THE VAPOR CONTENT OF THE AIR LAYER NEAR THE SOIL OF THE SANDY WOOD STEPPE

BY DR. J. JUHÁSZ

Besides the radiation system and the air circulation the active surfaces may play an important role in the development of the local characteristics of the temperature and the air humidity. They influence the general laws of the development of the air humidity, but do not change it.

The diurnal amplitude of the temperature is usually larger in valleys and low-lying places than on plains, slopes and peaks, because the peaks or elevations do not warm up so intensely as the lower-lying areas because they give off more heat to the air masses and at night they do not cool off so much because the cold air flows down to lower plases. In the relatively low-lying areas the air is cool and damp at night and in the early morning hours, but warm and dry in the afternoon. On the slopes and peaks or elevations in contradiction to the above findings an inverse picture develops (6).

The results of the examinations made on the sandy woody steppe of Csévharaszt also prove the development of peculiar relations between the temperature and the air humidity. The development of both factors under minimal relief conditions, especially in the presence of different active surfaces, confirms the general law (4).

In summer and fall the diurnal amplitude of the temperature was significantly smaller on the sandhill top than on the steppe meadow, the sedge meadow, and the space between the sandhills in consequence of the rise of the temperature minima and the diminution of the maxima. In connection with the autumn measurements we found that the nightly cooling of the air layers near the ground — depending on the density of the vegetation — developed by heat conduction in a much more complicated way than the warming (4).

On the basis of the spring, summer, and double fall measurements we could calculate the probable winter values. According to this calculation in the day the air layer near the soil at the higher places, as on the sandhill top and the steppe meadow, must be warmer than in the depressions, the interspaces of the sandhills. Because of the destruction of the nocturnal inversion no significant diurnal temperature variation in comparison with the depressions can be expected at the elevated places.

The importance of water for the development of plans is well known; if their water demand is not satisfied, there is a break in their development or they die altogether. Water as a climatic and soil factor is therefore extremely important in the soil as well as in the atmosphere.

The plants evaporate a large portion of the water taken up by their roots; but this process depends in each different area on the amount of the water already present in the air. Both in the home and foreign literature the danger of drought is mentioned (1).

Generally depending on the situation of the areas and the closeness of the plant communities, the vapor content of the local near-to-ground air layers is subject to different variations. The near-to-ground air layers often warm up and cool off intensely, and the saturation values vary accordingly. Some systematic correlation between the air temperature and the saturation values can be found from the point of view of the different relief conditions and plant communities in open, half-closed, and closed areas alike. The vapor content of the air can be investigated in relation with the air temperature. Aujeszky (1) gives data in gr/m^{3}on the correlation between air temperature and saturation values with an accuracy of hundredths (Table 1).

TABLE 1.

Variations of saturation values (according to Aujeszky)

Air temperatures °C	Saturation values gr/m^3
0	4,85
5	6,80
10	9,41
15	12,85
20	17,31
30	30,39
40	51,52

The saturation values recorded in the Table served as a basis for the preparation of a table (Table 2) in which we could demonstrate the changes in the saturation values with relative accuracy according to air temperature rises of half a degree.

Within the air temperature values shown, perhaps using interpolation, the saturation values of relative accuracy can be read immediately with the temperature values. By combined use of the saturation and relative humidity values the absolute vapor content and the deficiency of saturation can be calculated (1):

$$a = \frac{RA}{100}, \quad S = A - a = A - \frac{RA}{100} = A\left(1 - \frac{R}{100}\right),$$

However, before recording complex results of this sort from our material of investigation we think it necessary to mention on the basis of the saturation values in Table 2 the average rises of the saturation values (Table 3).

As can be seen in Table 3, a significant rise in the saturation values can be found only in the case of greater warming (above 20 degrees). Besides the saturation values we do not deal in this paper with the satura-

TABLE 2.

Variations of saturation values in their correlation with air temperatures

Air temperature °C	Saturation values gr/m³	Air temperature °C	Saturation values gr/m³
0,0	4,85	19,5	16,86
0,5	5,05	20,0	17,31
1,0	5,24	20,5	17,96
1,5	5,43	21,0	18,61
2,0	5,63	21,5	19,26
2,5	5,83	22,0	19,91
3,0	6,02	22,5	20,56
3,5	6,21	23,0	21,21
4,0	6,41	23,5	21,86
4,5	6,61	24,0	22,51
5,0	6,80	24,5	23,16
5,5	7,06	25,0	23,81
6,0	7,32	25,5	24,47
6,5	7,58	26,0	25,12
7,0	7,84	26,5	25,78
7,5	8,10	27,0	26,43
8,0	8,36	27,5	27,08
8,5	8,62	28,0	27,73
9,0	8,88	28,5	28,28
9,5	9,14	29,0	29,03
10,0	9,41	29,5	29,71
10,5	9,76	30,0	30,39
11,0	10,10	30,5	31,44
11,5	10,45	31,0	32,50
12,0	10,79	31,5	33,56
12,5	11,14	32,0	34,61
13,0	11,48	32,5	35,65
13,5	11,83	33,0	36,72
14,0	12,17	33,5	37,78
14,5	12,52	34,0	38,83
15,0	12,85	34,5	39,88
15,5	13,30	35,0	40,94
16,0	13,74	35,5	42,00
16,5	14,19	36,0	43,05
17,0	14,63	36,5	44,11
17,5	15,08	37,0	45,16
18,0	15,52	37,5	46,21
18,5	15,79	38,0	47,27
19,0	16,41	39,0	49,40
		40,0	51,52

tion temperature — dew point, hoarfrost point —, in spite of the fact that both of these factors are important data of the air.

If the rise of the saturation values is demonstrated in percentage, we must come to the conclusion that the percentile rise per 1 degree of the saturation values is 9,4% between 0—10 °C, 8,4% between 10—20 °C, 7,5% between 20—30 °C and 6,9% between 30—40 °C.

We found that with the rise of the temperature the saturation values also rise, but in a percentilely gradually decreasing measure.

TABLE 3.

The average rises of saturation values in degrees

Air temperature °C	Rise of saturation value gr/m³
0—5	0,44
5—10	0,52
10—15	0,69
15—20	0,89
20—30	1,33
30—40	2,11

We have already mentioned that knowing the values of air temperature, saturation and relative humidity we can demonstrate the absolute vapor content and the deficiency of saturation and so we can make a complex examination of the air humidity.

Before examination of the saturation values we have already mentioned the determination of the absolute vapor content and the deficiency of saturation (Table 4):

TABLE 4.

Survey of the air humidity

(e. g. Csévharaszt, Nov. 1962)

On the sandhill top (Nov. 2)

	Relative humidity at maximum					Relative humidity at minimum				
	T	A	R	a	S	T	A	R	a	S
	°C	gr/m³	%	gr/m³	gr/m³	°C	gr/m³	%	gr/m³	gr/m³
10 cm	5,7	7,14	100	7,14	—	12,2	10,93	73	7,98	2,95
150 cm	3,9	6,37	100	6,37	—	11,8	10,65	78	8,30	2,35
(Nov. 3)										
10 cm	4,8	6,72	100	6,72	—	14,6	12,59	66	8,30	4,29
150 cm	4,6	6,65	100	6,65	—	14,2	12,31	68	8,37	3,94
In space between hills (Nov. 2)										
10 cm	4,1	6,45	100	6,45	—	14,2	12,31	70	8,61	3,70
150 cm	4,2	6,49	100	6,49	—	12,0	10,79	76	8,20	2,59
(Nov. 3)										
10 cm	5,0	6,80	100	6,80	—	16,4	14,10	66	9,30	4,80
150 cm	4,9	6,76	100	6,76	—	13,4	11,75	71	8,34	3,41

Signs: T = temperature, A = saturation value, a = absolute vapor content, R = relative humidity, S = deficiency of saturation.

We do not give here the air humidity values of the other units of the investigated area (steppe meadow, Quercus robur stand, juniper brushwood with poplars, sedge meadow, oakwood with lilies of the valley, poplar grove and reedbed with nettles) because on the basis of the air humidity values listed in Table 4 we can see that the values of saturation are a function of the temperature. Every rise of 10 degrees between 0 and 40 degrees causes a 70—95% increase of the saturation values. But the increase, as mentioned above, shows a decreasing tendency with rising temperatures.

The great increase of the saturation values in heat leads to the result that in heat the absolute vapor content means only a small percentage of air humidity, and in cold a much greater one. If 9,41 gr/m^3 absolute vapor content at 40 degrees represents 18% relative humidity, the saturation value at 10 degress represents already 100%, and at lower temperatures even oversaturation.

Considering the rapid rise of the saturation values with the temperature we ascertained that in the case of the same relative humidity the deficiency of saturation is significantly greater in heat than in cold. In the case of 60% relative humidity at a temperature of 5 degrees wet surfaces have smaller evaporation loss than at 15 degrees. In the world of living beings evaporation has a great importance. The plants take up their nutrients from the soil in the form of water solutions and get rid of the superfluous amount of water by transpiration, i. e. evaporation. Since evaporation always involves real loss of heat it affects strongly not only the water balance but also the heat balance of plants.

It is unnecessary to emphasize the great physiological importance of the deficiency of saturation for each, for it is commonly known that its greatness or smallness has a decisive influence on the water loss of living beings.

Further practical justification of the theoretical theses and seasonal complex evaluation and comparison of the air humidity of the investigated areas requires a separate study.

Literature

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