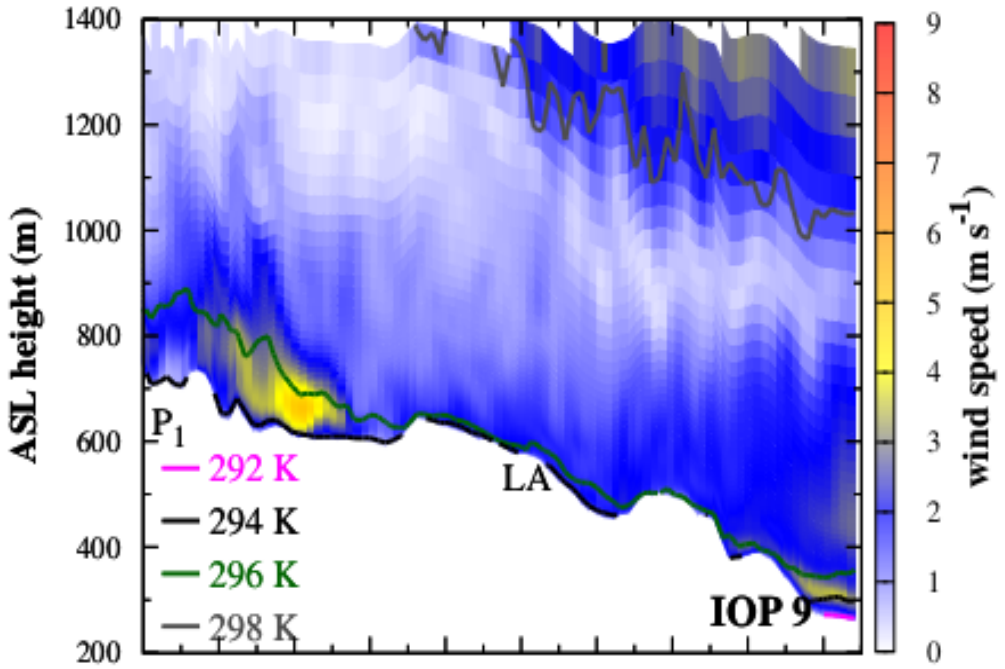
Surface Energy Budget in Lannemezan

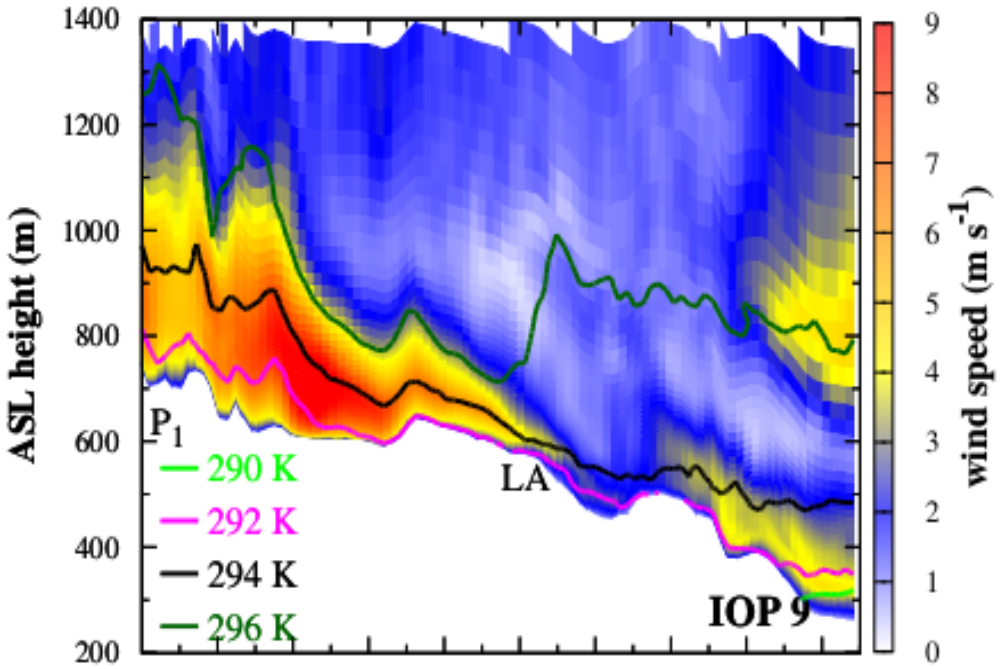
IOP 9



IOP 6

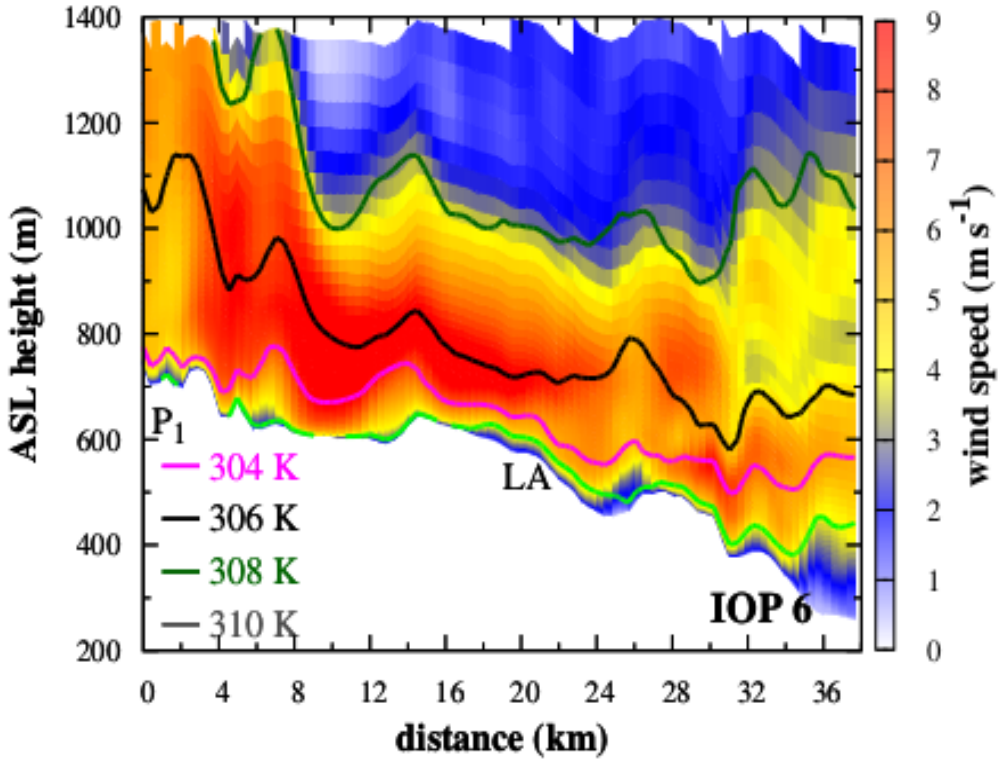


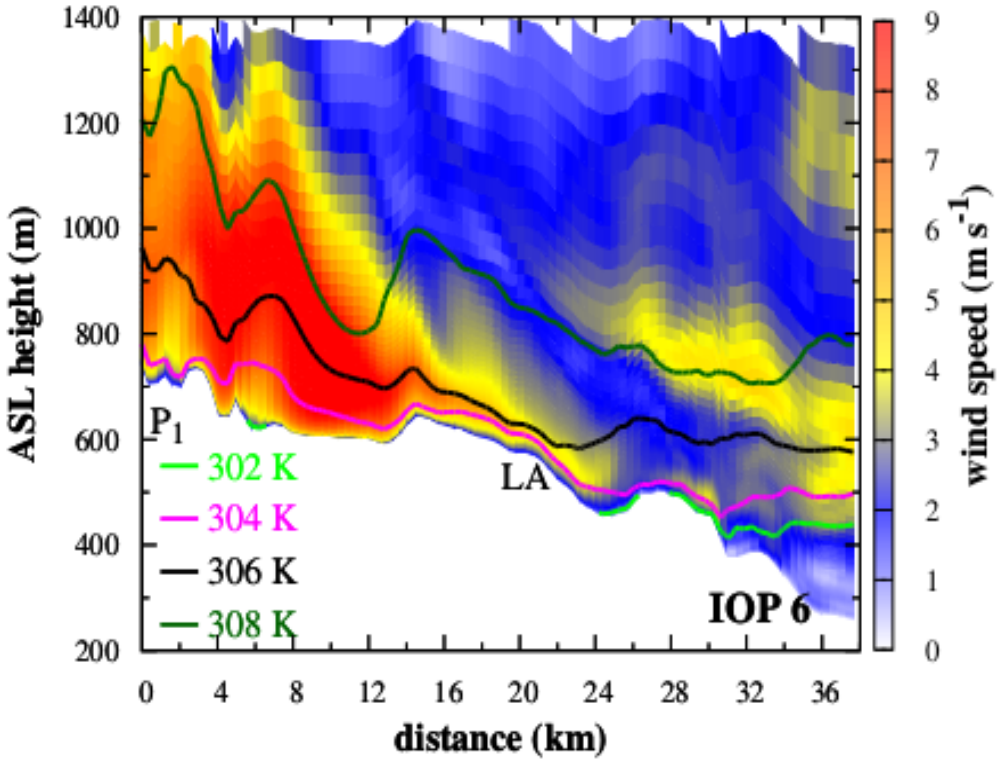


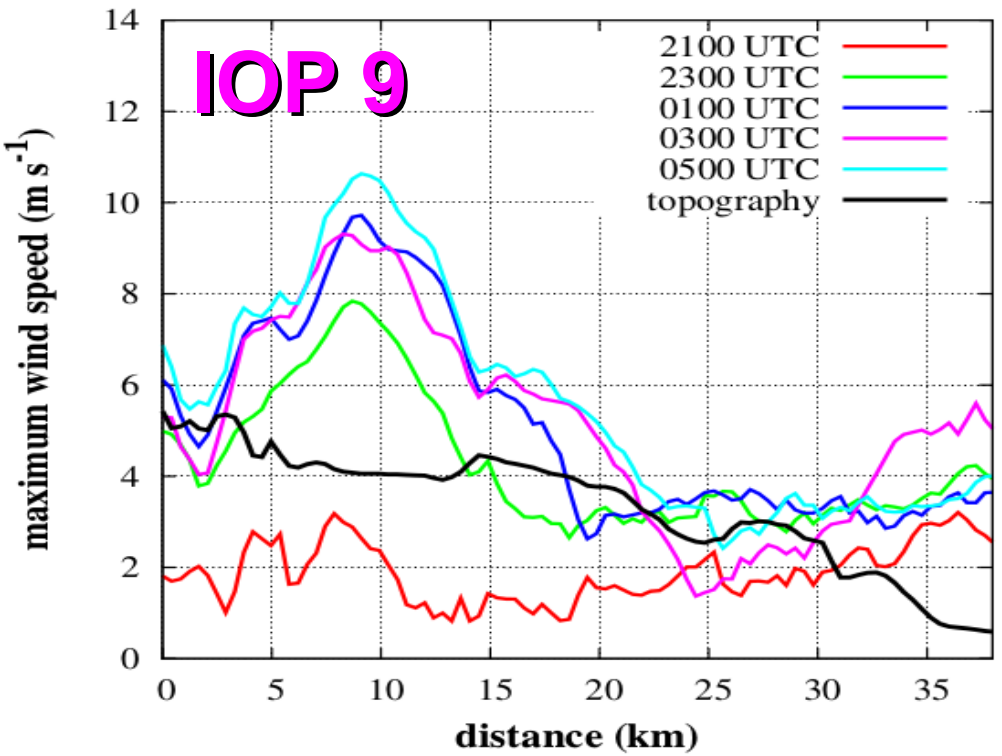


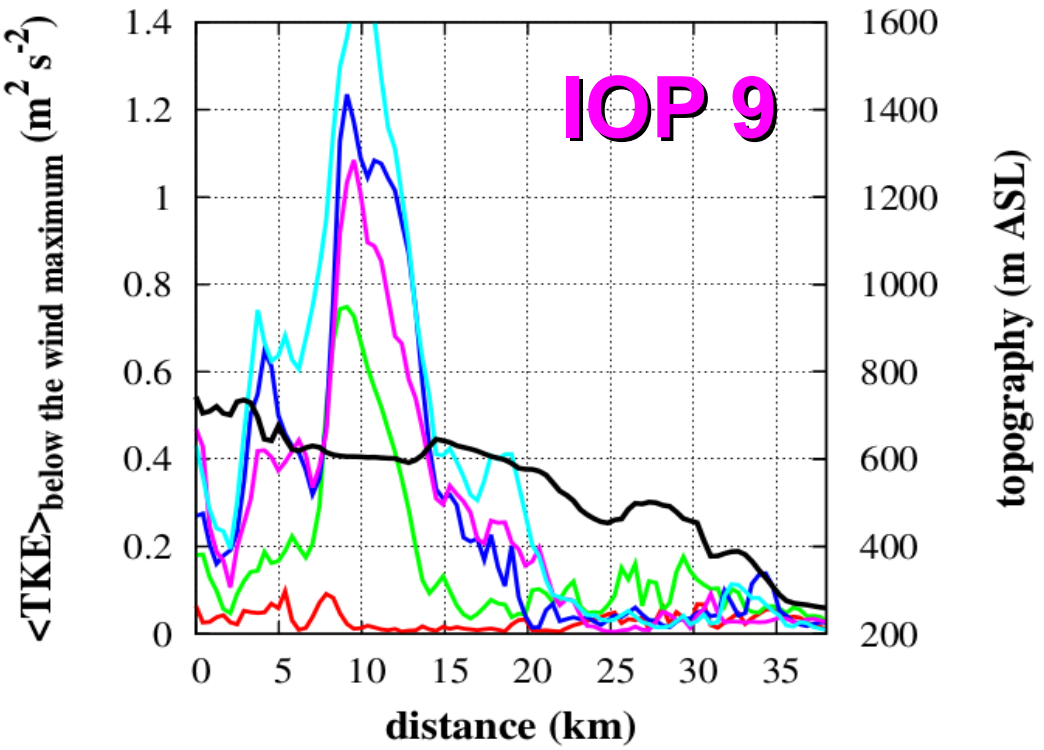
2130 UTC

0400 UTC

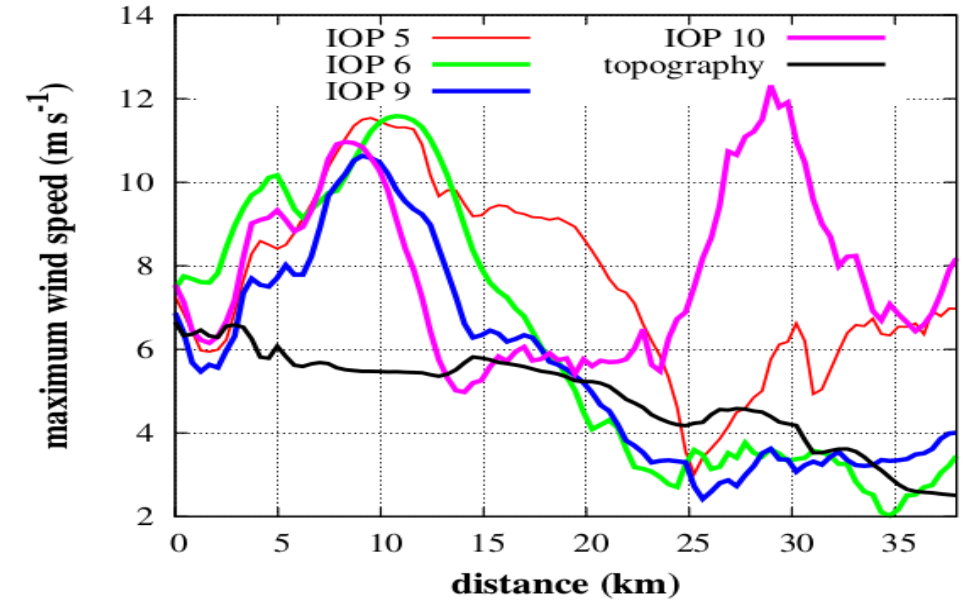


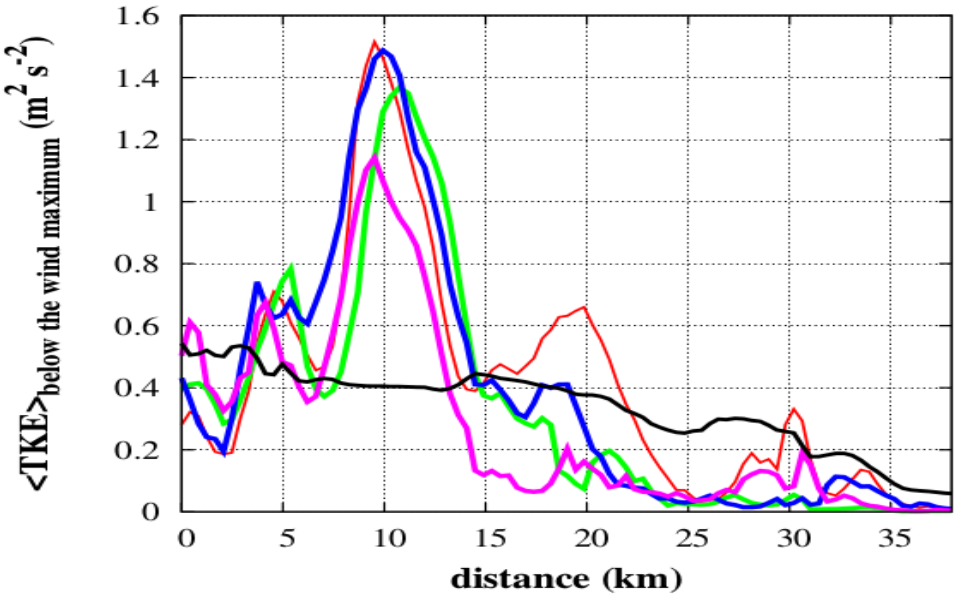


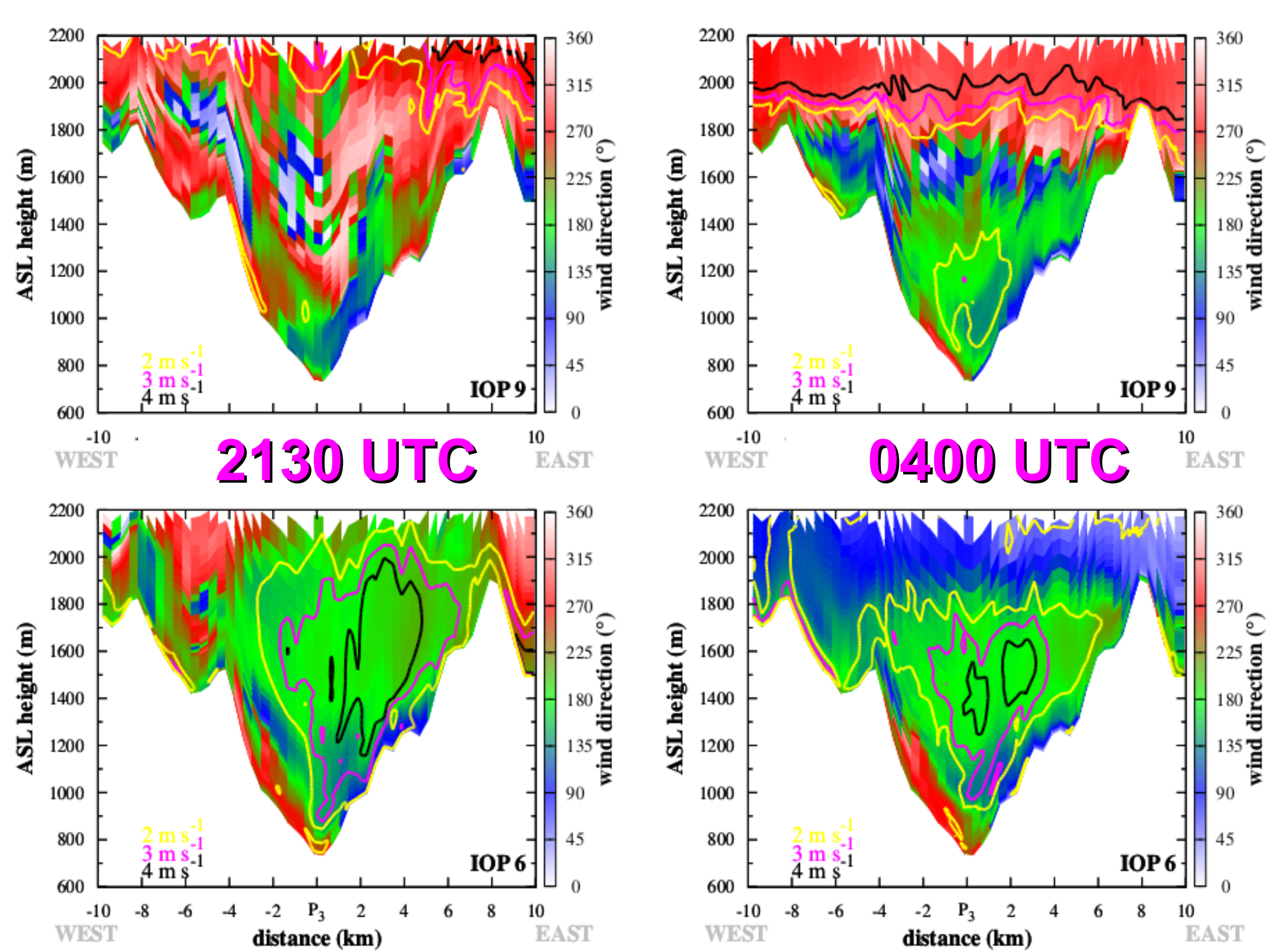




Propagation of the valley exit jet through the foothills (Lannemezan at about 20km)






2130 UTC
0400 UTC
IOP 9
IOP 6
2 m s-1
3 m s-1
4 m s-1
ASL height (m)
wind direction (°)
distance (km)
WEST
EAST
P3

CONCLUSIONS

1) Under clear-skies, no clouds and rain, the Aura valley is able to generate a valley exit jet

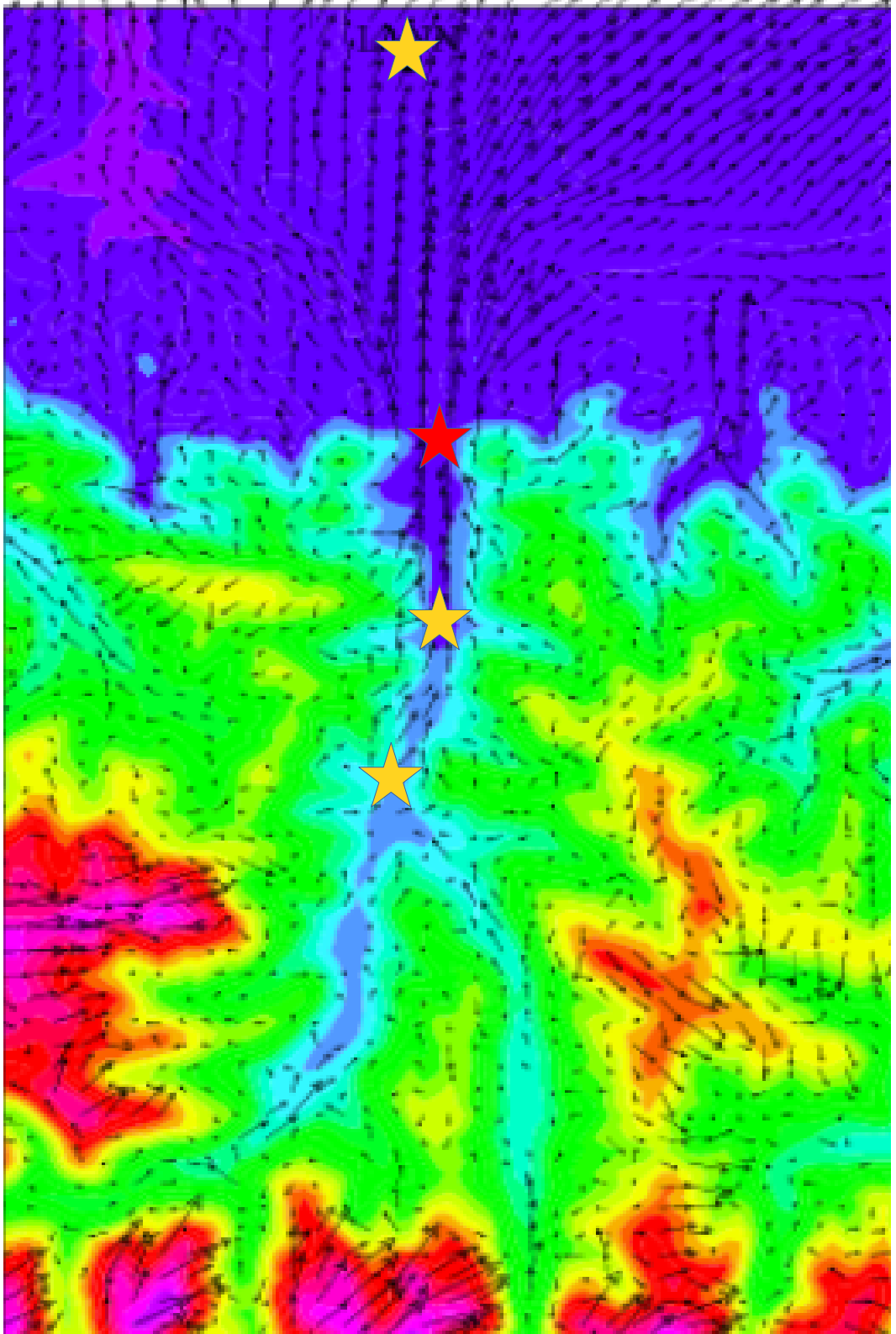
→ wind maximum of 8m/s
→ wind height between 50-250m AGL
→ generated 2h after sunset and nearly stationary during night-time
→ reaches Lannemezan for weak LS or moderate from the S
→ the jet propagates through the foothils where it is less intense and lower than at its exit

2) Its features depend on:
→ thermal differences between valley and plain
→ wind speed and direction of the LS wind

3) The main features of the ABL in Lannemezan are:
→ a diurnal cycle of the wind (N: day; S: night)
→ 3 types of thermal winds present:
locally-generated, valley exit jet and mountain-plain
→ mixing events linked to the presence of the valley exit jet
→ the evolution of the terms in the SEB depend on the presence of the jet

May-September 2018

Is the organization of the modelled flow in the Aura valley reallistic?



ACKNOWLEDGEMENTS

RESEARCH PROJECTS
CGL2012-37416-C04-01
CGL2015-65627-C3-1-R