

METHOD OF THE ESTABLISHMENT OF MESOCLIMATIC REGIONS IN TOWNS

Metody mezoklimatické rajonizace měst. — Na základě sedmiletého průzkumu mezoklimatu Brna bylo přikročeno k jeho rajonizaci. Bylo vymezeno celkem 9 hlavních typů a 6 podtypů odlišujících se vzájemně od sebe nižší nebo vyšší průměrnou teplotou či vlhkostí, intenzitou poklesu teploty ve večerních hodinách, rychlostí vzestupu teploty v ranních hodinách, velikostí denních extrémních teplot i vlhkosti. Rajonizace byla provedena pro 4 skupiny synoptických typů. Každá z těchto skupin synoptických typů umožňuje vznik a vývoj podobného druhu městského klimatu. Bylo zjištěno, že k vývoji podobných mezoklimatických poměrů ve městě dochází za typů Wa, Ea, H, částečně Wc, Wcs, SWa, SWc₁, SWc₂. Druhou skupinu tvoří typy NEa, SEa a část typů Nwa, Sa, SWa. Do třetí skupiny byly zařazeny typy NWc, Nc, NEc, Ec a část typů Nwa, Sa, BC, CC, SWc₁ a SWc₂. Ve čtvrté skupině jsou částečně typy Wc, Wcs, SWc₁, SWc₂, BC a CC. Z četnosti jednotlivých synoptických typů zařazených do 4 hlavních skupin můžeme pak stanovit i přibližnou četnost výskytu jednotlivých druhů městského mezoklimatu.

Since 1955 numerous mesoclimatic investigations for the purpose of the improvement of the knowledge of the town climate and of the establishment of the mesoclimatic regions were carried out in the town Brno and its surroundings. The prevailing part of the research of the temperature and of the humidity of the atmosphere was carried out by the system of measuring drives; the motor-car, the motor-cycle or the tram were used as means of communication (2, 3, 4) here. The measuring was carried out with an electric resistance thermometer or with a psychrometer during the drive. On certain synoptic situations a series of data about the temperature and humidity conditions of Brno in the individual day and year periods was acquired, during the 7 years of the research.

Some synoptic situations enable the origin and the development of a similar type of the mesoclimate. These situations may be consequently united in some groups according to their prevailing influence on the climatic conditions of the town. The situations with similar radiation conditions, diurnal amplitude of atmospheric temperature and humidity, intensity resp. direction of wind and other phenomena (e.g. fog, precipitation) were united. So for instance the development of similar mesoclimatic conditions occurs in the town during the situations Wa, Ea, H, partly Wc, Wcs, SWa, SWc with a light breeze or during the calm and with clear sky. At the situations Wa, Wc, Wcs and SWc

certain differences in humidity conditions described further in the characteristics of the individual mesoclimatic types can be noticed. The situations NEa, SEa and a part of the situations NWA, Sa, SWa with the fine up to half-fine weather, with strong sometimes moderate wind may be arranged in the second group. At this group only the situation NWA differs from the other ones in the humidity conditions. The situations NWc, Nc, NEc, Ec and that part of the situations NWA, Sa, BC, CC, SWc having the cloudy up to overcast and windy weather, belong to the third group. The situation Ec differs from the whole group in the humidity conditions. The situations Wc, Wcs, SWc, BC and CC belong to the fourth group, which is characterized by the overcast but calm weather.

It is necessary to remark, that the investigations of the temperature and humidity conditions were not carried out with the same accuracy at all situations. The conditions at the situations of the I. and the II. group were studied most thoroughly, while some situations of the groups III and IV were not checked by investigations perfectly.

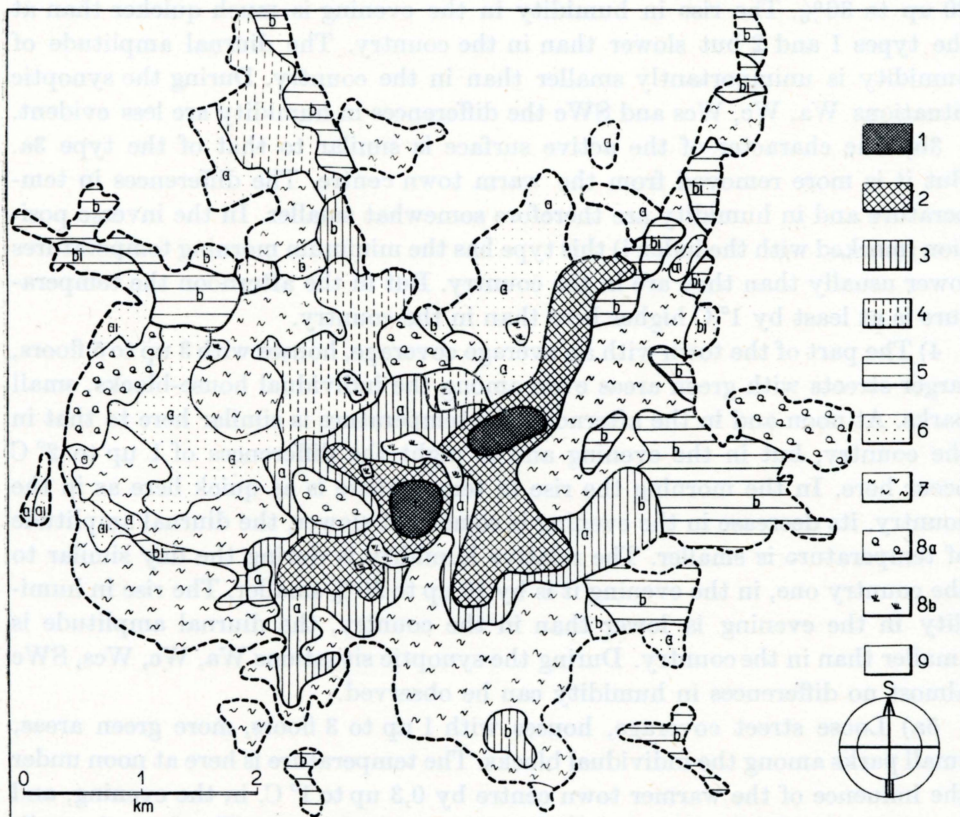
On the base of the extensive climatic investigations carried out in Brno, it was possible to begin with the establishment of the mesoclimatic regions of the town. There were defined 9 main types and 4 subtypes, differing one from another in the lower or higher temperature or humidity, in the intensity of the fall of temperature in the evening, in the speed of the rise of temperature in the morning, in the size of the extreme diurnal temperature and humidity.

But the mesoclimate could not been studied with the same accuracy in the whole town Brno. Such a research would involve high financial expenses, many measuring instruments and many workmen realizing the measurements. Therefore I applied to the study of the mesoclimate of some parts of the town Brno, in which the most mesoclimatic specialities occur. The dependence of the temperature and humidity conditions on the density and on the character of the coverage, on the height of the buildings, on the width of the streets, on the kind of vegetation, on the size of the green areas in the town etc., was stated. These results enabled then to compile the map of the mesoclimatic regions even on places, where the investigations were not carried out, or where their number was small. The most differentiated mesoclimatic conditions (of all 13 types and subtypes) occur comprehensibly under synoptic situations of the group I. Then it is possible to distinguish:

- 1) The densely built up centre of the town with narrow streets and houses with 5 up to 6 floors. This is the relatively warmest part of Brno. In the forenoon the temperature is the same or often even lower here (in summer) than in the open country, at night the temperature is by 1 up to 3° C higher here. The diurnal amplitude of temperature is considerably smaller than in the country, the temperature fall in the evening and the rise in temperature in the morning are slow. The relative humidity is on average by 15% lower during the day and

by 20 up to 30% lower in the evening than in the country. The decrease in humidity in the morning and its rise in the evening is much slower than out of town, its diurnal amplitude being smaller. The differences in humidity are less evident during the situations Wa, We, Wes and SWe.

2) The centre of the town with dense development, without green areas, with narrow and large streets, with houses with 4 up to 6 floors. During the



day, especially in the forenoon, the temperature is higher here than at the type 1, but at night it is a little lower (by some tenth of °C). The diurnal amplitude of temperature is substantially smaller than in the country but greater, than at the type 1. The nightly decrease and the rise in temperature in the morning are slow, but quicker than at the type 1. During the day the relative humidity is the same or higher here than at the type 1. But in the evening the difference reaches in comparison with the country at the most 20%. The decrease in humidity in the morning and its rise in the evening are distinctly quicker than at the type 1. During the synoptic situations Wa, We, Wes and SWe the differences in humidity are less evident.

3a) The part of the town with the average coverage, larger streets, with the lack of green areas, with houses with 3 up to 5 floors. This type uses to be constantly warmer than the open country. In summer in the afternoon by $0,5^{\circ}\text{C}$ (in the forenoon somewhat less) and in the evening by 1 up to 2°C . The diurnal amplitude of temperature is accordingly somewhat smaller than in the country but substantially greater than at the types 1 and 2. The relative humidity is during the day by 15 up to 25% lower here, in the evening then by 20 up to 30%. The rise in humidity in the evening is much quicker than at the types 1 and 2 but slower than in the country. The diurnal amplitude of humidity is unimportantly smaller than in the country. During the synoptic situations Wa, Wc, Wcs and SWc the differences in humidity are less evident.

3b) The character of the active surface is similar to that of the type 3a. But it is more removed from the warm town centre. The differences in temperature and in humidity are therefore somewhat smaller. In the inverse position (marked with the index i) this type has the minimum morning temperatures lower usually than they are in the country. But in the afternoon the temperature is at least by 1°C higher here than in the country.

4) The part of the town with an average coverage, houses with 3 up to 5 floors, larger streets with green areas even among the individual house-blocks, small parks. At noon and in the afternoon the temperature is similar here to that in the country, but in the evening and at night the differences of 1 up to 2°C occur here. In the morning the rise in temperature is as quick here as in the country, its decrease in the evening is somewhat slower, the diurnal amplitude of temperature is smaller. The relative humidity is during the day similar to the country one, in the evening it is by 10 up to 20% smaller. The rise in humidity in the evening is lower than in the country, the diurnal amplitude is smaller than in the country. During the synoptic situations Wa, Wc, Wcs, SWc almost no differences in humidity can be observed.

5a) Loose street coverage, houses with 1 up to 3 floors, more green areas, small parks among the individual blocks. The temperature is here at noon under the influence of the warmer town centre by $0,3$ up to 1°C , in the evening, and by 1 up to 2°C in the morning, higher than in the country. The diurnal amplitude is somewhat smaller here than in the country, the rise in temperature is quicker in the morning than at the type 3. The relative humidity is in the morning similar to the country one, during the day by 5 up to 10%, in the evening by 10 up to 20% smaller, the rise in humidity is slow in the evening. During the situations Wa, Wc, Wcs, SWc the differences in humidity do not occur.

5b) Character of the coverage like at the type 5a, only without the possibility of the influence of the warm centre of the town. During the day the temperature is similar to the country one, in the evening it is higher by up to 1°C . The differences in temperature between the country and this coverage are smaller

in winter than in summer. The diurnal amplitude of temperature is somewhat smaller than in the country. This type has in inverse positions (marked by the index i) especially during the cold periods of the year, lower minimum temperature, frequent fogs and a higher atmospheric humidity.

6a) Villa-coverage within green areas. The temperature conditions are during the day similar to the country ones, the temperature is by $0,3^{\circ}\text{C}$ higher here in the evening. The velocity of the rise in temperature in the morning and of its decrease in the evening and the humidity conditions are similar to the country ones. This type is in inverse positions characterized by lower minimum temperature, higher atmospheric humidity and more frequent fogs.

6b) Block-coverage (3 up to 6 floors) within green areas, the minimum distance of the individual blocks being 100 m. This type has the temperature conditions similar to these of the type 6a with the exception, that the temperature is here at noon by up to $0,5^{\circ}\text{C}$ and in the afternoon by some tenth of $^{\circ}\text{C}$ higher than in the country. The relative atmospheric humidity is the same here as in the country. This type is characterized in inverse positions (marked by the index i) by lower temperatures, higher atmospheric humidity and more frequent fogs.

7) Spaces built up with more extensive industrial plants or other equipments (exhibition ground, railway station, trackage). The mesoclimate is influenced strongly by the character of the active surface and even by the heat emitted by these plants. The mesoclimatic characteristics cannot be fixed accurately due to their heterogeneity, to their size and to their situation.

8a) Tree parks the mesoclimate of which depends on their area and position with regard to the town (near or far of the centre). It may be said in general, that near the centre the temperatures are by $0,3$ up to $0,8^{\circ}\text{C}$ lower here during the warm periods of the year, in the evening then by $0,5$ up to $1,2^{\circ}\text{C}$ lower than in the built up part. The decrease in temperature in the evening is somewhat slower here than in the country, but perceptibly quicker than in the built up parts. The relative humidity is by up to 20% greater here in the morning than in the centre, during the day by up to 15% greater.

8b) Grass parks without high verdure are at noon during the warm season by up to $0,4^{\circ}\text{C}$ colder, in the evening by $0,6$ up to $1,5^{\circ}\text{C}$ colder than the densely built up centre of the town. The decrease in temperature in the evening and its rise in the morning is as intensive as in the country. The relative humidity is somewhat smaller here than at parks with the high tree verdure.

9) Fields, meadows and gardens with the mesoclimate which is not influenced by the coverage. They are in inverse positions marked by the index i, on slopes facing south with higher average temperatures than by the index t.

The similar establishment of mesoclimatic regions of the town Brno is carried out at the remaining 3 groups of synoptic situations only with the difference, that many of the mesoclimatic types do not reflect more expressively

in them and therefore they are omitted or included into the other types.

The approximate frequency of the occurrence of the individual types of the town-mesoclimate is stated on the base of the frequency of the individual synoptic situations arranged into the 4 main groups.

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