MONITORING QUALITY AND PERFORMANCE OF THE RADIOSONDES STATIONS IN METEO-FRANCE

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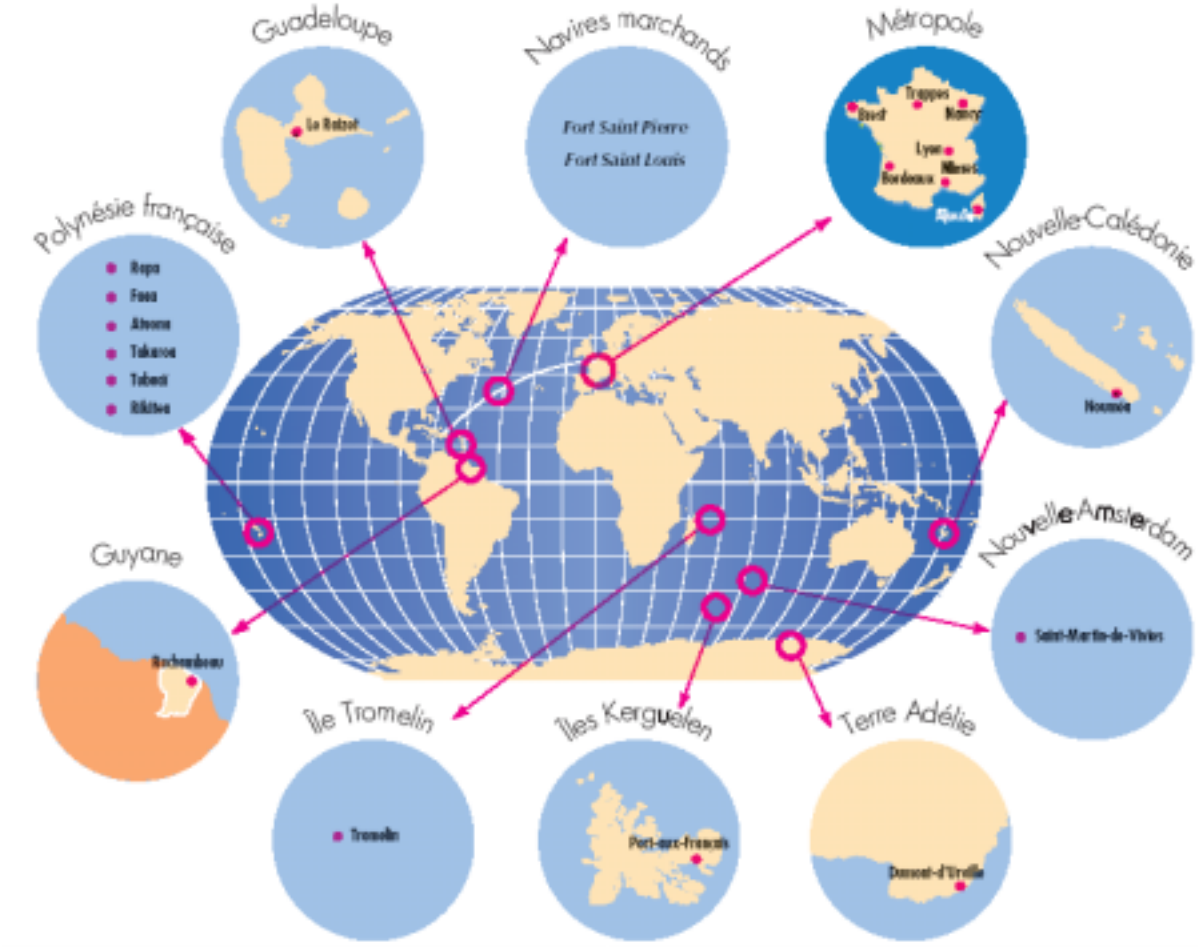
ABSTRACT

Quality management for upper air observation with radiosondes takes place in Meteo-France, both before the choice of equipment every three years and during its operational use.
After the publication of the tender, the offers are analyzed. The retained manufacturers, which fulfill administrative and technical requirements, are requested to provide a sample system and a number of radiosondes. The ground systems and radiosondes are then tested against each others during several ascents. The results of these ascents are then compiled in a technical report which is a key element along with financial proposals for the choice of one or several manufacturers in the contract covering the next three years. Some of the testing procedures are detailed here. The same procedure applies for balloons pre-testing.
After these choices are made, the new equipments are then installed in the Meteo-France upper air network. The next step is to insure that the quality of measurements will remain high and steady during the years of the contract validity. So Meteo-France performs monthly monitoring of radiosonding performance and quality. The monitored parameters and some examples are presented here.

TEXT

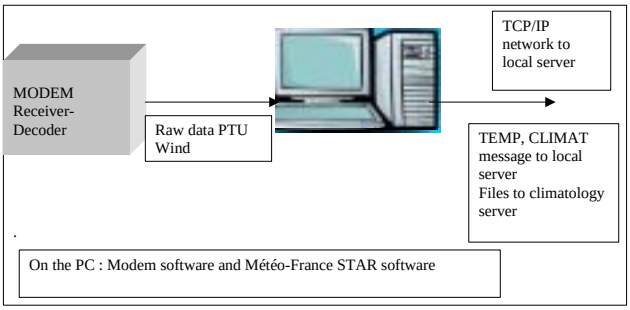
Radiosounding is still the backbone of the upper network. As Meteo-France operates 23 stations (7 in mainland France, 14 overseas and 2 ASAP) this implies significant costs, logistics and staff. An optimal performance requires careful system choices and performance monitoring.

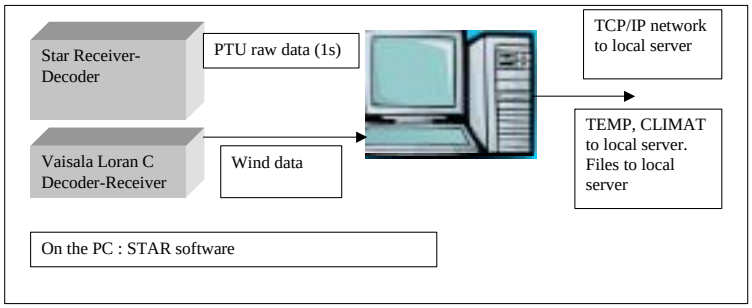


1. COMPARISON BETWEEN SYSTEMS AND RADIOSONDES

Every three years, Meteo-France issues tenders for its network's operation. These tenders cover ground systems, radiosondes and balloons. The administratively relevant offers are transmitted to the technical unit in charge of upper air in Toulouse. Each manufacturer is invited to install a sample system in Toulouse and to provide fifteen radiosondes.

One requirement is that the ground system can be interfaced with the Météo-France Star processing sofware at the decoded raw (PTU Wind) data level.





Examples of present configurations with Star software and manufacturer systems

1.1 Specifications

They are detailed in the following document CCTP : FMO 2970 D 0000

Radiosonde operating conditions

Pressure between 1050 and 3 hPa
Temperature between + 50 and - 90° C
Humidity between 0 and 100%
More specifically, the known temperature use limits taken from radiosounding data performed at extreme geographic positions can be reduced depending on the pressure:

PRESSURE hPa	Min. T.	Max. T.
1050	– 60	+ 50
500	– 60	0
100	– 90	– 30
50	– 90	– 30
10	– 90	– 30

Overall performance

Parameter	**Range**	**Resolution**	**Error**
Pressure	1050 to 3 hPa	1 hPa at 1050 hPa 0.1 hPa below 20 hPa Between 1050 and 20 hPa : 8.74 10-4P+0.08hPa	+-2 hPa at 1050 +-1.5 hPa at 500 +-5 hPa at 10
Temperature	-90 to +50°C	<0.1°C	+-0.5°C
Humidity	0 to 100%	<2%	+-5%
Transmitter frequency	400 to 406 MHz	Drift <200kHz	
Wind		50 m	1 m/s on each component

1.2 Test procedure

Each company selected supplied 15 radiosondes and a decoding receiving and processing system.
The tests for the call for proposals were conducted in two phases:

- Installation and commissioning of the equipment specific to each sonde, test bench, receiving and processing rack, antenna attachment and descent of the coaxial link cables with the participation of the manufacturers.

- Checks of the technical characteristics of the sondes, ground testing, shelter testing and flight testing during the following weeks.

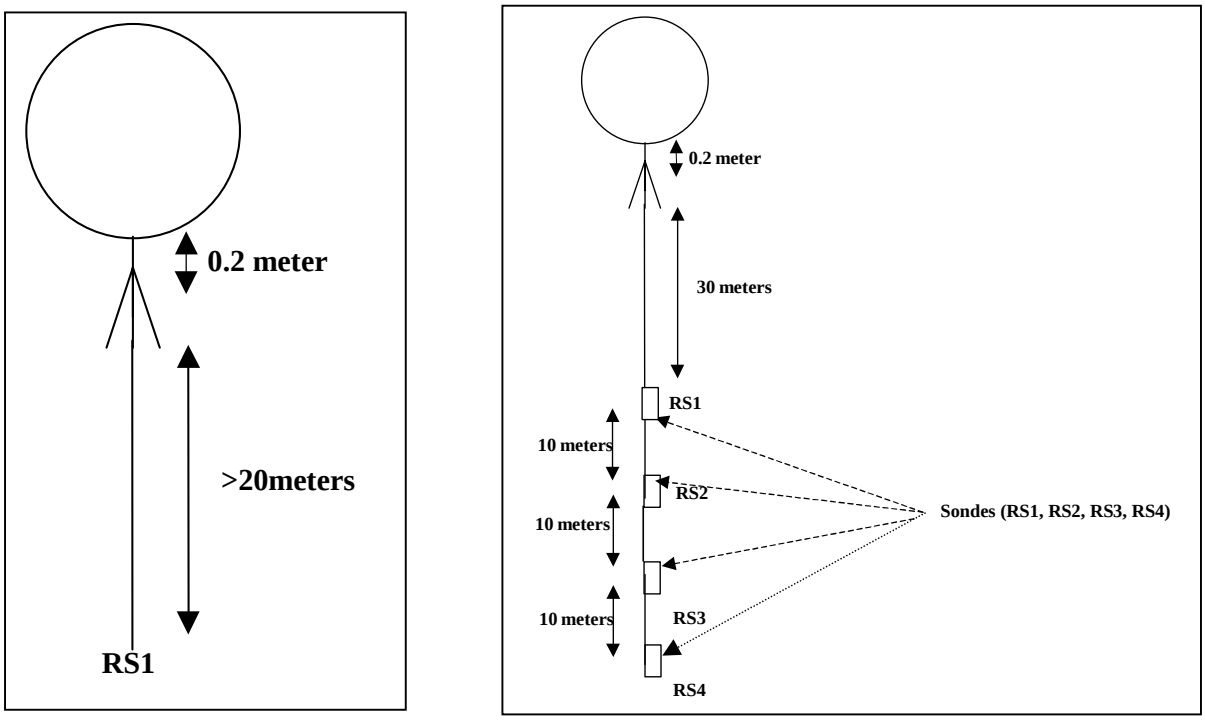
1.3 Flight testing details

Different configurations are used for these tests :

1.3.1 Vertical configurations

Advantage : Minimize interferences between radiosondes

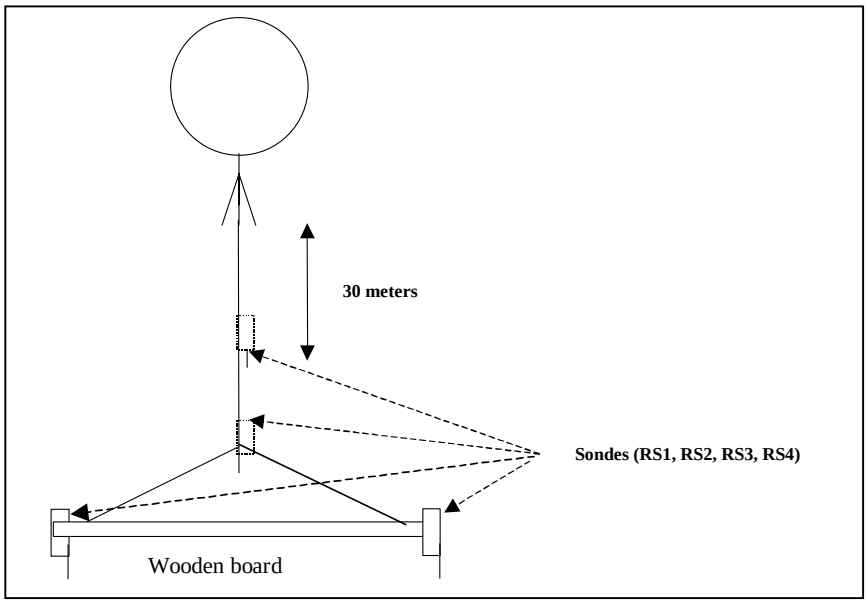
Disadvantage : Radiosondes are not at the same pressure level.



1.3.2 Triangular configurations

Advantage : It is possible to directly compare two radiosondes. The two radiosoundings are occurring at the same time at the same pressure level.

Disadvantage : The system does not allow a large distance between the radiosondes. The transmissions can sometimes disturb one another.



1.4 Results analysis : examples

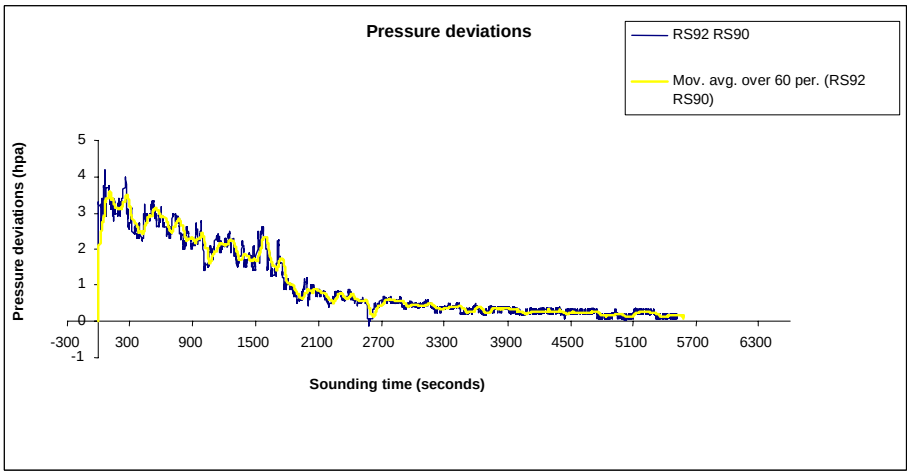
A reference radiosonde is taken. It generally is a radiosonde used operationally in the network since the precedent tender.

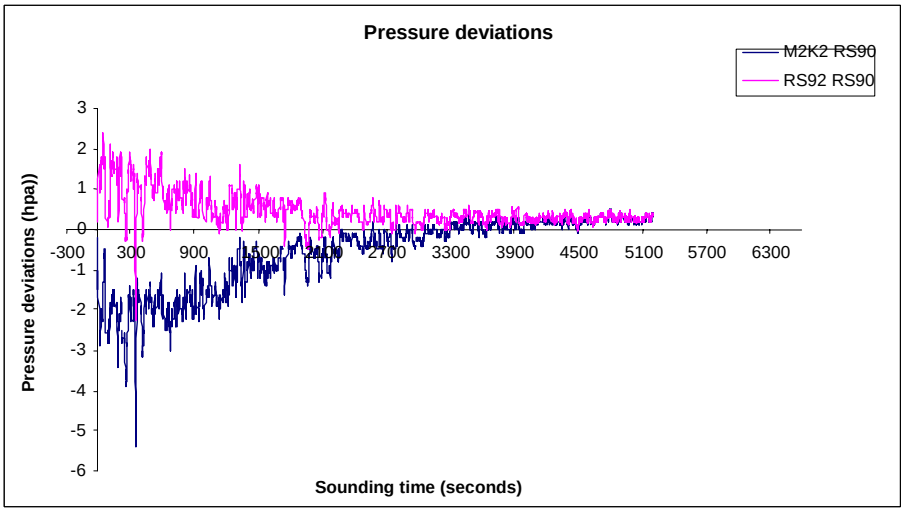
Among the parameters of the radiosonde itself the following are checked : weight, electrical consumption, autonomy, electromagnetic compatibility, frequency stability.

For meteorological parameters, pressure, temperature, humidity and wind are analyzed.

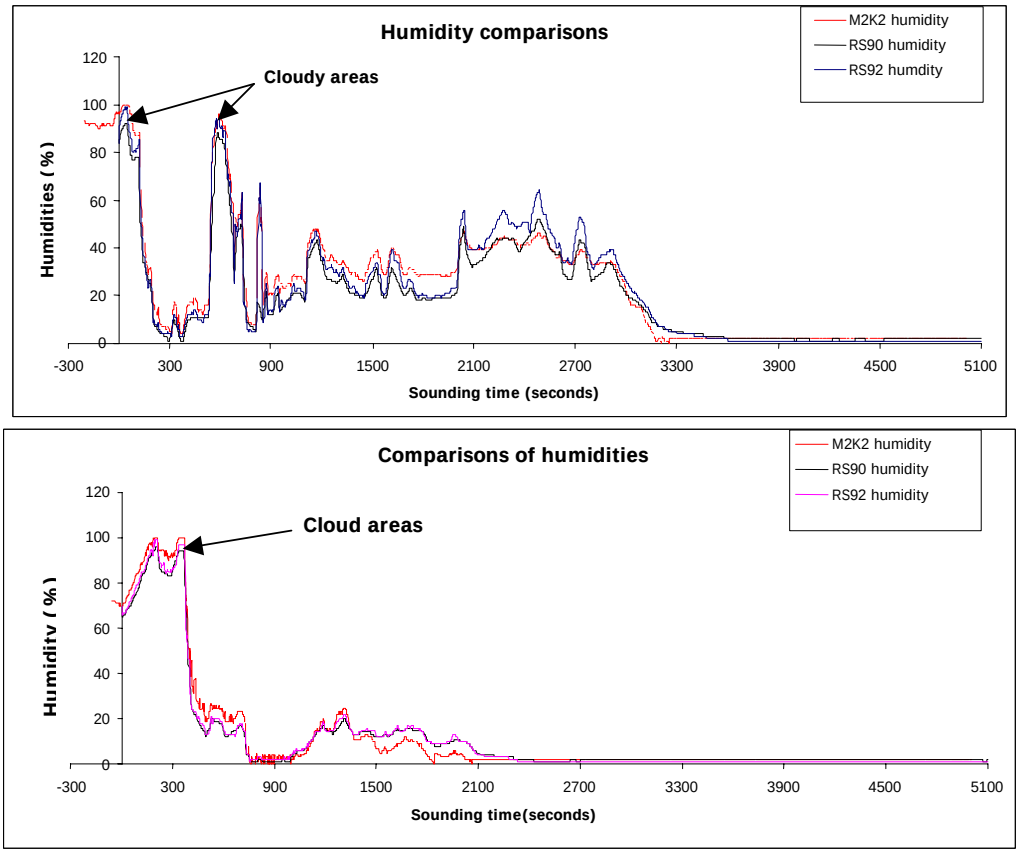
The following diagrams were plotted during the analysis of the 2003 tender. The reference radiosonde was then the RS90 from Vaisala. The tested one were the RS92KL, RS92AGP from Vaisala and the M2K2 from Modem with associated ground systems. The plots are based on raw data provided by the ground system to the Star software input.

Pressure



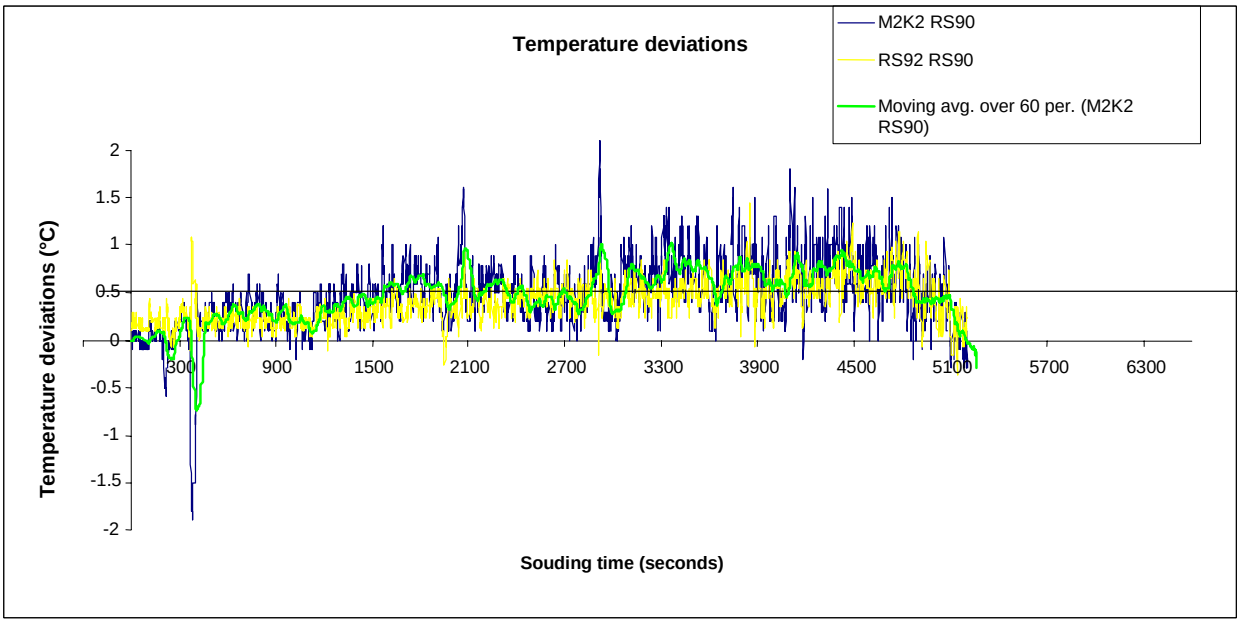


Humidity



Humidity profiles supplied by the sondes

Temperature



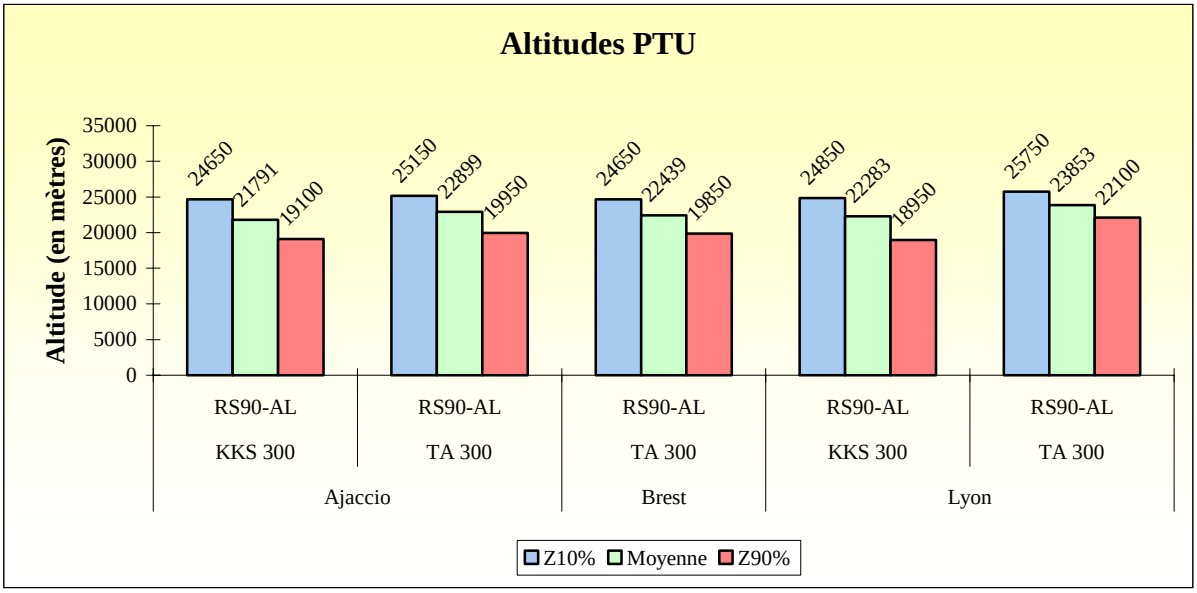
Deviation between the corrected instantaneous temperatures of the M2K2 and RS92 sondes and the corrected instantaneous temperatures of the RS90

2. OPERATIONAL RADIOSOUNDING PERFORMANCE MONITORING

During the three years of operation data from the network are monitored. This yields to diagrams which are analyzed each month. Corrective actions are undertaken if needed.

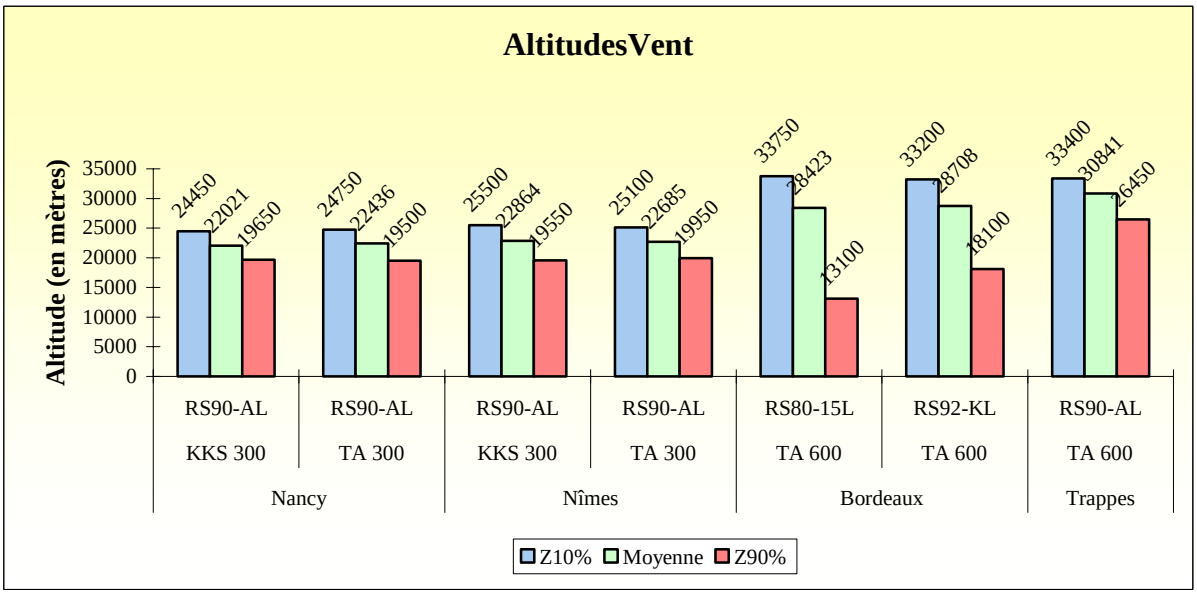
End of PTU :

reached in 10% of soundings (Z 10%)
average
reached in 90% of soundings (Z 90%)



End of wind :

reached in 10% of soundings (Z 10%)
average
reached in 90% of soundings (Z 90%)



PTU and wind data are of course monitored versus NWP products during the assimilation process.