ANALYSIS OF PRESSURE IN BUCHAREST BETWEEN 2009-2012

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Abstract: *In this paper, we monitored the weather station atmospheric pressure based on pressure values recorded by the station, we calculated the statistical analysis of the minimum, maximum and average atmospheric pressure in the years 2009-2012, and step values in the same range baric analyzed .*

Keywords: pressure, step barrel

1. Introduction

The pressure of the gaseous envelope surrounding the globe is called atmospheric pressure or barometric pressure.

Studying the atmospheric pressure regime and the distribution shows great theoretical importance because it allows explaining local circulation of the atmosphere, as well as meteorological processes such as gas exchange between the atmosphere and soil, evaporation or evapotranspiration.

Gravity is what keeps the atmosphere around the Earth and all her weight down its print them. Value in any point on the Earth's surface is equal to the weight of a column of air between that point and the upper limit of the atmosphere click on a unit area.[1]

Atmospheric pressure varies from one area to another depending on geographical latitude and temperature.

Pressure determinations at any point on the Earth's surface and in all geographic conditions, show that the pressure does not remain constant over time, presenting variations.

Pressure decreases with altitude. The decrease is not linear, but exponential - increase height in arithmetic progression, the pressure drops in geometric progression.

For Romania maxima occur at 500 and 1400 hours (in January) and 400, 1700 (in July), and minima occur at times in 1000, 2200 (January) and 900, 2400 (in July).

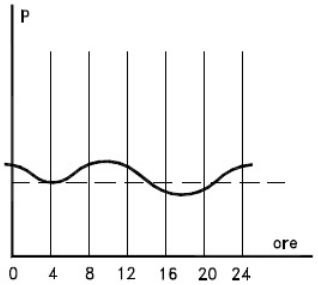


Figure 1 Daily variation of pressure [4]

Non-periodic variations and disturbances often called the most significant category designates the pressure changes. Their main cause is the temperature variations that generates dynamic processes in the atmosphere. Accidental pressure oscillations generally vary between 970mb and 1040 mb. In

exceptional cases, where depressions pressure can drop up to 925 mb and if anticyclones can grow up to 1070mb.

Atmospheric pressure varies with weather. In general, an increase in pressure means an improvement in the weather, and a decrease in pressure means a worsening of weather. Atmospheric pressure varies with altitude. As altitude is higher, the pressure will be lower. A good approximation is: for every 100 m climb in altitude, the pressure varies by 10 mb. Is approximately valid up to approximately 3000 m above sea level.

2. Materials and methods

Pressure was monitored with Weather Station: AWS / EV of ISB faculty, program version 2.3.2 Geco MICROS SIAP program automatically records the following parameters: pressure, air temperature, wind direction and speed, atmospheric humidity, solar radiation, rainfall [8].
Atmospheric pressure sensor (TBAR-V)
The sensor is in accordance with international specifications WMO (World Meteorological Organization).
To optimize the measurement, the sensor is equipped with electronic control inside that automatically compensates for temperature variations, ensuring good accuracy throughout operational. Structure protection range is made of plastic.
Internal circuits are protected from atmospheric discharges and polarity.
This is an analog sensor with linear output signal ranging from 0 V to +2 VDC.
- Measuring range: 700 - 1100 mb (hPa)
- Sensitivity: 0.1 mb (hPa)
- Accuracy: + / - 1.5 mb (hPa)
- Resolution: 0.1 mb (hPa)
- Linearity: + / - 0.15% (full scale)
- Temperature: - 30-60 0C
- Power supply: + 10 to + 16 VDC
- Output signal: 0 V (700 MB / hPa) at V + 2 (1100 MB / hPa)
- The sensor connector: 4 - pin female
- Mounting: with support provided (Φ mast 48-50 mm)

3. Results and discussion

Established law Laplace pressure variation with altitude. This complex is a logarithmic function. For ease of calculation was introduced step barrel. This is the vertical distance, in meters, for which there is a decrease in air pressure of 1 millibar.

Baric is calculated every step that can approximate a linear decrease of the pressure value as follows:

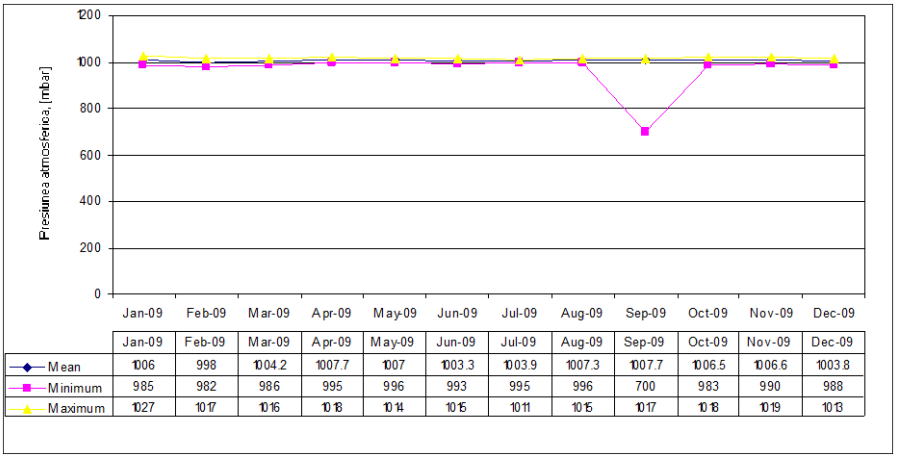
- At sea level falls to 1 mb to 8.4 m and 1 mm Hg for every 11.2 m;
- From 5000 m to 1 mb pressure drop every 16 m;
- From 11000 m to 1 mb pressure drop every 32 m [6]
- In this paper, we calculate the barometric stage based on the following mathematical relationships:

$$h = \frac{8000}{p}(1 + \alpha t)$$

where: p = pressure;
α = coefficient of expansion of the gas (0,04);
t = temperature at that time;

Evolution of atmospheric pressure values from one month to another is closely correlated with both air temperature, and especially with the dynamic atmosphere that carry latitudes investigated area baric air masses with different characteristics.

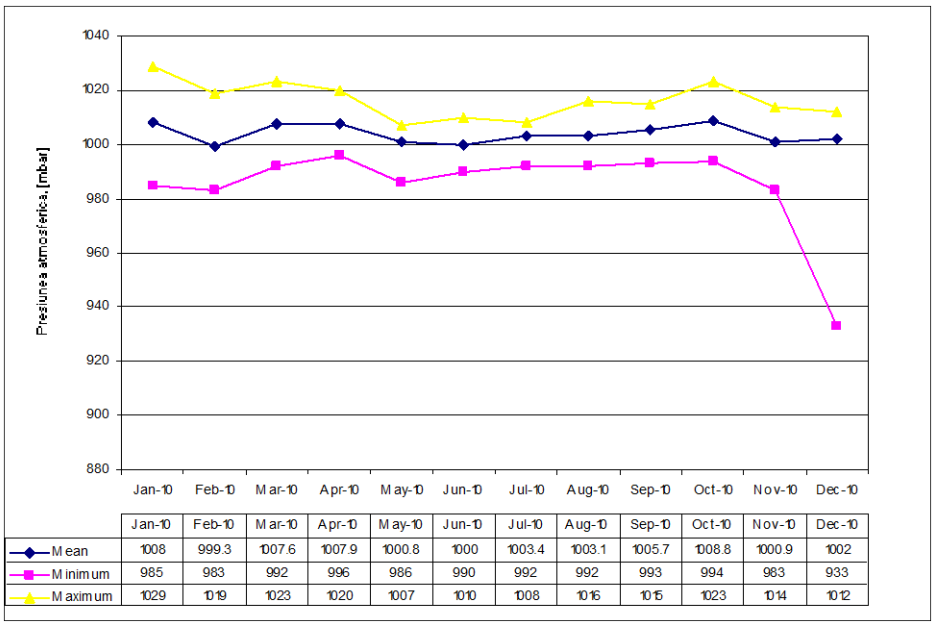
By statistical analysis based on the values of atmospheric pressure to stop we calculated the minimum, maximum, average atmospheric pressure and the results are shown in Figures 1 a - 1 d



	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09
Mean	1006	998	1004.2	1007.7	1007	1003.3	1003.9	1007.3	1007.7	1006.5	1006.6	1003.8
Minimum	985	982	986	995	996	993	995	996	700	983	990	988
Maximum	1027	1017	1016	1018	1014	1015	1011	1015	1017	1018	1019	1013

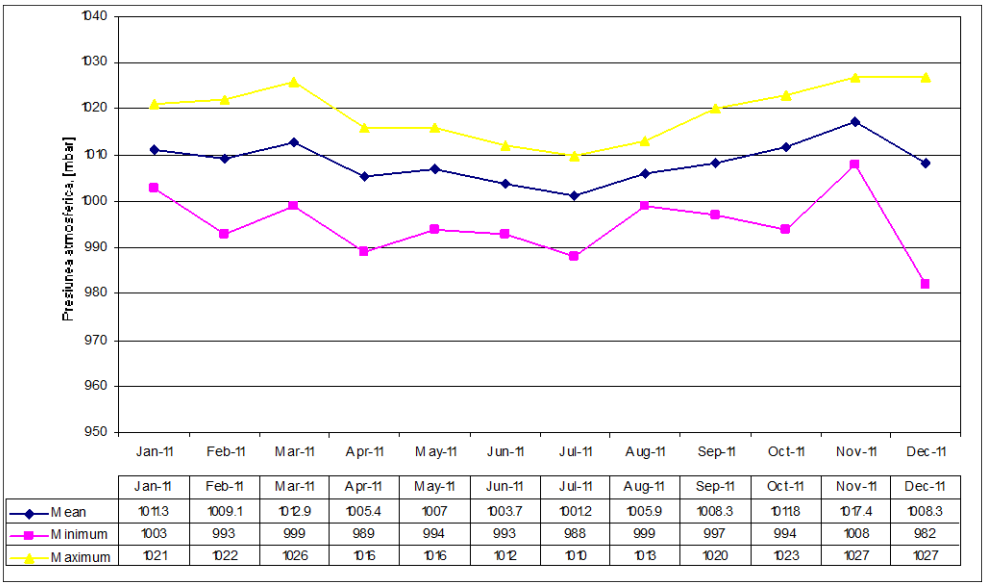
Figure 1 a Variation of the minimum, maximum, average pressure in 2009 in the city of Bucharest

It is apparent from the graph that the atmospheric pressure in the year 2009 in the month of January 1027 mbar maximum and lowest value in September 700 mbar.



	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10
Mean	1008	999.3	1007.6	1007.9	1000.8	1000	1003.4	1003.1	1005.7	1008.8	1000.9	1002
Minimum	985	983	992	996	986	990	992	992	993	994	983	933
Maximum	1029	1019	1023	1020	1007	1010	1008	1016	1015	1023	1014	1012

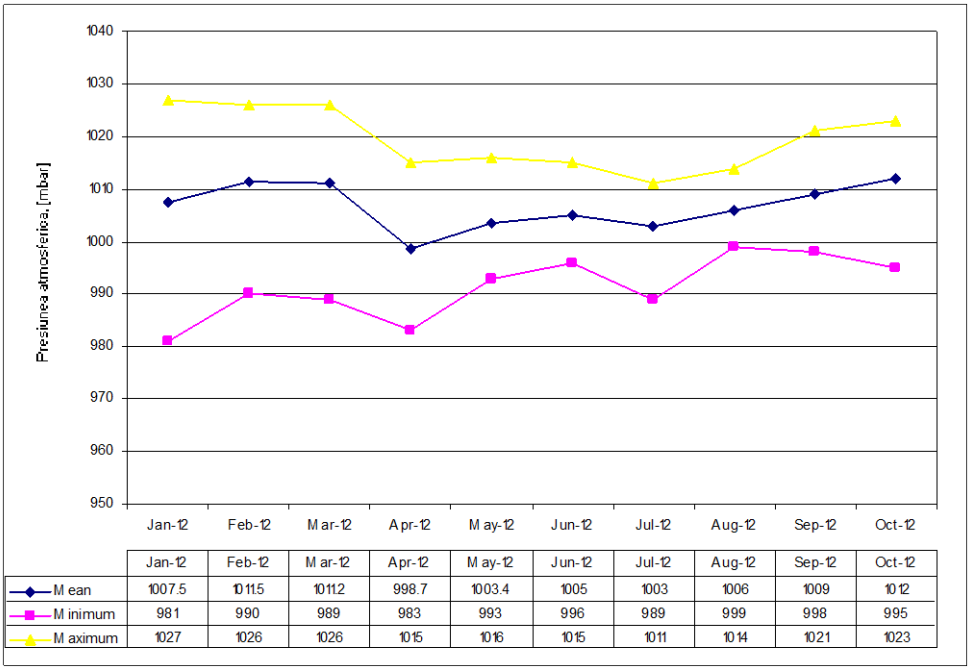
Figure 1 b Variation of the minimum, maximum, average pressure in 2010 in the city of Bucharest
Note that the maximum value was recorded in January 1029 mbar and 933 mbar minimum in December when the temperature was lower and.



	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
Mean	1011.3	1009.1	1012.9	1005.4	1007	1003.7	1001.2	1005.9	1008.3	1011.8	1017.4	1008.3
Minimum	1003	993	999	989	994	993	988	999	997	994	1008	982
Maximum	1021	1022	1026	1016	1016	1012	1010	1013	1020	1023	1027	1027

Figure 1 c Variation of the minimum, maximum, average pressure in 2011 in the city of Bucharest

The maximum value is 1026 mbar in March and the minimum pressure of 988 mbar was recorded in July.



	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12
Mean	1007.5	1011.5	1011.2	998.7	1003.4	1005	1003	1006	1009	1012
Minimum	981	990	989	983	993	996	989	999	998	995
Maximum	1027	1026	1026	1015	1016	1015	1011	1014	1021	1023

Figure 1 d Variation of the minimum, maximum, average pressure in 2012 in the city of Bucharest

This graph shows that the maximum value is 1027 mbar in January, and the minimum is 981 mbar station recorded all in January.

Note that the air pressure imposed temporary knows a great variability of the general circulation of the atmosphere. Given the predominance of a regime anticyclone in winter, when heat activates continental anticyclones strongly developed (Siberian and East European) and whose dorsal extend beyond South East, it records the highest values of atmospheric pressure. Weather influences the atmospheric pressure so a place can change over time. If atmospheric pressure grows we hope to

have nice time, if the atmospheric pressure decreases we expect the weather to become ugly. So atmospheric pressure varies from one place to another, varies with weather, altitude. When atmospheric pressure decreases (that is the lower temperature in the mountains) air is thinning and high atmospheric pressure air is more dense, more (when temperatures are high), sea.

We calculated the mean, maximum and minimum step baric in 2009-2012, based on the values of air temperature and atmospheric pressure and the results are shown in Figure 2 a - 2 d. Other authors in their work studied the statistical analyzes various materials [3,4,5,6].

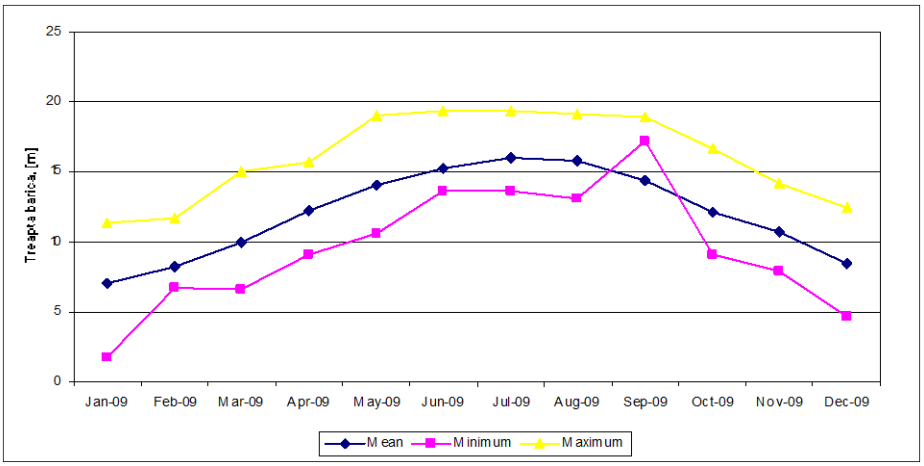


Figure 2 a The minimum, maximum, average baric stage in 2009

In 2009 the value of the step baric was 19 m in July, the lowest value in January of 1 m

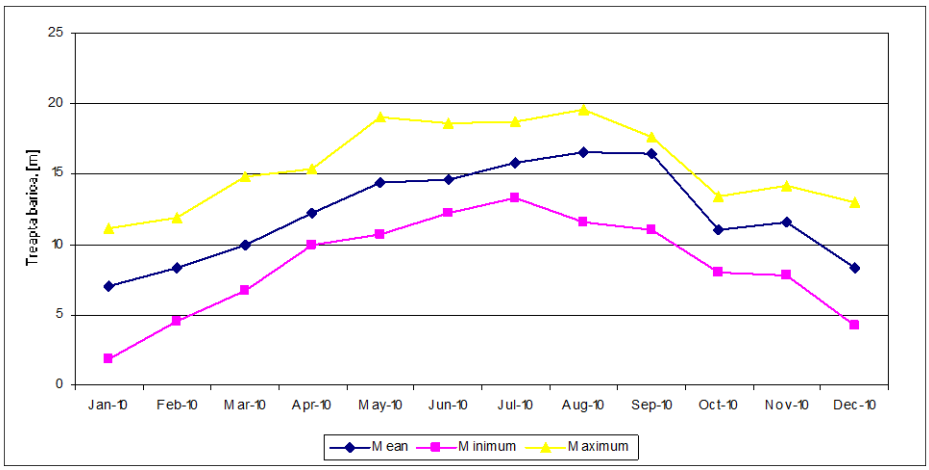


Figure 2 b The minimum, maximum, average baric stage in 2010

In 2010 the highest value of baric stage was about 19 m in August, the lowest value in January of about 1 m

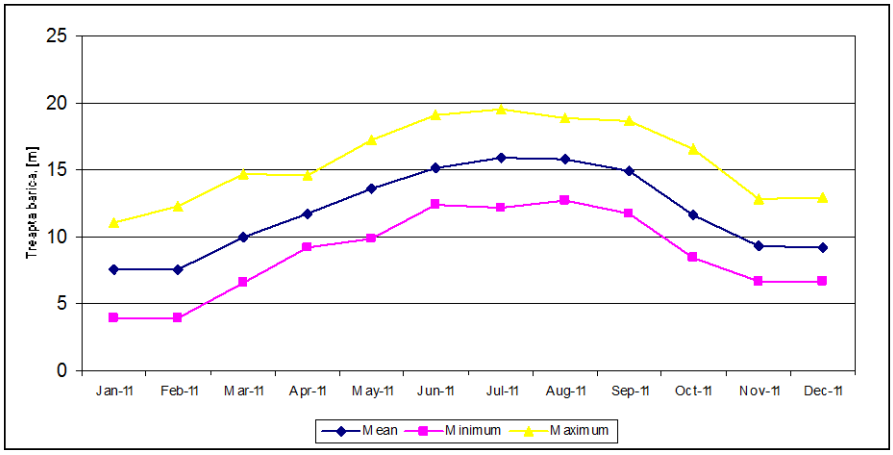


Figure 2 c The minimum, maximum, average baric stage in 2011

In 2010 the highest value of baric stage was about 19 m in July, the lowest value in January of about 1 m.

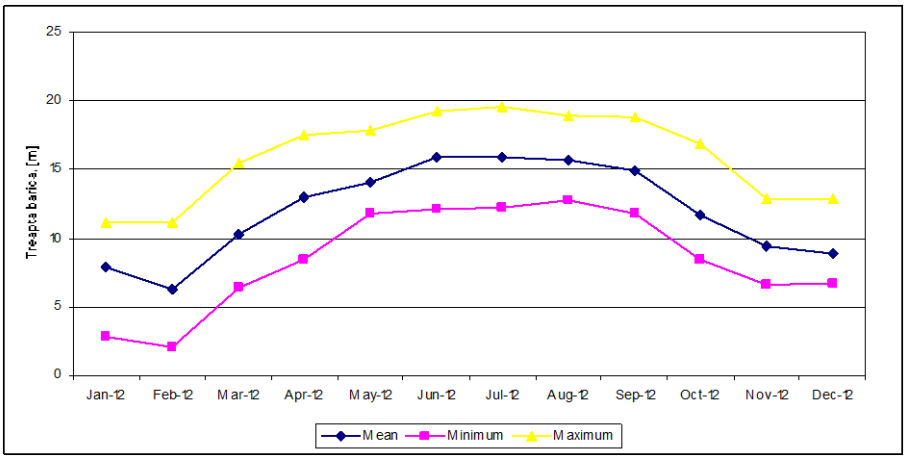


Figure 2 d The minimum, maximum, average baric stage in 2012

Conclusions

From the foregoing it follows that Bucharest is still located in the temperate climate and the Biotechnical Faculty of Engineering where the weather station is situated, is a protected area of influence of winds but has the advantage in terms of the values of solar radiation, which may be considered useful in the event the installation of solar panels.

Bucharest City fall transition moderate continental climate characteristic of the SE part of the Pannonian Plain, with some Mediterranean influences (version Adriatic). Its general features are marked by diversity and irregularity of atmospheric processes.

Movement of air masses from the west so in the cold persists and in the warm seasons and is characterized by mild winters, often with liquid precipitation. Frequently, even during winter, arriving from the Atlantic humid air masses, bringing significant rain and snow, less cold waves. Polar circulation is determined by cyclones in the North Atlantic Ocean and is characterized by decreases in temperature, cloudiness and precipitation in the form of sharp showers, and winter snowfall is accompanied by intensification of the wind. From September to February is manifested frequent intrusion of continental polar air masses coming from the East. However the influence is strongly felt cyclones and warm air masses from the Mediterranean, which generates thaw winter and summer

periods require stifling heat. Tropical circulation causes mild winters with large amounts of rainfall and the summer a while unstable with rain showers and thunderstorms.

Cold and dry air masses are accompanied by land surface pressures higher than warm and humid air masses. In turn, hot air, dry determined pressure greater than a mass of hot air as but not wet. Replacement of air masses with different can mean changes in atmospheric pressure and time, but the surface pressure fluctuations may present even without changing air masses because pressure may decrease or increase as local air is heated or cooled.

In addition to changes in air pressure resulting from variations in the temperature and water vapor content, the pressure may also be influenced by the type of air circulation. Winds diverge from a central point on the earth's surface causes the center air descending from above, the diverging air taking place, if the surface diverges more air than the top down, the air density and pressure drop. In the case of wind converging to a point on the earth's surface, if more air than converge rises to higher altitudes, the air density and pressure increase.

REFERENCES

[1] APOSTOL L. – *„Meteorologie si climatologie"*, Editura Universitatii Suceava 2000

[2] N. Topor, V. Mosoiu, N. Vancea - *Meteorologie Aeronautica 1967*

[3] D. Stoica, G Stanciu: "Influence the degree of sorting the separation process a conical sieve" Digest Journal of Nanomaterials and Biostructures Vol. 8, No. 2, April - June 2013, p. 513 - 518

[4]Irina Istrate, Diana Cocârță, Silvia Neamțu, Talida Cirlioru, The assessment of an alternative treatment for PCB polluted soils in the romanian context - bench scale tests, 2012, Water air and soil pollution, vol 224 (4),DOI: 10.1007/s11270-013-1516-2, ISSN: 0049-6979 (print version), ISSN: 1573-2932 (electronic version);

[5] Dumitru Popovici, George Strejea, Ion Mihaila – Performante si limite umane in aviatie , Bucuresti 2009.

[6] C. O. Rusănescu, G. Paraschiv, G. Voicu, M. Rusănescu - Comparative Analysis of Atmospheric Temperature Values, Relative Humidity In 2009 And 2010 In West Side Of Bucharest City, Bulletin USAMV Agriculture, 68(2)/2011, Print ISSN 1843-5246; Electronic ISSN 1843-5386, pag. 130-138

[7] Rusănescu Carmen Otilia – Îndrumar de meteorologie si climatologie, Editura Matrix Rom, Bucuresti 2013