SPATIAL DISTRIBUTION OF AIR HUMIDITY IN BIHOR COUNTY

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Abstract

This study focuses on the spatial distribution and multiannual variation of the main hygrometric parameters (relative humidity, vapour pressure of water, saturation deficit) in the area of Bihor county.

The characteristics of hygrometric parameters in the area of Bihor county have been analysed for the period from 1970 to 2012 based on the values of the elements that characterise atmospheric humidity. The variation of the hygrometric parameters was followed at seven weather stations located in low-lying, depressed and mountainous areas so that the entire area of Bihor country was covered.

The values of the hygrometric parameters are influenced by convective and advective movements, by turbulent flows, as well as water phase changes.

As a result of the humid climate in the west of the continent, relative humidity has rather high values in the area included in the study.

Key words: relative humidity, saturation deficit, vapour pressure of water.

INTRODUCTION

The amount of water vapours depends on the sources of air masses, on the physical-geographic features, on the condition of the ground surface, on the degree of continentalisation, on rainfalls etc. (Gaceu O., 2005; Köteles N., Ana Cornelia Moza, 2010; Köteles N., Ana Cornelia Pereş, 2011; Măhăra Gh., 2001; Moza (Pereş) Ana Cornelia, 2009; Pereş Ana Cornelia, N. Köteles, 2011, 2012; Pereş Ana Cornelia, 2012). The main sources of water vapours in the area of the study are the Atlantic Ocean and the Mediterranean Sea. The increase in air humidity is also influenced, to a lesser extent, by water evaporation from the Earth's land, from the surfaces of rivers, lakes, from wet surfaces, and by plant transpiration (Gaceu O., 2005; Köteles N., Ana Cornelia Moza, 2010; Măhăra Gh., 2001; Moza (Pereş) Ana Cornelia, 2009; Pereş Ana Cornelia, N. Köteles, 2012).

MATERIAL AND METHOD

In order to study the characteristics of air humidity in the area of Bihor county, data measured at weather stations in the area of the study from 1970 to 2012 were used. The weather stations included in the study were the following: Săcueni (125 m), Oradea (136 m), Holod (163 m), Ştei

(278 m), Borod (333 m), Dumbrăviţa de Codru (586 m), Stâna de Vale (1108 m), all of them located in the area of Bihor county.

In most cases the data analysed were collected over a period of 43 years. There were two exceptions, namely, the weather station in Dumbrăviţa de Codru, which was set up in 1983, so it provided data for 30 years only, and the weather station in Stâna de Vale, set up in 1979, so the data collected there covered a period of 34 years.

RESULTS AND DISCUSSIONS

1. Relative humidity

In the area of Bihor county, the annual averages of relative humidity usually increase with altitude, from 76.3% recorded in Săcueni to la 88.6% in Stâna de Vale (see Figure 1). The influence of local factors interrupts in certain places the altitudinal distribution of relative humidity. Thus, the value (78%) in Ştei is lower than the one in Holod (80.6%), and in Dumbrăviţa de Codru the multiannual average (72%) is lower than the values at the other weather stations.

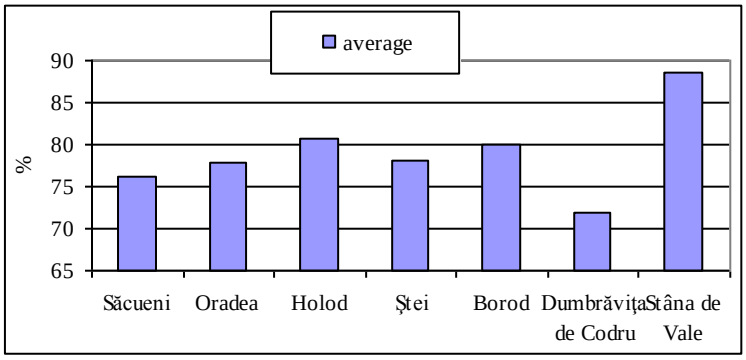

Figure 1. Distribution of multiannual averages of relative humidity (%) in Bihor county

Looking at the annual pattern of relative humidity, it can be seen that the values are higher in wintertime, in December in particular. Thus, the value is 92% in Stâna de Vale, 90.1% in Holod, 86.2% in Borod, in Săcueni 86.8%, while in Oradea and Ştei the highest values are recorded in January, 88.2% and 84% respectively. The higher values in December can be explained by a higher frequency of warm and humid air coming from the Mediterranean Sea, as compared to January, when the frequency of cold and dry air brought from the north and north-east by the East-European, Siberian or Scandinavian Anticyclone increases (Gaceu O., 2005; Moza (Pereş) Ana Cornelia, 2009).

The lowest values of relative humidity are recorded in the warm period of the year. Thus, in April the value is 66% in Dumbrăviţa de Codru, 73% in Ştei, 74.1% in Borod, 74.3% in Holod, in May 69.2% in Săcueni, 85.7% in Stâna de Vale, while in Oradea the lowest value is recorded in July, that is, 70.1% (see Figure 2).

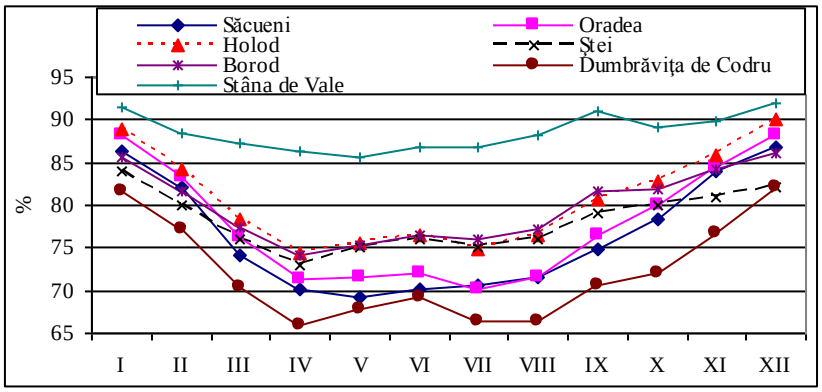

Figure 2. Distribution of monthly averages of relative humidity (%) in Bihor county

The frequency of days with specific characteristics of relative humidity varies both spatially and in time.

The annual average number of days with very low relative humidity, values ≤ 30%, in any of the hours recorded varies between 9.4 and 9.6 days in Săcueni and Oradea, 12.3 days in Ştei, 4.2 days in Borod and 2.6 days in Stâna de Vale.

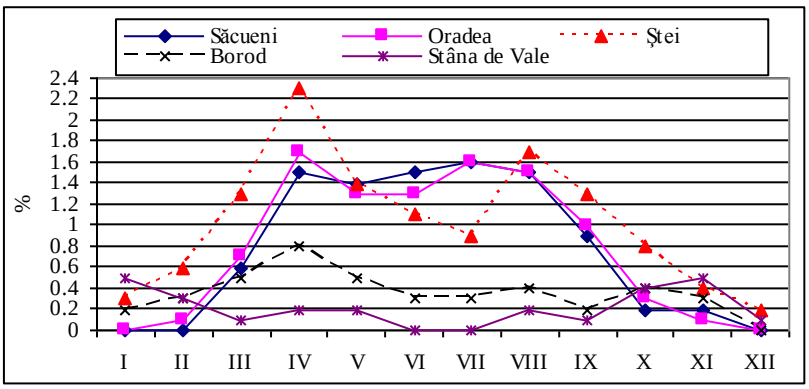

Figure 3. Distribution of monthly averages of relative humidity ≤ 30%, in Bihor county

During the year, the monthly average frequency of days with relative humidity ≤ 30% varies from one region to another based on the

geographical features. Generally, the frequency of these days is higher in wintertime in the mountains (0.5 days in Stâna de Vale in January). At lower altitudes, in depressed areas, they are more frequent in spring, e.g. in April (0.8 days in Borod and 2.3 days in Ştei), while at the weather stations located in the low-lying areas, high values are recorded in spring and in summer, thus, in Oradea 1.7 days are recorded in April and 1.6 in July, and in Săcueni 1.6 days in July (see Figure 3).

The lowest number of days with relative humidity ≤ 30% in the mountains is recorded in the warm season, in June and July. At lower altitudes, in depressed areas and in the lowlands, these values are recorded in wintertime, that is, in December-January (0.0 – 0.2 days).

The annual average number of days with relative humidity ≤ 50% in at least one of the hours recorded is higher in the low-lying areas and in the depressed ones, with values of 115.8 days in Oradea and Săcueni, 117.3 days in Borod, 129.9 days in Ştei, and is lower in the mountains: 47.7 days in Stâna de Vale.

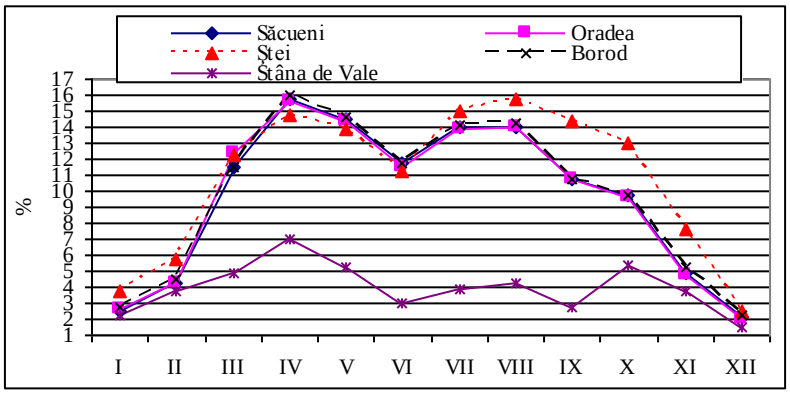

Figure 4. Distribution of monthly averages of relative humidity ≤ 50% in Bihor county

The monthly average frequency of days with relative humidity ≤ 50% has the highest values in April, thus there are 16.0 such days in Borod, 15.8 in Săcueni, 15.6 in Oradea and 7.0 in Stâna de Vale. The lowest averages in the area of the study are in December, that is, 1.5 days in Stâna de Vale, 2.0 days in Oradea, 2.1 days in Săcueni, 2.2 days in Borod and 2.5 days in Ştei (see Figure 4).

The annual frequency of days with relative humidity of ≥ 80% at noontime (when the temperature reaches maximum values) is highest in the mountains, 134.0 days, and drops below 100 days in the low-lying areas, with values of 82.7 days in Ştei, 79.8 days in Borod, 89.8 days in Săcueni and 91.1 days in Oradea.

The monthly average number of days with relative humidity ≥ 80% has the highest values in December, with 18.1 days in Stâna de Vale, 14.9 days in Ştei, 14.7 days in Borod, 19.7 in Săcueni and 19.9 days in Oradea. Relative humidity has higher values in wintertime as the temperatures are lower and the advection of wet Mediterranean air is more frequent. The lowest values are recorded in the summer months (July and August), thus: 2.3 days in Oradea, 2.2 days in Săcueni, 3.2 days in Borod, 3.3 days in Ştei and 3.4 days in Stâna de Vale (see Figure 5). The values are lower in the summer due to higher air temperature averages.

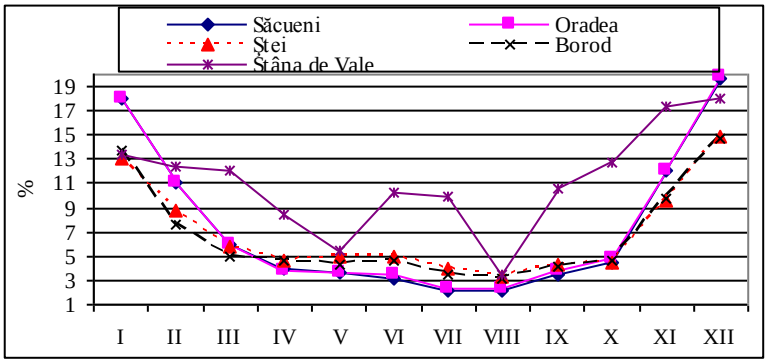

Figure 5. Distribution of monthly averages of relative humidity ≥ 80% in Bihor county

2. Vapour pressure of water

Vapour pressure of water changes in inverse proportion to altitude, the annual average being between 10.5 mb in Oradea and 8.0 mb in Stâna de Vale (see Figure 6).

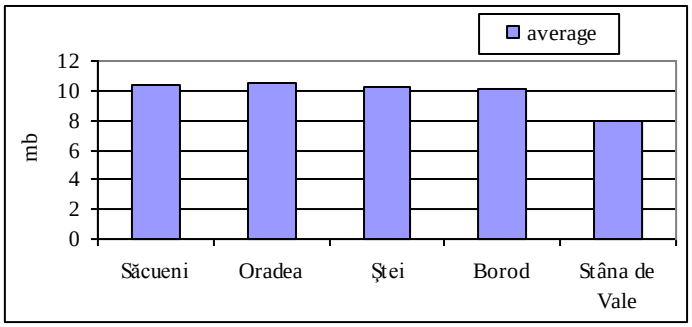

Figure 6. Distribution of multiannual averages of vapour pressure of water (mb) in Bihor county

The highest values of vapour pressure of water in the area of the study are recorded in July, that is, 17.0 mb in Săcueni, 16.8 mb in Oradea, 16.4

mb in Ştei and in Borod, and they continue to drop to 13.4 mb in the mountains. The lowest values are usually recorded in January, that is, 5.0 mb in Oradea, Săcueni, Ştei and Borod, while in Stâna de Vale, the minimum value, 4.0 mb, is recorded in February (see Figure 7).

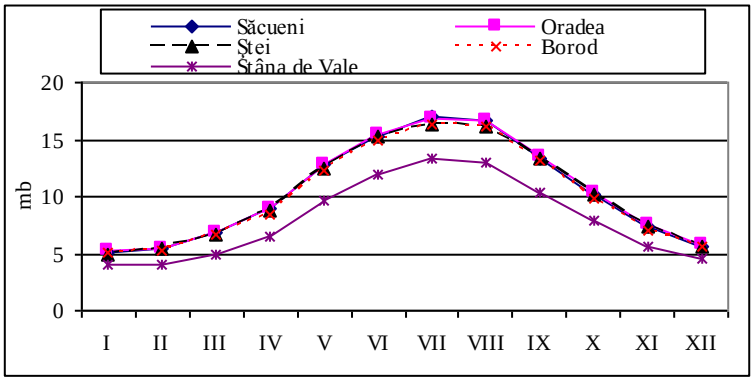

Figure 7. Yearly pattern of vapour pressure of water in Bihor county

3. Saturation deficit

In the area of Bihor county the highest annual averages of saturation deficit are recorded in the lowlands (4.5 mb in Oradea and Săcueni), then they drop gradually to 3.5-3.8 mb in depressed areas and have the lowest values in the mountains, that is, 1.6 mb (see Figure 8).

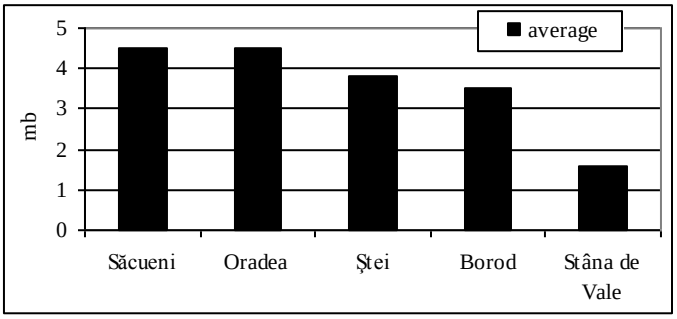

Figure 8. Distribution of multiannual averages of saturation deficit (mb) in Bihor county

The monthly averages of saturation deficit during a year are higher in the summer months, with the maximum value in July, they drop with altitude from approximately 9 mb recorded in Oradea and Săcueni to approximately 7 mb in Ştei and Borod, and to approximately 3 mb in Stâna de Vale (see Figure 9).

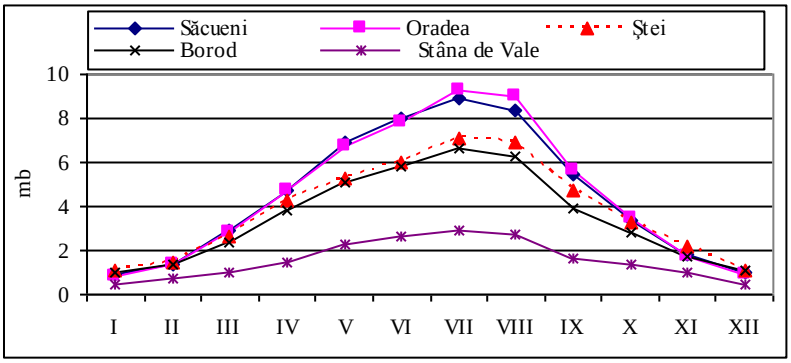

Figure 9. Annual pattern of saturation deficit in Bihor county

The lowest values are recorded in wintertime, thus, in January these values are 0.8 mb in Oradea, 0.9 mb in Săcueni, 1.0 mb in Ştei and in Borod, and in Stâna de Vale 0.5 mb in January and December (see Figure 9). The lowest values recorded in Stâna de Vale are also due to the fact that it is situated on the way of air masses coming from the west.

CONCLUSIONS

As a result of the influence of the humid climate, the annual averages of relative humidity are high, with values between 76.3% in Săcueni and 88.6% in Stâna de Vale.

Relative humidity is influenced by the pattern of air temperature, thus in wintertime when the air temperature has the lowest values, relative humidity has the highest ones, and in summertime the situation is reversed.

The annual values of vapour pressure of water are approximately 10 mb in the depressed and low-lying areas, and they drop to 8.0 mb in the mountains. During the year, the monthly averages of vapour pressure of water grow as the temperature increases and as the wind becomes stronger, which accelerates evaporation.

Saturation deficit changes in inverse proportion to altitude. The pattern of saturation deficit during a year is an increasing one from January to July, when the highest value is recorded, after that the values begin to drop.

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