RAINFALL INDICES IN THE CITY OF BUCHAREST

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Abstract: In this paper is analyzed rainfall regime with rainfall indices: the amount of rainfall, conventional balance of humidity (K), emberger rainfall coefficient.
Specific precipitation amounts are calculated analysis of the ecological factors that characterize either the period of accumulation of biologically active water horizon (XI-III) or maximum biological activity (VII-VIII). We performed conventional moisture balance. We calculated the average yearly rainfall in 2009-2012. We calculated the eco-climatic indices for the city of Bucharest, a city with a lot of vegetation, parks, and green spaces to highlight issues tend aridity of the region. According to the data processed, the city of Bucharest has a temperate continental climate. Specific four seasons, winter, spring, summer and autumn. Bucharest winters are very mild with little snow and relatively high temperature, while in recent years are very hot summers, very hot with little precipitation.

Keywords: indices of rainfall, rainfall, annual precipitation

1. Introduction

Bucharest is situated on the banks of Dambovita river that empties in Arges affluent of the Danube. Several lakes stretch along the river Colentina, within the city, as Floreasca lake Tei and lake Colentina, and in the center there is a lake in Cismigiu. This lake, former marsh the old medieval city, is surrounded by gardens Cismigiu, inaugurated in 1847. Besides Cismigiu, there is a number of large parks: Herastrau (the Village Museum) and the Botanical Gardens (the largest in Romania and includes over 10,000 species of plants, including exotic) Youth Park, Park Alexandru Ioan Cuza and more smaller parks and green spaces of the district municipalities [1] .

The climate and topography of the surroundings of Bucharest are very suitable for agriculture. Growing grain, vegetables and fruit trees. In addition a number of plants growing wild, damaging crops and which man tries to destroy them (weeds). The forests grow a wide variety of fungi, ferns and moss. [2].

The meteorological concept of aridity has a temporal reference, is a phenomenon characterized by low rainfall (period arid, arid year). Currently over a third of Earth's land is affected by aridity. The main drivers of aridity are: rainfall, temperature, continental, albedo, etc. [3]. Biogeographic point of view, the lack of water in the soil produces a growth deficit of plant species and even create large discontinuities in the carpet vegetable.

And other authors have studied their works rainfall in different regions of the world [4,5].

2. Materials and methods

The amount of rainfall is monitored weather station. Technical specifications of precipitation sensor it is a digital sensor. Measuring range: unlimited; maximum measuring range: 0 to 300 mm / h.

3. Results and discussion

Based on data recorded by the weather station 24 hours out of 24, we performed statistical analysis, and calculated the amounts of precipitation analysis specific ecological factors characterize either the period of accumulation of biologically active water horizon (XI-III) or maximum biological activity (VII-VIII).

The period from November to March is a time of excess water in the soil, the accumulation of which is very necessary but vegetation structure in the first two stages of vegetative (germination and sprouting).

High temperatures during this period leading to high values of actual evapotranspiration (Satmari, 2010). Due to the development of all the leaves, the plants are also needs maximum, which results in the depletion of water from the soil [6].

For weather station in Bucharest, we performed calculations based on data recorded by station and got the values shown in Figure 2.

Table 1 The amount of rainfall

The amount of rainfall recorded in the month XIX-III 2009	319
The amount of rainfall recorded in the month XIX-III 2011	221.6
The amount of rainfall recorded in the month XIX-III 2012	185.6
The amount of rainfall recorded in the month VII-VIII2009	211.2
The amount of rainfall recorded in the month VII-VIII2010	95.4
The amount of rainfall recorded in the month VII-VIII2011	128.4
The amount of rainfall recorded in the month VII-VIII2012	130.3

The sum of precipitation during the cold season of the year represents the total water amount resulted from both solid and liquid precipitation. The cold season is as important as the warm one from the pluviometric point of view, as it ensures the water reserve in the soil that is then used during the first phonological phases. The amounts registered during this interval represents about 35-40 percent of the annual mean, which is about 221.6 mm (2011).

. The highest value is 319 mm in 2009 (Table 1).

The sum of the precipitation amounts during the maximum consumption period represents the precipitation amount corresponding to the interval July-August, when there are also registered the highest thermal values. These amounts represent about 19 percent of the annual mean. Generally, this interval is characterized by long and intensive drought periods. The highest values are 211.2 mm in 2009 and the lowest values in 2010 of 95.4 mm.

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We perform conventional balance of humidity (K) [7].

$$K = \frac{\sum P(T \geq 10)}{\sum T \geq 10^0 C} \qquad (5)$$

$$K_{2009} = \frac{\sum PIV - IX}{\sum TIV - IX} = \frac{= 16.8 + 59.4 + 97.2 + 143 + 68.2 + 67.6}{13.43 + 19.4 + 22.94 + 25.4 + 24.6 + 20.4} = 3.58$$

$$K_{2010} = \frac{\sum PIV - IX}{\sum TIV - IX} = \frac{= 52.6 + 119.6 + 102.4 + 69.2 + 26.2 + 33.2}{13.48 + 21.27 + 20.52 + 24.57 + 26.75 + 19.134} = 3.21$$

$$K_{2011} = \frac{\sum PIV - IX}{\sum TIV - IX} = \frac{= 36 + 137.4 + 79.8 + 74.2 + 54.2 + 0}{12.02 + 17.7 + 22.5 + 24.95 + 24.46 + 21.92} = 3.09$$

$$K_{2010} = \frac{\sum PIV - IX}{\sum TIV - IX} = \frac{= 54.2 + 179.8 + 58.4 + 78.4 + 65.3 + 35.4}{15.4 + 19.5 + 21.3 + 25 + 24.6 + 22.1} = 3.69$$

Conventional balance of humidity is favorable climate for the degree of forest vegetation. Conventional balance of moisture values calculated for 2009-2012 based on the values of air temperature and rainfall recorded by the weather station, ranged between 3.09 and 3.69 so only part of the storm water gets up in the soil. We calculated the amount of rainfall recorded based on station in the years 2009 - 2012 and the maximum rainfall in the same period (figure 1 and 2).
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We calculated the amount of rainfall recorded based on station in the years 2009 - 2012 and the maximum rainfall in the same period.

Annual average amount of rainfall in 2009 is 708 [mm/year]
Annual average amount of rainfall in 2010 is 652.2 [mm/year]
Annual average amount of rainfall in 2011 is 510.6 [mm/year]
Annual average amount of rainfall in 2012 is 721.9 [mm/year]
The highest value of rainfall was recorded in 2009 by 708 [mm/year]
The smallest amount of rainfall was recorded in 2011 of 510.6 [mm/year]
The highest quantity of precipitation falls in May 2012 = 197.4 mm, 137.4 mm followed by May 2011.
The least amount of precipitation falling in February 2011 = 12 mm
The maximum monthly = 40.8 mm in August 2009
Monthly Minimum quantity = 0 .4 mm in September and November 2011

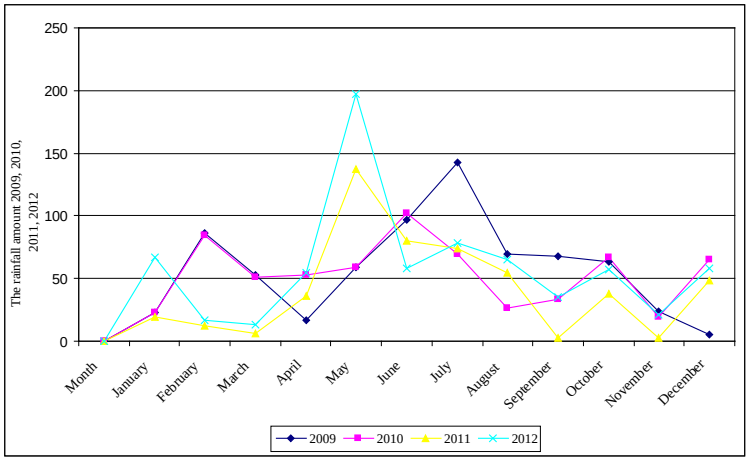

Figure 1 The rainfall amount calculated for the 12 months of the years 2009, 2010, 2011, 2012

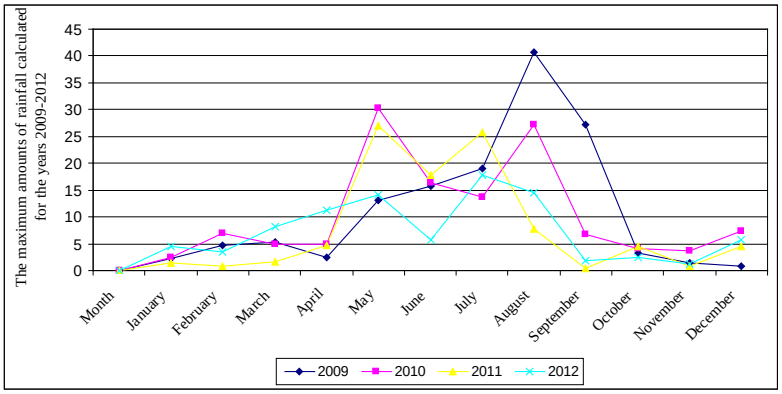

Figure 2 The maximum amounts of rainfall calculated for the years 2009, 2010, 2011, 2012

Emberger rainfall coefficient

$$Q = \frac{100 \cdot P}{M_i^2 - m_i^2} \qquad (6)$$

P – average annual rainfall
M – maximum average annual rainfall
m-minimum average annual rainfall

Year	Calculated values for Q
2009	45,25
2010	59,80
2011	70,97
2012	53,19
2013	50,37

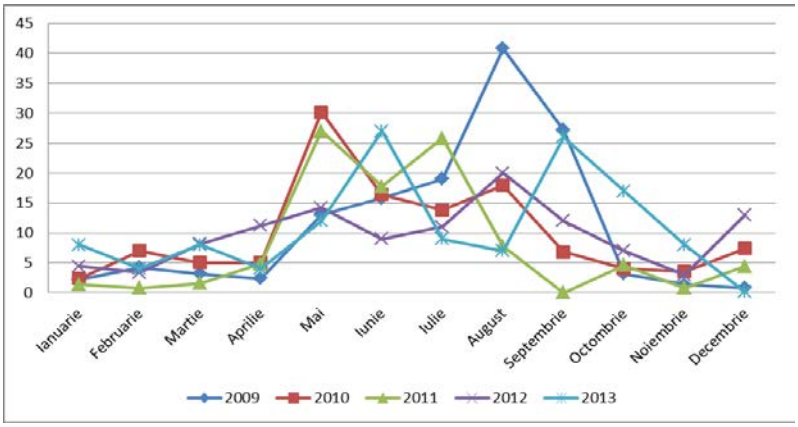

Figure 3 Maximum annual rainfall

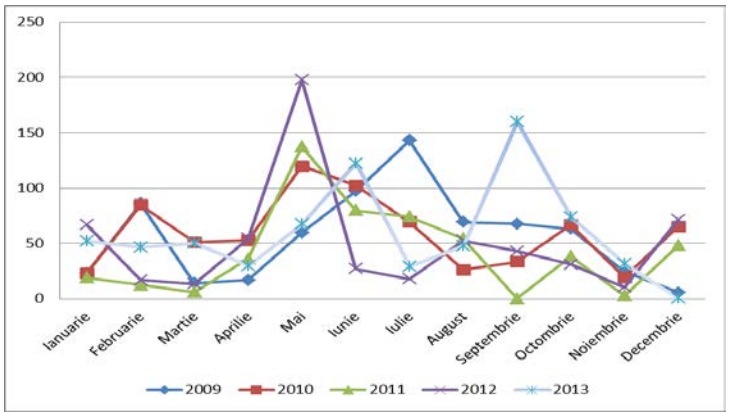

Figure 4 The amount of rainfall in 2009-2013

Conclusions

We observed that annual average rainfall in 2012 is 721.9 [mm/year] with the highest value in the range examined.

The smallest value in 2011 of 510.6 [mm/year] followed by the precipitation of 2010 to 510.6 [mm / year].

The highest value of rainfall was recorded in 2009 by 708 [mm/year].

The smallest amount of rainfall was recorded in 2011 of 510.6 [mm/year].

The highest quantity of precipitation falls in May 2012 = 197.4 mm, followed by May 2011, with the value of 137.4 mm.

The least amount of precipitation falling in February 2011, = 12 [mm].

The maximum monthly = 40.8 [mm] in August 2009.

Monthly minimum quantity = 0 .4 [mm] in September and November 2011.

Maximum amount of rainfall in 24 hours is an important feature of rainfall in Bucharest. The high frequency of these rainfall especially emphasizes the warm half of the continental climate of the country. They are generated by a high absolute humidity of the air, the more intense frontal activity and thermal convection, which stimulates the development of clouds and increase rainfall.

Number of days with precipitation> 0.1 mm during the year is not constant from month to month. In general, he has a variation that resembles with the annual course of monthly precipitation amounts. The months with the highest number of days with precipitation are May and August, and the fewest days is recorded in September and February. Frequency the average yearly rainfall in the city of Bucharest exceed 110 days.

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