

SOME LANDMARKS OF THE DANUBE DELTA BIOCLIMATE

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Abstract

The paper analyses some features of the relationship between the geographical environment of the Danube Delta and the human body (bioclimatic stress, thermal comfort) for people moving here seasonally, for tourism, leisure, sports (fishing, hunting) etc..

Keywords: human bioclimate, bioclimatic stress, thermal comfort, class time, Danube Delta

1. INTRODUCTION

Danube Delta, with its specific geographical environment, climate, its large extension of surface water and vegetation, caused a very specific bioclimate, compared to that of the plains and surrounding hills. To highlight the particularities of this bioclimate there are analysed some bioclimatic indices based on the main climatic parameters that influence the relationship between climate and body, namely: skin stress, lung stress and total bioclimatic stress, thermal comfort and discomfort and time classes.

2 SKIN STRESS

Sensations of heat or cold, in the thermoregulation, are felt by the body, by the skin in contact with the ambient air. These sensations are dependent mainly on temperature and air flow speed.

Stress is expressed by skin cooling power P (in kcal/m²/s), dependent temperature ($t^{\circ}\text{C}$) and wind speed (in m/s), according to a formula proposed by Siple and Passel (1945) and used by Besancenot (1974), (Teodoreanu *et al.* 1984)

The value of cooling power between 300 and 599 kcal/m²/s is considered a stress index 0, which therefore does not require thermoregulation. Kcal/m²/s below 300 is considered hypotonic stress in summer, by triggering thermolysis (indices -1 and -2). In hot conditions, the body adapts by different means of cooling, for example perspiration. Over 600 kcal/m²/s, hypertonic stress, triggering thermogenesis, in winter (index +1, +2, +3, +4) then the body adapts by some heating methods, such as shivering. By summing each monthly index (diurnal and nocturnal) skin stress intensity is calculated annually, correlated with altitude.

Studies by researchers for Romania indicate a change in skin stress index from the highest values of over 50, found in the high mountains, due to low temperatures and strong winds, up to values below 10 conventional units, recorded in the hilly regions as the Getic Subcarpathians especially due to generally moderate temperatures and relatively common atmospheric calm. Skin stress fields have indices quite high due to low winter temperatures, especially those high in summer and enough high wind speeds. (Teodoreanu *et al.* 1984).

Delta has a relatively moderate average annual skin stress, with values below 30 units. (Sulina and St. George 24 respectively 21, and Tulcea 25, Galaţi, 30). Hypertonic stress is characteristic 5-6 months of the year, the growing occurring in Sulina, especially due to a constant wind. In summer, there are 2-3 months/year, with hypotonic character (generally less on the coast, where is moving permanent an active cool air and forward in inland), the rest are about four months/year relaxing (two in spring and two in autumn).

For summer, we calculated the stress of July following the same formula and found that the cooling power value is less than 300 kcal/m²/s all over the Delta, which places it in the category of hypotonic stress, except Sulina, whose station is practically outside the land here kcal/m²/s stress exceeds 300, then fall into the category relaxing, because the lower temperatures and stronger winds than in inland are reducing the heating of the land.

3. LUNG STRESS

This stress is caused by moisture in the breathing air, by absorbing oxygen and eliminating carbon dioxide. (Nicolas 1959; Besancenot 1974; Teodoreanu *et al.* 1984). When moisture is less than 31.3 mb pulmonary evaporation occurs, dehydration and molecular concentration, optimal breathing phenomenon. At a tension of water vapor over 31.3 mb, the stress causes hydration, and dilution of blood, very difficult to bear stress on the body.

When the amount of water vapor in the atmosphere, expressed as vapor pressure is between 7.5 and 11.6 mb, the index is appreciated as balanced, relaxing, no stress (index 0). Under 7.4 mb it is considered a dehydrated stress (indices +1 and +2), especially in winter when the air is dry and the body feels tend mucosal dehydration. In the warmer months of the year, the amount of water vapor induces greater stress, is moisturizing the tendency of mucosal hydration (index -1, -2, -3, -4).

By summing each monthly index (diurnal and nocturnal) lung stress intensity is calculated annually. Correlated with altitude, it shows the lowest values (<30) in the hills and mountains medium. At 1500 m, the stress is higher, and at over 2000 m, due to a drier air, the index exceeds 40 conventional units. The Danube Delta, lung stress index is high (over 40) whereas the quantity of water vapor in the air is high (both visible water vapor pressure and relative humidity > 80%). Thus, at Sulina this index is 49 units, at St. George 44, and at Tulcea and Galați, is 40 respectively 37. Between December and March, stress is dehydrated, from May to October, it is moisturizing, and in April and November, this index is balanced.

4. TOTAL BIOCLIMATIC STRESS

This summation is the result of skin and lung stress and indicates the main elements of climate action on the human body, felt by the skin and the lungs. Bioclimatic stress in Romania recorded the highest total in the mountains (over 100) and the lowest (under 30), in the hilly area of the Subcarpathians. Total bioclimatic stress in the delta is large, around 65 conventional units (Sulina 73), due to a particularly large effect of moisture and wind almost constantly.

5. THERMAL COMFORT DURING THE WARM SEASON

For tourists, fishermen, hunters who are coming to the Delta especially in spring until autumn, we determined a thermal comfort index, which is based on the values of air temperatures, relative humidity and wind speed, according to different formulas and diagrams, used by bioclimatologists (Yaglou-Yakovenko 1927; Missenard 1937; Teodoreanu 2002 etc).

In July, at 13h, when it is the maximum heating of the year, the delta area is 7-10 days/ month with thermal comfort, 6-9 days of discomfort by heating, about two days with discomfort by cooling. As wind is generally considered over 4-5 m/s uncomfortable for the body it requires protection, especially if the temperature is lower. In the delta, in sheltered places, the number of days of discomfort by the summer wind is relatively smaller, less than 10 days/month. The exception is Sulina station, situated practically in the open sea, where the number of days with wind discomfort is more than 17 days/month. (Teodoreanu *et al* 1984). Sheltered from wind, thermal comfort increases obviously, and sometimes even increases heat discomfort.

During the year, thermal comfort is in May several days per month, increases in summer and is reduced to a few days/ month in October.

6. TIME CLASSES

It is a method used by physicians of the former Soviet Union in order to establish indications for aero-helio-hydro-therapy, especially in the Black Sea resorts of Crimea. There are used averages and extremes of temperature, moisture, wind speed, insolation, precipitation. 16 classes (types) are established as weather, grouped into three categories: 1) warm weather, no frost, ($t_{min} > 0^{\circ}C$), with 8 classes, 2) classes with the transition temperature by $0^{\circ}C$ ($t_{min} \leq 0^{\circ}C$ $t_{max} > 0^{\circ}C$), two classes, and 3) while freezing ($t_{max} < 0^{\circ}C$), with six classes (Fedorov, Chubukov 1949; Baibakova 1964).

Romanian seaside, including the Danube Delta, in the winter months is dominated by 0°C transition temperature, 40-50%, especially class VIII, with high cloudiness, followed, by warm classes, about 30% (especially class VI, the weather cloudy, 15-20% and VII, rainy, ~ 10%). The rest (15-20%) are frosty classes, particularly class XI (average day temperature -2,5... -12,4°C).

The summer months are characterized by warm classes, predominantly class III, sunny and moderately warm (20-30%), class II, warm, sunny (20-30%), followed by class IV cloudiness day (15 - 20%), class VI, cloudy (~ 10%), class VII, the rain (<10%). Class XVI appears in July, very hot and very wet (5 -10%). Class I, sunny and very warm, occurs rarely, only in July and August (2 - 3%). In intermediate seasons, are frequently the same classes' time warm, especially III and IV (50-60%), VI (30%) and VII (10-15%).

The most favorable classes for natural cure of any kind are II, III, V, warm and sunny, which generally occur under a stable anticyclone and are characterized by the normal course of all meteorological elements for human body is well adapted. Classes IV, VI and VII are less favorable, with unstable weather with high cloudiness, wind and sometimes rain, causing meteorotrope reactions, especially for the elderly, possibly with rheumatic or cardiovascular disease.

7. CONCLUSIONS

In terms of bioclimate, inhabitants of a region are adapted to climate, with all its features, more or less comfortable.

In discussing the above adaptation to specific conditions of the Delta people moving here in different seasons, usually briefly. Such high air humidity and wind speed are defining elements in establish bioclimatic stress and thermal discomfort. There is here a large thermal inertia and sunburn caused by descendant's winds of the surface water land. These features reduce stress and bioclimatic discomfort.

For relaxation, aerotherapy, training to increase capacity for thermoregulation, sport and tourism, it is found that the practice season during natural cure, is quite broad, from March - April, until October - November. For young, healthy, trained, these activities can take place in the months from December to February, with restrictions, depending on the weather and hydrological conditions.

Sunbathing and hydrotherapy can be practiced within the delta, at the contact areas between aquatic and land, and especially on the coast, the beaches at Sulina, St. George, Gura Portiței, Grindul Lupilor, Chituc, etc.. (where, in addition to the benefits of sun and water, we can add specific air filled with saline aerosols and air ionization relatively high especially in the land breeze).

Associated with the environment, the beauty of the canals' and levees' landscape, with lush vegetation, specific forests and reed, the marine landscape, climatic conditions contribute decisively to the increase of the region's tourist valences.

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