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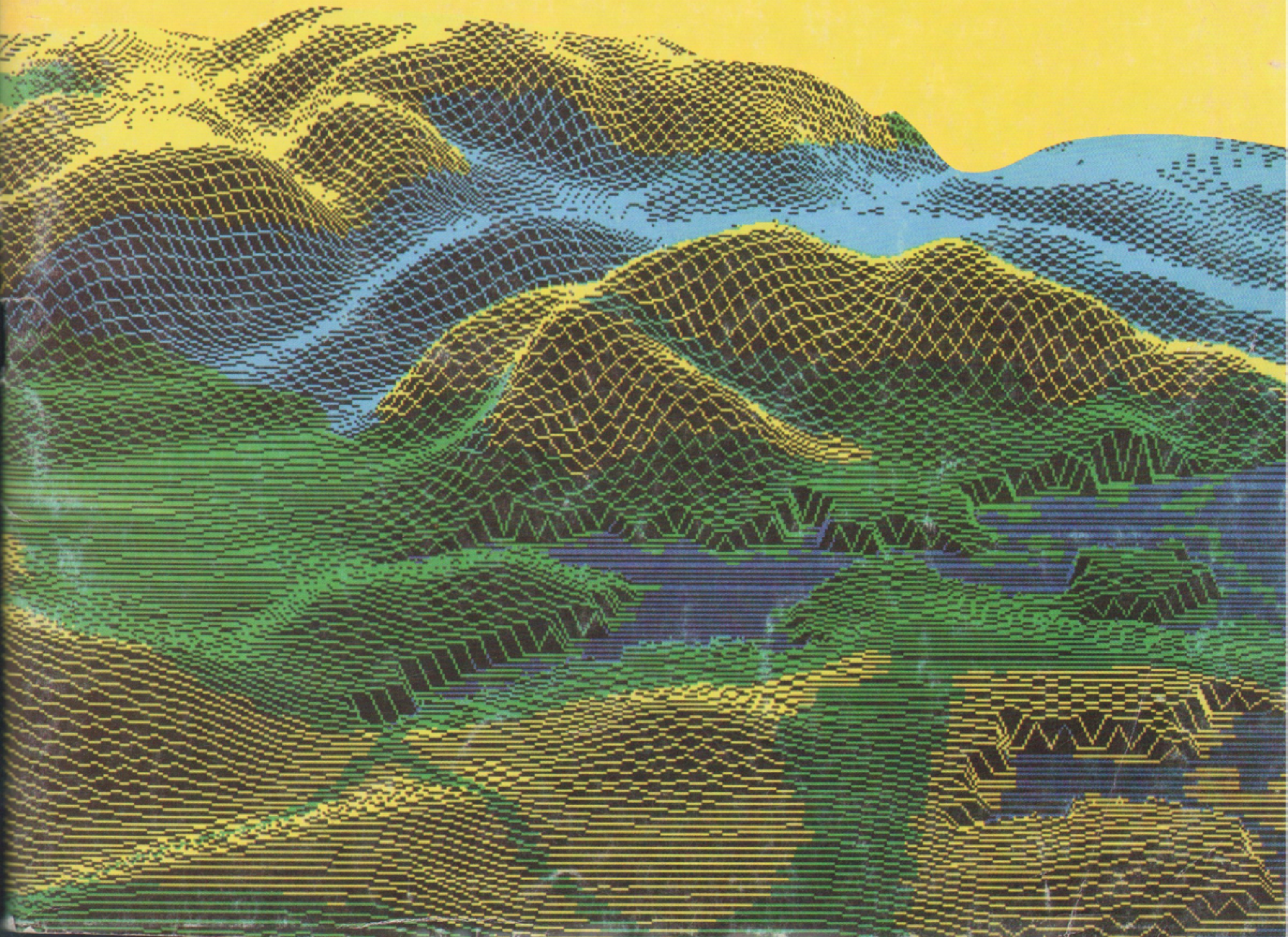

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Contents

GENERAL AND DETAILED TOPOCLIMATIC MAPPING FOR PURPOSES OF ENVIRONMENT PROTECTION

Evžen Quitt

Abstract

Detailed topoclimatic maps at the scale of 1 : 50 000 can illustrate a whole range of processes occuring in surface and lower parts of the boundary layer of atmosphere. Typical climatic situation was assumed at quantifying extent, intensity and frequency of these processes, under which the topoclimate can fully develop. Basis for compilation of the map consists of 8 registers of an information system with data in digital form for units 100 × 100 m.

Shrnutí

Topoklimatická mapa

Podrobné topoklimatické mapy v měřítku 1 : 50 000 zobrazují celý komplex procesů v přízemí a spodní části mezní vrstvy ovzduší. Při kvantifikaci rozlohy, intenzity a četnosti těchto procesů se předpokládala typická povětrnostní situace za níž se může topoklima plně rozvinout. Podkladem pro sestavení mapy je 8 registrů informačního systému s daty v digitální podobě pro jednotky 100 × 100 m.

Key words: topoclimatic map, boundary layer of atmosphere, information system

Since the mid-50's, topoclimatic surveys were made by Geographical Institute in various parts of the country, mainly in connection with building large technological facilities. Their major objective consisted in quantification of effects of different types of active surface and different relief forms on processes occuring in the surface and boundary layers of atmosphere. It is namely exactly here where topoclimatic situation can most influence dispersion of atmospherical admixtures.

Experience from the research resulted in establishment of a geographical information system for purposes of environment protection in the 70's. After having been filled with data, the information system was employed at topoclimatic mapping of territory of entire Czechoslovakia at the scale of 1 : 500 000. The country was divided into a network of squares 1 × 1 km for each of them we derived basic characteristics about articulation of topography and its forms, both physical and biological properties of the surface, surface exposure to cardinal points, its inclination and moisture conditions. The information unit area of 1 km^2 fully corresponded to the scale of this topoclimatic map (1 : 500 000 up to 1 : 200 000). Incidentally, size of the information unit was very close to data gained from remote sensing by meteorological satellites. These data can namely be used for modelling processes occuring in the lower part of boundary layer of atmosphere. The information system has made it possible to apply regional approach at studying the topoclimatic processes. By entering the data of prognostic character, we could further develop ideas on possible changes of topoclimate in the near future, which would be caused by anthropogenic activities.

Application of this information system gave rise to an easy-to-survey topoclimatic map of the Czech Republic at a scale of 1 : 500 000, later then to a map of air pollution published in Atlas of Environment and Population Health at a scale of 1 : 1 000 000, and a map of topoclimatic types of Central Europe at a scale of 1 : 1 500 000, which was published in Austria in 1992 as a part of the Atlas of Eastern and Southeastern Europe.

Linking up with the Collection of geological and purpose maps of natural resources worked out and published in the end of the 80's at the Central Geological Institute in Prague, methodology was worked out of compilation of a Collection of geographical maps of environment in the Czech

Republic at a scale of 1 : 50 000. Compiled were sample sheets of basic map of CSR 24-32 BRNO and 34-22 Hodonín including topoclimatic maps. In the enclosed sample collection we also bring the topoclimatic map of Brno surroundings (Appendix No. 5).

The topoclimatic map at a scale of 1 : 50 000 illustrates a whole range of processes occuring in the surface and lower parts of boundary layer of atmosphere. These processes participate to the decisive extent at distribution of air pollutants and this is the reason why knowledge of their spatial distribution is necessary for assessment of air pollution situation at the level of regions, districts and individual localities. It is also needed for dispersion studies made into existing or planned sources of air pollution at curbing area and building plans for investment development of municipalities in which evaluation of the issue of atmosphere protection follows out from the Act on Environment. In advanced countries, similar documents can be seen at local city councils where they provide a basis for decision-making about larger investment projects.

The topoclimatic map can quantify intensity, duration or frequency of processes occuring in typical climatic situations within the surface and lower parts of boundary layer of atmosphere. Special attention is being paid to phenomena which are most important in terms of their participation at distribution of air pollutants:

- thermic causes of turbulence,
- dynamic causes of turbulence,
- size and duration of vortex movements,
- variability of wind vector with height,
- pre-requisites for confluence and difluence of streamlines,
- possibility to support catabatic run-off of cooled air from slopes,
- intensity of ventilation,
- frequency of temperature inversions,
- duration of temperature inversions,
- intensity of temperature inversions.

This quantification of topoclimatic processes will facilitate assessment of their effects onto dispersion potential of atmospheric admixtures exactly in the atmosphere layer which is most important for health condition of the population, natural landscape components or depositions of heterogeneous substances in ecosystems.

Definition of atmospheric admixtures dispersion potential in the surface and lower parts of boundary layer of atmosphere is therefore a starting point for synthetic studies of processes that take place here under typical climatic conditions. This is an essential part of dispersion studies, which cannot be neglected. At calculating the expected measure of air pollution, these studies can namely be based on very simplified inputs that characterize atmospherical processes. Regarding the used input data and methodology of calculation, the mathematical model is not capable of grasping a whole range of processes of primary importance, which can markedly participate at modification of air pollution characteristics stated in the dispersion study. Topoclimatic valuation of processes affecting dispersion of atmospherical admixtures in the surface layer of atmosphere form therefore a very essential basis for correct interpretation of data included in these dispersion studies.

It seems therefore entirely unrealistic to work out standpoints to erection of large technological plants without appropriate knowledge of distribution of processes in the lower part of boundary layer of atmosphere and their quantification, and thus to fulfil fundamental requirements of the Law no. 17/92 Gaz. on environment. Data contained in the topoclimatic map will thus facilitate not only finalization of the dispersion studies up to the condition applicable for ecological and technical practice, but namely guidance of area and development plans for investment development in municipalities.

The eight information databank systems in digital form for information units of 100 × 100 m serve as a base for compilation of detailed topoclimatic maps at a scale of 1 : 50 000 (but also that of 1 : 25 000). The databank registers in question are as follows:

1) Macroclimatic characteristic providing a survey on distribution of selected 25 most important data (mean air temperature in January, April, July and October, average number of tropical days t_{max} 30 °C and more, summer days t_{max} 25 °C and more, frost days t_{min} −0.1 °C and less, ice days t_{max} −0.1 °C and less, days with severe frosts t_{min} −10.1 °C and less, arctic days t_{max} −10.0 °C and less, and the number of days with average temperature 10 °C and more. The number of days with average temperature 0 °C and more ensured at 80% and the date of onset and end of the period, temperature sums of days with temperatures 5 °C and more, and then 10 °C ensured at 80% are next data. Precipitation regime was characterized by totals for growing period and winter period, number of days

with precipitation 1 mm and more and 10 mm and more, number of days with snow cover 1–20 cm, 21–40 cm, and thicker than 41 cm. The macroclimatic characteristic was closed with the number of clear and clouded days – see Fig. 1.

2) Arrangement of inversion areas and quantification of duration, frequency and intensity of local inversions – see Fig. 2.

3) Possibilities of development and degree of catabatic processes intensity (cooled air run-off from slopes with consequential accummulation in concave forms of the relief) – see Fig. 3.

4) Amount of sun radiation and its management – see Fig. 4.

5) Locations with altered air moisture content – see Fig. 5.

6) Distribution of ventilation intensity in the main or possibly also second prevailing wind direction – see Fig. 6.

7) Synthetizing index of atmospheric admixtures dispersion negative potential – see Fig. 7.

8) Synthetizing index of atmospheric admixtures dispersion positive potential – see Fig. 8.

These registers of information system serve not only for compilation of detailed topoclimatic maps, but they also assist at explaining local differences in deposition of heterogeneous substances, at considerations on possible dislocation of annoying odours from large agricultural plants specialized in livestock production or chemical factories, at resolving issues of the most suitable routing and design of road, railway and water communications, at building large hydrotechnical works, and particularly at assessing distribution possibilities of air pollution sources.

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Explanations to the graphical output

Figure 1-A sample of graphical output from information system in the vicinity of Polička, providing macroclimatic characteristic of the area (Quitt 1971).

Y – mildly temperate climatic area MT 3
V – cold climatic area CH 7

Figure 2-A sample of graphical output from information system, showing distribution of inversion positions.

A – Vertically very thin temperature inversions (amidst the valley, several meters above active surface), occuring occasionally only at night with insignificant temperature differences against the open area.
B – Vertically very thin temperature inversions, occuring sometimes even at day time with significant temperature differences against the open area.
C – Vertically thick temperature inversions afflicting about a third of the valley profile, occuring frequently also at the day time, with pronounced temperature differences against the open area.

Figure 3-A sample of graphical output from the register informing about possibilities of catabatic process development.

A – Catabatic run-off of cool air from slopes, preconditioned to transfer atmospherical admixtures and odours to lower altitudes.
B – Very pronounced catabatic run-off of large volumes of cool air from slopes, accompanied by intensive transfer of atmospheric admixtures to lower altitudes.
C – Massive catabatic processes supported by character and inclination of active surface with great area of cool air collection district.
Z – Trajectory of concentrated micro-advective transfer of accumulated cool air matters.

Figure 4-A sample of graphical output from the register of information system on distribution of locations with altered air humidity.

A – Increased values of namely absolute air humidity, caused by the character of active surface and aquiferation of sub-surface layers. Pre-conditions for increased occurence of fog by up to 20%. Favourable conditions for incidence of hydrophilic plant communities as well as for rise of hydromorphic soils.
B – Increased values of both absolute and relative air humidity content, influenced mainly by catabatic processes and by position at the bottom of inversion valleys. Increased frequency of fogs by 20% and more.
C – Increased values of both absolute and relative air humidity content, influenced-beside the active surface with aquifer sub-surface layers-also by catabatic processes and decreased minimum temperatures on the bottom of inversion valleys. Pronounced increase in fogs (up to 40%). Favourable conditions for hydrophilic plant communities and rise of hydromorphic soils.

Figure 5-A sample of graphical output from information system providing characteristic of solar radiation amount and its management.

A – Less irradiated areas (96% in January as well as in annual average and less solar irradiation when compared with horizontal plane). Massive decrease in temperature maximums. Micro-advective circulation under conditions of suitable temperature contrasts. Snow cover duration longer by more than 20%.
B – Well irradiated areas (120–150% in January, 111–120% annual average solar irradiation when compared with plains). Higher temperature maximums support formation of micro-advective air transfers. Snow cover duration shorter by more than 20%.

C – Well irradiated areas (as above) but with active surface formed by forest. Intensity of micro-advective processes suppressed. In coniferous forest stands-snow cover life shorter only by 10%.
G – Normally irradiated areas, with regard to urban surface with higher average temperatures by up to 0.5 °C, temperature maximums higher by about 1.5 °C, duration of snow cover shorter by 20% and more.

Figure 6-A sample of graphical output from information system on distribution of aeration intensity and wind field dislocation.

B – Locations with highly increased frequency of dead calm (over 30% cases) with very weak aeration and thus low dispersion of atmospherical admixtures.
P – Locations with medium effective aeration at the level of peak plain.
H – Windward locations with WNW dominating wind directions and heavy aeration.
D – Windward locations with the second main wind direction from SSE and with heavy aeration.
K – Pronounced control-to-confluence of streamlines with main prevailing wind direction from WNW.
Z – Pronounced control-to-confluence of streamlines with the second main prevailing wind direction from SSE.

Figure 7-A sample of graphical output of negative potential index of atmospheric admixture dispersion.

A – From time to time, slightly reduced capacity for dispersion of atmospheric admixtures, derived from incidence of occasional weak temperature inversions and low total values of solar radiation.
B – Reduced capacity for dispersion of atmospheric admixtures, derived namely from the incidence of weak temperature inversions occuring mainly in combination with increased frequency of calm.
C – Low capacity for dispersion of atmospheric admixtures, based on frequent-in comparison to the previous stage more intensive-temperature inversions which last for longer part of the day in the cold part of the year.
E – Very low capacity for dispersion of atmospheric admixtures, caused by frequent temperature inversions which can last more days, and by increased frequency of calm.

Figure 8-A sample of graphical output for index of positive potential of atmospheric admixtures dispersion.

G – Slightly increased pre-conditions for dispersion of atmospheric admixtures, supported namely by micro-advective processes of by more intensive aeration.
H – Increased capacity for dispersion of atmospheric admixtures, derived from very pronounced catabatic processes and intensive aeration.
I – Good pre-condition for dispersion of atmospheric admixtures, given by very heavy and efficient aeration.

Fig. 1 - General and Detailed Topoclimatic Mapping

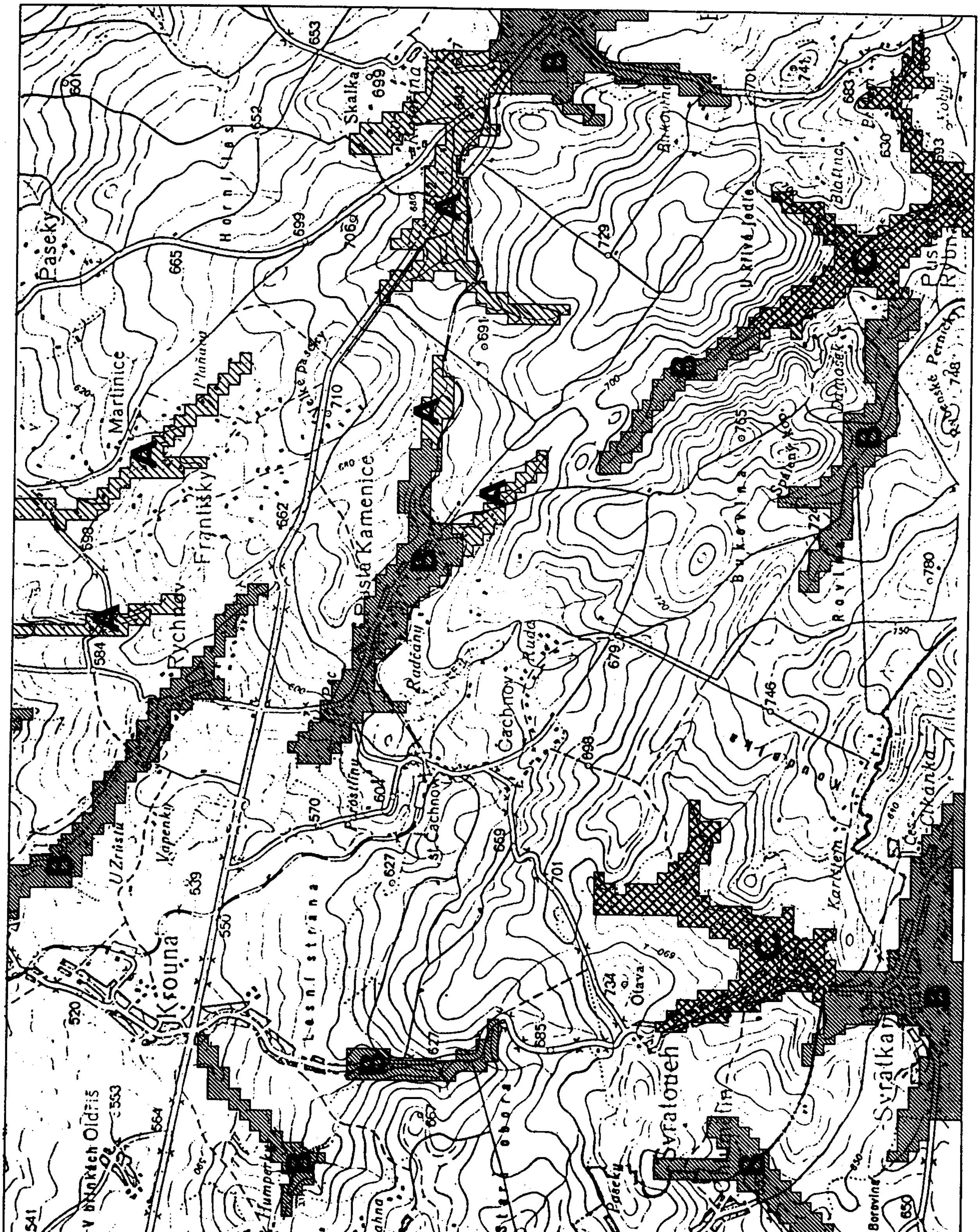

Fig. 2 - General and Detailed Topoclimatic Mapping

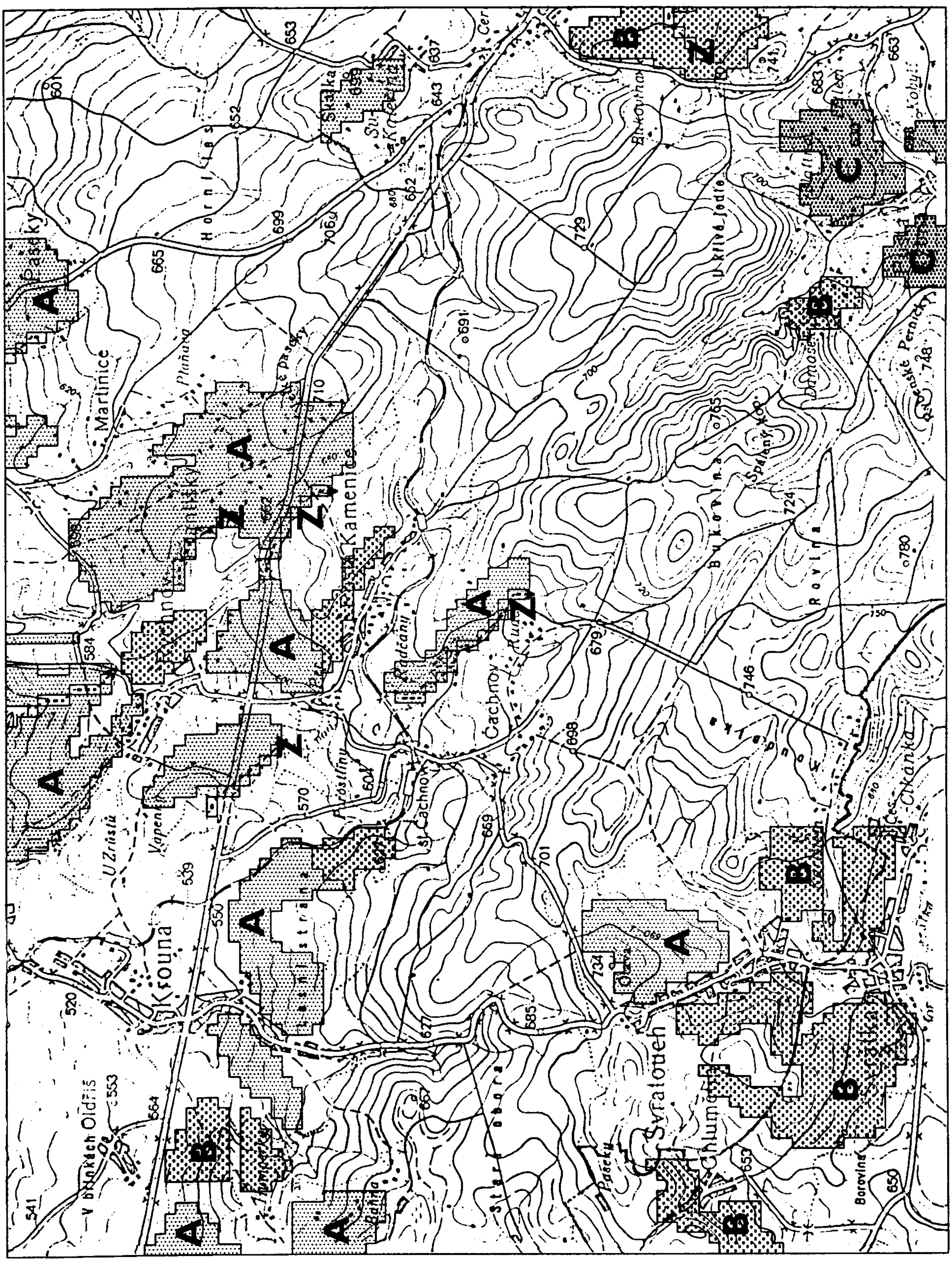

Fig. 3 - General and Detailed Topoclimatic Mapping

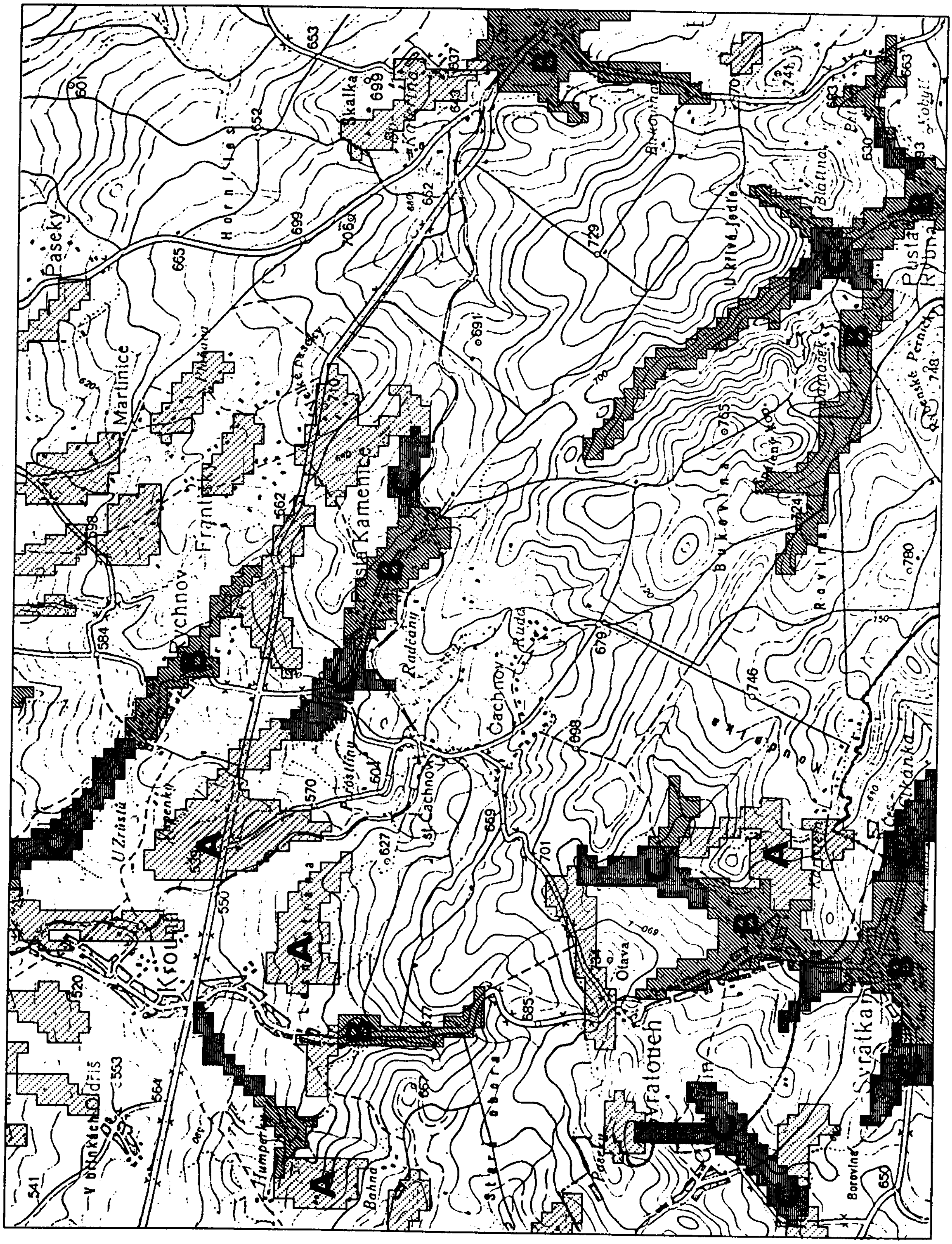

Fig. 4 - General and Detailed Topoclimatic Mapping

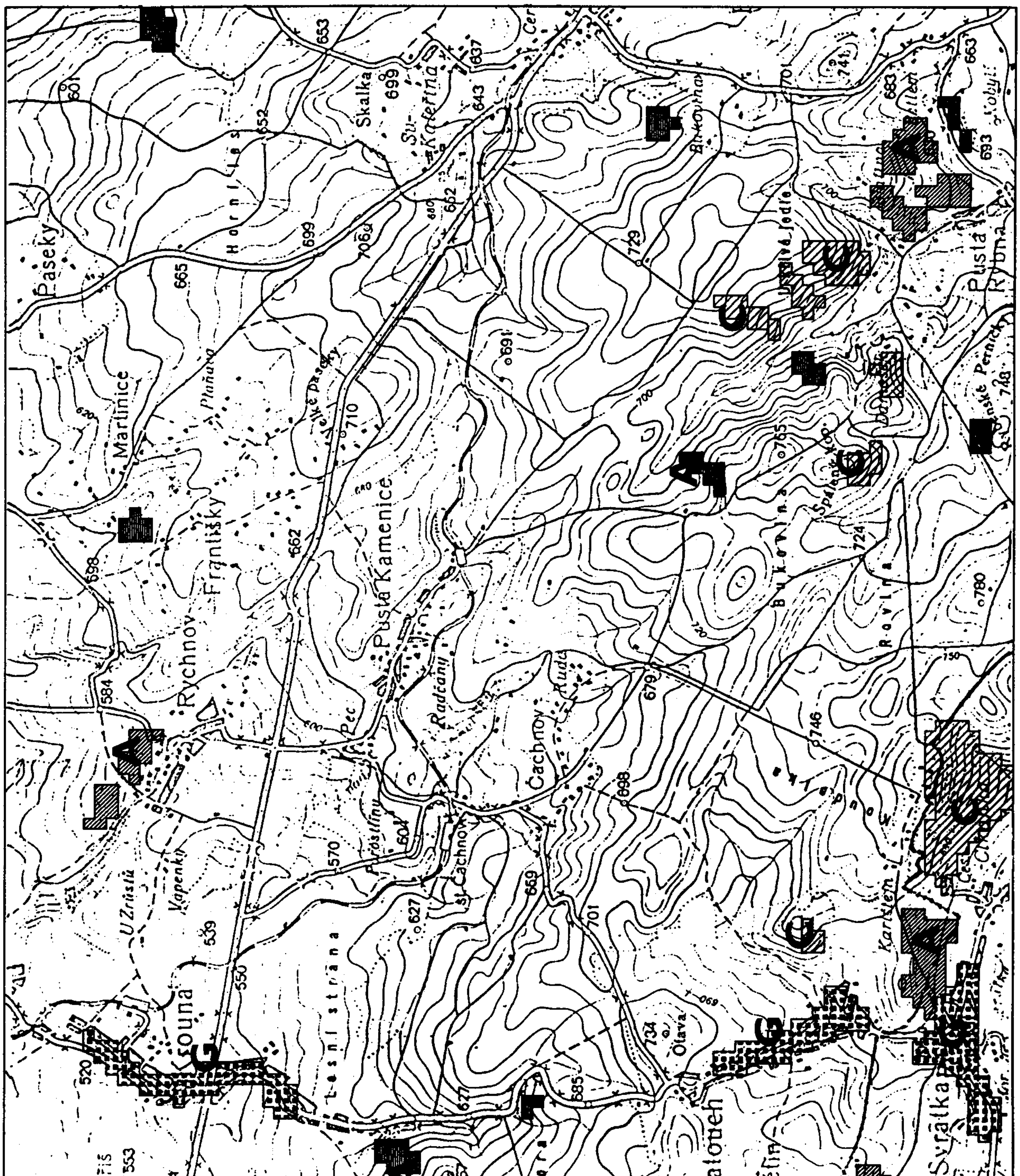

Fig. 5 - General and Detailed Topoclimatic Mapping

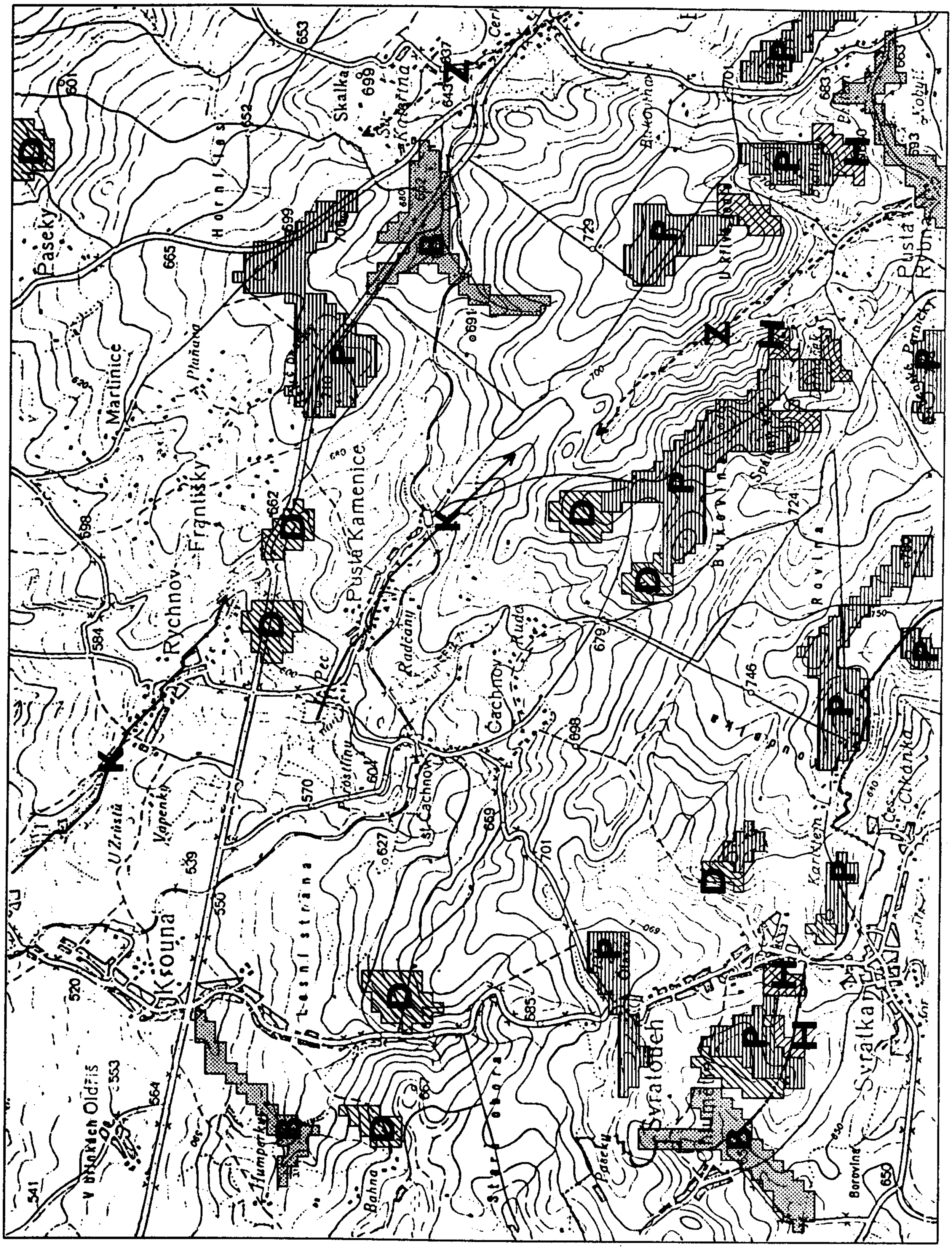

Fig. 6 - General and Detailed Topoclimatic Mapping

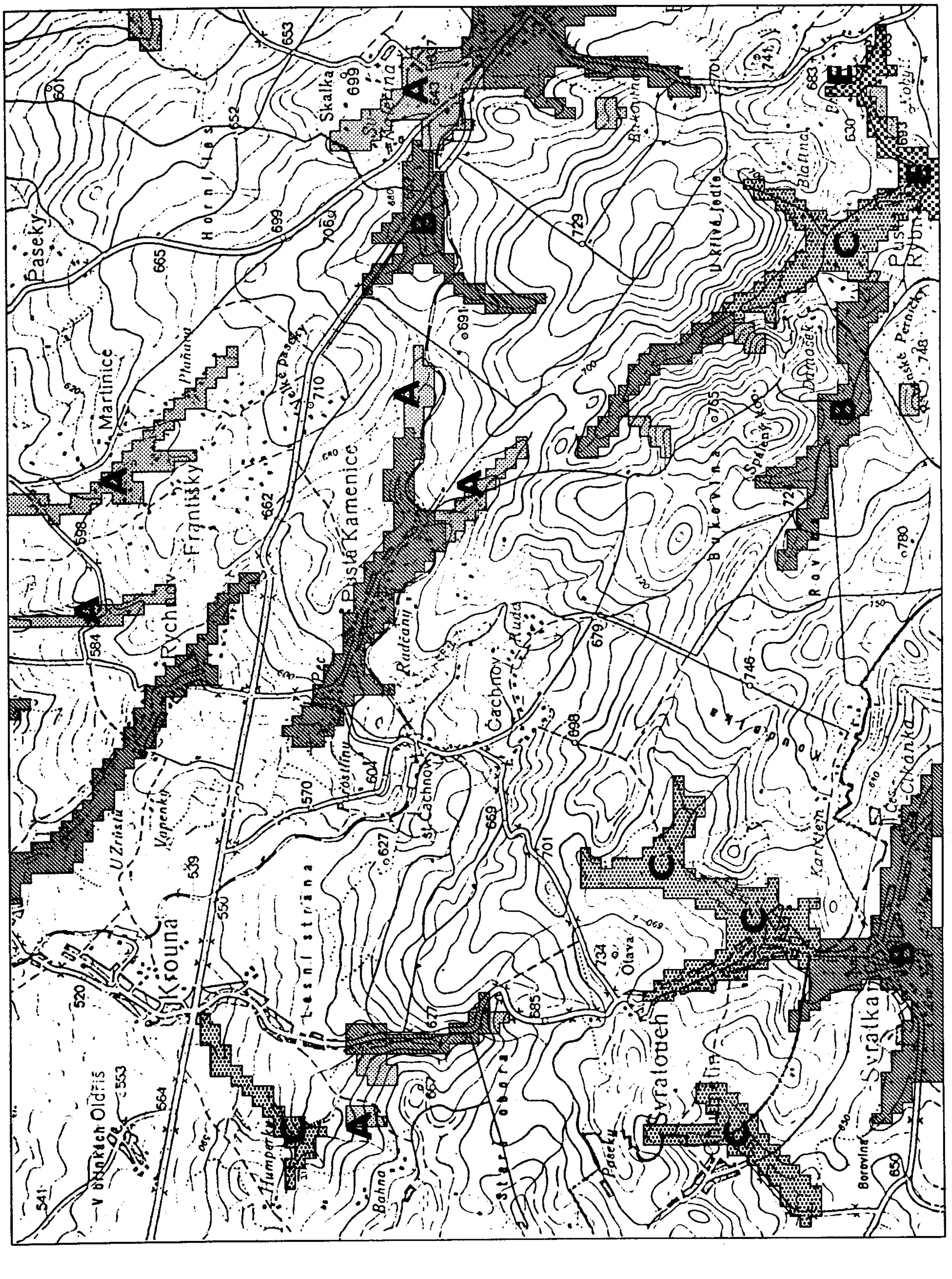

Fig. 7 - General and Detailed Topoclimatic Mapping

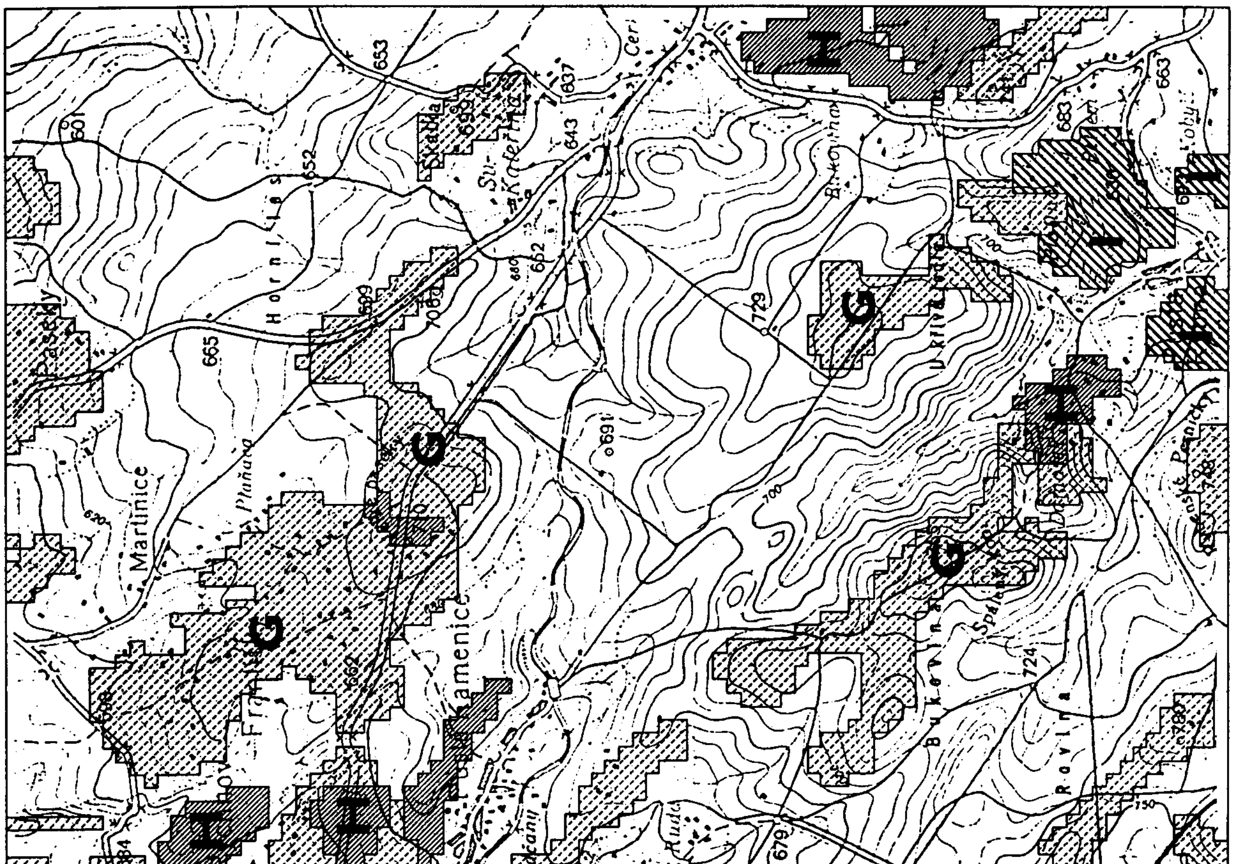

Fig. 8 - General and Detailed Topoclimatic Mapping

Explanations to the Topoclimatic Map of the Brno Surroundings - Appendix No. 5

Topoclimate of Hilly Lands

1 - topoclimate of peak parts distinctly protruding above the surroundings, 2 - topoclimate of convex formations merging with the surroundings (peak plane), 3 - ditto with the low loose housing, 4 - topoclimate of slopes under very good solar irradiation, 5 - ditto with a possibility of pronounced catabatic flow, 6 - topoclimate of slopes under normal solar irradiation, 7 - ditto with the low loose housing, 8 - ditto with a possibility of pronounced catabatic flow, 9 - topoclimate of slopes under minor solar irradiation, 10 - ditto with a possibility of pronounced catabatic flow, 11 - topoclimate of deeply incised valleys, 12 - ditto with the low loose housing, 13 - topoclimate of indented formations with local temperature inversions, 14 - ditto with the low loose housing, 15 - topoclimate of indented formations with weak local temperature inversions, 16 - ditto with the low loose housing, 17 - ditto highly urbanized with the high housing, 18 - ditto affected by extensive water areas.

Topoclimate of Highlands

19 - topoclimate of peak parts distinctly protruding above the surroundings, 20 - topoclimate of convex formations merging with the surroundings (peak plane), 21 - ditto with the low loose housing, 22 - topoclimate of slopes under very good solar irradiation, 23 - ditto with a possibility of pronounced catabatic flow, 24 - topoclimate of slopes under normal solar irradiation, 25 - ditto with the low loose housing, 26 - ditto with a possibility of pronounced catabatic flow, 27 - topoclimate of slopes under minor solar irradiation, 28 - ditto with a possibility of pronounced catabatic flow, 29 - topoclimate of deeply incised valleys, 30 - ditto with the low loose housing, 31 - topoclimate of indented formations with pronounced local temperature inversions, 32 - ditto with the low loose housing, 33 - topoclimate of indented formations with less pronounced local temperature inversions, 34 - ditto with the low loose housing.

Effects on processes and characteristics of some climatic elements of ground layer of the atmosphere in individual types of topoclimate

Climatic characteristic in boundary layer of different topoclimate types

1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1	1	1	1	1	4	1	3	3	3	3	2-3	3-4
2	1-2	1	1	1-2	1	3-4	1	3	3	3	3	3	3
3	2-3	1	1	2	2	2-3	1	3-4	3-4	2-3	3	2-3	3
4	2	2	2	3	2-3	2-3	1	4	3	2	2-3	2	4
5	2	3	2	3	2-3	2-3	1	4	3-4	2	3	2	4
6	2	2	1-2	2-3	2	2-3	1	3	3	3	3	3	3
7	2-3	1-2	1-2	3	2-3	2	1	3-4	3-4	2-3	3	2-3	3
8	2	3	1-2	2-3	2	2-3	1	3	3-4	3	3	3	3
9	2	2	1	2	1-2	2-3	1	2	2-3	3-4	3-4	4	2
10	2	3	1	2	1-2	2-3	1	2	3	3-4	3-4	4	2
11	3-4	1	1	2-3	2-3	1-2	3	2	2	4	4	4	2
12	4	1	1	3	2	1	2-3	2-3	2-3	3-4	4	3-4	2
13	3	1	1	2-3	1-2	2	2-3	3-4	2	3	3-4	3	3
14	3-4	1	1	3	2-3	1-2	2	3-4	2-3	2-3	3-4	2-3	3
15	2-3	1	1	2	1-2	2-3	2	3	2-3	3	3	3	3
16	3	1	1	3	2-3	2	1-2	3-4	3	2-3	3	2-3	3
17	4	1	1	4	4	1	1	4-5	4-5	1-2	2	1	4-5
18	2	1	1	1	3	3	1-2	2	3-4	4	4	3	2
19	1	1	1	1	1	4-5	1	3	3	3	3	2-3	4
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30	4	1	1	3	3	1	3	2	2-3	4	4	4	2
31	3-4	1	1	2-3	2	2	4	3-4	1-2	3	4	3-4	3
32	4	1	1	3	3	1-2	3-4	3-4	2	2-3	4	3	3
33	3	1	1	2-3	1-2	2-3	2-3	3	2-3	3	3-4	3	3
34	3-4	1	1	3	2-3	2	2	3-4	3	2-3	3-4	2-3	3

1 - number of legend item in the map, 2 - altitude-related variability of wind vector in the lower part of atmosphere boundary layer, 3 - intensity of catabatic flow under the radiation type of weather, 4 - intensity of anabatic flow under the radiation type of weather, 5 - intensity of vortex flow, 6 - vertical movements in the atmosphere, 7 - intensity of aeration, 8 - pre-conditions for occurrence of local air temperature inversions, 9 - maximum air temperature under the radiation type of weather, 10 - minimum air temperature under the radiation type of weather, 11 - relative air humidity by day, 12 - relative air humidity at night, 13 - duration of snow cover, 14 - evaporation.

Classification criteria

1 absent, negligible, severely reduced
2 weak, low, reduced
3 medium, normal
4 strong, high, increased
5 very strong, very high, severely increased

Surroundings of the Brno water reservoir *Photo: K. Kirchner*

5

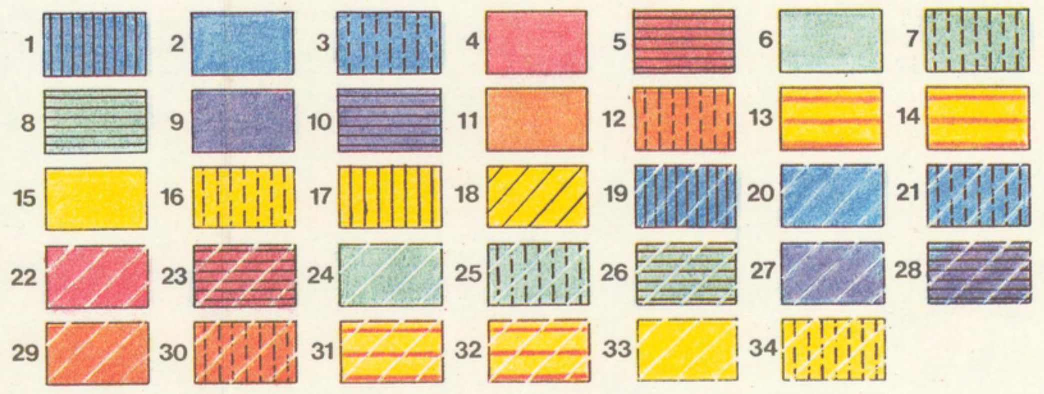
TOPOKLIMATICKÁ MAPA ČSR

24 - 32 BRNO

1 : 50 000

1 cm = 500 m

Základní interval vrstevnic 10 m



TOPOKLIMA PAHORKATIN:
1 - topoklima vrcholových částí výrazně vystupujících nad okolí; **2** - topoklima konvexních tvarů splývajících s okolím (vrcholovou rovinou); **3** - dtto s nízkou rozvolněnou zástavbou; **4** - topoklima velmi dobře osluněných svahů; **5** - dtto s možností výrazného katabatického proudění; **6** - topoklima normálně osluněných svahů; **7** - dtto s nízkou rozvolněnou zástavbou; **8** - dtto s možností výrazného katabatického proudění; **9** - topoklima méně osluněných svahů; **10** - dtto s možností výrazného katabatického proudění; **11** - topoklima hluboce zařezaných údolí; **12** - dtto s nízkou rozvolněnou zástavbou; **13** - topoklima vhloubených tvarů s místními inverzemi teploty; **14** - dtto s nízkou rozvolněnou zástavbou; **15** - topoklima vhloubených tvarů se slabými místními inverzemi; **16** - dtto s nízkou rozvolněnou zástavbou; **17** - dtto silně urbanizovaných s vyšší zástavbou; **18** - dtto ovlivněných rozsáhlejší vodní hladinou.

TOPOKLIMA VRCHOVIN:
19 - topoklima vrcholových částí výrazně vystupujících nad okolí; **20** - topoklima konvexních tvarů splývajících s okolím (vrcholovou rovinou); **21** - dtto s nízkou rozvolněnou zástavbou; **22** - topoklima velmi dobře osluněných svahů; **23** - dtto s možností výrazného katabatického proudění; **24** - topoklima normálně osluněných svahů; **25** - dtto s nízkou rozvolněnou zástavbou; **26** - dtto s možností výrazného katabatického proudění; **27** - topoklima méně osluněných svahů; **28** - dtto s možností výrazného katabatického proudění; **29** - topoklima hluboce zařezaných údolí; **30** - dtto s nízkou rozvolněnou zástavbou; **31** - topoklima vhloubených tvarů s výraznými místními inverzemi teploty; **32** - dtto s nízkou rozvolněnou zástavbou; **33** - topoklima vhloubených tvarů s méně výraznými místními inverzemi teploty; **34** - dtto s nízkou rozvolněnou zástavbou.

OVLIVNĚNÍ PROCESŮ A CHARAKTERISTIK VYBRANÝCH KLIMATICKÝCH PRVKŮ PŘÍZEMNÍ VRSTVY OVZDUŠÍ V JEDNOTLIVÝCH DRUZÍCH TOPOKLIMATU

1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1	1	1	1	1	4	1	3	3	3	3	2-3	3-4
2	1-2	1	1	1-2	1	3-4	1	3	3	3	3	3	3
3	2-3	1	1	2	2	2-3	1	3-4	3-4	2-3	3	2-3	3
4	2	2	2	3	2-3	2-3	1	4	3	2	2-3	2	4
5	2	3	2	3	2-3	2-3	1	4	3-4	2	3	2	4
6	2	2	1-2	2-3	2	2-3	1	3	3	3	3	3	3
7	2-3	1-2	1-2	3	2-3	2	1	3-4	3-4	2-3	3	2-3	3
8	2	3	1-2	2-3	2	2-3	1	3	3-4	3	3	3	3
9	2	2	1	2	1-2	2-3	1	2	2-3	3-4	3-4	4	2
10	2	3	1	2	1-2	2-3	1	2	3	3-4	3-4	4	2
11	3-4	1	1	2-3	2-3	1-2	3	2	2	4	4	4	2
12	4	1	1	3	2	1	2-3	2-3	2-3	3-4	4	3-4	2
13	3	1	1	2-3	1-2	2	2-3	3-4	2	3	3-4	3	3
14	3-4	1	1	3	2-3	1-2	2	3-4	2-3	2-3	3-4	2-3	3
15	2-3	1	1	2	1-2	2-3	2	3	2-3	3	3	3	3
16	3	1	1	3	2-3	2	1-2	3-4	3	2-3	3	2-3	3
17	4	1	1	4	4	1	1	4-5	4-5	1-2	2	1	4-5
18	2	1	1	1	3	3	1-2	2	3-4	4	4	3	2
19	1	1	1	1	1	4-5	1	3	3	3	3	2-3	4
20	1-2	1	1	1-2	1	3-4	1	3	3	3	3	3	3
21	2-3	1	1	2	2	2-3	1	3-4	3-4	2-3	3	2-3	3
22	2-3	3	3	3	3	2-3	1	4	3	2	2-3	2	4
23	2-3	4	3	3	3	2-3	1	4	3-4	2	3	2	4
24	2-3	3	2-3	2-3	2	2-3	1	3	3	3	3	3	3
25	3	2-3	3	3	2-3	2	1	3-4	3-4	2-3	3	2-3	3
26	2-3	4	2-3	2-3	2	2-3	1	3	3-4	3	3	3	3
27	2-3	3	1	2	1-2	2-3	1	2	2-3	4	3-4	4-5	2
28	2-3	4	1	2	1-2	2-3	1	2	3	4	3-4	4-5	2
29	4	1	1	2-3	3-4	1-2	3-4	1-2	2	4-5	4	4-5	1-2
30	4	1	1	3	3	1	3	2	2-3	4	4	4	2
31	3-4	1	1	2-3	2	2	4	3-4	1-2	3	4	3-4	3
32	4	1	1	3	3	1-2	3-4	3-4	2	2-3	4	3	3
33	3	1	1	2-3	1-2	2-3	2-3	3	2-3	3	3-4	3	3
34	3-4	1	1	3	2-3	2	2	3-4	3	2-3	3-4	2-3	3

1 - číslo vysvětlivky na mapě; **2** - proměnlivost vektoru větru s výškou ve spodní části mezní vrstvy ovzduší; **3** - intenzita katabatického proudění za radiačního typu počasí; **4** - intenzita anabatického proudění za radiačního typu počasí; **5** - velikost vírového proudění; **6** - vertikální pohyby v atmosféře; **7** - intenzita provětrávání; **8** - předpoklady k výskytu místních inverzí teploty vzduchu; **9** - maximální teplota vzduchu za radiačního typu počasí; **10** - minimální teplota vzduchu za radiačního typu počasí; **11** - relativní vlhkost vzduchu ve dne; **12** - relativní vlhkost vzduchu v noci; **13** - trvání sněhové pokrývky; **14** - výparnost;

CHARAKTERISTIKA BALOVÉHO OHODNOCENÍ

1 - chybí, nepatrná, silně snížená
2 - slabé, nízká, snížená
3 - střední, normální
4 - silné, vysoká, zvýšená
5 - velmi silné, velmi vysoká, silně zvýšená

SOUBOR GEOGRAFICKÝCH MAP ŽIVOTNÍHO PROSTŘEDÍ

TOPOKLIMATICKÁ MAPA ČSR. List 24 - 32 Brno
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