THE INFLUENCE OF AIR HUMIDITY ON THE ENVIRONMENT IN THE AREA OF SLATINA CITY

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Abstract:
This article focuses on a thorough analysis of air humidity in the area of Slatina city, in terms of relative humidity, fume tension and saturation deficit for the period 1977 – 2006. The aim of this analysis is to highlight the evolution in time and space of this meteorological element, but especially to observe its contribution to pollution of the urban area. The article sums up the author's personal conclusions, emphasizing the role of air humidity on pollution, through stimulating chemical reactions (from the atmosphere) and favoring wet smog.

Key words: *air humidity, annual and monthly cycles, Slatina, influence, environment pollution.*

JEL classification: *Q50, Q53, Q54.*

1. Introduction

The quantity of water vapors in the atmosphere is conditioned by the origin of the air masses, by the frequency of precipitations and the nature of the underlying active surface. Water vapors found in air masses that pass over or stay above the area of Slatina city are mainly brought from the Atlantic Ocean and the Mediterranean Sea, but also from the direct evaporation of water, snow, and plant evapotranspiration right on soil surface.

Water humidity is analyzed through three of the indicators that define it, respectively: relative humidity, vapor tension and saturation deficit.

Specific conditions for heating urban air, and also rapid drain of water from precipitations through the sewerage net, result in reduced air humidity, so that depending on the city's features, relative values may be lower than those of neighborhood by 10 – 25%. However, there are some situations, such as the meteorological station Strihareț-Slatina, when air humidity is held constant, due to local conditions like green areas in the immediate nearby (Strihareț forest).

The purpose of this article is to analyze air humidity is the area of Slatina city, along with the relation between air humidity and the pollution of the environment.

2. Relative humidity

Relative humidity, also known as the "hygrometric state", is the percentage ratio of real tension and saturation tension of water vapors in the air. Relative humidity expresses best the degree of dryness of atmosphere. For urban climate study, due to its influence on comfort and human health, it is important to measure this parameter and its variation on an annual, monthly, and daily basis. In an urban area, the value of relative humidity is as reduced as building density, thermal heating, and the degree of industrialization are higher, and as green areas are more limited.

The annual average of relative humidity recorded by Strihareț-Slatina meteorological station during the period 1977 – 2006 is 80%, a higher value than the specific average of the area (under 78%), because of both the location of the city, that is in the Olt river's meadow, and the permanent evaporation over an aquifer surface.

In the annual scheme of the average value observed in fig. 1 it is easily noticeable the existence of two points of minimum and two points of maximum contoured clearly. The monthly average of relative humidity is, generally, inversely related with air temperature, the higher values being recorded in cold seasons, and the lower values, in the warm seasons, as shown in fig. 1.

The main minimum is recorded in July-August: up to 72% and 73%, when temperatures reach an extremely high value (22,5 ºC for July and 21,9 ºC for August), while the secondary minimum is recorded in May-June having the same value for both months, that is 74%, when humid advections are very rare, active underlying surface evaporation is low and the temperature is higher than 16 ºC. The main maximum is recorded in December – 91%, explained by the frequent warm but very humid advections coming from the Mediterranean Sea, whilst the secondary maximum is recorded in January – 89%. Relatively high values are also recorded in February (84%) and November (88%), when the number of days with precipitation rises, as seen in fig. 1.

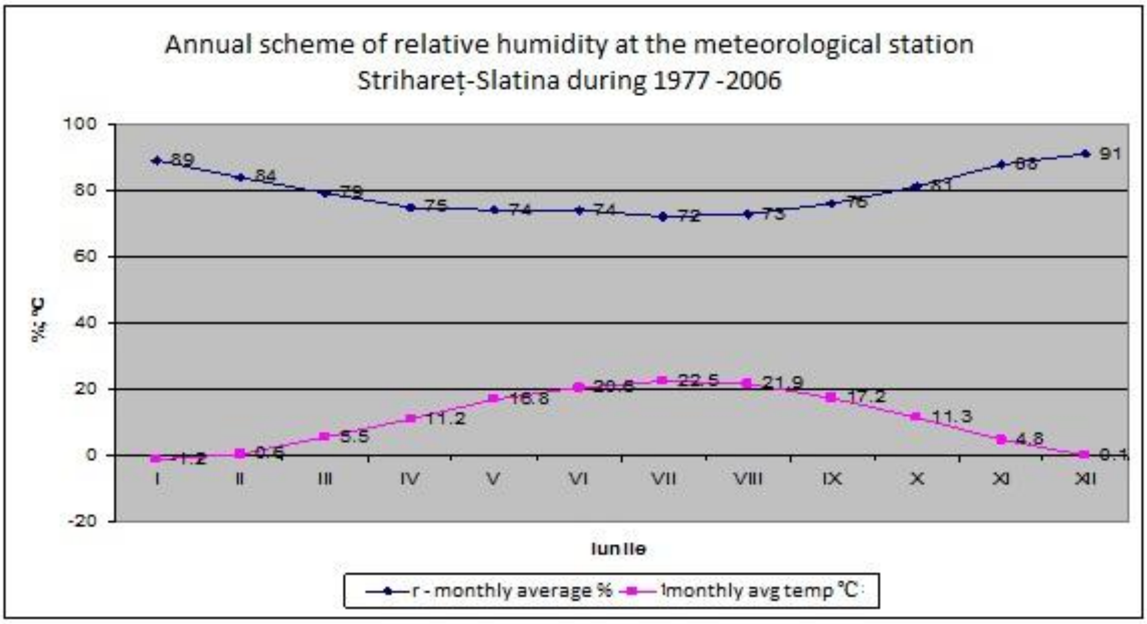

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Fig. 1

In the relative humidity scheme which indicates the tight indirect relation between this element and air temperature, a very important particularity is the annual average amplitude, which in the area of Slatina city is quite high, specific to areas with a temperate continental climate.

The daily evolution of air humidity is strongly related to the evolution of air temperature and water vapors. A maximum is noticeable at night and early morning hours, before sunrise, when temperature is lower, and a minimum point in afternoon hours when temperature reaches its maximum. Maximum and minimum daily points of relative humidity differ depending on season. In *April*, a maximum of relative humidity is recorded before morning, having values of 87-90%, due to low air temperature, while the daily minimum is recorded during the first hours of the afternoon, having values of 39-45%, when air temperature and vapor tension reach nigh values. As a result, the daily amplitude varies between 39% and 45%, strengthening the above statement. In *December*, the maximum occurs during the night time, and the minimum, in the first hours of the afternoon, without a certain pattern for exact hours and values for the minimum or maximum of relative humidity. Because of daily low variations of air temperature and local air masses' movement, daily relative humidity oscillations are not significant.

An important characteristic of this climatic element is the *frequency of the days* in which relative humidity is lower or higher than specified limits, such as:

- *the number of days recording relative humidity equal to or lower than 30% (**dry days**)*, are situations of excessive lowering of air humidity and indicates a high degree of dryness, less than one day in winter and records higher values (more than one day) in summer, specifically during April – September with an average of 5 to 10 days, for the interval 1961 – 2000 (Romanian climate, 2008);
- *the number of days with relative humidity equal to or higher than 80% (**humid days**)*, when at 1 P.M. there are conditions of very high humidity, because usually, at this hour of the day, the relative humidity reaches minimum values, so that the higher frequency of these days is recorded in the cold semester of the year, and the lowest, in the interval April – October, when air advection of hot and dry continental air is more frequent.

The values of this meteorological parameter contribute positively or negatively to climate features regarding the amplification of air dryness, which may become harmful to the environment when associated with soil dryness.

3. Water vapors tension

Water vapors' tension is their self pressure while in the atmosphere. Air temperature and the characteristic of evaporated surface are determinative factors for the repartition of water vapors' tension and its annual and daily evolution. The pressure of water vapors over a unit of horizontal surface is higher as the temperature is higher. Also, high temperatures hurry the evapotranspiration speed and enable the atmosphere to stock a high amount of water vapors. The annual average amount of water vapors recorded at Strihareț-Slatina meteorological station for the years 1977 – 2006 is 11.4 hPa.

Spatial distribution and annual evolution of monthly averages of water vapors' tension at the Strihareț-Slatina meteorological station are shown in fig. 2, and as noticed, low values are recorded during winter, with a minimum point of 5.1 hPa in January (the coldest month) and higher values in the summer months, with a maximum point of 19 hPa in July (the hottest month).

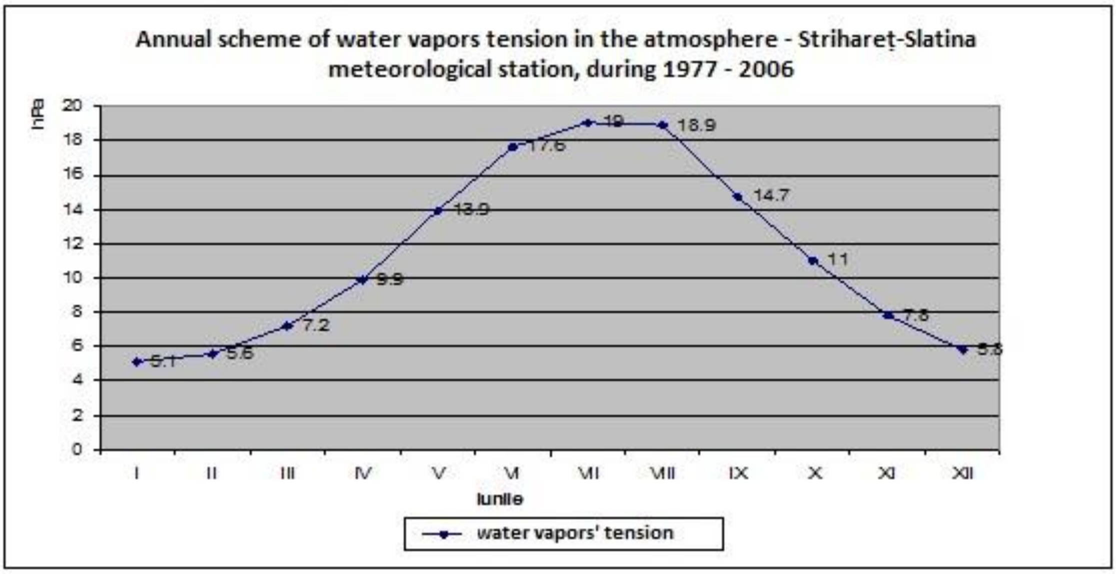

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Fig. 2

From January to July, real water vapors tension rises continually, recording values that vary between 5.6 hPa in February, to 17.6 hPa in June between the monthly minimum and maximum lowering then to 5.8 hPa in December. Altogether, the graph shows that the values for spring months are lower than those for autumn months.

4. Saturation deficit

Saturation deficit is defined by the difference between saturation tension and real tension of water vapors. It is expressed as an important climatic parameter. Because it coordinates the permanent water exchange between the inferior troposphere and other levels of troposphere of the planet. When saturation deficit has low values, the evaporation process is lowering.

The annual and monthly scheme of saturation deficit resembles the annual and monthly scheme of air temperature.

The values of saturation deficit are shown in fig. 3. The annual average value of saturation deficit is 4.3 hPa, with a minimum of 0.6 hPa recorded in January and December, and a maximum of 9 hPa, recorded in July. Fig. 3 shows that the values of saturation deficit are higher in summer than in winter, hence negatively influencing the vegetation.

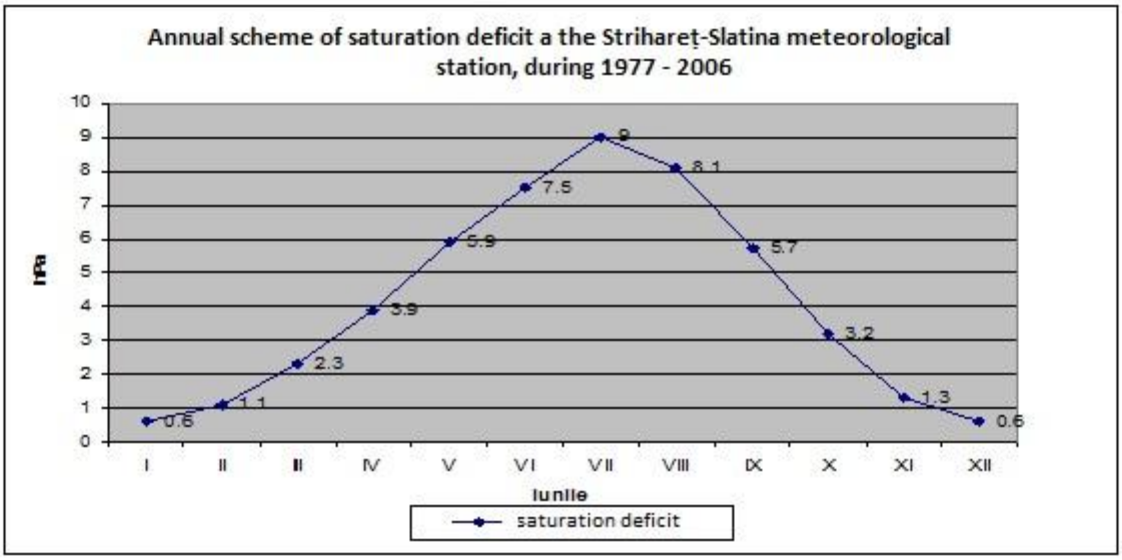

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Fig. 3

During daylight, the values of saturation deficit rise from morning until noon and lower to the evening, as the temperature lowers.

5. The influence of air humidity over environment pollution

Air humidity leads to the formation of the wet or London smog. The smog is a mix of fog and smoke with negative consequences, such as: allows developing a high concentration of impure substances in the urban air (for example CO_2 in the urban atmosphere may rise from 0.04 up to 0.14 per cent), or decreased visibility.

A high quantity of water vapors determines chemical reactions with sulfur oxides and other sulfates in the air that may lead to formation of sulfuric acid, highlighting the pollution phenomenon in the urban area.

6. Conclusions

Having knowledge of the characteristics of air humidity is very important for various activity domains, but especially for people’s health and comfort.

Rising air humidity in the urban area of Slatina city has a negative effect on urban atmosphere, leading to pollution. However, its secondary role regarding temperature as a meteorological element is to contribute to temporary pollution episodes occurrence for the two seasons of the year (the warm season, between April and September, and the cold season, between October and March), due to high values of over 80% as explained above in the article. It is also significant that Slatina is situated in the most representative aluminum industry centre in Romania, and as a result, fluoride and its composites pollution is specific for the area.

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