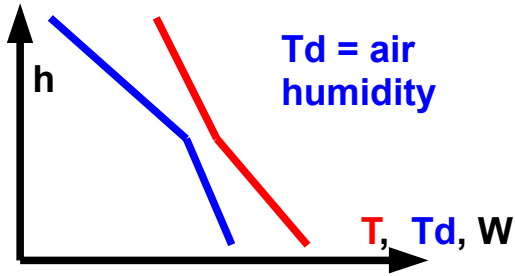
What is a aerological profile (sounding) ?

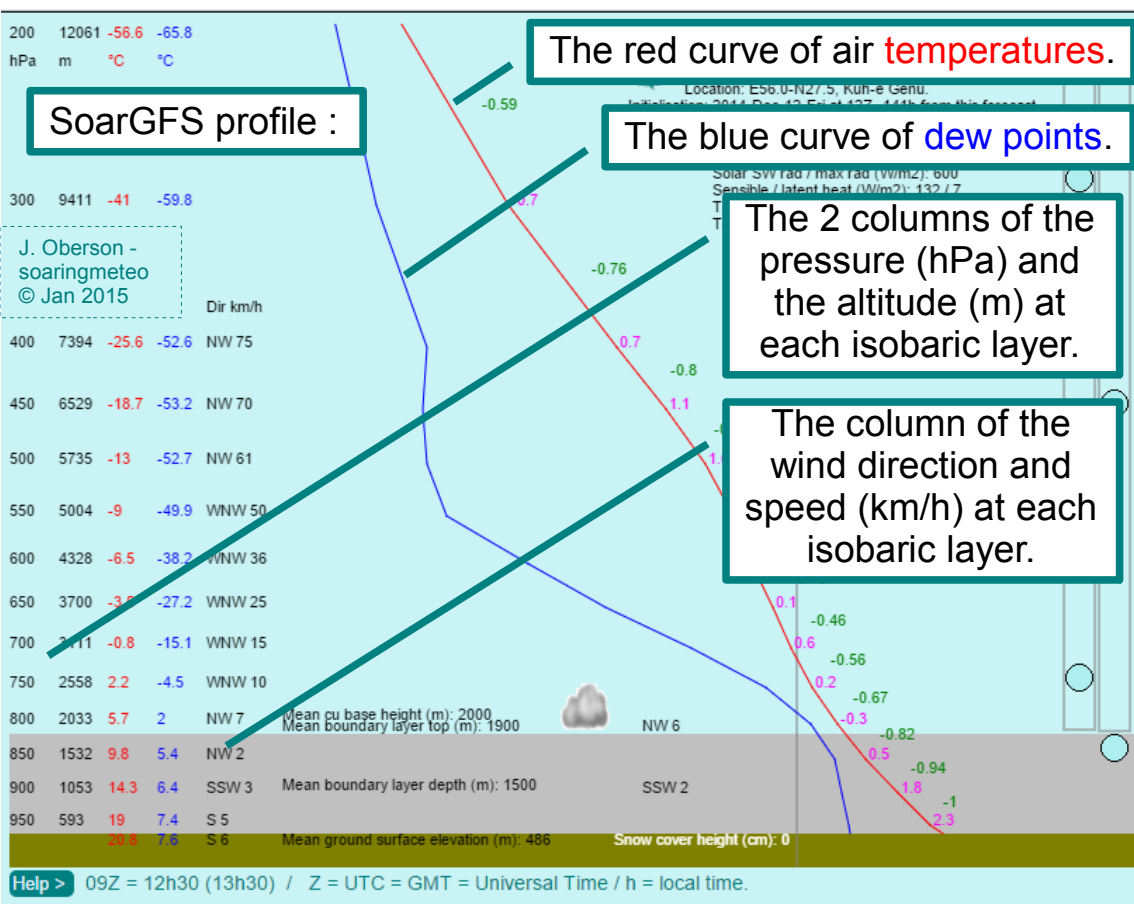
It is a simple xy graph. It represents at **any particular time and place**, the repartition of the air temperature T, the dewpoint Td and the wind x according to the altitude h=y.

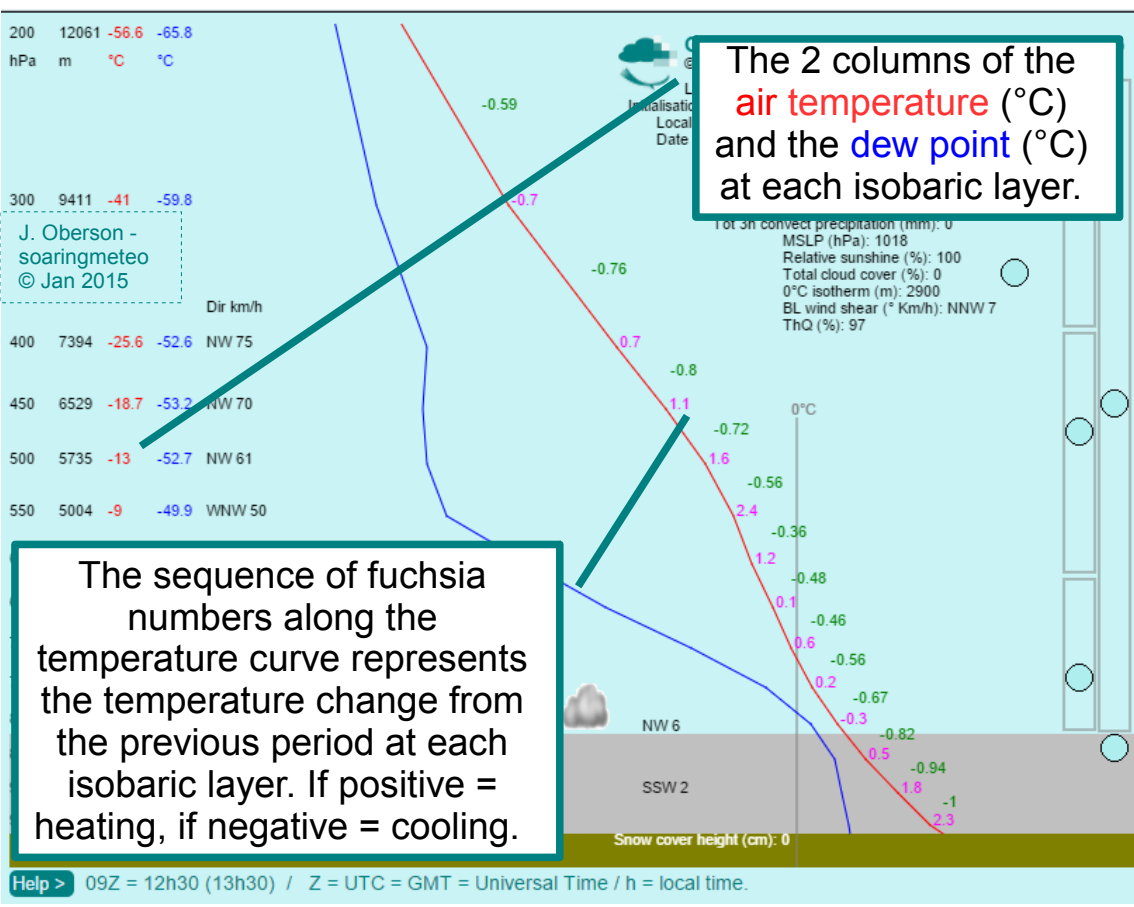


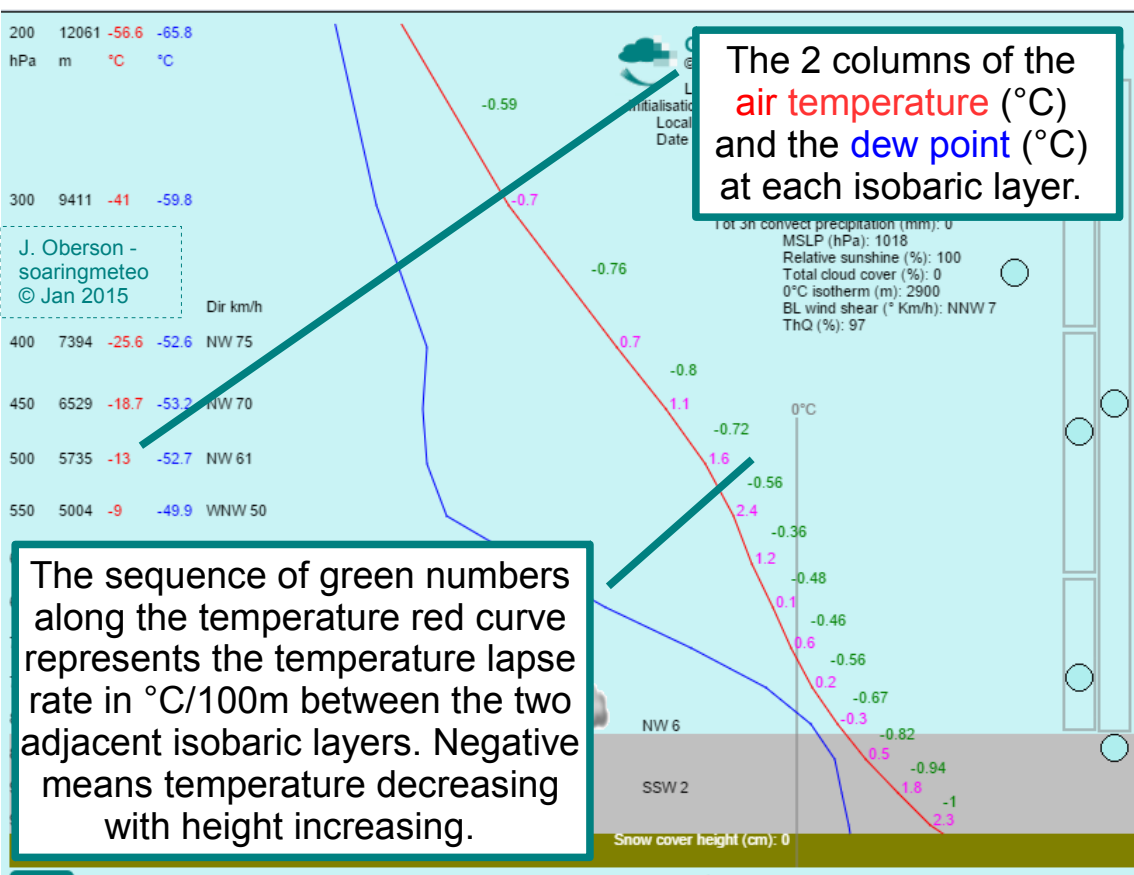
The profile can result from measurements (radiosonde) at some geographical location or can be forecast from simulation computation by a numerical weather model at each of its grid points. Because air pressure decreases with height increases, altitude can be represented by length (m) or by pressure (hPa). There are standard pressure layers at standard altitudes (but altitude of these layers actually vary according to seasons and meteorological conditions):

hPa	1000	900	850	800	750	700	650	600	500	400	300	200
m ~	0	1000	1500	2000	2500	3100	3700	4300	5600	7200	9200	12000

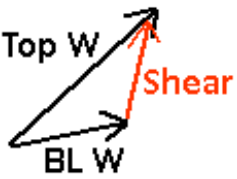
hPa = hectoPascal. 1 hPa = 1 mb.


The red curve of air temperatures.
SoarGFS profile :
The blue curve of dew points.
The 2 columns of the pressure (hPa) and the altitude (m) at each isobaric layer.
The column of the wind direction and speed (km/h) at each isobaric layer.
J. Oberson - soaringmeteo © Jan 2015
Location: E56.0-N27.5, Kuh-e Genu.
Solar SW rad / max rad (W/m2): 600
Sensible / latent heat (W/m2): 132 / 7
hPa m °C °C
Dir km/h
200 12061 -56.6 -65.8
300 9411 -41 -59.8
400 7394 -25.6 -52.6 NW 75
450 6529 -18.7 -53.2 NW 70
500 5735 -13 -52.7 NW 61
550 5004 -9 -49.9 WNW 50
600 4328 -6.5 -38.2 WNW 36
650 3700 -3.5 -27.2 WNW 25
700 3111 -0.8 -15.1 WNW 15
750 2558 2.2 -4.5 WNW 10
800 2033 5.7 2 NW 7
850 1532 9.8 5.4 NW 2
900 1053 14.3 6.4 SSW 3
950 593 19 7.4 S 5
29.8 7.6 S 6
Mean cu base height (m): 2000
Mean boundary layer top (m): 1900
Mean boundary layer depth (m): 1500
Mean ground surface elevation (m): 486
NW 6
SSW 2
Snow cover height (cm): 0
-0.59
0.7
-0.76
0.7
-0.8
1.1
0.1
-0.46
0.6
-0.56
0.2
-0.67
-0.3
-0.82
0.5
-0.94
1.8
-1
2.3
Help >
09Z = 12h30 (13h30) / Z = UTC = GMT = Universal Time / h = local time.


200 12061 -56.6 -65.8
hPa m °C °C
300 9411 -41 -59.8
J. Oberson - soaringmeteo © Jan 2015
Dir km/h
400 7394 -25.6 -52.6 NW 75
450 6529 -18.7 -53.2 NW 70
500 5735 -13 -52.7 NW 61
550 5004 -9 -49.9 WNW 50
-0.59
-0.7
-0.76
0.7
-0.8
1.1
-0.72
1.6
-0.56
2.4
-0.36
1.2
-0.48
0.1
-0.46
0.6
-0.56
0.2
-0.67
-0.3
-0.82
0.5
-0.94
1.8
-1
2.3
0°C
Tot 3h convect precipitation (mm): 0
MSLP (hPa): 1018
Relative sunshine (%): 100
Total cloud cover (%): 0
0°C isotherm (m): 2900
BL wind shear (° Km/h): NNW 7
ThQ (%): 97
NW 6
SSW 2
Snow cover height (cm): 0
The 2 columns of the air temperature (°C) and the dew point (°C) at each isobaric layer.
The sequence of fuchsia numbers along the temperature curve represents the temperature change from the previous period at each isobaric layer. If positive = heating, if negative = cooling.
Help >
09Z = 12h30 (13h30) / Z = UTC = GMT = Universal Time / h = local time.


The 2 columns of the air temperature (°C) and the dew point (°C) at each isobaric layer.
The sequence of green numbers along the temperature red curve represents the temperature lapse rate in °C/100m between the two adjacent isobaric layers. Negative means temperature decreasing with height increasing.
hPa m °C °C
200 12061 -56.6 -65.8
300 9411 -41 -59.8
400 7394 -25.6 -52.6 NW 75
450 6529 -18.7 -53.2 NW 70
500 5735 -13 -52.7 NW 61
550 5004 -9 -49.9 WNW 50
Dir km/h
J. Oberson - soaringmeteo © Jan 2015
-0.59
-0.7
-0.76
0.7
-0.8
1.1
-0.72
1.6
-0.56
2.4
-0.36
1.2
-0.48
0.1
-0.46
0.6
-0.56
0.2
-0.67
-0.3
-0.82
0.5
-0.94
1.8
-1
2.3
0°C
Tot 3h convect precipitation (mm): 0
MSLP (hPa): 1018
Relative sunshine (%): 100
Total cloud cover (%): 0
0°C isotherm (m): 2900
BL wind shear (° Km/h): NNW 7
ThQ (%): 97
NW 6
SSW 2
Snow cover height (cm): 0
Help >
09Z = 12h30 (13h30) / Z = UTC = GMT = Universal Time / h = local time.

Some information about dates, times, location of the GFS grid point, meteorological parameters. Wind shear is the vectorial difference between the convective layer wind (BL wind) and the wind at the top of this layer.



Air temperature (°C), dew point (°C) and wind above ground level. Mean macroscale ground altitude. Ground snow cover.

GFS 0.5° aerological profile by Soaringmeteo
© 2014 - soaringmeteo.ch - orthogonal graph
Location: E56.0-N27.5, Kuh-e Genu.
Initialisation: 2014-Dec-12-Fri at 12Z -141h from this forecast.
Local time: 12h30 (13h30).
Date and UTC time: 2014-Dec-18-Thu : 09Z.
CAPE / CIN (J/kg): 20 / -4
Solar SW rad / max rad (W/m2): 600
Sensible / latent heat (W/m2): 132 / 7
Tot 3h accumul precipitation (mm): 0
Tot 3h convect precipitation (mm): 0
MSLP (hPa): 1018
Relative sunshine (%): 100
Total cloud cover (%): 0
0°C isotherm (m): 2900
BL wind shear (° Km/h): NNW 7
ThQ (%): 97

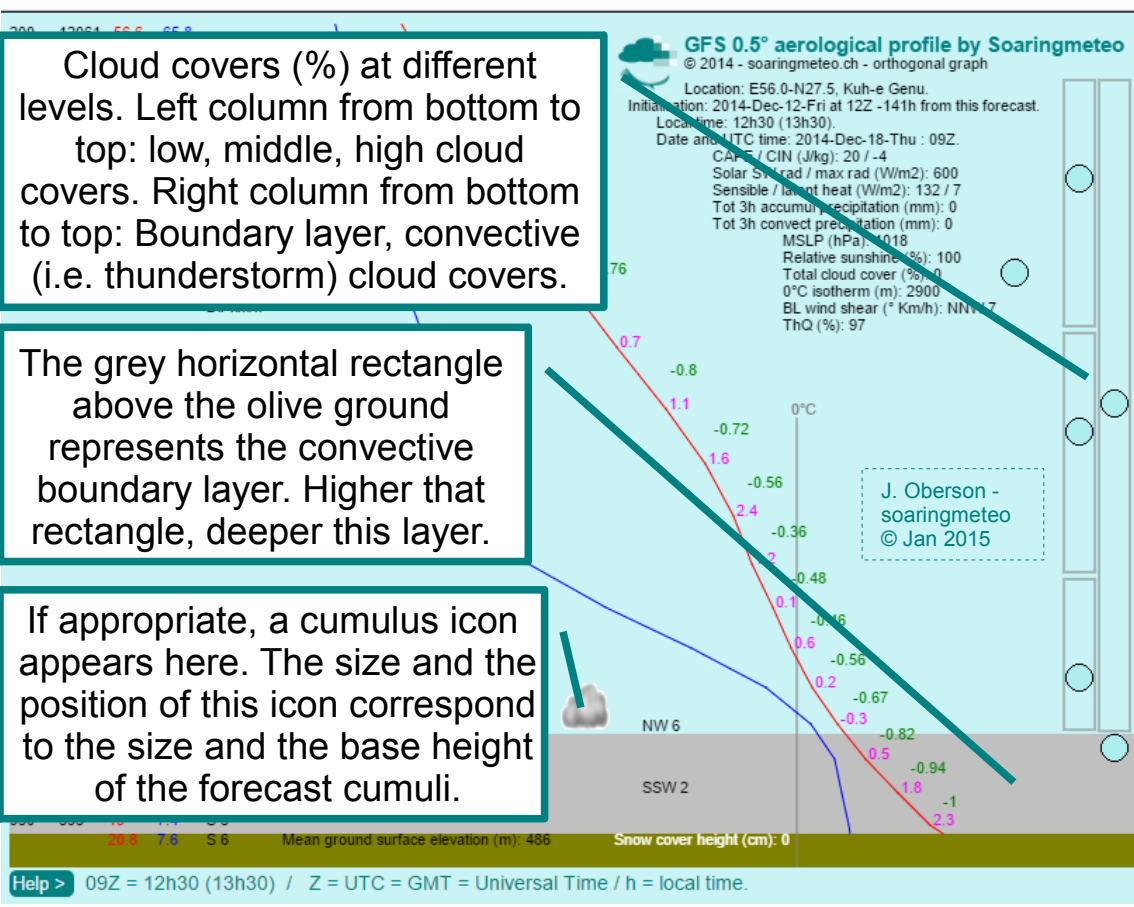
450	6529	-18.7	-53.2	NW 70
500	5735	-13	-52.7	NW 61
550	5004	-9	-49.9	WNW 50
600	4328	-6.5	-38.2	WNW 36
650	3700	-3.5	-27.2	WNW 25
700	3111	-0.8	-15.1	WNW 15
750	2558	2.2	-4.5	WNW 10
800	2033	5.7	2	NW 7
850	1532	9.8	5.4	NW 2
900	1053	14.3	6.4	SSW 3
950	593	19	7.4	S 5
		20.8	7.6	S 6

Mean cu base height (m): 2000
Mean boundary layer top (m): 1900
Mean boundary layer depth (m): 1500
Mean ground surface elevation (m): 486
Snow cover height (cm): 0

0°C
0.7
-0.8
1.1
-0.72
1.6
-0.56
2.4
-0.36
1.2
-0.48
-1
2.3

J. Oberson - soaringmeteo © Jan 2015

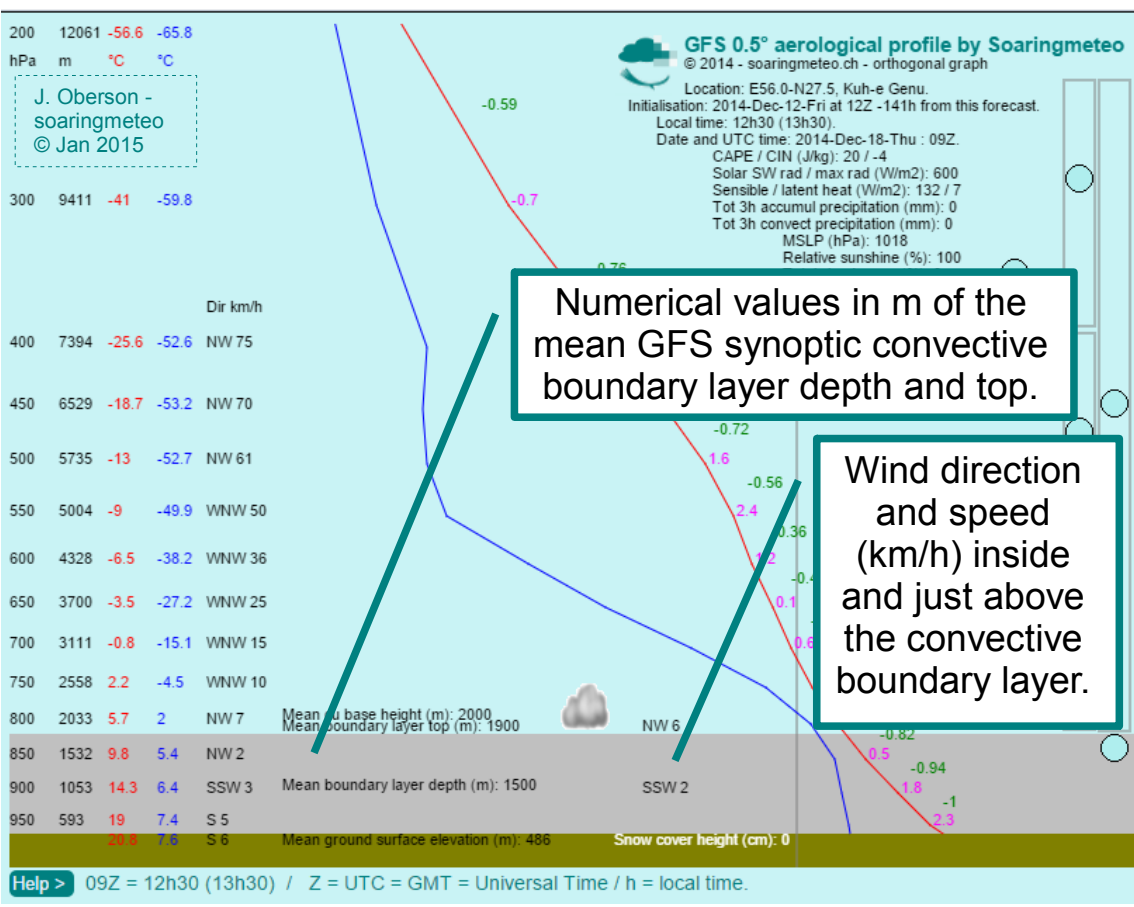
Help > 09Z = 12h30 (13h30) / Z = UTC = GMT = Universal Time / h = local time.



Cloud covers (%) at different levels. Left column from bottom to top: low, middle, high cloud covers. Right column from bottom to top: Boundary layer, convective (i.e. thunderstorm) cloud covers.

The grey horizontal rectangle above the olive ground represents the convective boundary layer. Higher that rectangle, deeper this layer.

If appropriate, a cumulus icon appears here. The size and the position of this icon correspond to the size and the base height of the forecast cumuli.

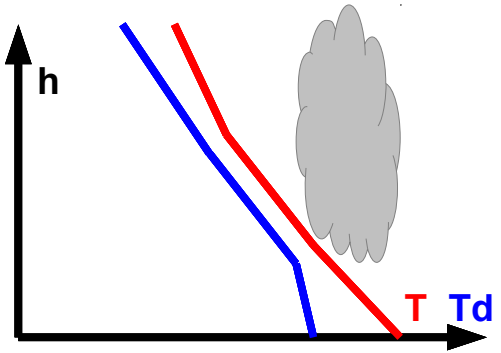

GFS 0.5° aerological profile by Soaringmeteo
© 2014 - soaringmeteo.ch - orthogonal graph
Location: E56.0-N27.5, Kuh-e Genu.
Initialisation: 2014-Dec-12-Fri at 12Z -141h from this forecast.
Local time: 12h30 (13h30).
Date and UTC time: 2014-Dec-18-Thu : 09Z.
CAPE / CIN (J/kg): 20 / -4
Solar SW rad / max rad (W/m2): 600
Sensible / latent heat (W/m2): 132 / 7
Tot 3h accumul precipitation (mm): 0
Tot 3h convect precipitation (mm): 0
MSLP (hPa): 1018
Relative sunshine (%): 100
J. Oberson - soaringmeteo © Jan 2015
hPa m °C °C
Dir km/h
200 12061 -56.6 -65.8
300 9411 -41 -59.8
400 7394 -25.6 -52.6 NW 75
450 6529 -18.7 -53.2 NW 70
500 5735 -13 -52.7 NW 61
550 5004 -9 -49.9 WNW 50
600 4328 -6.5 -38.2 WNW 36
650 3700 -3.5 -27.2 WNW 25
700 3111 -0.8 -15.1 WNW 15
750 2558 2.2 -4.5 WNW 10
800 2033 5.7 2 NW 7
850 1532 9.8 5.4 NW 2
900 1053 14.3 6.4 SSW 3
950 593 19 7.4 S 5
20.8 7.6 S 6
Numerical values in m of the mean GFS synoptic convective boundary layer depth and top.
Wind direction and speed (km/h) inside and just above the convective boundary layer.
Mean cu base height (m): 2000
Mean boundary layer top (m): 1900
Mean boundary layer depth (m): 1500
Mean ground surface elevation (m): 486
NW 6
SSW 2
Snow cover height (cm): 0
-0.59
-0.7
-0.72
1.6
-0.56
2.4
0.36
-0.82
0.5
-0.94
1.8
-1
2.3
Help >
09Z = 12h30 (13h30) / Z = UTC = GMT = Universal Time / h = local time.

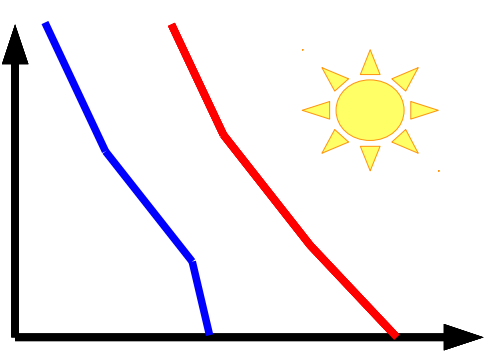
Cloud cover in % : examples from links to right, 100, 65, 50, 25, 0.

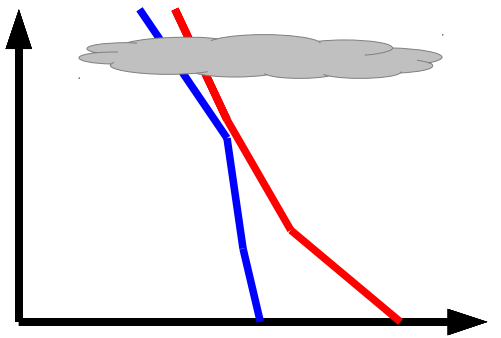
Zero or almost zero risk | Low risk | Medium risk | High risk | Very high risk of thunderstorm

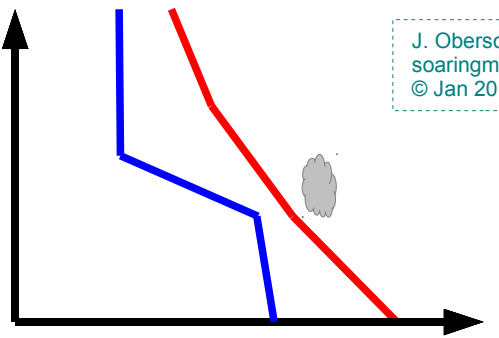
No or rare cumulus. | Cu humilis to mediocris. | Cu mediocris to congestus | Cu congestus to cumulonimbus

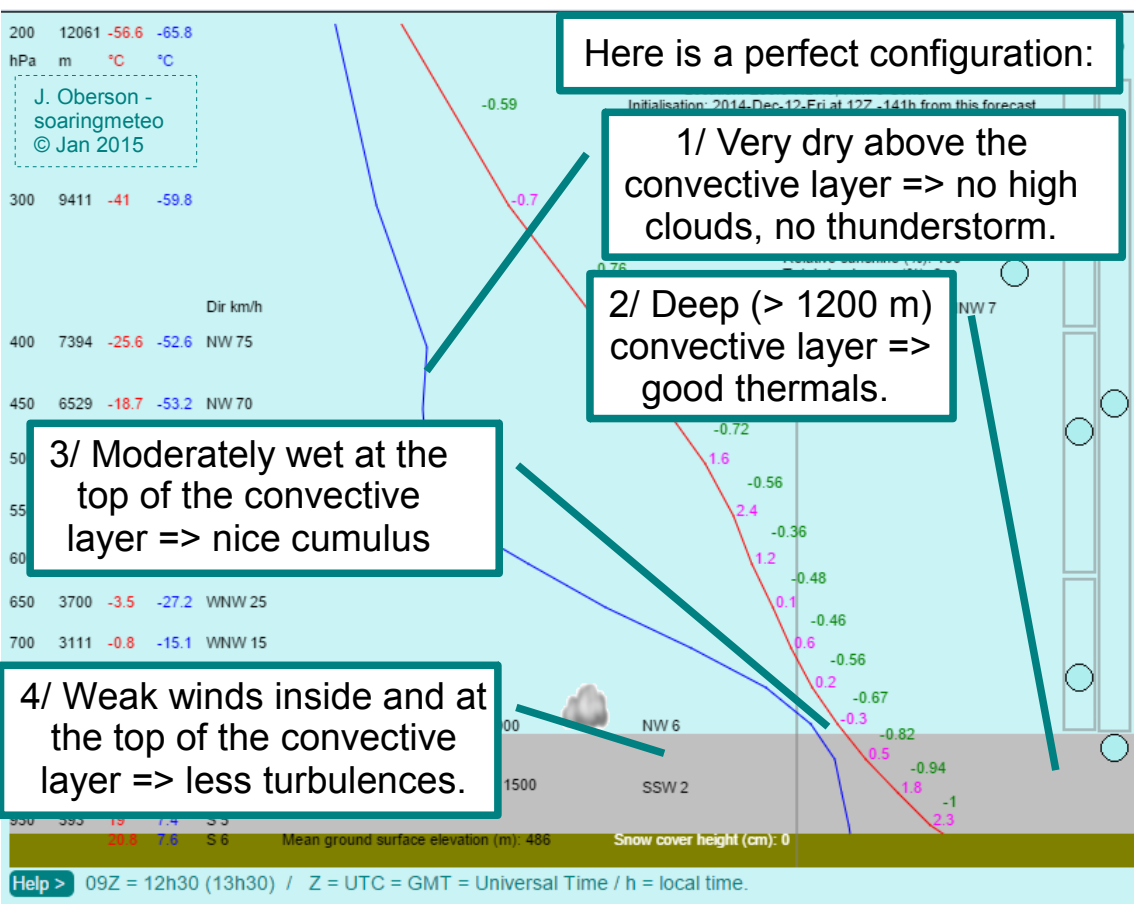
The shape and position of the temperature and dew point curves are important to interpret a profile and to forecast nebulosity. The principle is : closer is the humidity blue curve to temperature red one, wetter is the atmosphere, more probable are the clouds:

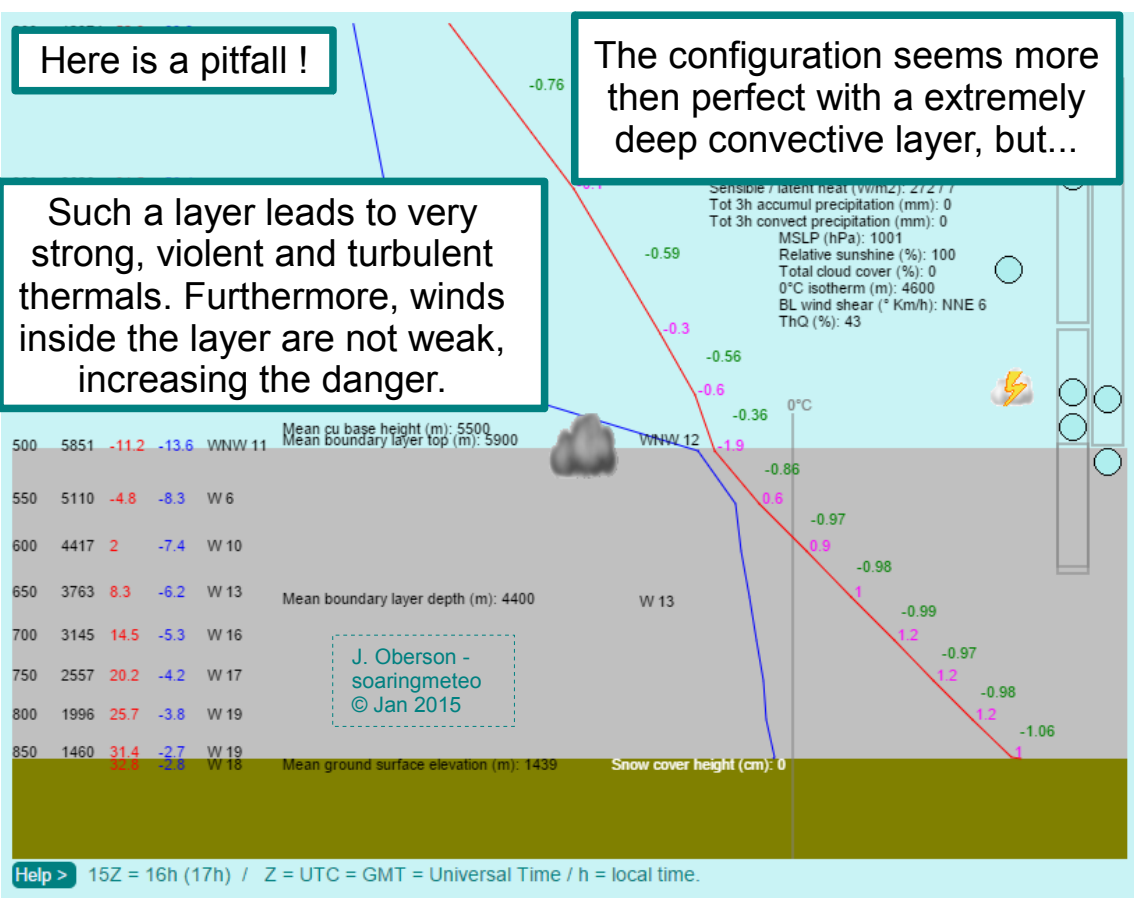


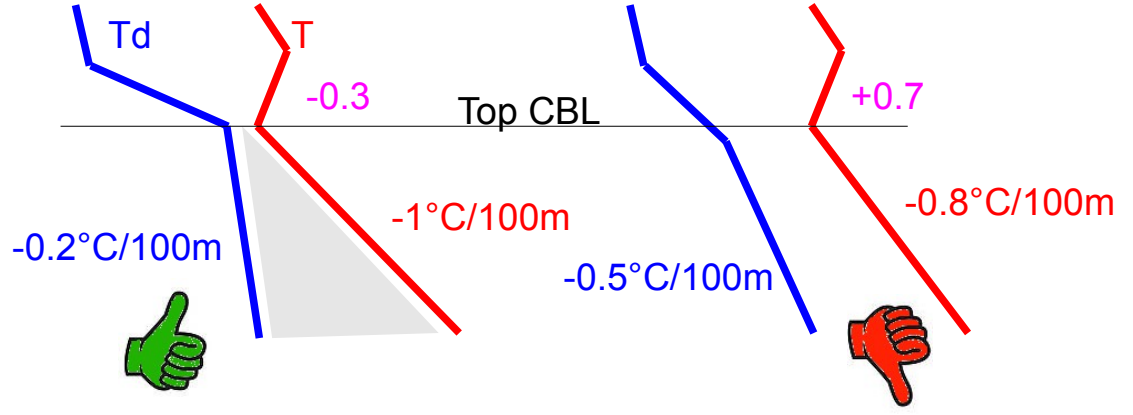







Here is a perfect configuration:
1/ Very dry above the convective layer => no high clouds, no thunderstorm.
2/ Deep (> 1200 m) convective layer => good thermals.
3/ Moderately wet at the top of the convective layer => nice cumulus
4/ Weak winds inside and at the top of the convective layer => less turbulences.
J. Oberson - soaringmeteo © Jan 2015
200 12061 -56.6 -65.8
hPa m °C °C
300 9411 -41 -59.8
Dir km/h
400 7394 -25.6 -52.6 NW 75
450 6529 -18.7 -53.2 NW 70
650 3700 -3.5 -27.2 WNW 25
700 3111 -0.8 -15.1 WNW 15
NW 7
NW 6
SSW 2
Mean ground surface elevation (m): 486
Snow cover height (cm): 0
Help >
09Z = 12h30 (13h30) / Z = UTC = GMT = Universal Time / h = local time.


Here is a pitfall !
The configuration seems more then perfect with a extremely deep convective layer, but...
Such a layer leads to very strong, violent and turbulent thermals. Furthermore, winds inside the layer are not weak, increasing the danger.
-0.76
-0.59
-0.3
-0.56
-0.6
-0.36
-1.9
-0.86
0.6
-0.97
0.9
-0.98
1
-0.99
1.2
-0.97
1.2
-0.98
1.2
-1.06
1
0°C
Sensible / latent heat (W/m2): 272 / 7
Tot 3h accumul precipitation (mm): 0
Tot 3h convect precipitation (mm): 0
MSLP (hPa): 1001
Relative sunshine (%): 100
Total cloud cover (%): 0
0°C isotherm (m): 4600
BL wind shear (° Km/h): NNE 6
ThQ (%): 43
Mean cu base height (m): 5500
Mean boundary layer top (m): 5900
Mean boundary layer depth (m): 4400
Mean ground surface elevation (m): 1439
Snow cover height (cm): 0
WNW 12
W 13
500 5851 -11.2 -13.6 WNW 11
550 5110 -4.8 -8.3 W 6
600 4417 2 -7.4 W 10
650 3763 8.3 -6.2 W 13
700 3145 14.5 -5.3 W 16
750 2557 20.2 -4.2 W 17
800 1996 25.7 -3.8 W 19
850 1460 31.4 -2.7 W 19
W 18
J. Oberson - soaringmeteo © Jan 2015
Help >
15Z = 16h (17h) / Z = UTC = GMT = Universal Time / h = local time.



Last tricks :
the T and Td curves inside the CBL should shape a nice inclined triangle. T-Td at the top of CLB should equal 3-7°C to get nice cumuli. < 3°C => clouds over-development. > 7°C => blue thermals. At the top of the CBL, it is more favourable when cooling rather warming from previous period is observed (fuchsia numbers). T and Td lapse rates should equal about -1 and -0.2 °C/100m respectively. Different lapse rates as on the right side image are not favourable.