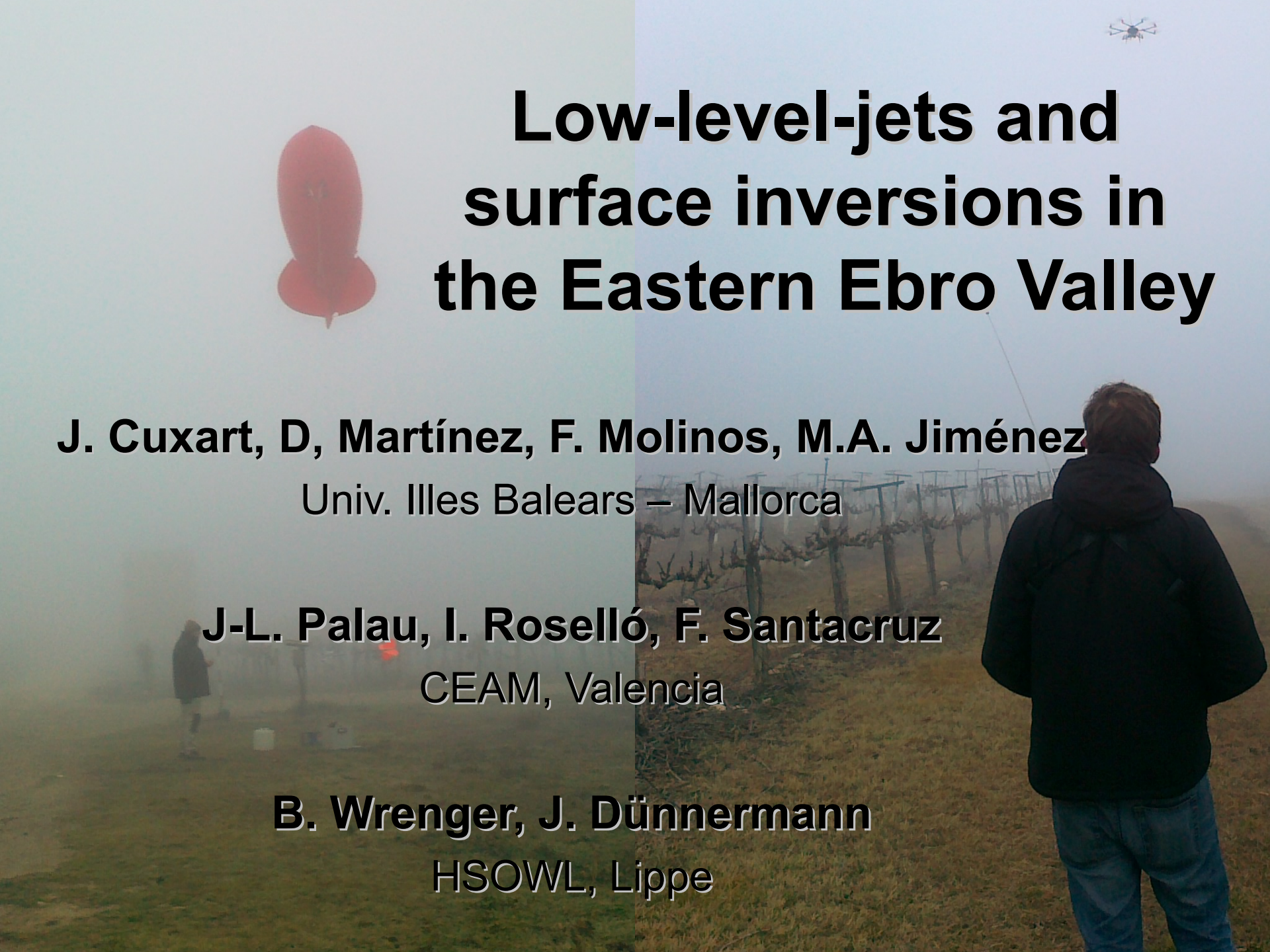


Low-level-jets and surface inversions in the Eastern Ebro Valley

J. Cuxart, D, Martínez, F. Molinos, M.A. Jiménez

Univ. Illes Balears – Mallorca

J-L. Palau, I. Roselló, F. Santacruz

CEAM, Valencia

B. Wrenger, J. Dünnermann

HSOWL, Lippe

Concepts

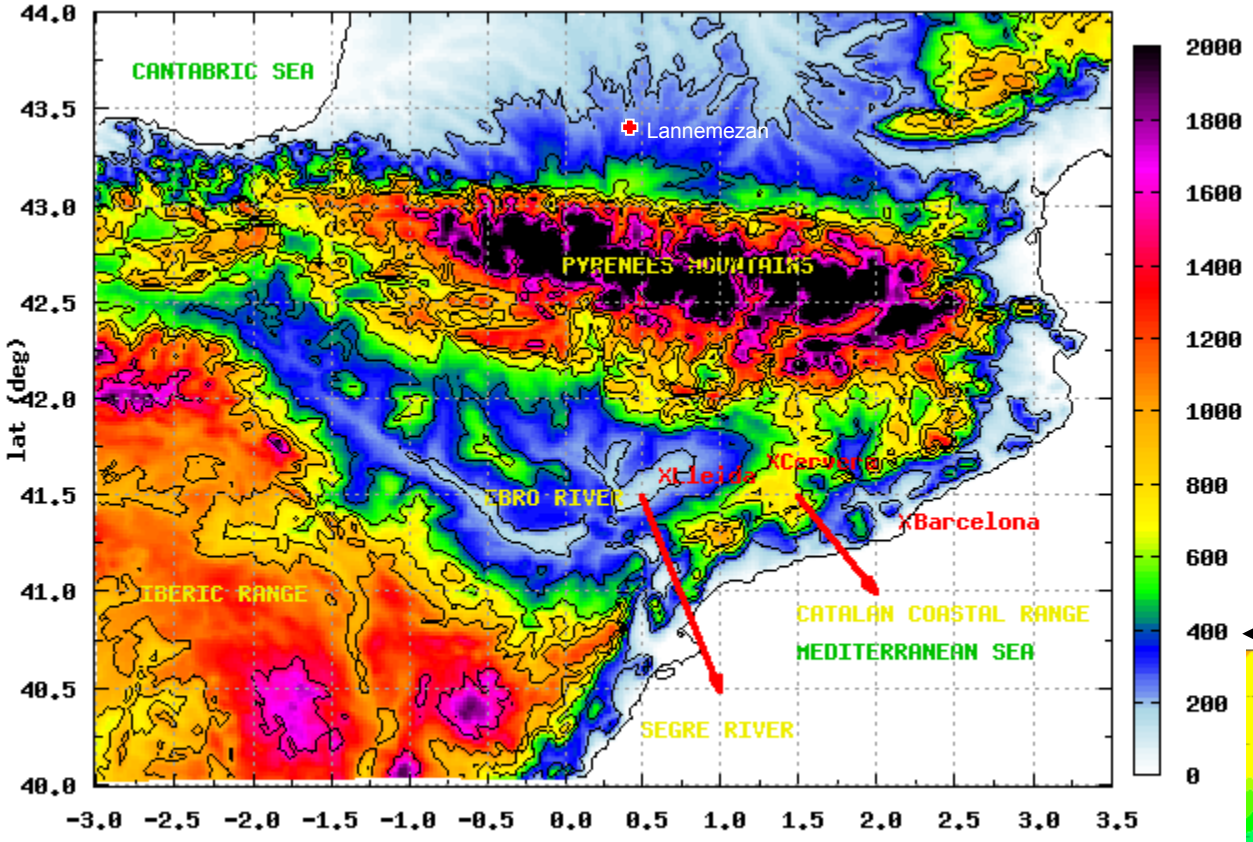
When no well-defined synoptic gradients occur on a basin, low-level flows or jets (LLJs) develop at a variety of scales, mainly due to spatial thermal differences.

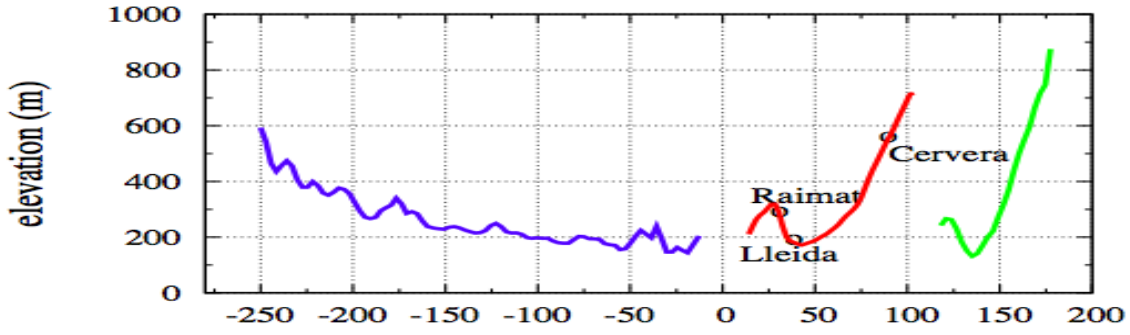
- These LLJs may be generated by surface heterogeneities, local slopes, close hills or far away mountain ranges, even if the area of interest is a very flat and wide land.

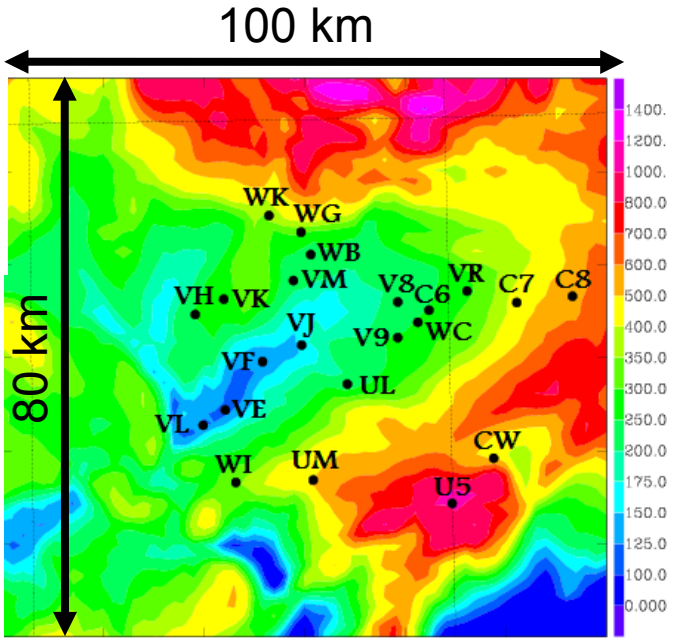
- Development of surface radiation inversions is controlled by the surface energy budget but very much conditioned by mixing coming from aloft (from LLJs for instance)

Objective: Study the dynamics for the Eastern Ebro basin and the characteristics of these LLJ formed at a basin scale and their interaction with surface inversions.

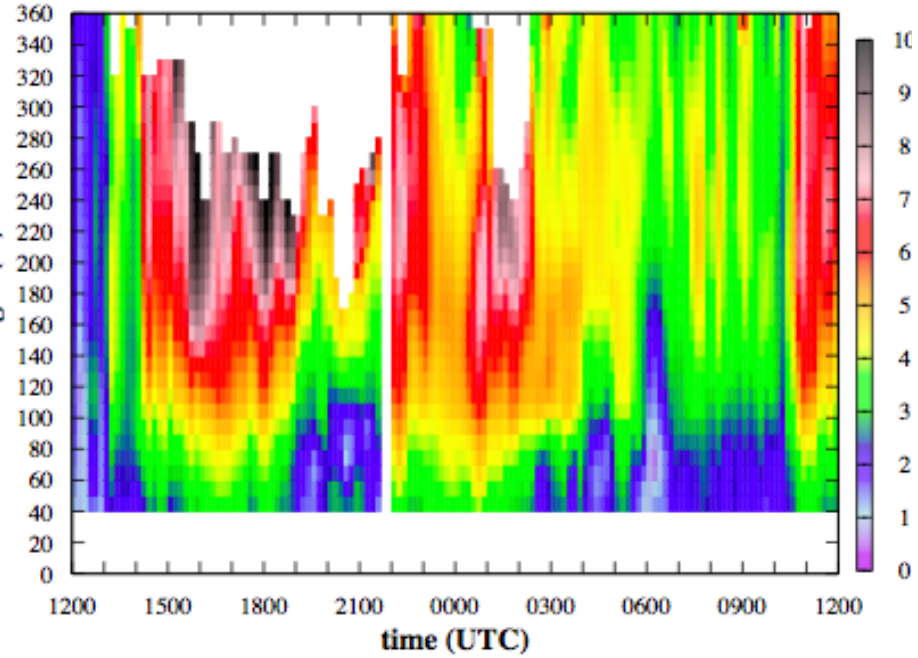
The Ebro Basin

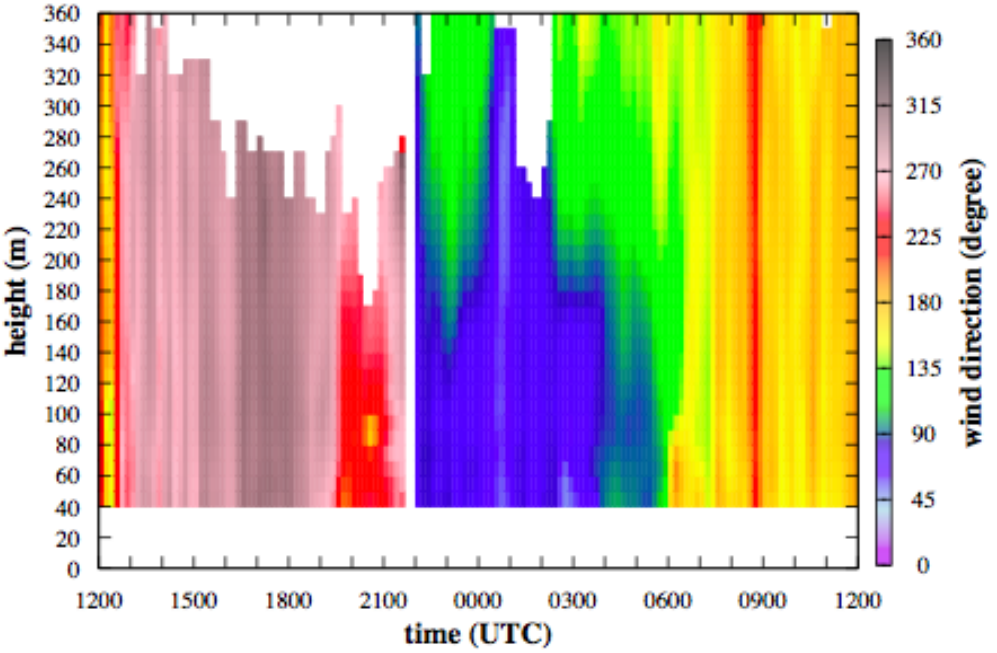


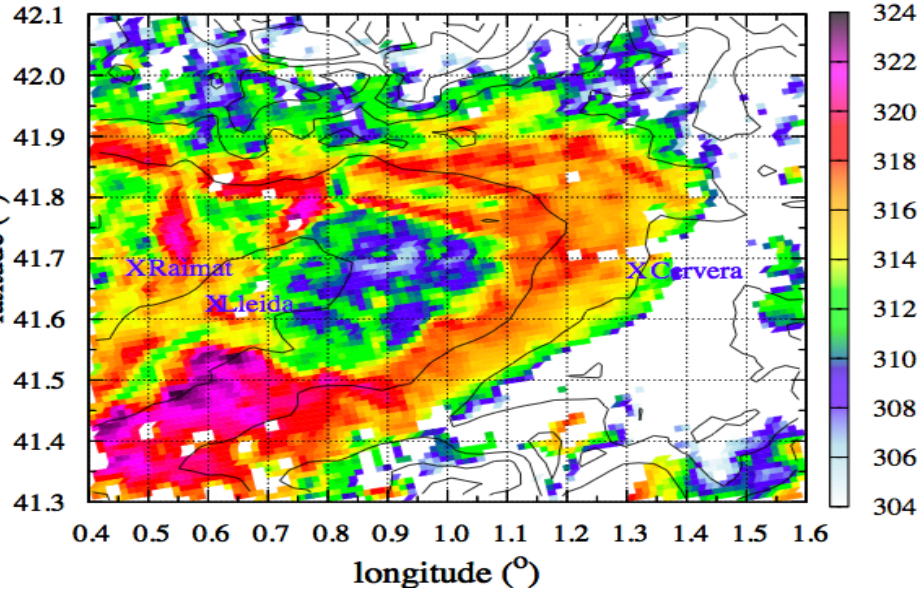


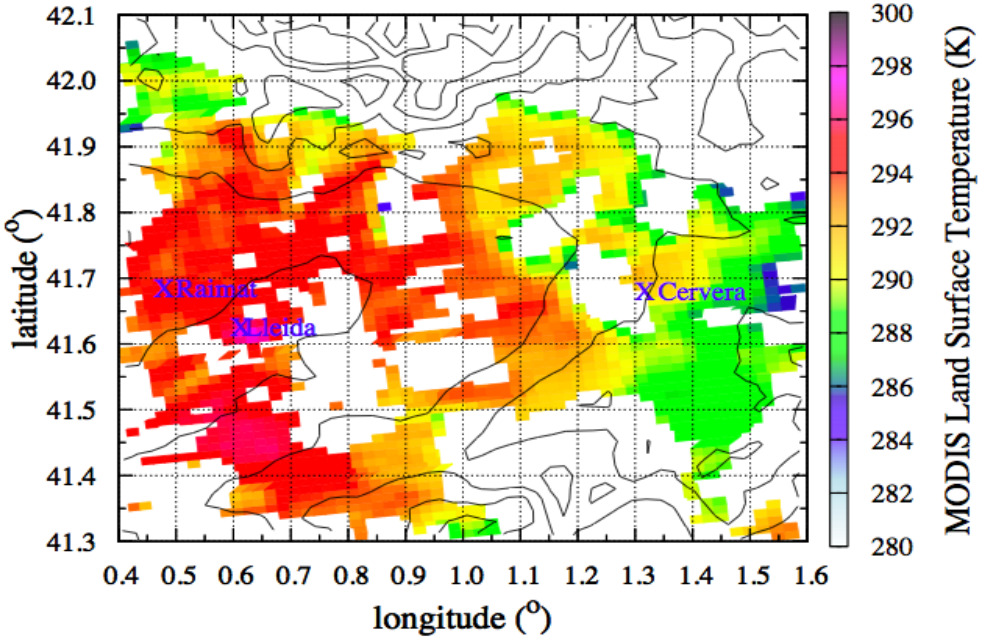


Local Wind Evolution

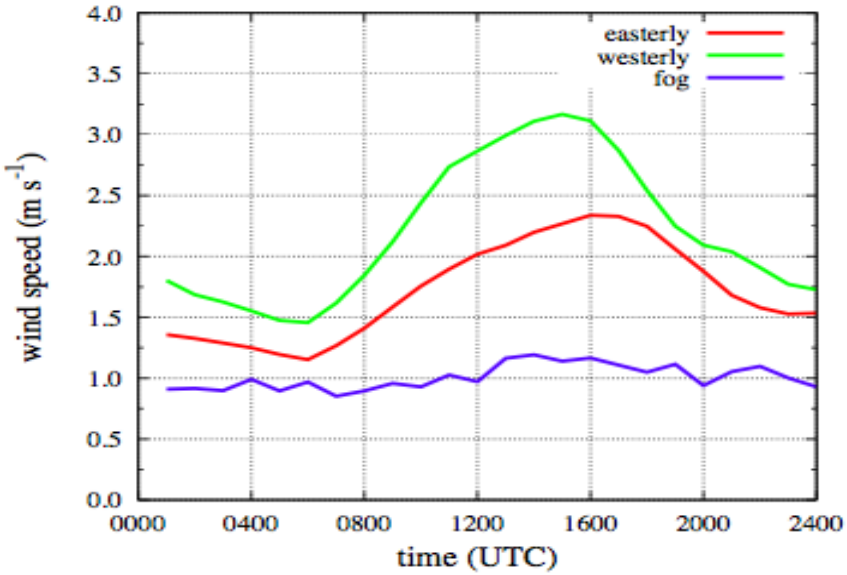


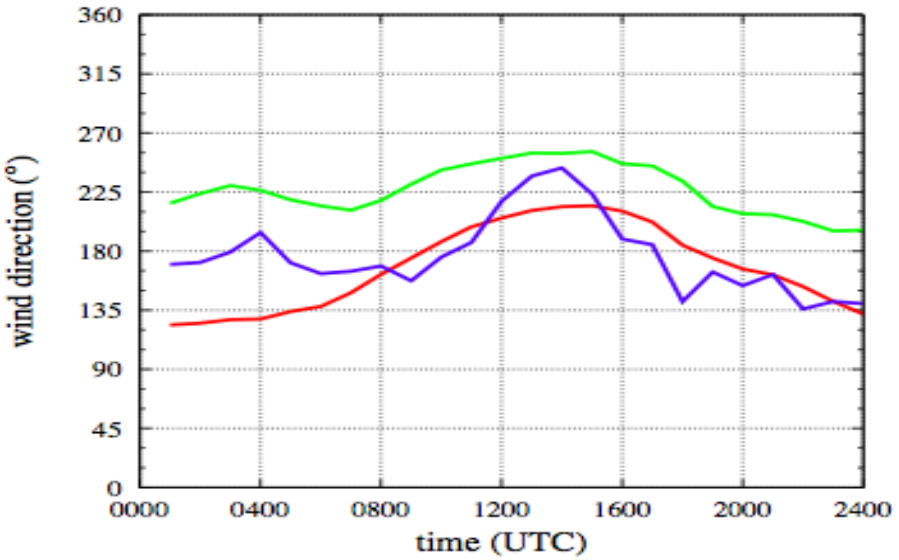


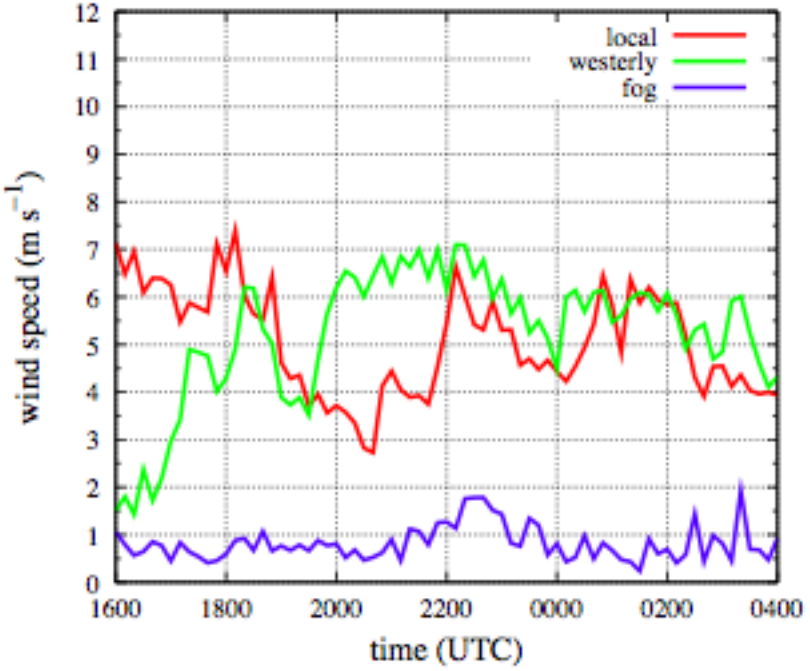


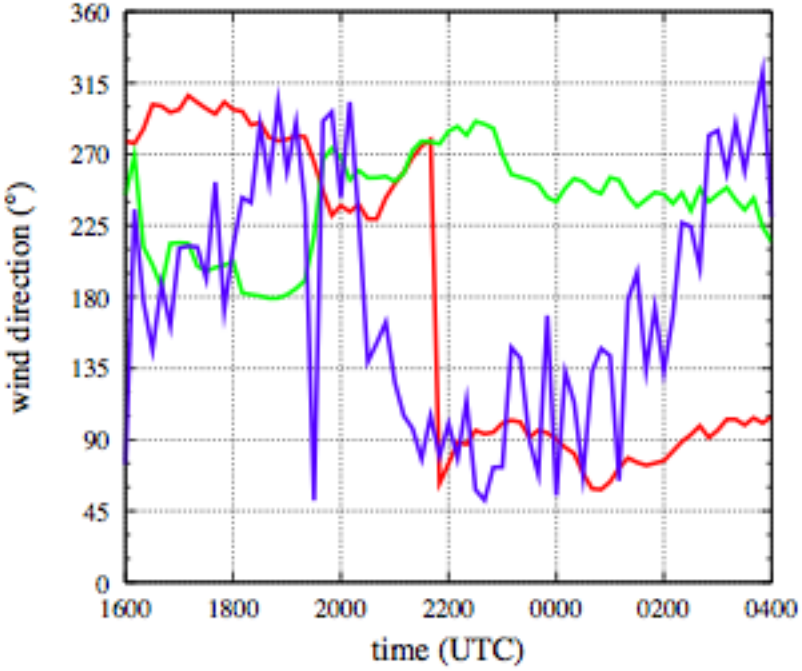


Local Wind Evolution

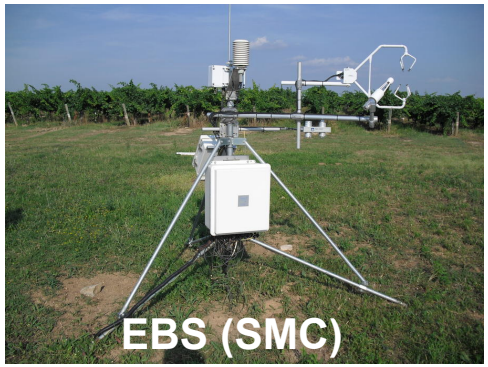


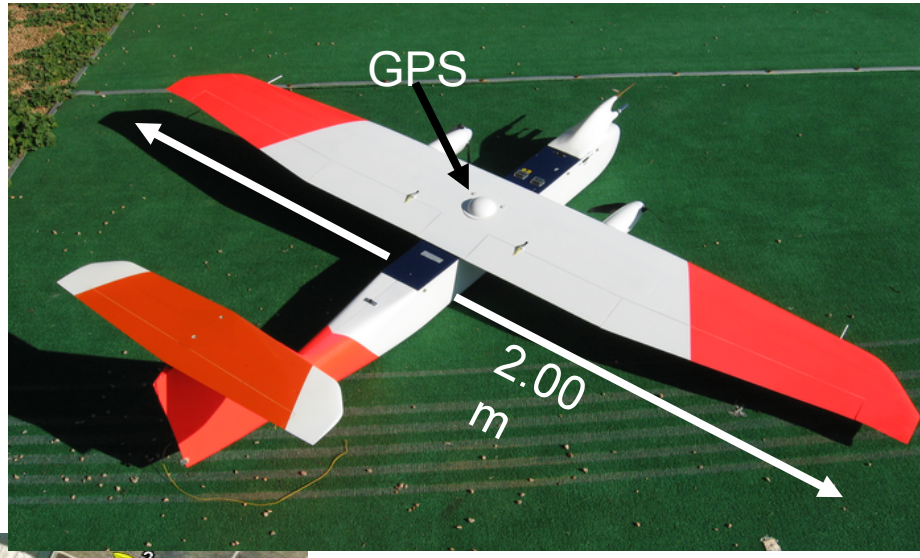






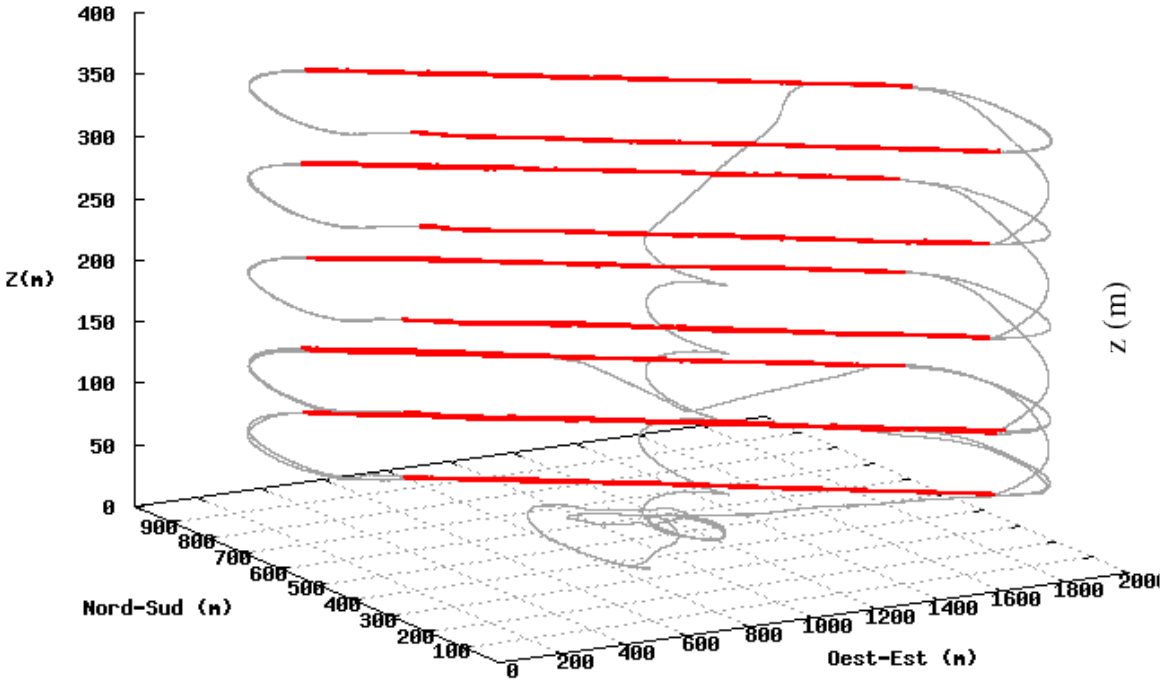
The LBF2009 Campaign (Instrumentation)

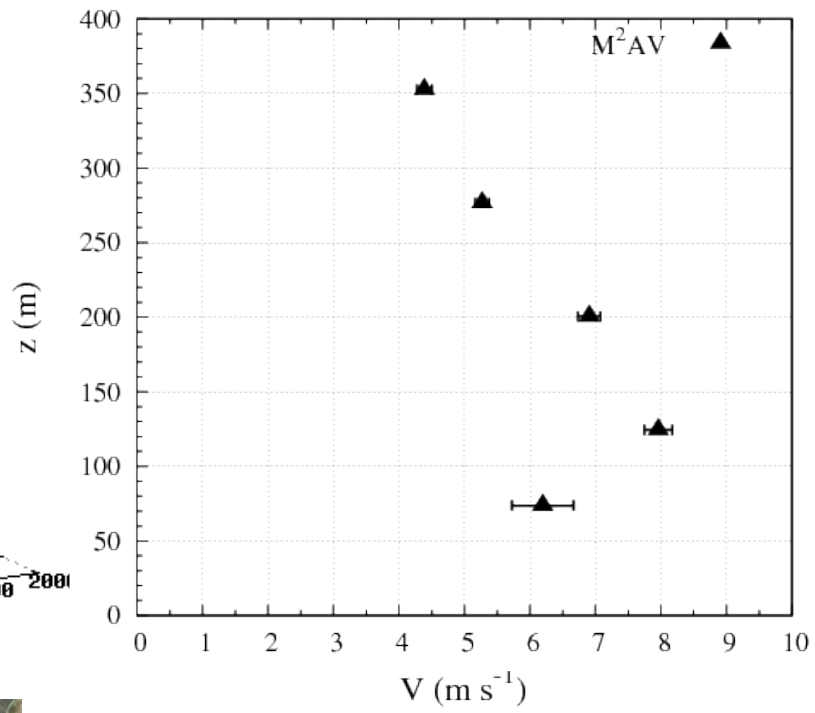


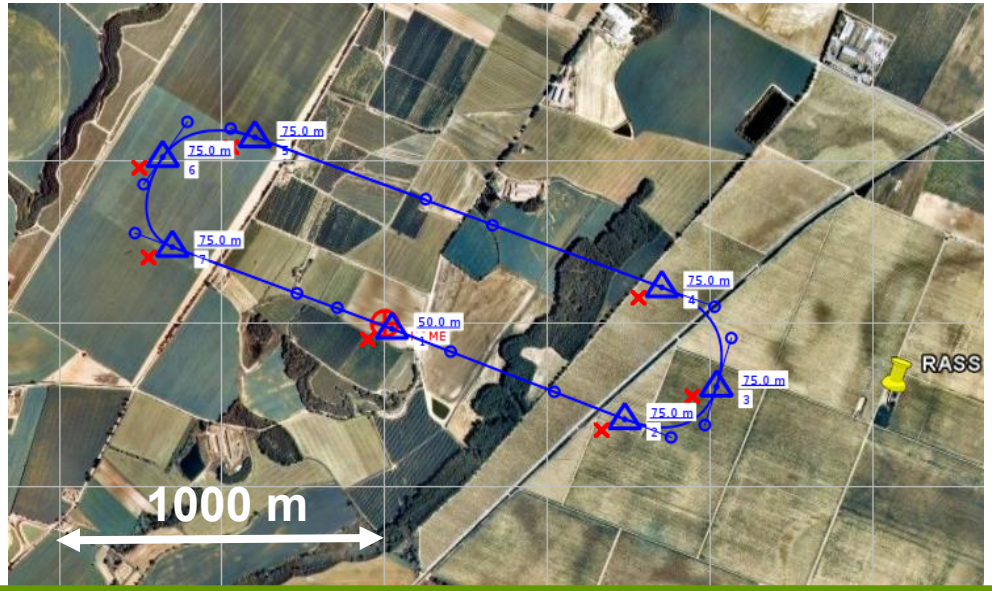


LBF2009 Campaign:
30th June – 14th July 2009

Flight strategy







2 convective-advective flights

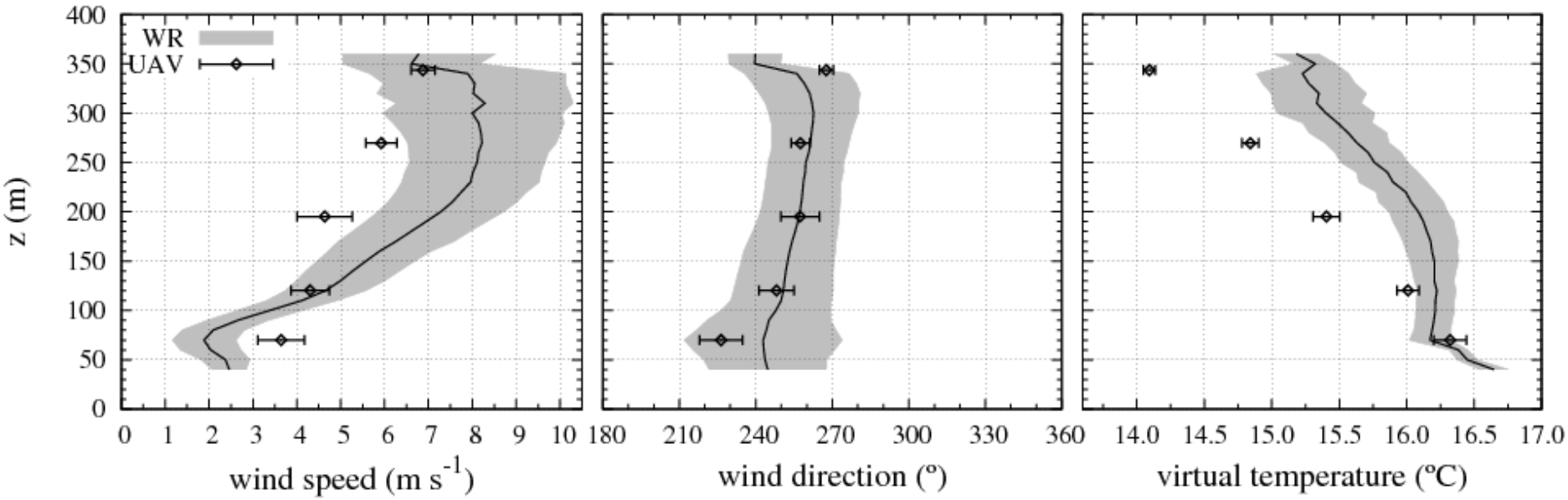
1 neutral cloudy daytime flight

3 westerly night flows

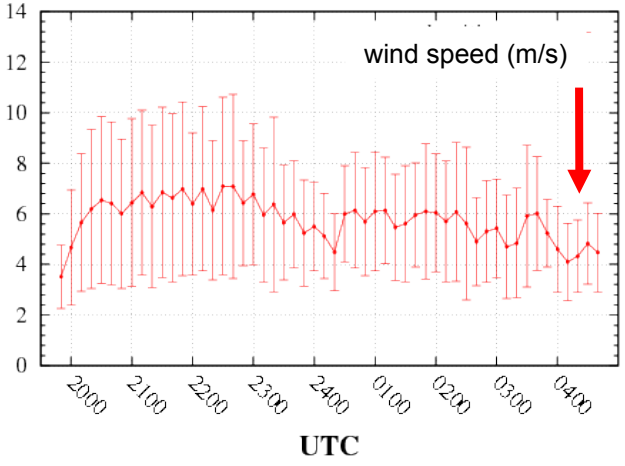
3 easterly (local) night flows

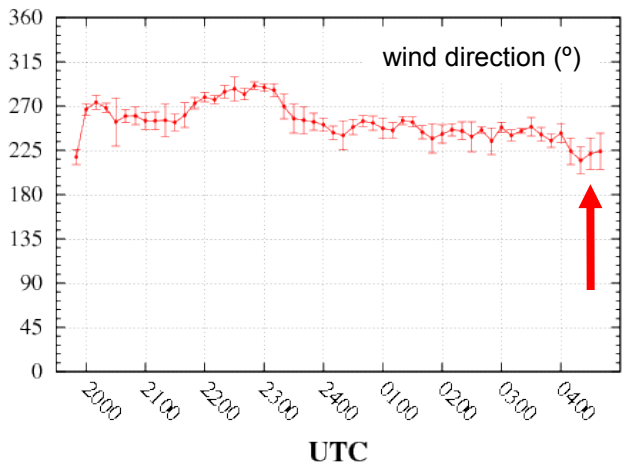
Vertical profiles (Weak westerly case)

Comparison Carolo-M2AV ↔ WindRass-Scintec



WindRass-Scintec: time evolution of the vertically averaged profiles along the night

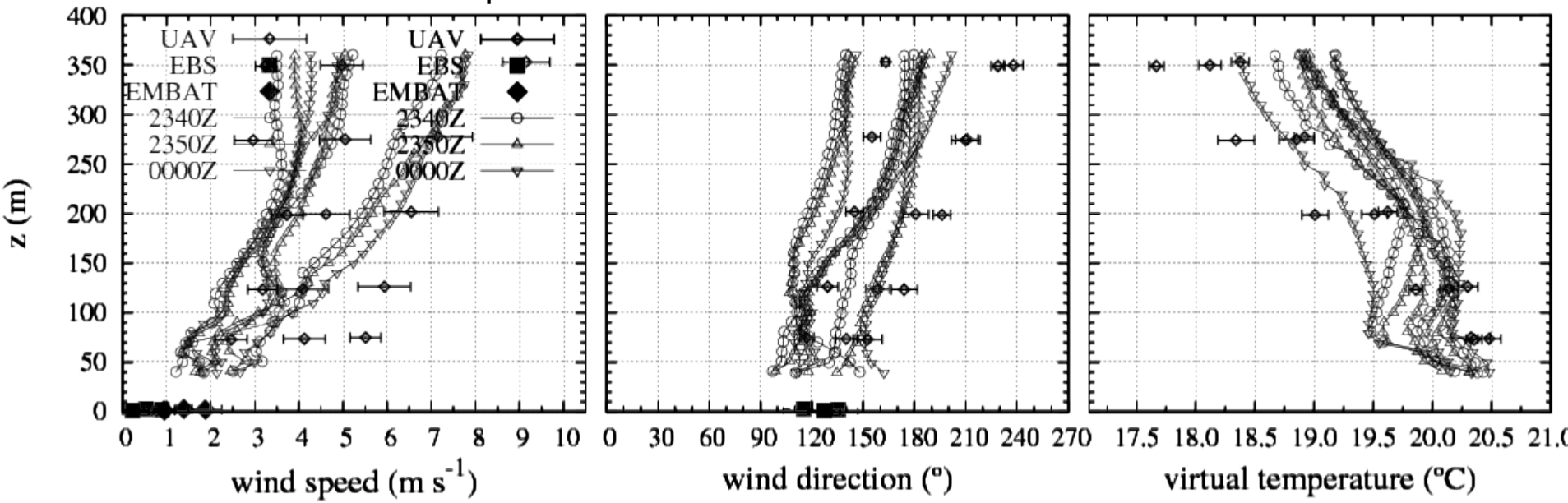




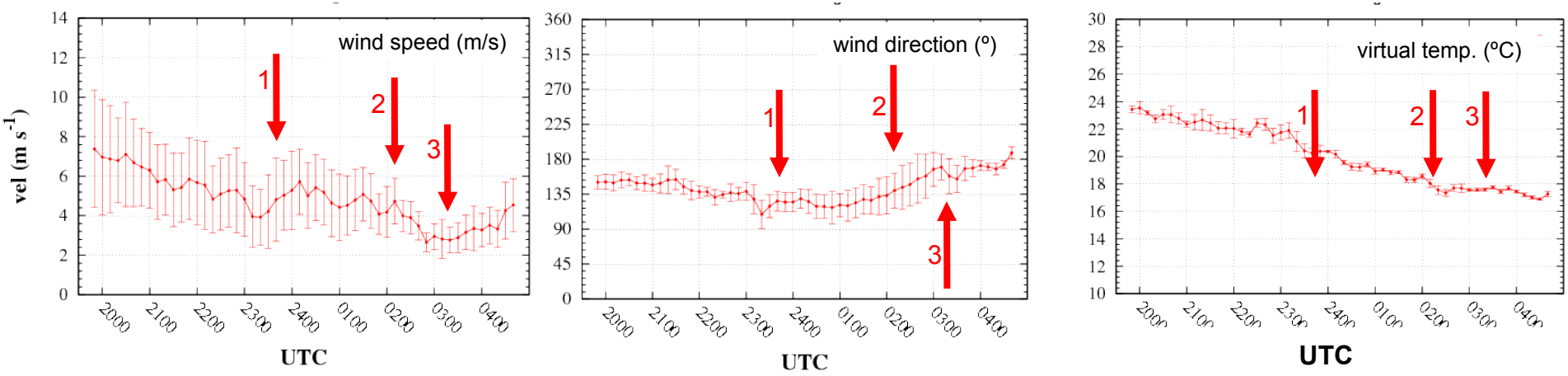
virtual temp. (°C)

Vertical profiles (easterly local flow)

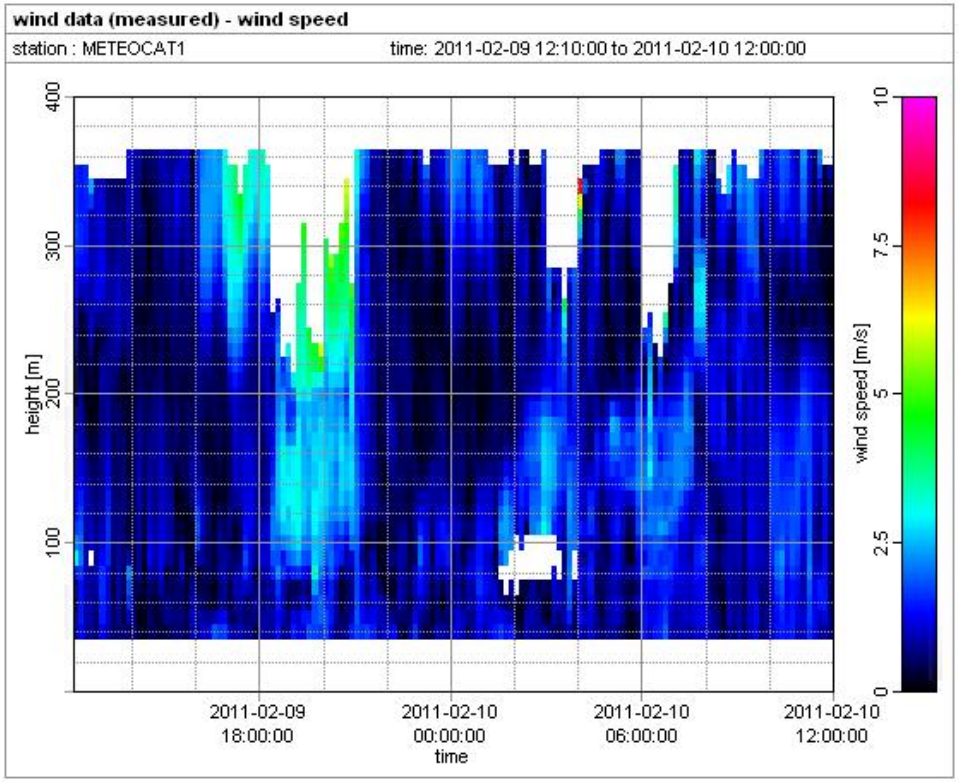
Comparison Carolo-M2AV ↔ WindRass-Scintec

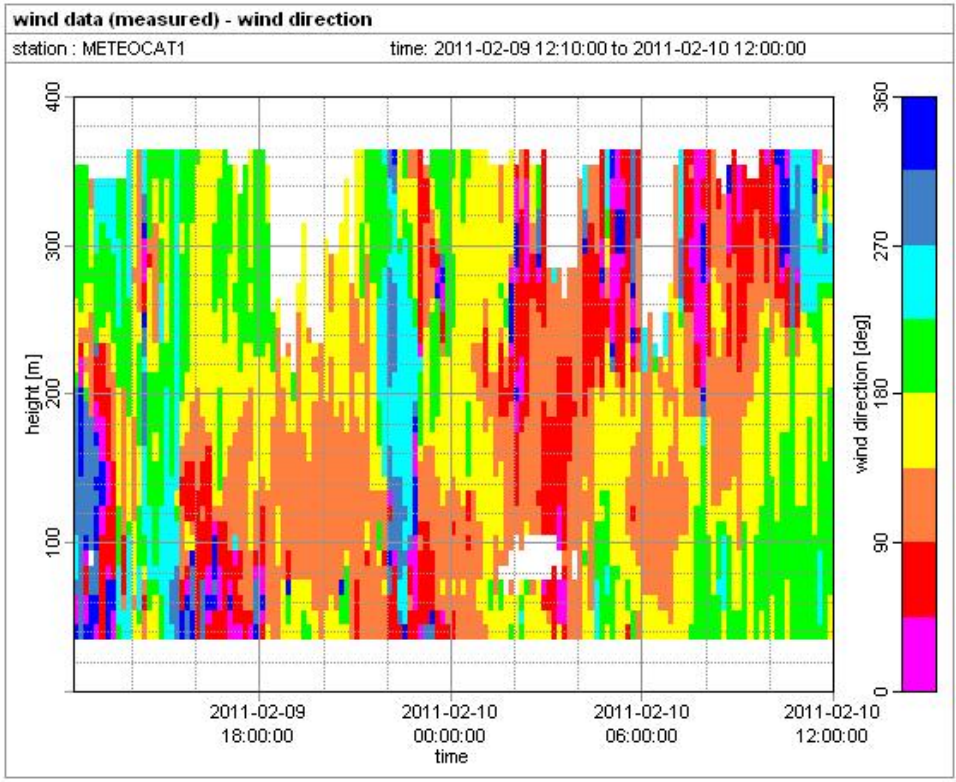


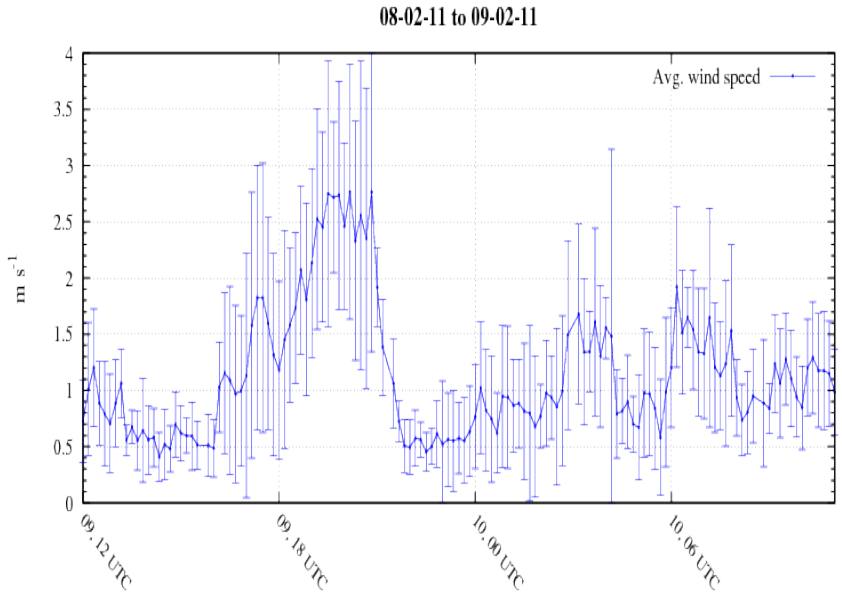
WindRass-Scintec: time evolution of the vertically averaged profiles along the night

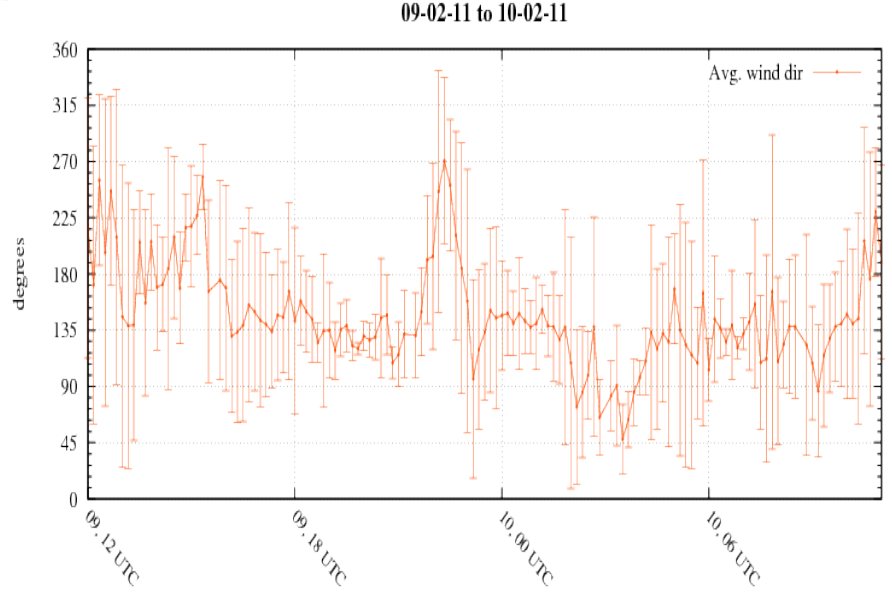


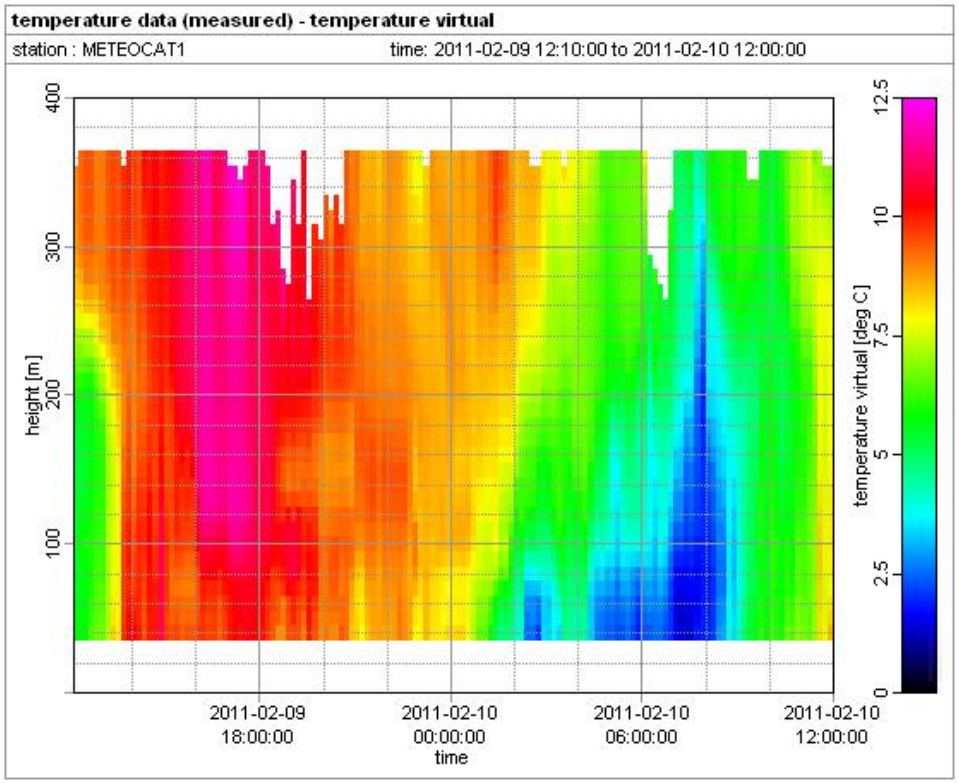
Surface Inversions and Fog '11


wind data (measured) - wind speed
station : METEOCAT1
time: 2011-02-09 12:10:00 to 2011-02-10 12:00:00
height [m]
wind speed [m/s]
2011-02-09 18:00:00
2011-02-10 00:00:00
2011-02-10 06:00:00
2011-02-10 12:00:00
time

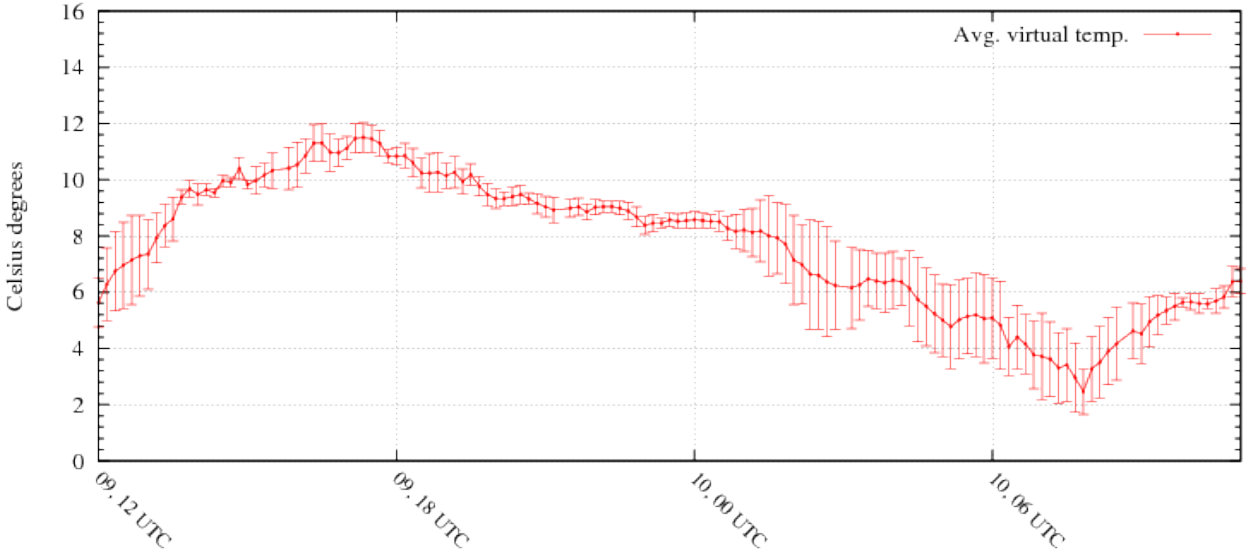

wind data (measured) - wind direction
station : METEOCAT1
time: 2011-02-09 12:10:00 to 2011-02-10 12:00:00
height [m]
wind direction [deg]
2011-02-09 18:00:00
2011-02-10 00:00:00
2011-02-10 06:00:00
2011-02-10 12:00:00
time

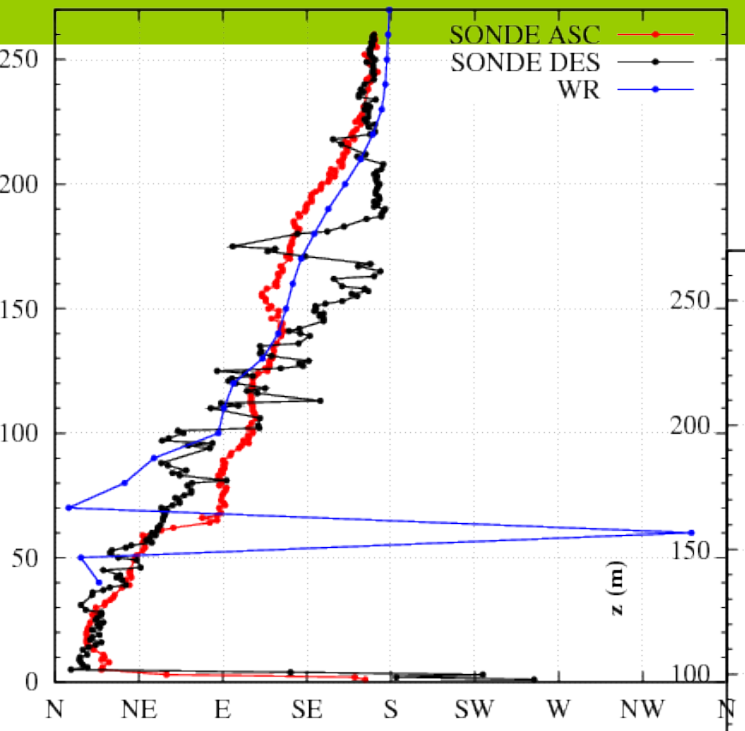

08-02-11 to 09-02-11
Avg. wind speed
m s-1
09 , 12 UTC
09 , 18 UTC
10 , 00 UTC
10 , 06 UTC

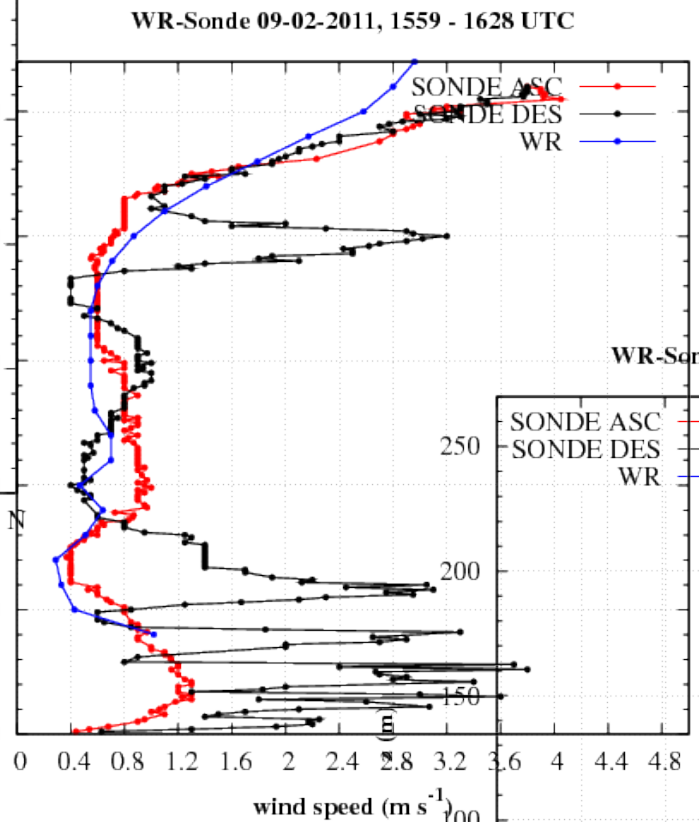

09-02-11 to 10-02-11
Avg. wind dir
degrees
09 , 12 UTC
09 , 18 UTC
10 , 00 UTC
10 , 06 UTC

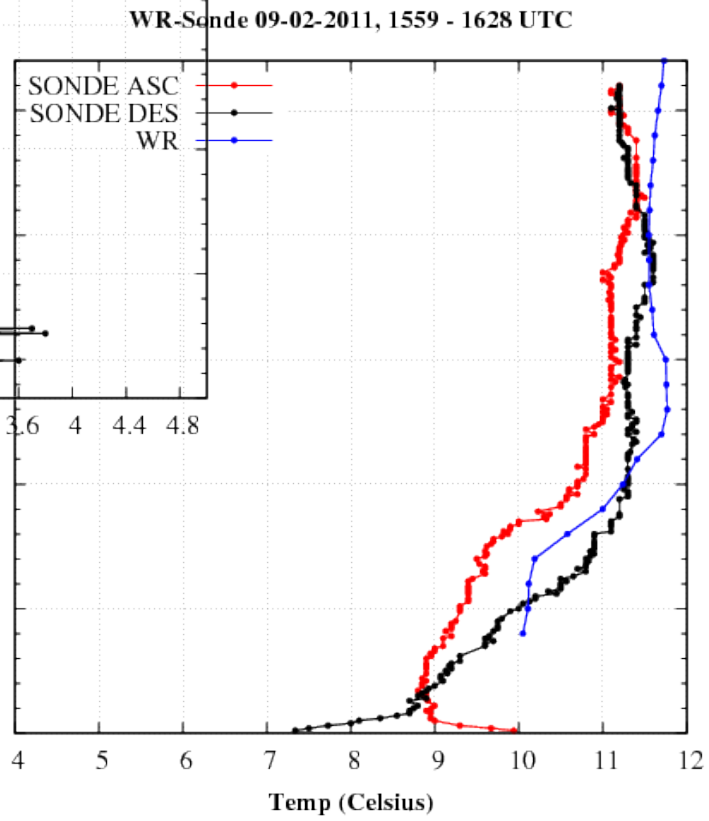


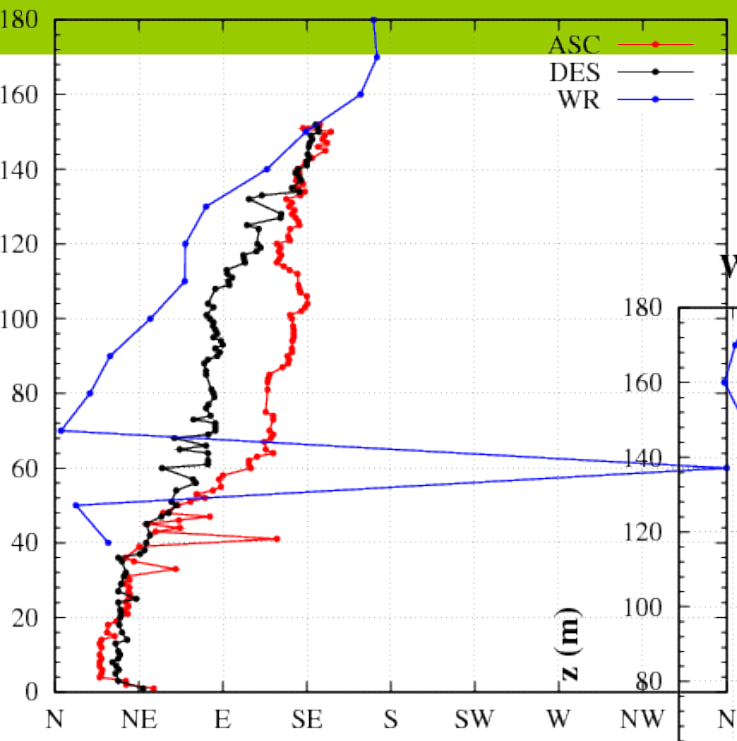
09-02-11 to 10-02-11

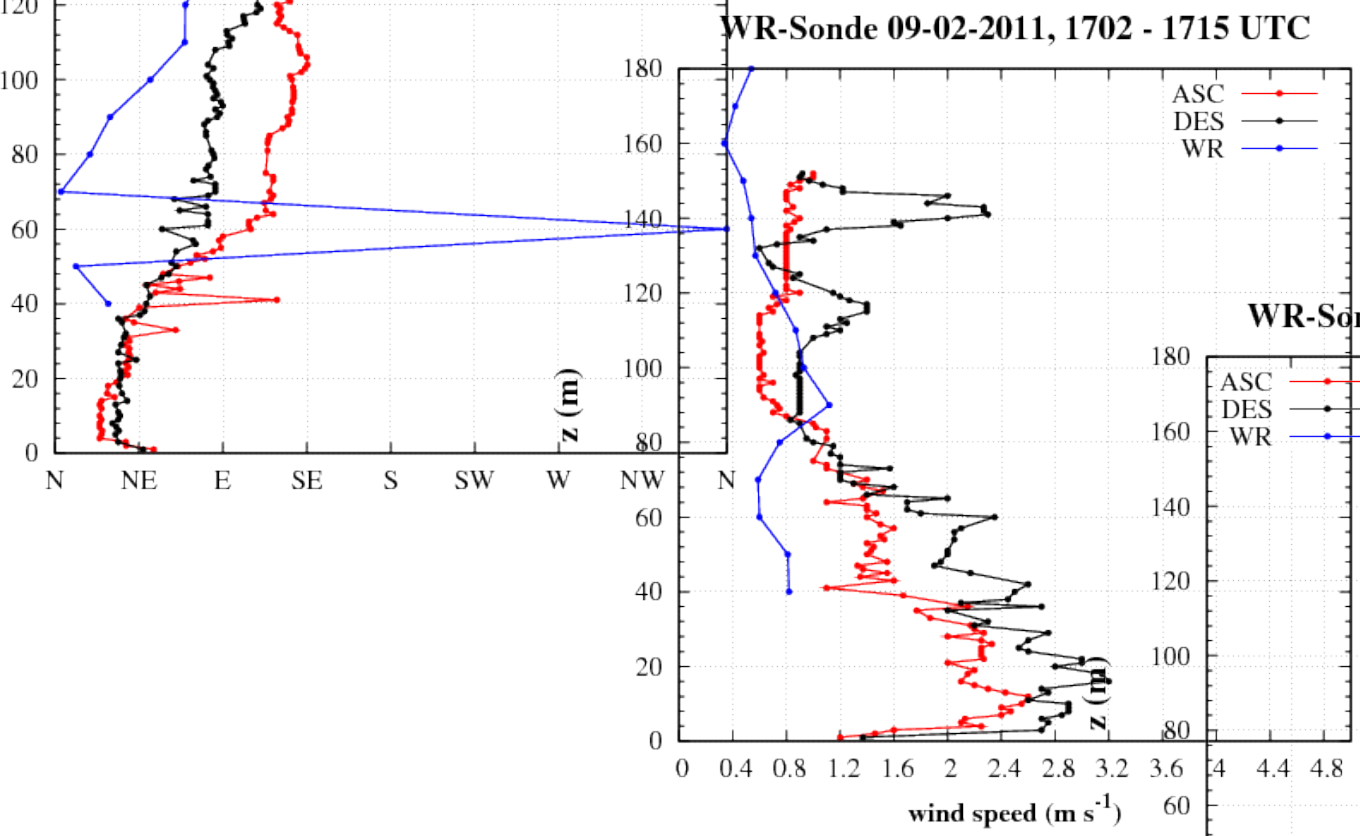


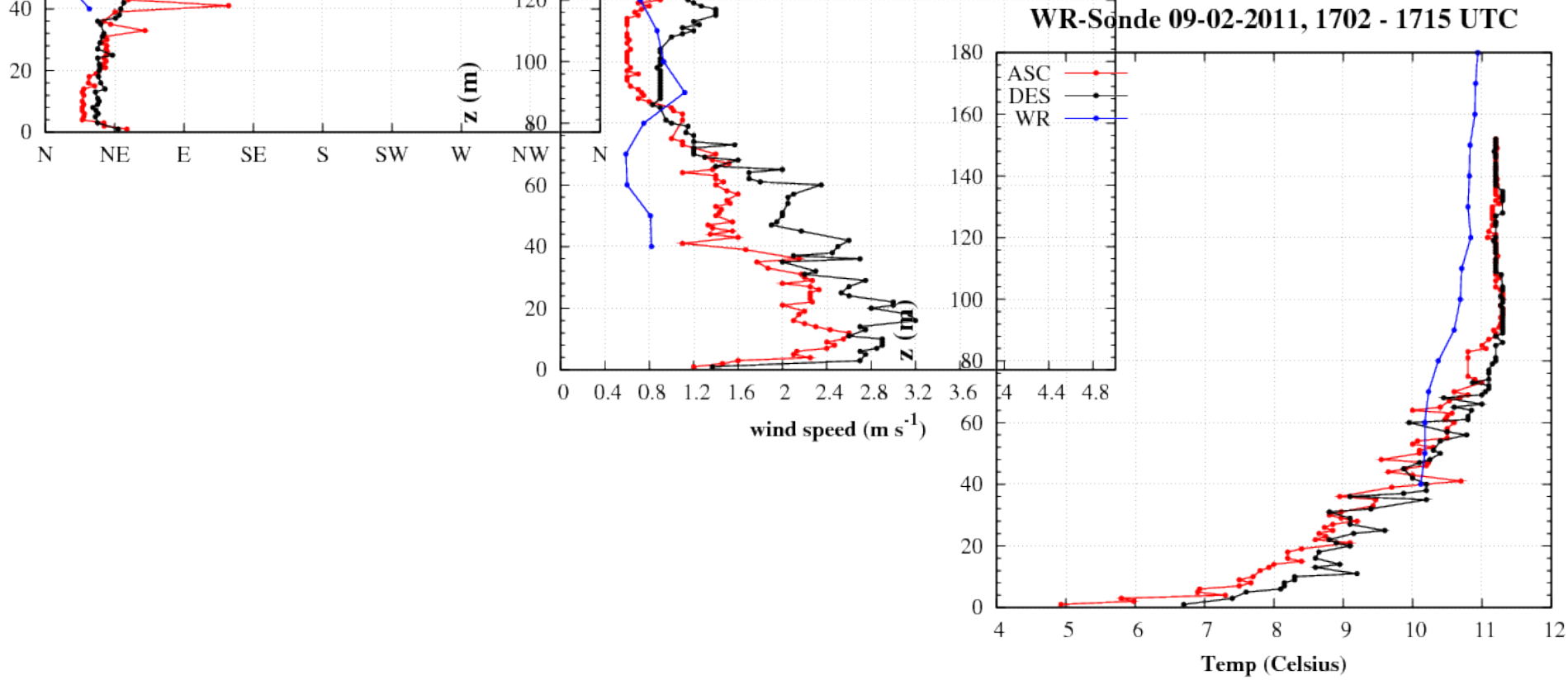

WR-Sonde 09-02-2011, 1559 - 1628 UTC
SONDE ASC
SONDE DES
WR
z (m)
0
50
100
150
200
250
N
NE
E
SE
S
SW
W
NW
N

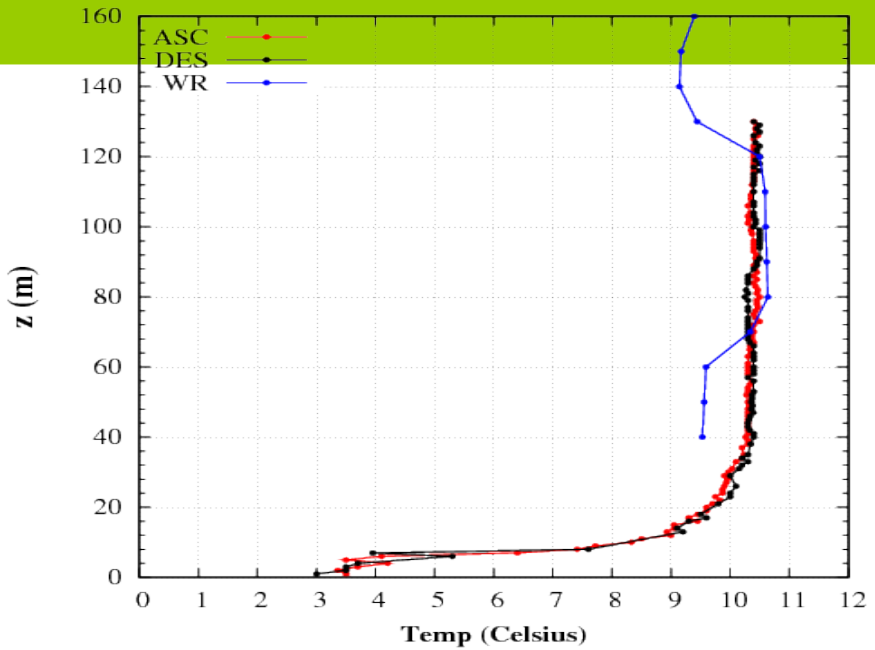

WR-Sonde 09-02-2011, 1559 - 1628 UTC
SONDE ASC
SONDE DES
WR
z (m)
0
50
100
150
200
250
0
0.4
0.8
1.2
1.6
2
2.4
2.8
3.2
3.6
4
4.4
4.8
wind speed (m s-1)

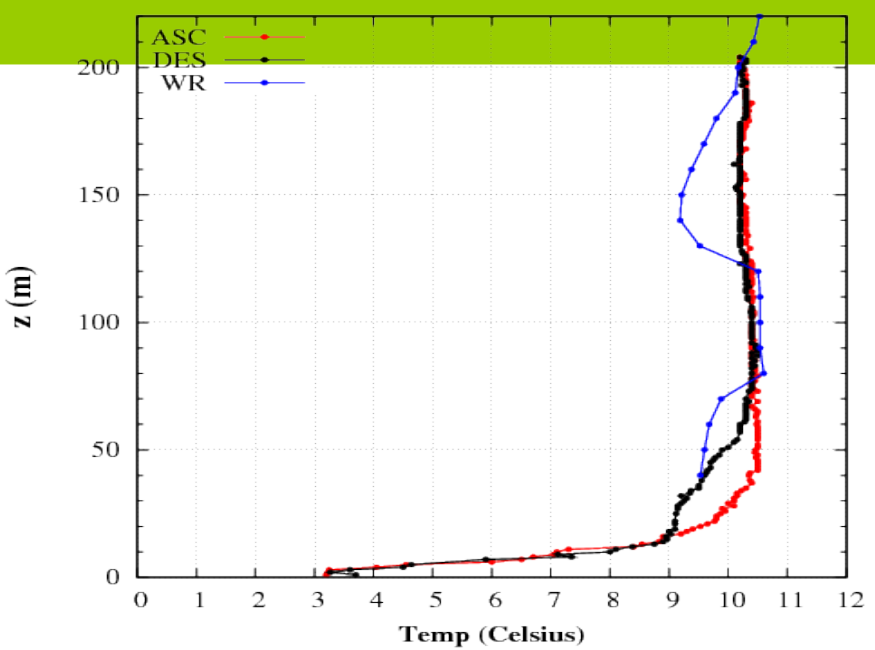

WR-Sonde 09-02-2011, 1559 - 1628 UTC
SONDE ASC
SONDE DES
WR
0
50
100
150
200
250
4
5
6
7
8
9
10
11
12
Temp (Celsius)

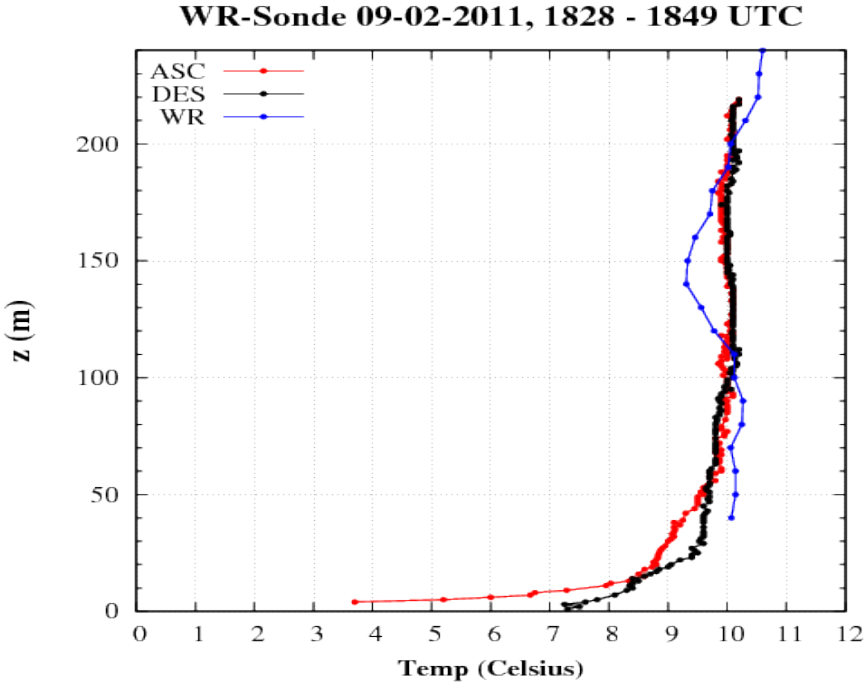

WR-Sonde 09-02-2011, 1702 - 1715 UTC
ASC
DES
WR
z (m)
N
NE
E
SE
S
SW
W
NW
N

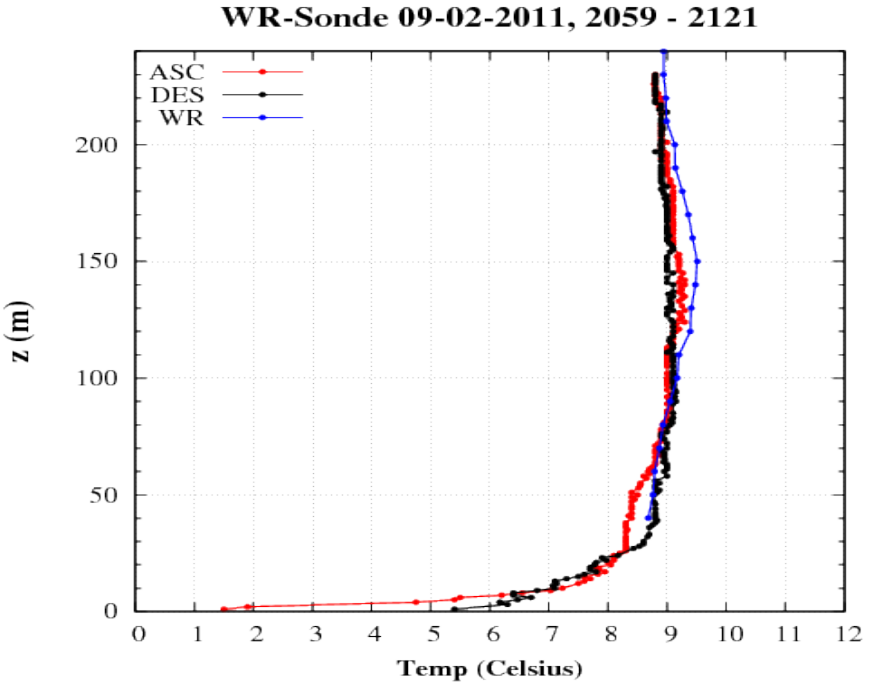

WR-Sonde 09-02-2011, 1702 - 1715 UTC
ASC
DES
WR
z (m)
wind speed (m s-1)

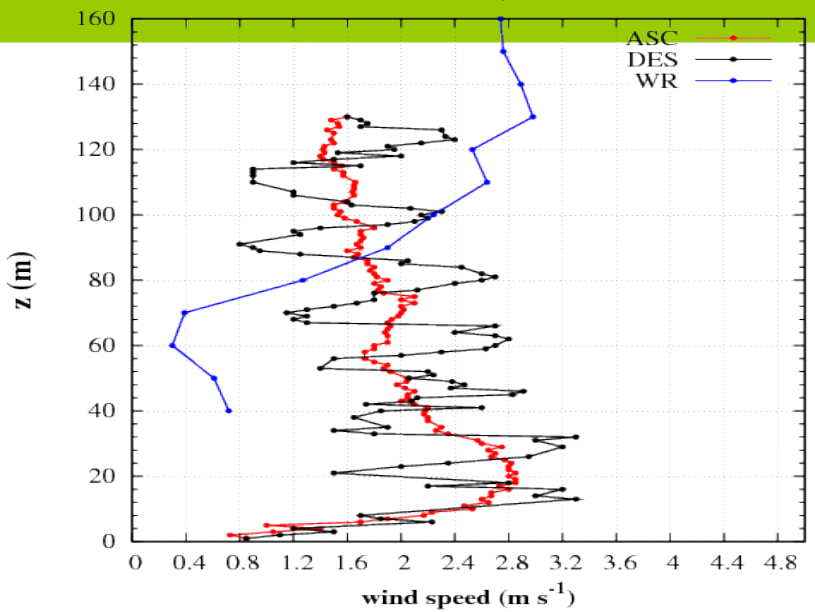

WR-Sonde 09-02-2011, 1702 - 1715 UTC
ASC
DES
WR
Temp (Celsius)

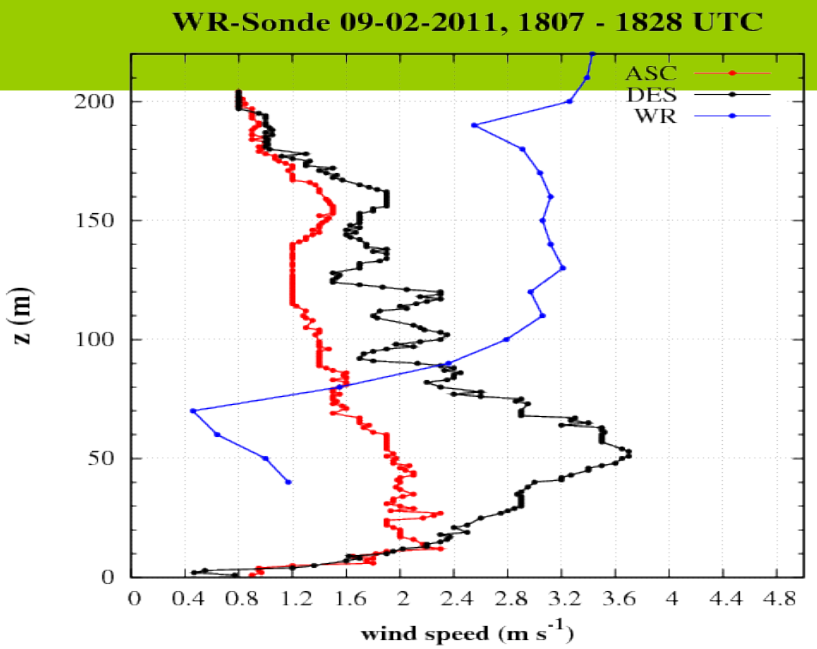

WR-Sonde 09-02-2011, 1752 - 1807 UTC
ASC
DES
WR
z (m)
Temp (Celsius)

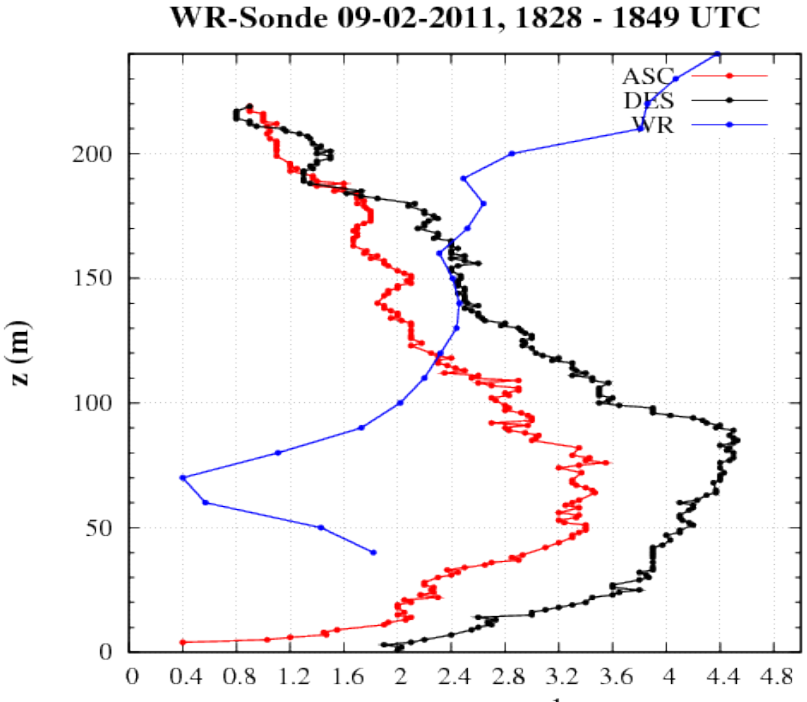

WR-Sonde 09-02-2011, 1807 - 1828 UTC
ASC
DES
WR
z (m)
Temp (Celsius)

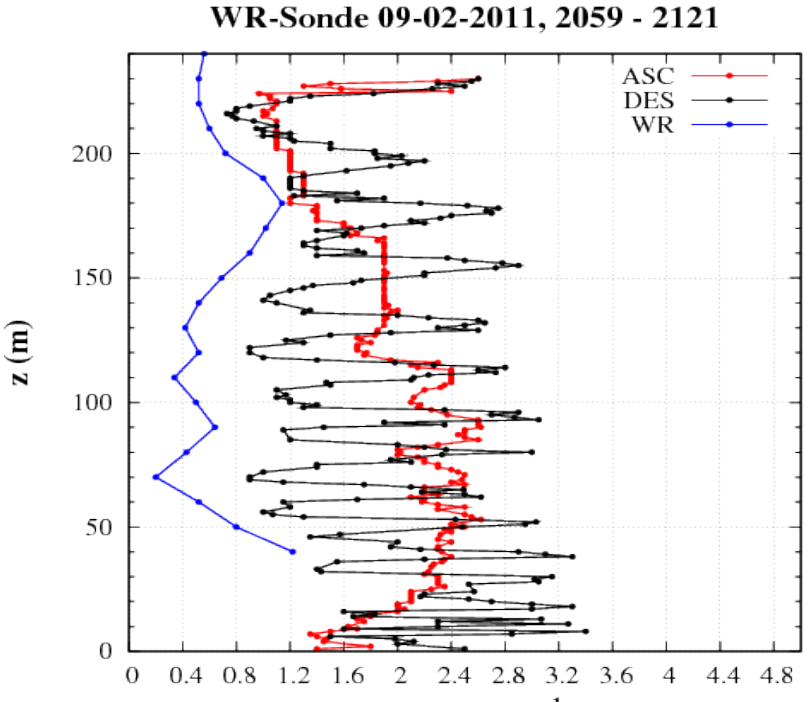

WR-Sonde 09-02-2011, 1828 - 1849 UTC
ASC
DES
WR
z (m)
Temp (Celsius)

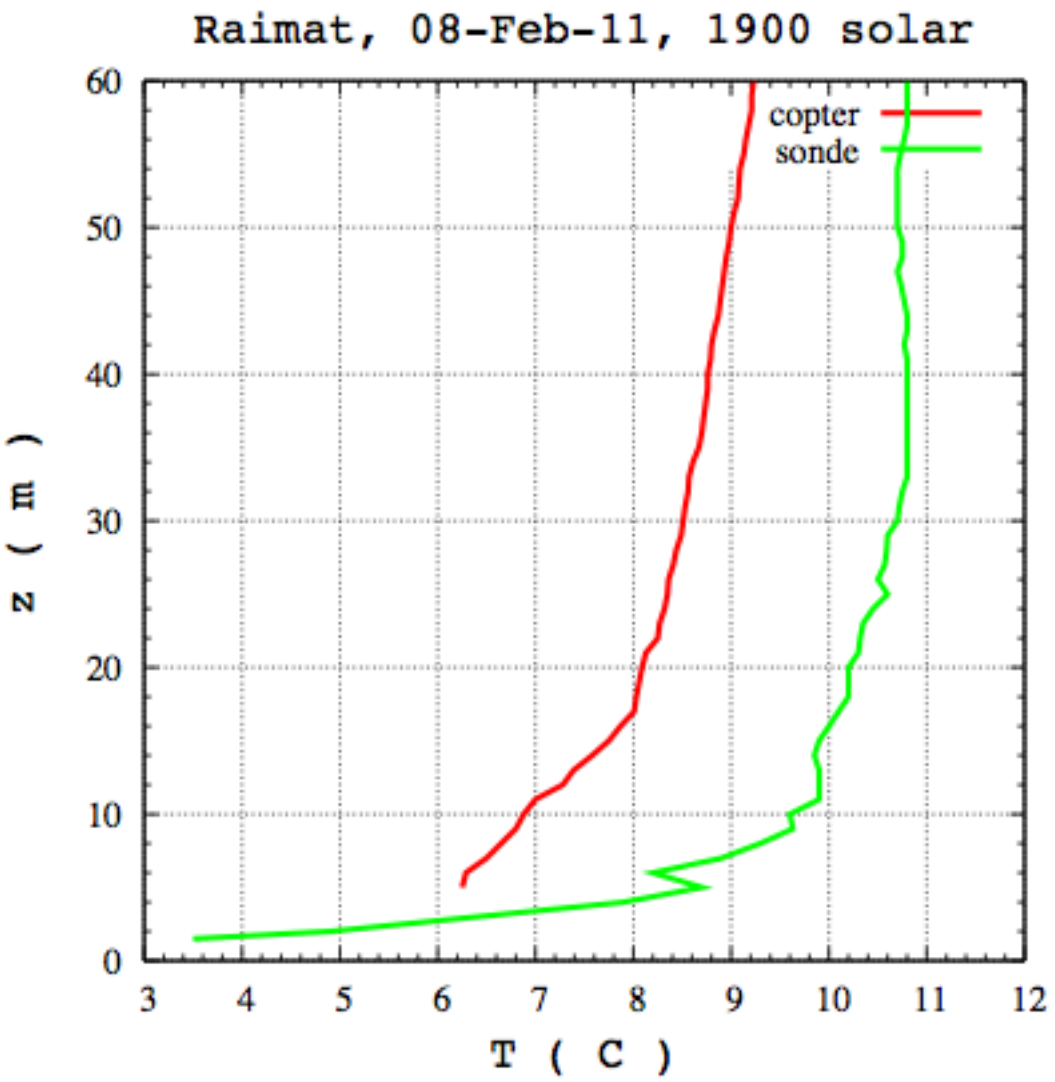

WR-Sonde 09-02-2011, 2059 - 2121
ASC
DES
WR
z (m)
Temp (Celsius)


WR-Sonde 09-02-2011, 1752 - 1807 UTC
ASC
DES
WR
z (m)
wind speed (m s-1)


WR-Sonde 09-02-2011, 1807 - 1828 UTC
ASC
DES
WR
z (m)
wind speed (m s-1)

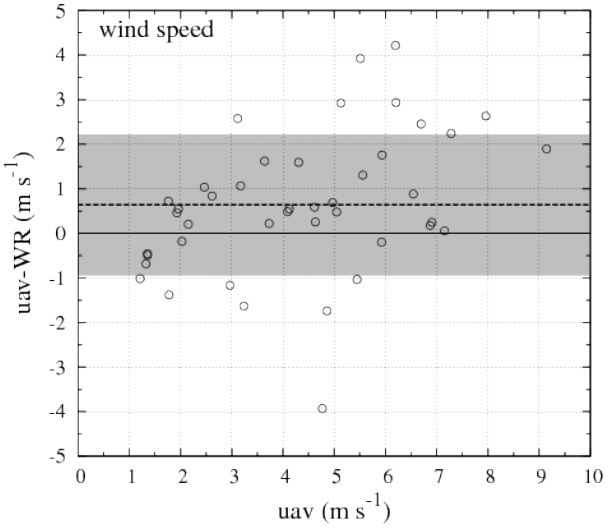

WR-Sonde 09-02-2011, 1828 - 1849 UTC
ASC
DES
WR
z (m)

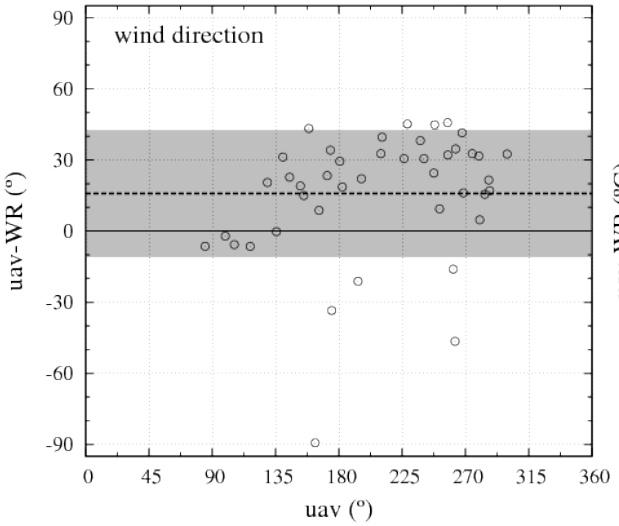

WR-Sonde 09-02-2011, 2059 - 2121
ASC
DES
WR
z (m)


Raimat, 08-Feb-11, 1900 solar
copter
sonde
z (m)
T (C)
0
10
20
30
40
50
60
3
4
5
6
7
8
9
10
11
12

Statistical comparison results

Comparison Carolo-M2AV ↔ WindRass-Scintec





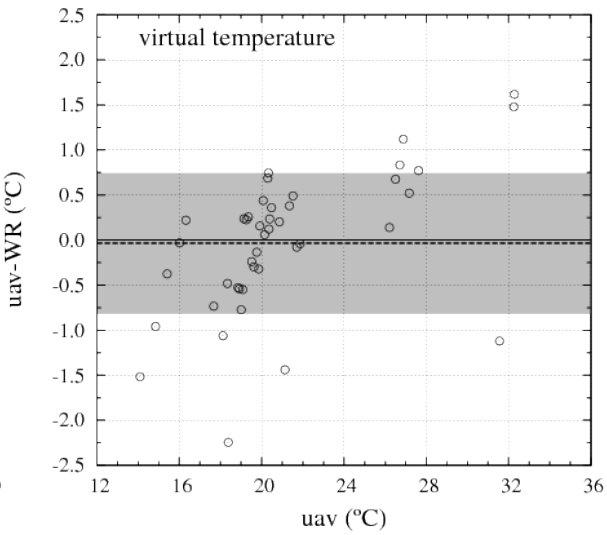


Table 1 Statistics of the comparison between WindRASS (WR)and UAV (July 2009) and Captive Balloon sonde (S) (July 2010): mean error (ME), standard deviation of the difference (SDD) and estimated accuracies (Acc) are indicated

	ME ± SDD (S-WR)	ME ± SDD (UAV-WR)	Acc S	Acc WR	Acc UAV
Virtual Temp.	$(0.7 \pm 0.7)K$	$(-0.04 \pm 0.78)K$	0.5 K	0.2 K	0.6 K
Wind Speed	$(0.5 \pm 1.6)ms^{-1}$	$(0.6 \pm 1.6)ms^{-1}$	N.A.	1 ms^{-1}	1 ms^{-1}
Wind Direction	$(24 \pm 11)°$	$(16 \pm 27)°$	N.A.	15 °	15 °