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# THE OLDEST DESCRIPTION OF THE CLIMATE OF MORAVIA FROM THE YEAR 1815

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## SHRNUTÍ

### NEJSTARŠÍ POPIS KLIMATU MORAVY Z R. 1815

Dosavadní studie o klimatu Brna se opírají o údaje od r. 1851. V předkládaném referátu je podán překlad a rozbor nejstaršího dochovaného komplexního popisu podnebí Moravy (se zvláštním zřetelem k Brnu), který byl uveřejněn německy v časopise „Moravia" 30. srpna 1815. Z textu vyplývá, že v Brně se konala meteorologická měření již v r. 1798.

Studovaný text se skládá ze 2 částí; I. Matematické klima, II. Fyzické klima. Charakteristiky podnebí v dnešním smyslu obsahuje závěr II. dílu. Většina údajů se vztahuje k Brnu ($\varphi = 49°12'$ N, $\lambda = 16°34'$ E); přesné místo pozorování však neznáme. Jeho nadmořská výška byla přibližně 225 m. Popis klimatu je doplněn některými fenologickými a faunistickými charakteristikami.

Autorem pojednání je podle provedeného rozboru s největší pravděpodobností moravský vlastivědný pracovník Karl Joseph Jurende. Většinu údajů přebíral od odborníků, které zřejmě doplňoval některými vlastními postřehy. V uvedeném překladu je pro větší srozumitelnost proveden přímo přepočet ze starších na současné jednotky; převodní vztahy jsou uvedeny. Z rozboru plyne, že meteorologická měření a pozorování jsou dobré kvality. Na tehdejší dobu nejmodernější se jeví závěr: dynamické pojetí moravského podnebí, kde je popsán průběh počasí při jednotlivých směrech větru.

Pro Brno je udáván průměrný roční tlak vzduchu 744,9 torr (ve výšce stanice), absolutní extrémy teploty +35,0 a —27,3 °C. Průměrný roční úhrn srážek je 611,1 mm; největší srážky má srpen a červen, nejnižší leden a únor. Převládá severozápadní vítr.

## СОДЕРЖАНИЕ

### САМОЕ СТАРОЕ ОПИСАНИЕ КЛИМАТА МОРАВИИ ИЗ 1815-ого ГОДА

Существующие до сих пор очерки о климате г. Брно базируют на данных с 1851 г. В предлагаемом докладе содержается перевод и анализ самого старого комплексного описания климата Моравии (принимая в особое внимание г. Брно). Это описание было опубликовано на германском языке в журнале „Моравия" 30-ого августа 1815 г. Из контекста вытекает, что в г. Брно проводились метеорологические наблюдения уже в 1798 г.

Изучаемый текст состоит из 2 частей: 1. Математическое клима, 2. Физическое клима. Конец второй части заключает в себе характеристики климата в совершенном смысле. Большинство данных относится к г. Брно ($\varphi = 49°12'$ с. ш., $\lambda = 16°34'$ в. д.); точное

место измерений однако незнакомо. Его высота над уровнем моря была приблизительно 225 м. Описание климата дополняется некоторыми фенологическими и фаунистическими характеристиками.

Автором трактата является после проведения анализи с наибольшей вероятностью моравский краеведческий работник Карл Иосиф Юренде. Большинство данных он перенимал от специалистов, которые, по-видимому, дополнивал некоторыми собственными наблюдениями. В предлагаемом переводе проводится для большой понятности прямо пересчитание старших на современные единицы (с приведенными взаимоотеношениями между ними).

Из анализа вытекает, что качество отдельных метеорологических измерений и наблюдений очень хорошое. Самым современным является конец климатического описания, динамическое понимание климата, где описается ход погоды при отдельных направле ниях ветра.

Для г. Брно сообщается между прочим: среднее годовое давление воздуха 744,9 торр (без редукции на уровень моря), абсолютные экстремы температуры +35,0 °C и —27,3°C. Средняя годовая сумма осадков 611,1 мм; самые большие месячные суммы осадков в августе и в июне, самые низкие в январе и феврале. Преобладает северозападный ветер.

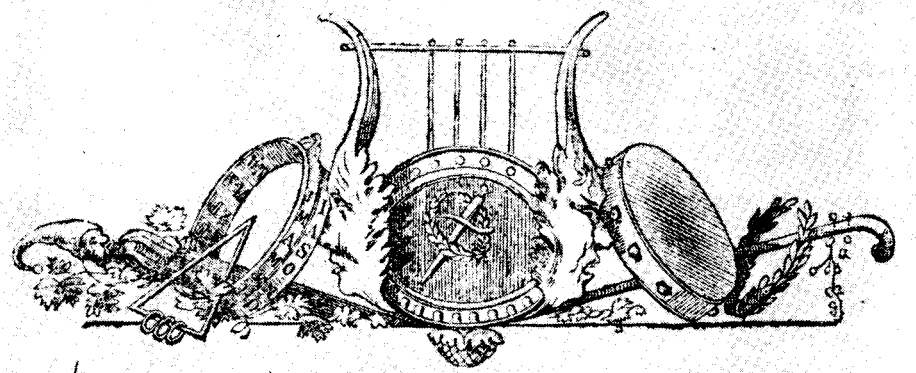
## 1. INTRODUCTION

While evaluating the life-work of Ass. Prof. Dr. B. Hrudička (19. 11. 1904—13. 4. 1942), we should not omit his pioneer work in the history of the Czech meteorology. In this contribution to this topic I would like to present more closely the oldest description of the climate of Moravia to the professional public.

This treatise, which has been quoted by Vitásek F. (1952), was published in German in the magazine „Moravia" on the 30th of August 1815. It covers 4 pages on $21 \times 29.5$ cm. It comprises two major parts: I. The mathematical climate, and II. The physical climate, The first part contains data on the geographical latitude, on the lenght of the day and of the night, etc. Thus it deals with „climate" in the broader conception of that ancient period when climate represented the whole physico-geographical description of the region including the „climate" of our conception. The quoted broader conception supposed that the climate (in its present conception) is determined only by the dependence on the latitude, i.e it is only a function of the latitude. A. v. Humboldt was the first to point out the incorrectness of this supposition. His map of yearly average isotherms in 1817 has namely shown that isotherms are not parallel to geographical parallels (Munzar J. 1967).

It is only the second part dealing with the physical climate which studies the characteristics, (after data on the altitudes above sea level and on the terrain), which correspond to our conception of the climate: these paragraphs deal with the pressure and temperature of the atmosphere, with peculiarities of the Moravian climate, weather and wind conditions. The description is completed by some phenological characteristics and calender phenomena in fauna.

It is the aim of this work to present a traslation of extracts from the above mentioned treatise which concern climate in its actual sense and to make an attempt at their evaluation. To make the text more comprehensible the individual quantitative data are presented here directly in their recalculation to the present units (The relationships for their convertion appear in the notes). The complete text, published here in paragraph 2, is the clossing part of the second portion of the article under study. An exception is the average tempe-




# Moravia.

Mittwoch den 138. 30. Auguſt 1815.


## Mährens Klima.

### I. Mathematiſches Klima.

(Man vergleiche meinen Mähr. Wanderer. 1833. S. 15.)

1. Rang, und Charakter des mähriſchen Klima. — Mährens Himmelsſtrich. — Brünns Pol- und Aequatorshöhe, — Taglänge, — Dämmerung ꝛc.

Mähren liegt im 8. Klima: weil der längſte Tag zwiſchen 7 und 8 halbe Stunden länger, als unter dem Aequator — alſo gegen 16 Stunden lang iſt. — Die geographiſche Breite Brünns iſt nach Brügs Beſtimmungen 49 Gr. 11 Min. 42 Sek.*). Brünns Polhöhe erreicht alſo die Breite vom ſüdlichen Kamtſchatka; und Irkutzk in Siberien liegt nur 3 Grade nördlicher (52° 15') als Brünn.

Die Aequatorshöhe Brünns iſt alſo 40 Gr. 48 Minut. 18 Sek. Aus dieſem folgt: — Am längſten Tage ſcheint die Sonne zu Brünn 15 Stunden, 58½ Minuten; — Sie ſteht zu Mittag im Meridian am höchſten 64 Gr. 16 Minut. 9 Sek. (oder 120 Sonnenbreiten) über dem Horizonte.

Am kürzeſten Tage ſcheint die Sonne 8 Stunden 1½ Minut. ſie ſteht zu Mittage im Meridian am niedrigſten alſo nur 17 Gr. 20 Minut. 27 Sek. oder 32 Sonnenbreiten. Sie ſteht im höchſten Sommer faſt viermal höher als zu Weihnachten; genauer 46 Grad, 55 Minuten, 42 Sekunden, oder 88 Sonnenbreiten.

Die Dämmerung unter Brünns Parallele dauert vom 7. Juny bis 6. July die ganze Nacht, während dem die Sonne nie unter den Dämmerungskreis hinabſteigt. — Am 21. Juny als am längſten Tage, geht die Sonne zu Brünn zu Mitternacht 39 Minut. 33 Sek. über den Dämmerungskreis weg. — Unter der Breite von 48 Graden, 32 Minut. 9 Sek. (alſo ſüdwärts unter Mähren) liegt am 21. Juny zu Mitternacht die Sonne genau auf den Dämmerungskreis.

2. Geographiſche Lage des Landes: — nördlichſter — ſüdlichſter Punkt.

Der nördlichſte Punkt Mährens, zugleich der höchſte — (die Plattforme des Spieglitzer Schneebergs) hat die Breite von 50 Graden, 12 Minut. 28 Sek. (David). — Der ſüdlichſte, zugleich der niedrigſte Punkt Mährens hat die Breite von 48 Graden, 40 Minut.

(Szenitz 48° 40' 40" — Egbell 48° 42' 59" — Holitſch 48° 48' 25" (Lypsky) liegen in der Nähe von Landshuths Parallele, welches etwas nördlich über den ſüdlichen Punkt Mährens ſteht.)

Die Breitendifferenz macht 1 Gr. 32 Min. 28 Sek. folglich beträgt die größte Breite Mährens (faſt ge-

*) Liebkamm fand den Spielberg 49 Gr. 11 Min. 28 Sek. welches Beck in der M. Korresp. der Erd- und Himmelskunde 3. Band. S. 130. auf 49 Gr. 11 Min. 32 Sek. berechnet.

Fig. 1. Reproduction of the titel page of the paper: „Climate of Moravia“ from the journal „Moravia“, 1815.

rature, which originally belongs to part I, which has been added, however, to the the portion dealing with extremes in temperature because of chronological reasons.

## 2. THE CLIMATE OF MORAVIA

### 2.1 ATMOSPHERIC PRESSURE IN BRNO – ITS AVERAGE, HIGHEST AND LOWEST MARK

The average value of barometer was given to me by WUSSIN as 744.8 torr. KNITTELMAYER has found the atmospheric pressure in Brno 744.9 torr according to the average of five years. The lowest value of the barometer has been observed by him on the 31st of January 1805 — 720.0 torr; the highest one on January 28, 1802 — 765.0 torr. The difference is then 45 torr.

### 2.2 TEMPERATURE – THE WARMEST DAYS AND THE STRONGEST FROST IN BRNO

(The average temperature of our zone, i.e. also in Brno, is 11.9 °C).

The highest temperature in Brno (August 1807 and July 1811) was 35.0 °C, the strongest frost (December 26, 1798) — 27.5 °C. The highest amplitude of temperature in Brno is 62,5 °C. Temperatures higher than 37.5 °C and frosts under —32.2 °C should occur in Brno only very rarely (!?).

Let us show the data of one year as an example: in 1804 the highest temperature was on August 1st 31.9 °C; the strongest frosts on December 21st achieved —22.5 °C, the amplitude represented 54.4 °C.

The highest amplitude from the warmest summer days to the most cruel winter temperatures is 62.5 °C. It is too much! Such a big difference does not appear even on the border of the Alps, among the Swiss rocks covered with permanent ice!!

### 2.3 ADVANTAGES OF THE MORAVIAN CLIMATE

The basin-like region of Moravia, with disregard to its altitude above sea level and to its altitude, has a milder climate than many a country on the same parallel and in the same altitude, because it inclines strongly to the South. (The northernmost limit of the Moravian viniculture is on 49°12′). Only the easterly wind, blowing here from the 1820 km long Carpathian chain, touches the border of Moravia, which is quite open on this side, and strongly and quickly cools down the air.

### 2.4 THE GREAT VARIABILITY OF THE LOCAL MORAVIAN CLIMATE

The Moravian climate, as well as its soil, is very variable. Here, too, Arabia is situated near the blessed Canaan! The climate of the country is mild and agreeable on its South: near Kroměříž, Bzenec, Lednice, etc. It is harsh and cold to the North: in the vinicity of Branná, Rýmařov, Žďár nad Sázavou, etc. In the South and Southwest, for example, there are prosperous vineyards, while in the northernmost part rye and oats often fail to ripen and flax and potatoes are covered with snow from time to time.

The difference in the timing of harvest seasons between southern and northern Moravia — hardly 150 km far from each other is 5 to 6 weeks! In Brno, first ripe cherries appear at the beginning of June, in Branná the time of cherries is August.

## 2.5 THE AVERAGE DATE OF EFFLORESCENCE OF TREES IN BRNO

Near Brno the average date of efflorescence of trees is May 6 or 7. In southern Moravia more frequently at the end of May. The most early blossoms in Brno were observed on April 7 (1815), the lattest efflorescence on May 13 (1809) and 14 (1812). The difference of the start of blossom periods is then 37 days!

## 2.6 THE MORAVIAN SPRING FESTIVAL CAUSED BY THE COMING OF BIRDS OF PASSAGE AND OTHER NATURAL PHENOMENA WHICH OCCUR EACH YEAR

The Moravian climate can be observed in fauna, too, as follows;

1. Skylark sings around February 20.
2. Wild geese return over Moravia on March 1 (1815).
3. Wagtails and thrushes appear around March 24.
4. Moravian water streams ascend due to the thawing of mountain snow around April 1, but very often sooner.
5. Bat appears on April 4, disappears around October 20.
6. Swallows appear around April 15, disappear around September 15.
7. Bunting sings around April 18.
8. Cuckoo can be heard around April 24, becomes silent around June 24.
9. Nightingale sings around April 23, becomes silent around June 25.
10. Cock-chafer appears around April 26.
11. Quail can be heard around May 6.

## 2.7 WEATHER

Every place in Moravia has (as nearly everywhere) its own climate in accordance with its own location. The yearly amount of precipitations is 611,1 mm according to observations of eight years. The most abundant precipitations are those of August and June, the lowest in January and February. In November and February it rains and snows with the highest frequence, precipitations are rarest in May and October. On the average, there are 148 days with precipitations in one year, 12 days in one month and 3 days in one week.

According to observations of eight years had

| | | | |
|---|---|---|---|
| 3 winter months (XII, I, II) | in total | 322 | days with precipitations, |
| 3 spring months (III, IV, V) | ,, | 288 | ,, |
| 3 summer months (VI, VII, VIII) | | 304 | ,, |
| 3 autumnal months (IX, X, XI) | | 281 | ,, |

The highest number of days with precipitations is then that of winter (i.e. 40.2 in one year), the lowest that of spring and autumn (36.0 and 35.1 respectively). In general, however, nothing quite certain can be said about weather.

Always and everywhere wind will be the leading factor of weather. (Only the Moon is somewhat helpful in it!). ,,Is there any other more variable thing

than weather?" — a proverb known all over the world! — There is a realm of changes above our heads. How it is boiling here, raging, how it is furious — just like a yeasting sea, lashed by roaring winds!

### 2.8 WINDS

In Moravia, the northwesterly wind prewails each year, though it changes with the opposite southeasterly wind just like the high and low tide. Wind usually blows in the direction of mountain ranges. All other winds are of less importance, insignificant at least, they do not last. Nights are usually without wind. Winds in Moravia often change quickly and unexpectedly.

In winter northeasterly wind desides about the start and duration of strong frosts. With the northwesterly wind sky is only rarely clear. It is usually clearer with the southeasterly wind. Rains, storms and permanent overcast weather comes from the western side-either from the West or Southwest, or even from the South. J***de.

## 3. AN EVALUATION OF THE DESCRIPTION OF THE CLIMATE OF MORAVIA IN 1815

Who was the author? After studying the whole year of the magazine „Moravia" and contemporary literature it seems nearly certain that the author of the treatise is KARL JOSEPH JURENDE, known by his articles about the history and geography of Brno and surrounding regions, a corresponding member of the Royal and Imperial Moravian and Silesian Society for the improvement of tillage, for natural history and knowledge of the country. Aged 35, when he publishes his article on the climate of Moravia (he was born April 24, 1780), 176 his works had been already published, as can be seen in his own list. In this list of his own publications in the same year of „Moravia" he often employs the cipher J** de. We can thus believe that he was the author of our treatise.

JURENDE is a typical polyhistorian worker in history and geography of his region. It is evident in his list of publications as well. We cannot say, however, that JURENDE is also the author of a part of meteorological observations. He must have adopted some data — e.g. from WUSSIN or KNITTELMAYER. It cannot be excluded, however, that he used his own experience in the treatise. The question of his own contribution is not important for this contribution. It is decisive that he published the first complex view of the climate of his country, taking advantage of the first quantitative measurements. There are only very fragmentary news about weather up to the second decade of the last century. JURENDE had elaborated a similar article already in 1813, it is true (even in two versions, as it seems), these works were not preserved, however. One of them has been mentioned at the beginning of the treatise under study. Under the title of the first part — Mathematical climate — there is a note in parentheses: cf. my article in the magazine „Mähr. Wanderer", 1813, p. 15. It seems, however, that these were rather only passages from mathematical geography. The second article contained quite certainly some climatological characteristics — the question is of an article in the magazine „Verkündiger", 1813, p. 16. Extracts from it have been published by C. D'ELVERT (1856, 4). It is practically impossible to determine which part dates from 1813, however, as they appear together with later data. We may therefore justly consider our

treatise from 1815 the oldest preserved description of the Moravian climate. Let us return, however, to its evaluation.

First of all we have to admit that we have no knowledge of the exact location of these observations or measurements in Brno (cca 225 m, $\varphi = 49°12'$ N, $\lambda = 16°34'$ E), and we do not know the methods which were used in it. In general, however, the mesurements can be qualified as very good. It also results from a comparision of a characteristics of the atmospheric pressure. The average atmospheric pressure in Brno-Tuřany (H = 245 m) in the height of the station in 1951—1960 is 740.2 torr, i.e. there is only a small deviation of more than 3 torr (this could be caused by a different altitude above sea level of the station). As much as the extreme amplitude is concerned, we can compare it only with Praha-Klementinum (H = 202 m): 52.5 torr. This is, however, in the period 1851—1960 (Podnebí ČSSR, 1969, 296—297), while Knittelmayer's measurements lasted only for 5 years.

There is only one datum which is not trustworthy: the average annual temperature of the air 11.9 °C. According to Podnebí ČSSR (1961, 26) the average annual temperature in Brno-Květná (H = 223 m, $\varphi = 49°12'$ N, $\lambda = 16°34'$ E) in the period 1901—1950 is 8.4 °C. The warmest place in Moravia is Hodonín (9.5 °C). It is possible, however, (testified also by the fact, that this datum appears, in the other part of the treatise, i.e. mathematical geography, that it has been taken from a different source (unlike other data on temperature). There is namely neither logical connection to data on extreme temperatures, the latter originating obviously from direct measurements in Brno. It was apparently an older datum on temperatures in mild latitudes; numerically, it is of the order of Pécs (11.2 °C) or Szeged (11.3 °C) — see HEYER E. (1963, 423).

In extreme temperatures JURENDE supposes the span of absolute extremes from —31.2 °C to 37.5 °C. In Brno-Květná the following values were achieved in the period 1926—1950; absolute minimum —30,4 °C, absolute maximum 36.1 °C. (Podnebí ČSSR, 1961, 32—35). This is a very good coincidence, the prognosticated amplitude differs only with 2.2 °C. It confirms the fact that the measurements were not taken on thermometres exposed to the sun, as could seem from the datum on the average temperature. Jurende's interrogation mark following the forecast of extremes has thus no reason to be.

Let us turn our attention to phenological data. Here a comparison with actual characteristics is difficult as we have no data directly from Brno and as we do not know which trees were taken into account. We can only offer the beginning of efflorescence of appletrees in Šlapanice, district Brno-countryside (H = 230 m, $\varphi = 49°10'$ N, $\lambda = 16°44'$ E). The average beginning of efflorescence in the period 1926—1940 accrues to April 30; most frequently it was April 12 and the lattest was May 11 (PODNEBÍ ČSSR, 1961, 242—243, 266—267).

The calendar characteristics of the phenomena of Moravian fauna seem to be real. This can be acknowledged on the case of skylar. The question is not of a mechanical use of a piece of weather lore (e.g. of Candlemas, of February 2), which is problematical but apparently of a direct observations.

The average total of precipitation in Brno-Pisárky (H = 204 m) in the period 1901—1950 is 547 mm (Podnebí ČSSR, 1961, 138). There is a good coinci-

dence in order with older measurements. Their higher values (with 12 %) are partly due to the fact that the time series are considerably different. A good coincidence is also in the case of months with most abundant precipitations: according to JURENDE it is August and June, according to actual data July, June and August (77, 70 and 63 mm respectively). The smallest precipitations are according JURENDE in January and February, now it is February, January and March (24, 27 and 27 mm respectively).

I consider the last paragraph of Jurende's treatise the most interesting one — it deals with the wind conditions. It cannot be said generally that on the average, the northwesterly wind is prevailing in Moravia, it does represent, however, the most frequent direction of winds in Brno (14.5 %), in Bystřice nad Pernštejnem (17.4 %), Olomouc (15.0 %) and Prostějov (15.5 % of all observations) (PODNEBÍ ČSSR 1961, 80—81). The very conclusion is the most modern part of the treatise, as it summarizes the dynamics of the Moravian climate in a very truthful way. I should remind that the causative explanation of climate was not yet very usual at the beginning of the 19th century and JURENDE could thus become a good example to many our later pioneers of meteorology in Moravia.

## 4. CONCLUSION

The oldest preserved description of climate of Moravia (especially of Brno), the author of which is K. J. JURENDE, is not only an interesting item of our cultural history. It also gives more precision to the history of meteorological observations in Brno. M. NOSEK (1953, 200) quotes, in accordance with F. VITÁSEK the beginning of meteorological observations in Brno in 1799 and their continuation to 1813, later with some interruptions to the middle of last century. From Jurende's data on extremes of temperature it results, however, that observations were made in Brno already in 1798. Also data on the period of observations are different. Thus it is necessary to cast new light on the beginnings of meteorological observations in Moravia. The leading motivation should be efforts to contribute to the knowledge of climatic oscillation in our country before 1850, for its effect have a generally considerable economic significance. The longer series of observations is at our disposal the deeper knowledge of the problem of relationships between man and his environment we shall have —in our case the influence of weather and climate upon man and his economic activities, and on the contrary.

## 5. NOTES

1) Data on atmospheric pressure are given for a altitude of the station above sea level, i.e. not converted to the sea level. The pressure is given in the following units: Zoll and Linie. Their relations as follows: 1 Zoll = $2.63401 \times 10^{-2}$m, 1 Linie = $2.195 \times 10^{-3}$ m.

2) Temperature of the air is given according to Réaumur. The relation is 1 °R = 5/4 °C. In the paragraph about temperature there were some obvious Jurende's errors, which have been already removed in my translation. For example, Jurende says that the absolute amplitude of the temperature is 50.5 °R (63.1 °C). The given values, however, have an amplitude of 50 °R [28 °R (35.0 °C) and —22 °R (—27.5 °C)], i.e. 62.5 °C. Similarly for the year

1804 the difference between values 25.5 °R and —18 °R (31.9 °C and —22.5 °C respectively) is 43.5 °R (54.4 °C), not 44 °R (55.0 °C) as written in the text in question.
3) Distances are given in Austrian post miles; 1 mile = 7.586 km.
4) Atmospheric precipitations are given as their total in the above mentioned period of eight years, not their average. in weight or lenght units on square foot (Kvadratfuß) — in Wiener Pfunds and Lots, or in Zolls and Linies. The relations are: 1 Kvadratfuß = 0.099 m², 1 Pfund = 0.560060 kg, 1 Lot = 1.750 dkg. Distances are explained in note 1. After converting them to actual units I have made also a convertion of the average of the above mentioned period, as it is now usual.

It can be easily seen that also days with precipitations (or days with snow and rain according to Jurende) are expressed as a total of eight years. I have recalculated them therefore according to the actual standard (in brackets).

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Obr. 1. Faksimile titulní stránky článku „Klima Moravy" z časopisu „Moravia" z r. 1815.

Рис. 1. Факсимиле заглавия статьи „Климат Моравии" из журнала „Моравия" (от 30-ого августа 1815 г.).