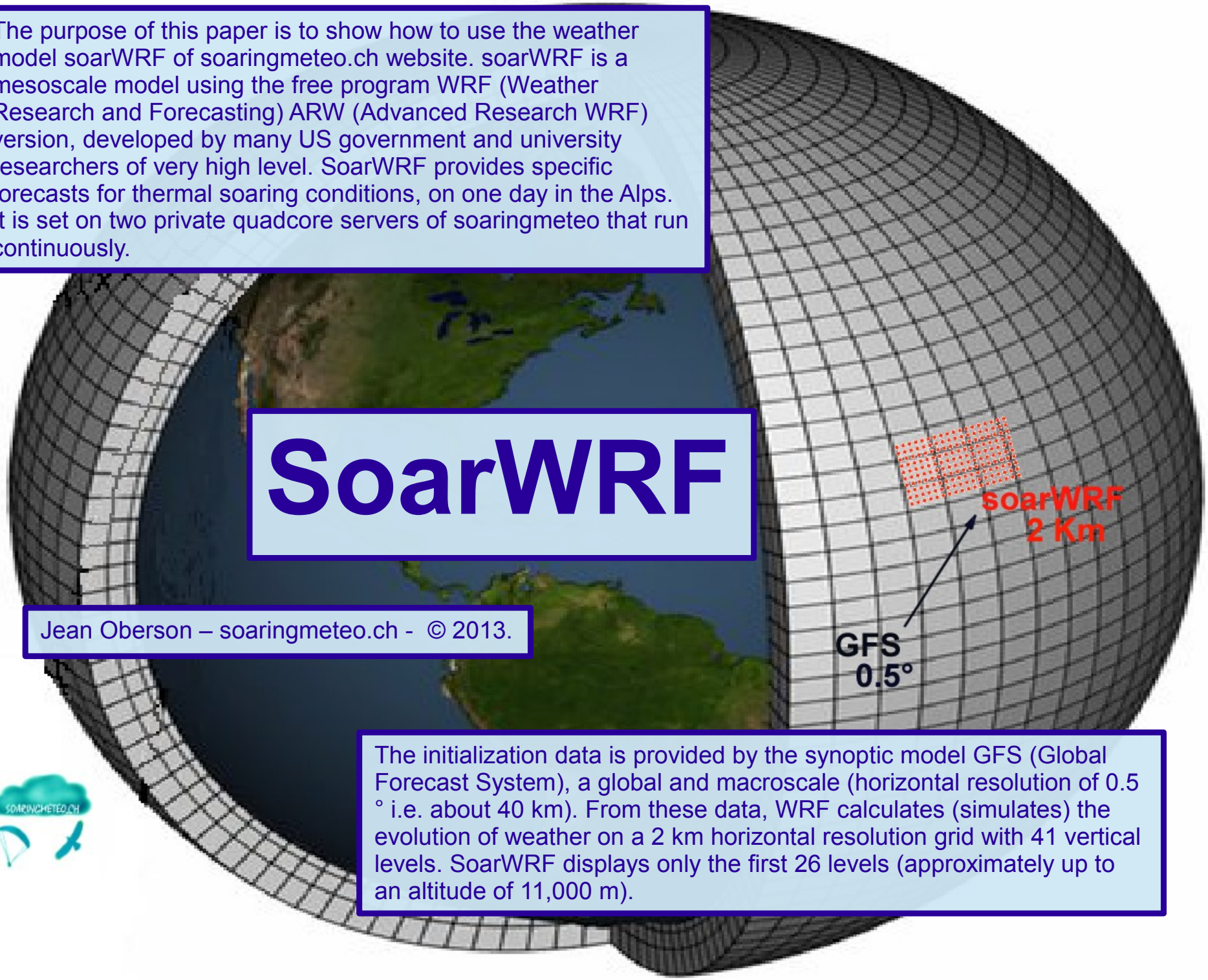
The purpose of this paper is to show how to use the weather model soarWRF of soaringmeteo.ch website. soarWRF is a mesoscale model using the free program WRF (Weather Research and Forecasting) ARW (Advanced Research WRF) version, developed by many US government and university researchers of very high level. SoarWRF provides specific forecasts for thermal soaring conditions, on one day in the Alps. It is set on two private quadcore servers of soaringmeteo that run continuously.

SoarWRF

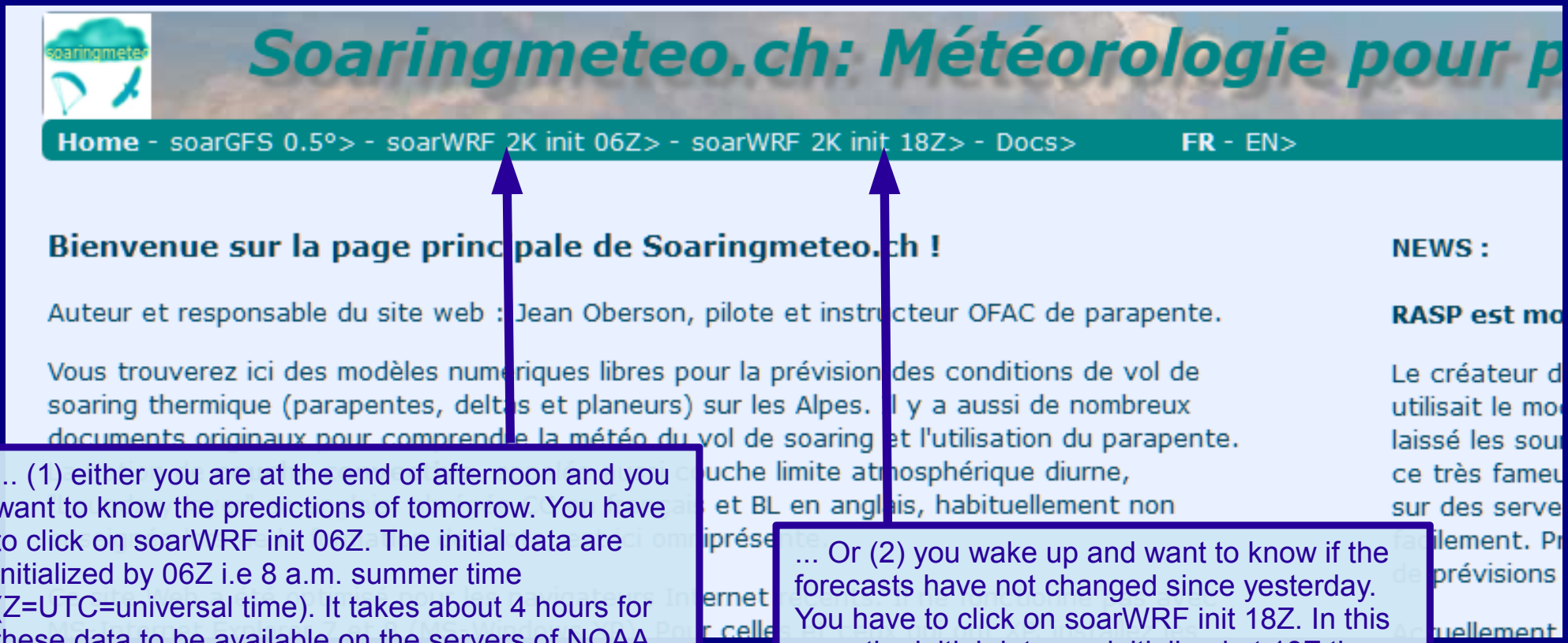
Jean Oberson – soaringmeteo.ch - © 2013.



The initialization data is provided by the synoptic model GFS (Global Forecast System), a global and macroscale (horizontal resolution of 0.5 ° i.e. about 40 km). From these data, WRF calculates (simulates) the evolution of weather on a 2 km horizontal resolution grid with 41 vertical levels. SoarWRF displays only the first 26 levels (approximately up to an altitude of 11,000 m).

Calculations of soarWRF forecasts are distributed on 2 servers and conducted in three stages (three domains) : 1/ the MOAD (mother of all domains) with 18 Km resolution, then 2/ the first 6 Km resolution sub-domain, 3/ finally, server 1 calculates the 2 km resolution subdomain (in red, central Alps, 150x279 horizontal grid points) and server 2 calculates the two 2 km resolution subdomains (in orange, south and east of the Alps, respectively 99x129 and 135x162 horizontal grid points). MOAD and 6K are the same for the two servers and are quickly calculated. The first five rows of grid points around the edges of the domains do not provide very reliable predictions.

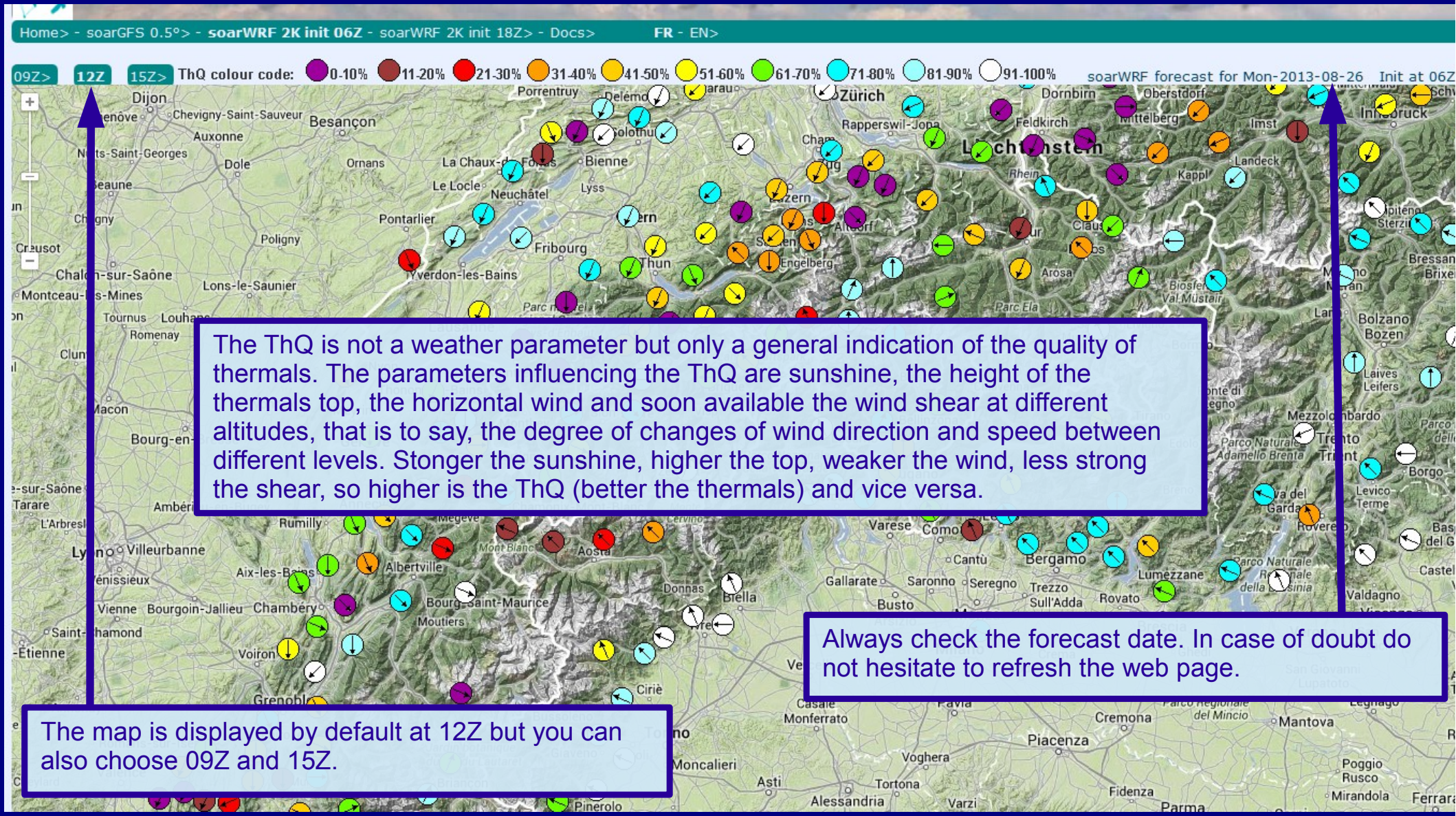
Let's go to the main page soaringmeteo.ch. To access soarWRF two choices are presented to you, ...



... (1) either you are at the end of afternoon and you want to know the predictions of tomorrow. You have to click on soarWRF init 06Z. The initial data are initialized by 06Z i.e 8 a.m. summer time (Z=UTC=universal time). It takes about 4 hours for these data to be available on the servers of NOAA. Then WRF servers work almost as much to calculate, prepare and upload the results on the hosting servers of soaringmeteo. The forecast is valid for the next day.

... Or (2) you wake up and want to know if the forecasts have not changed since yesterday. You have to click on soarWRF init 18Z. In this case the initial data are initialized at 18Z the day before of the forecasts for the current day.

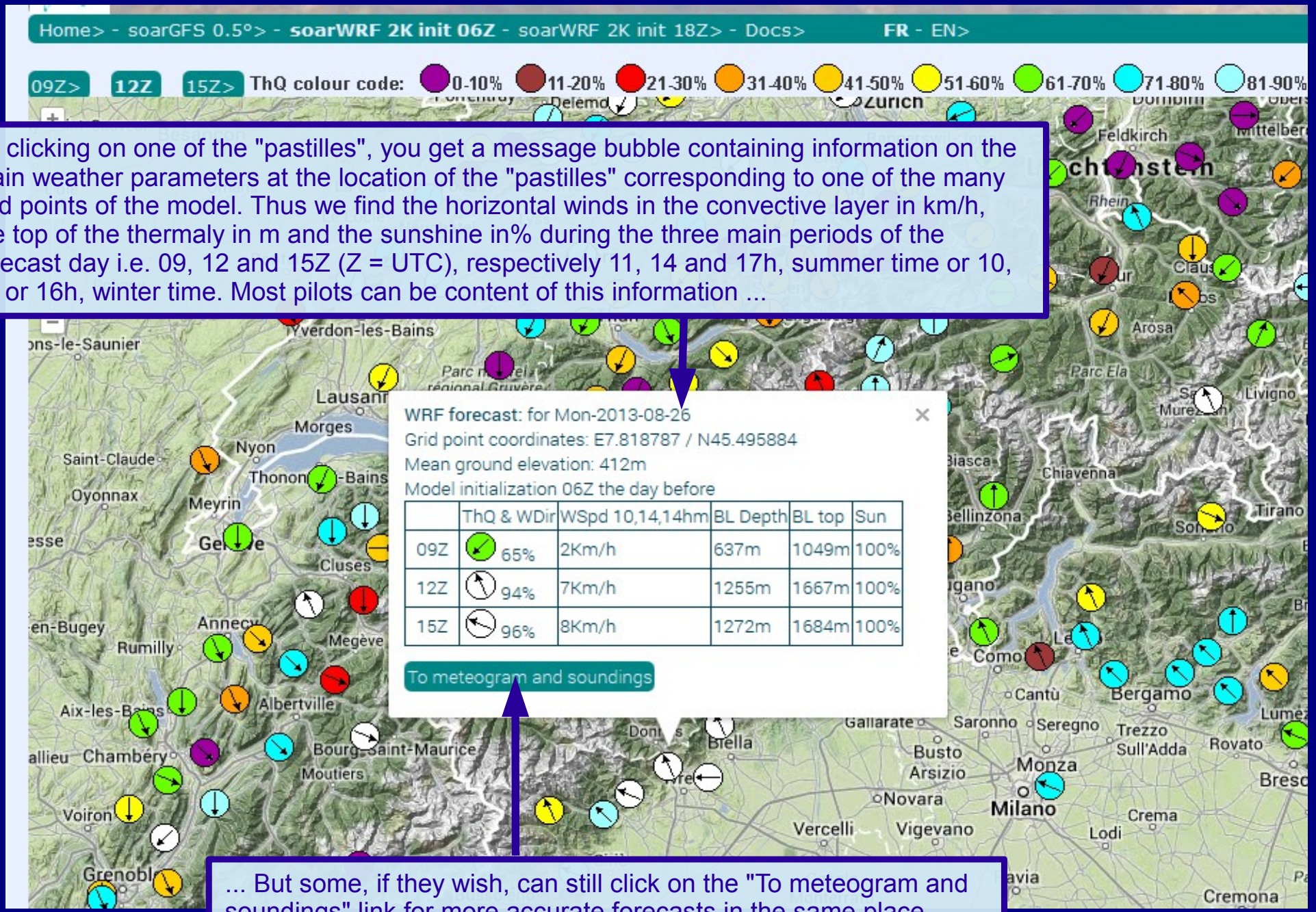
In these two cases, you get a page with a GoogleMap centered on the Alps. On this map there is a multitude of color "pastilles" representing the overall quality of thermal (ThQ = thermal quality index) with an arrow representing the direction of the wind in the upper part of the convective layer. Closer the color to white, the better the thermals and the ThQ and vice versa. The ThQ extends from violet (0-10%) corresponding to difficult, dangerous or impractical thermals to white (90-100%) indicating good thermals.

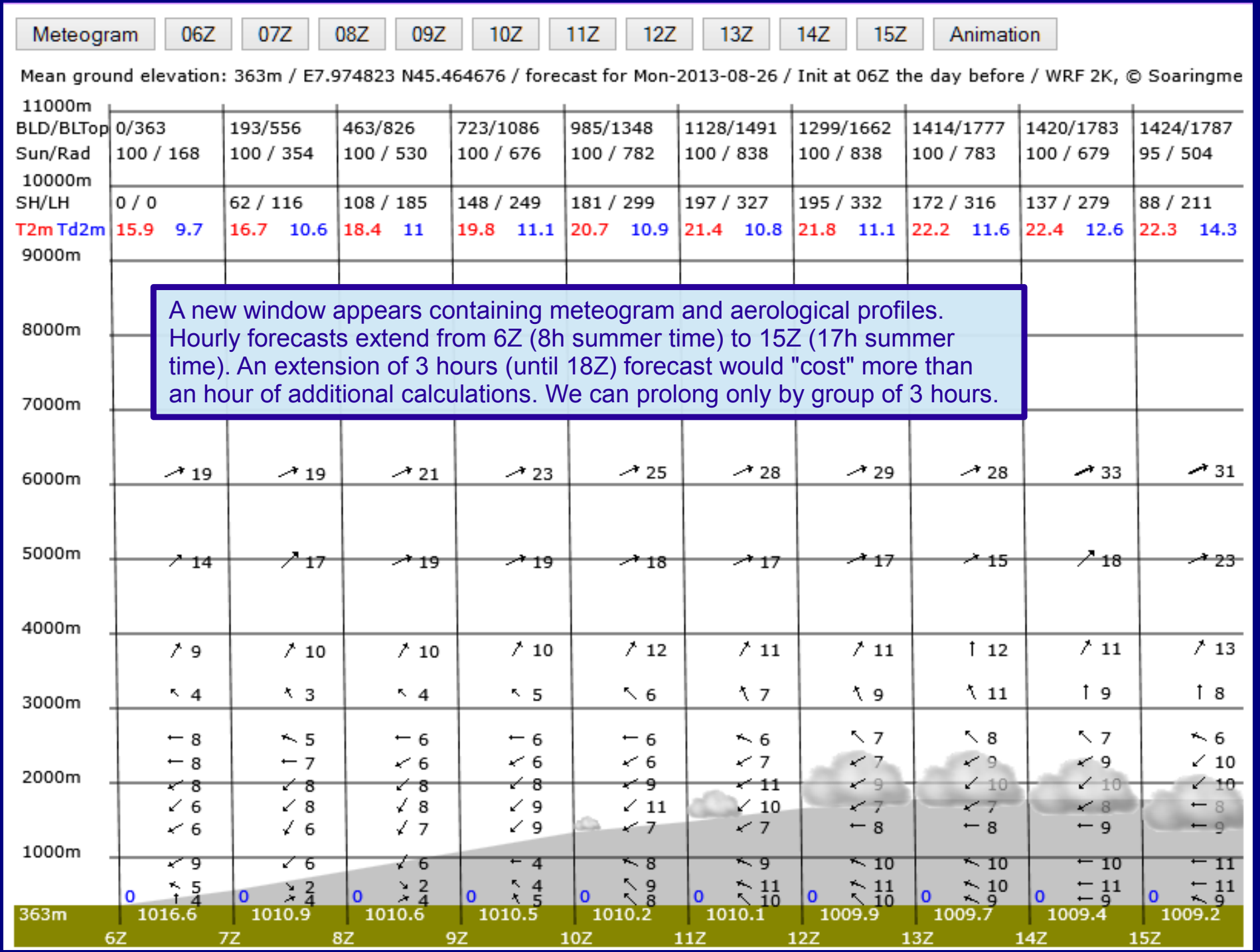


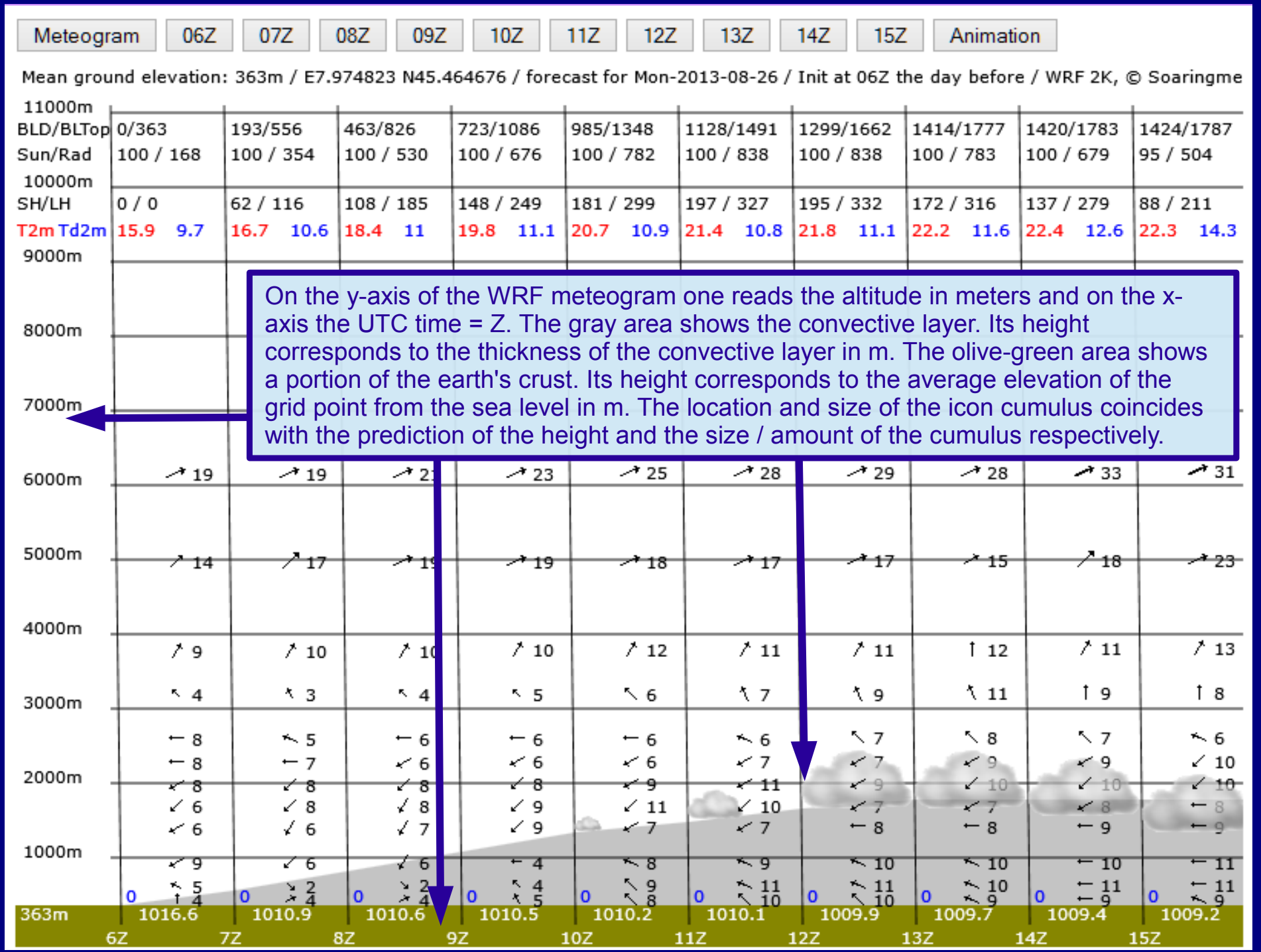
The ThQ is not a weather parameter but only a general indication of the quality of thermals. The parameters influencing the ThQ are sunshine, the height of the thermals top, the horizontal wind and soon available the wind shear at different altitudes, that is to say, the degree of changes of wind direction and speed between different levels. Stonger the sunshine, higher the top, weaker the wind, less strong the shear, so higher is the ThQ (better the thermals) and vice versa.

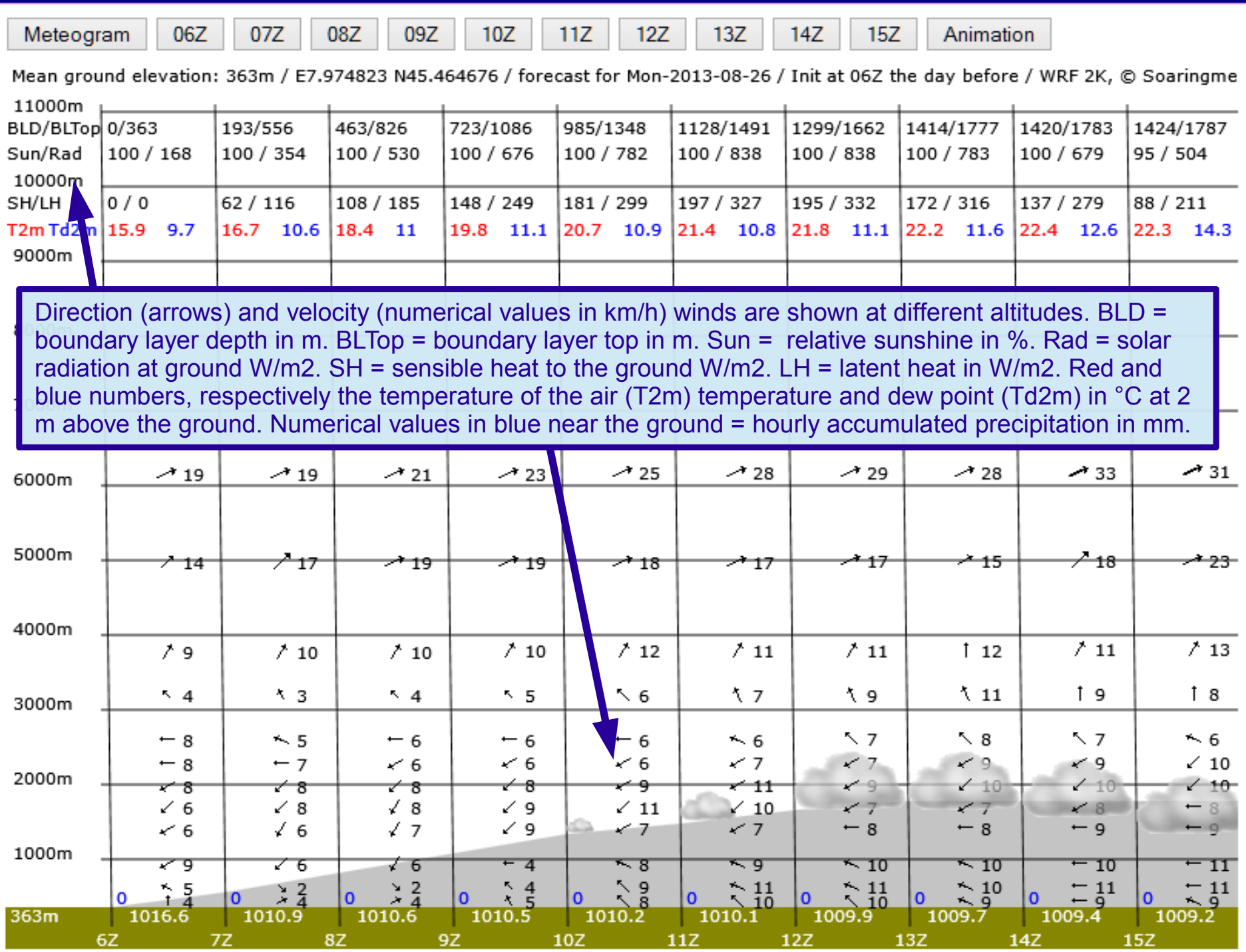
Always check the forecast date. In case of doubt do not hesitate to refresh the web page.

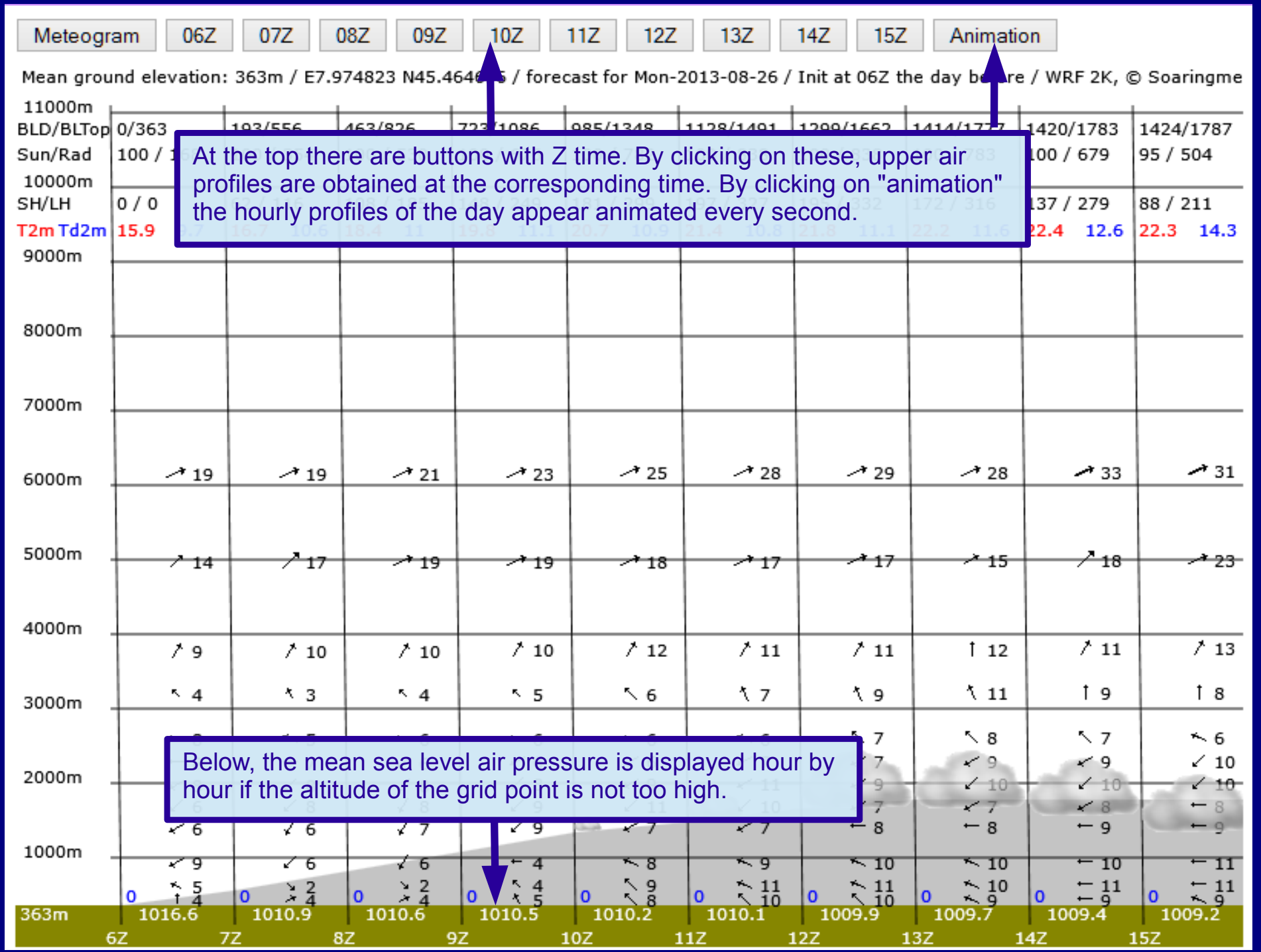
The map is displayed by default at 12Z but you can also choose 09Z and 15Z.

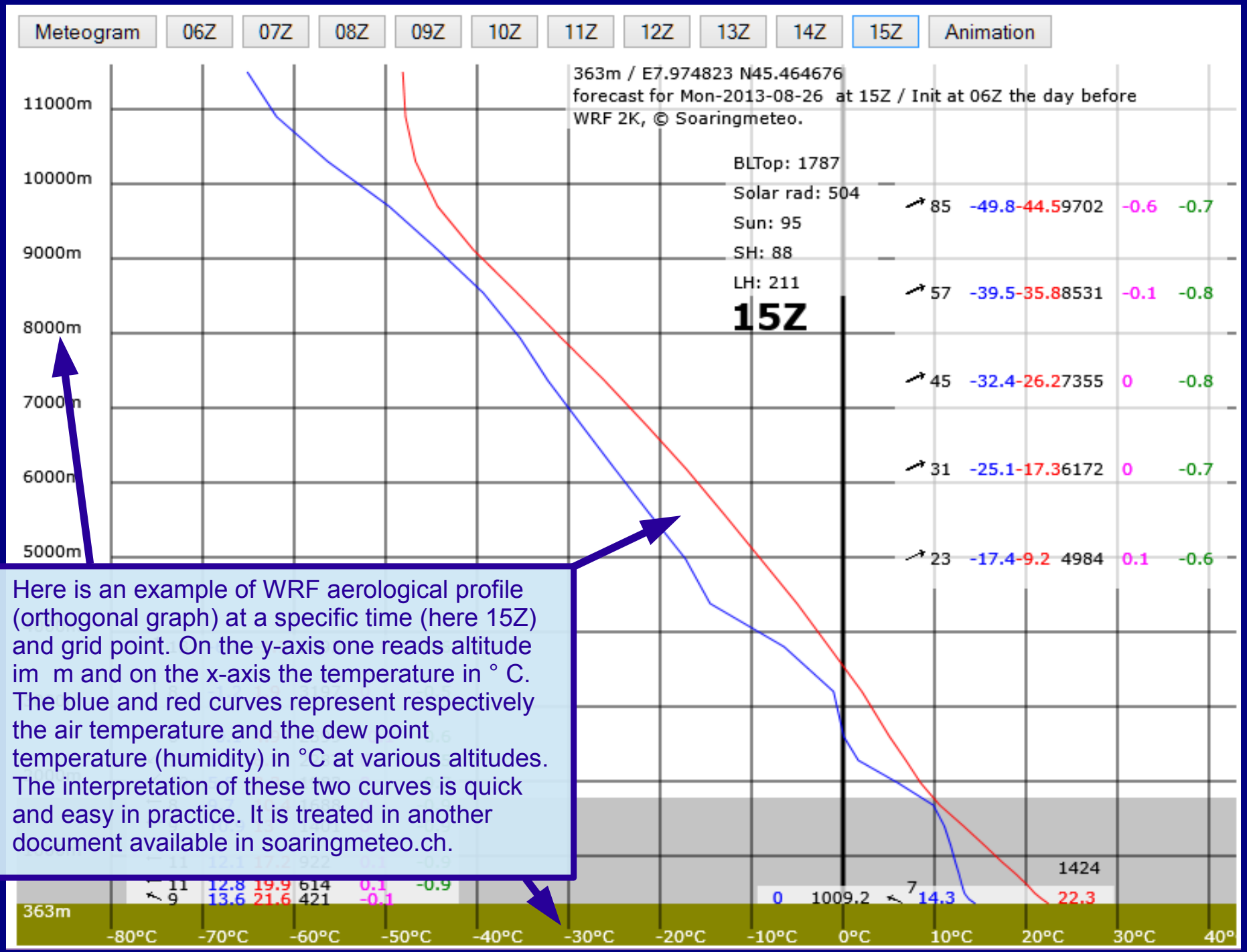

Home> - soarGFS 0.5°> - soarWRF 2K init 06Z - soarWRF 2K init 18Z> - Docs> FR - EN>
09Z> 12Z 15Z> ThQ colour code: 0-10% 11-20% 21-30% 31-40% 41-50% 51-60% 61-70% 71-80% 81-90%
By clicking on one of the "pastilles", you get a message bubble containing information on the main weather parameters at the location of the "pastilles" corresponding to one of the many grid points of the model. Thus we find the horizontal winds in the convective layer in km/h, the top of the thermaly in m and the sunshine in% during the three main periods of the forecast day i.e. 09, 12 and 15Z (Z = UTC), respectively 11, 14 and 17h, summer time or 10, 13 or 16h, winter time. Most pilots can be content of this information ...
WRF forecast: for Mon-2013-08-26
Grid point coordinates: E7.818787 / N45.495884
Mean ground elevation: 412m
Model initialization 06Z the day before
ThQ & WDir | WSpd 10,14,14hm | BL Depth | BL top | Sun
09Z | 65% | 2Km/h | 637m | 1049m | 100%
12Z | 94% | 7Km/h | 1255m | 1667m | 100%
15Z | 96% | 8Km/h | 1272m | 1684m | 100%
To meteogram and soundings
... But some, if they wish, can still click on the "To meteogram and soundings" link for more accurate forecasts in the same place.


Meteogram
06Z
07Z
08Z
09Z
10Z
11Z
12Z
13Z
14Z
15Z
Animation
Mean ground elevation: 363m / E7.974823 N45.464676 / forecast for Mon-2013-08-26 / Init at 06Z the day before / WRF 2K, © Soaringme
11000m
BLD/BLTop 0/363 193/556 463/826 723/1086 985/1348 1128/1491 1299/1662 1414/1777 1420/1783 1424/1787
Sun/Rad 100 / 168 100 / 354 100 / 530 100 / 676 100 / 782 100 / 838 100 / 838 100 / 783 100 / 679 95 / 504
10000m
SH/LH 0 / 0 62 / 116 108 / 185 148 / 249 181 / 299 197 / 327 195 / 332 172 / 316 137 / 279 88 / 211
T2m Td2m 15.9 9.7 16.7 10.6 18.4 11 19.8 11.1 20.7 10.9 21.4 10.8 21.8 11.1 22.2 11.6 22.4 12.6 22.3 14.3
9000m
8000m
7000m
6000m
5000m
4000m
3000m
2000m
1000m
A new window appears containing meteogram and aerological profiles. Hourly forecasts extend from 6Z (8h summer time) to 15Z (17h summer time). An extension of 3 hours (until 18Z) forecast would "cost" more than an hour of additional calculations. We can prolong only by group of 3 hours.
363m 1016.6 1010.9 1010.6 1010.5 1010.2 1010.1 1009.9 1009.7 1009.4 1009.2
6Z 7Z 8Z 9Z 10Z 11Z 12Z 13Z 14Z 15Z

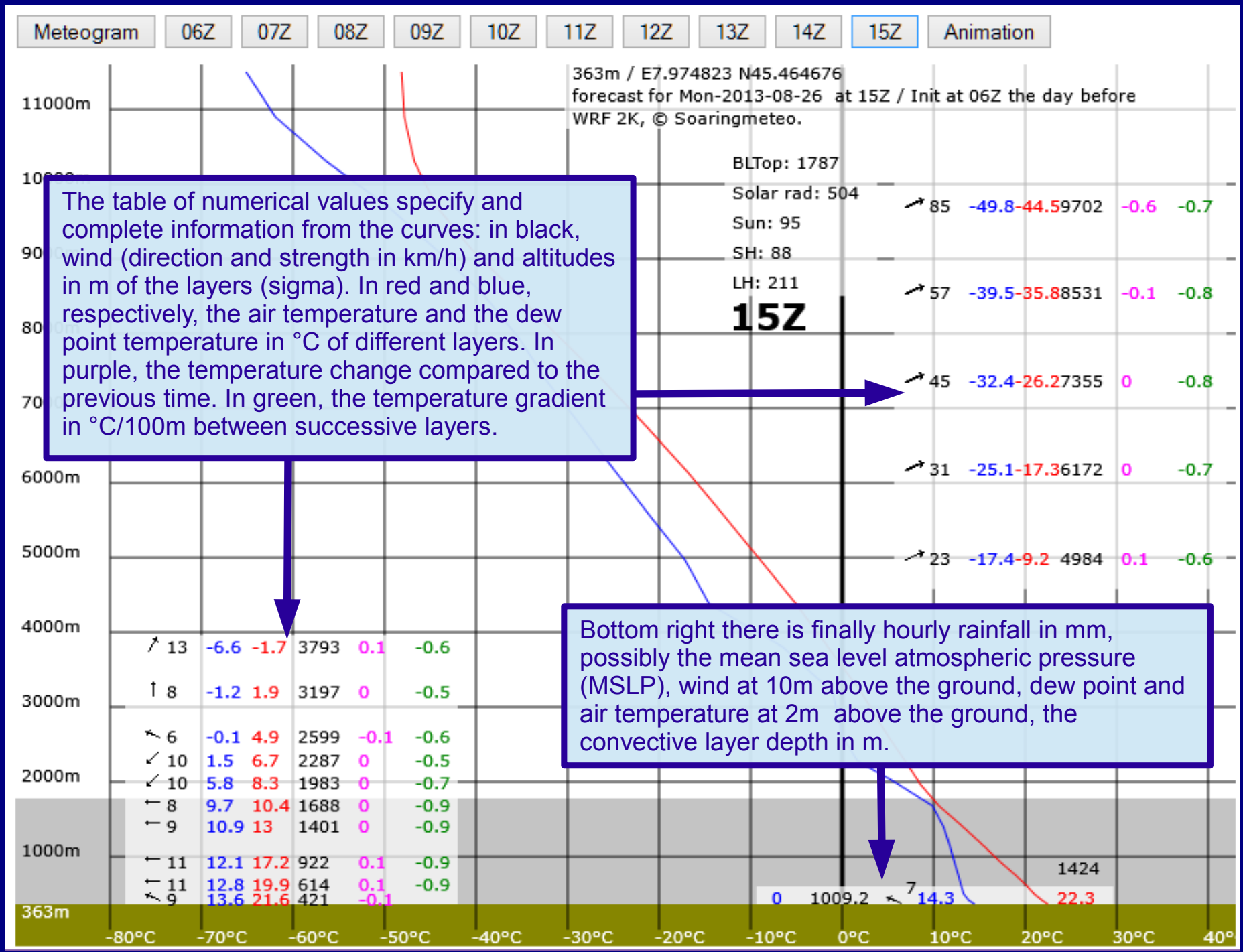

Meteogram
06Z
07Z
08Z
09Z
10Z
11Z
12Z
13Z
14Z
15Z
Animation
Mean ground elevation: 363m / E7.974823 N45.464676 / forecast for Mon-2013-08-26 / Init at 06Z the day before / WRF 2K, © Soaringme
11000m
BLD/BLTop 0/363 193/556 463/826 723/1086 985/1348 1128/1491 1299/1662 1414/1777 1420/1783 1424/1787
Sun/Rad 100 / 168 100 / 354 100 / 530 100 / 676 100 / 782 100 / 838 100 / 838 100 / 783 100 / 679 95 / 504
10000m
SH/LH 0 / 0 62 / 116 108 / 185 148 / 249 181 / 299 197 / 327 195 / 332 172 / 316 137 / 279 88 / 211
T2m Td2m 15.9 9.7 16.7 10.6 18.4 11 19.8 11.1 20.7 10.9 21.4 10.8 21.8 11.1 22.2 11.6 22.4 12.6 22.3 14.3
9000m
8000m
7000m
6000m
5000m
4000m
3000m
2000m
1000m
On the y-axis of the WRF meteogram one reads the altitude in meters and on the x-axis the UTC time = Z. The gray area shows the convective layer. Its height corresponds to the thickness of the convective layer in m. The olive-green area shows a portion of the earth's crust. Its height corresponds to the average elevation of the grid point from the sea level in m. The location and size of the icon cumulus coincides with the prediction of the height and the size / amount of the cumulus respectively.
363m 1016.6 1010.9 1010.6 1010.5 1010.2 1010.1 1009.9 1009.7 1009.4 1009.2
6Z 7Z 8Z 9Z 10Z 11Z 12Z 13Z 14Z 15Z


Meteogram
06Z
07Z
08Z
09Z
10Z
11Z
12Z
13Z
14Z
15Z
Animation
Mean ground elevation: 363m / E7.974823 N45.464676 / forecast for Mon-2013-08-26 / Init at 06Z the day before / WRF 2K, © Soaringme
11000m
BLD/BLTop 0/363 193/556 463/826 723/1086 985/1348 1128/1491 1299/1662 1414/1777 1420/1783 1424/1787
Sun/Rad 100 / 168 100 / 354 100 / 530 100 / 676 100 / 782 100 / 838 100 / 838 100 / 783 100 / 679 95 / 504
10000m
SH/LH 0 / 0 62 / 116 108 / 185 148 / 249 181 / 299 197 / 327 195 / 332 172 / 316 137 / 279 88 / 211
T2m Td2m 15.9 9.7 16.7 10.6 18.4 11 19.8 11.1 20.7 10.9 21.4 10.8 21.8 11.1 22.2 11.6 22.4 12.6 22.3 14.3
9000m
Direction (arrows) and velocity (numerical values in km/h) winds are shown at different altitudes. BLD = boundary layer depth in m. BLTop = boundary layer top in m. Sun = relative sunshine in %. Rad = solar radiation at ground W/m2. SH = sensible heat to the ground W/m2. LH = latent heat in W/m2. Red and blue numbers, respectively the temperature of the air (T2m) temperature and dew point (Td2m) in °C at 2 m above the ground. Numerical values in blue near the ground = hourly accumulated precipitation in mm.
6000m
19 19 21 23 25 28 29 28 33 31
5000m
14 17 19 19 18 17 17 15 18 23
4000m
9 10 10 10 12 11 11 12 11 13
3000m
4 3 4 5 6 7 9 11 9 8
2000m
8 5 6 6 6 6 7 8 7 6
8 7 6 6 6 7 7 9 9 10
8 8 8 8 9 11 9 10 10 10
6 8 8 9 11 10 7 7 8 8
6 6 7 9 7 7 8 8 9 9
1000m
9 6 6 4 8 9 10 10 10 11
5 2 2 4 9 11 11 10 11 11
0 4 0 4 0 4 0 5 0 8 0 10 0 10 0 9 0 9 0 9
363m 1016.6 1010.9 1010.6 1010.5 1010.2 1010.1 1009.9 1009.7 1009.4 1009.2
6Z 7Z 8Z 9Z 10Z 11Z 12Z 13Z 14Z 15Z

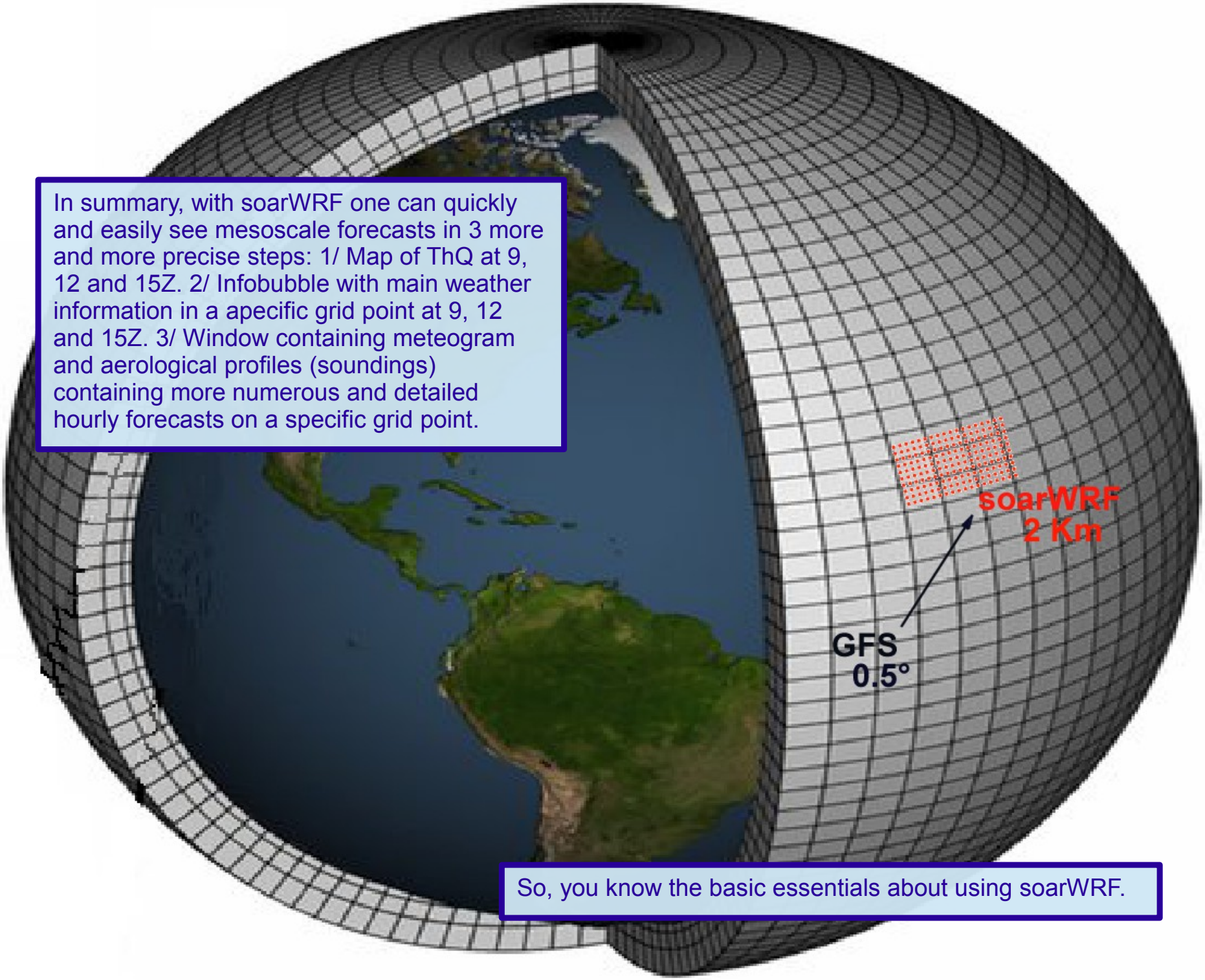

Meteogram
06Z
07Z
08Z
09Z
10Z
11Z
12Z
13Z
14Z
15Z
Animation
Mean ground elevation: 363m / E7.974823 N45.464
/ forecast for Mon-2013-08-26 / Init at 06Z the day be
re / WRF 2K, © Soaringme
11000m
BLD/BLTop 0/363
1420/1783
1424/1787
Sun/Rad 100 /
100 / 679
95 / 504
10000m
SH/LH 0 / 0
137 / 279
88 / 211
T2m Td2m 15.9
22.4 12.6
22.3 14.3
9000m
8000m
7000m
6000m
5000m
4000m
3000m
2000m
1000m
At the top there are buttons with Z time. By clicking on these, upper air profiles are obtained at the corresponding time. By clicking on "animation" the hourly profiles of the day appear animated every second.
Below, the mean sea level air pressure is displayed hour by hour if the altitude of the grid point is not too high.
363m
1016.6
1010.9
1010.6
1010.5
1010.2
1010.1
1009.9
1009.7
1009.4
1009.2
6Z
7Z
8Z
9Z
10Z
11Z
12Z
13Z
14Z
15Z



Here is an example of WRF aerological profile (orthogonal graph) at a specific time (here 15Z) and grid point. On the y-axis one reads altitude im m and on the x-axis the temperature in ° C. The blue and red curves represent respectively the air temperature and the dew point temperature (humidity) in °C at various altitudes. The interpretation of these two curves is quick and easy in practice. It is treated in another document available in soaringmeteo.ch.


Meteogram
06Z
07Z
08Z
09Z
10Z
11Z
12Z
13Z
14Z
15Z
Animation
363m / E7.974823 N45.464676
forecast for Mon-2013-08-26 at 15Z / Init at 06Z the day before
WRF 2K, © Soaringmeteo.
BLTop: 1787
Solar rad: 504
Sun: 95
SH: 88
LH: 211
15Z
11000m
90
80
70
6000m
5000m
4000m
3000m
2000m
1000m
363m
-80°C
-70°C
-60°C
-50°C
-40°C
-30°C
-20°C
-10°C
0°C
10°C
20°C
30°C
40°
85 -49.8 -44.5 9702 -0.6 -0.7
57 -39.5 -35.8 8531 -0.1 -0.8
45 -32.4 -26.2 7355 0 -0.8
31 -25.1 -17.3 6172 0 -0.7
23 -17.4 -9.2 4984 0.1 -0.6
13 -6.6 -1.7 3793 0.1 -0.6
8 -1.2 1.9 3197 0 -0.5
6 -0.1 4.9 2599 -0.1 -0.6
10 1.5 6.7 2287 0 -0.5
10 5.8 8.3 1983 0 -0.7
8 9.7 10.4 1688 0 -0.9
9 10.9 13 1401 0 -0.9
11 12.1 17.2 922 0.1 -0.9
11 12.8 19.9 614 0.1 -0.9
9 13.6 21.6 421 -0.1
0 1009.2 7 14.3 22.3
1424
The table of numerical values specify and complete information from the curves: in black, wind (direction and strength in km/h) and altitudes in m of the layers (sigma). In red and blue, respectively, the air temperature and the dew point temperature in °C of different layers. In purple, the temperature change compared to the previous time. In green, the temperature gradient in °C/100m between successive layers.
Bottom right there is finally hourly rainfall in mm, possibly the mean sea level atmospheric pressure (MSLP), wind at 10m above the ground, dew point and air temperature at 2m above the ground, the convective layer depth in m.

In summary, with soarWRF one can quickly and easily see mesoscale forecasts in 3 more and more precise steps: 1/ Map of ThQ at 9, 12 and 15Z. 2/ Infobubble with main weather information in a apecific grid point at 9, 12 and 15Z. 3/ Window containing meteogram and aerological profiles (soundings) containing more numerous and detailed hourly forecasts on a specific grid point.



So, you know the basic essentials about using soarWRF.