

THE EARLIEST INSTRUCTIONS FOR WEATHER OBSERVATIONS IN BOHEMIA FROM THE 1ST HALF OF THE 19TH CENTURY (A HISTORICAL NOTE)¹⁾

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with 5 figures in the text

CONTENTS

<i>Zusammenfassung</i>	334
<i>Summary</i>	335
1 Introduction	335
2 Instruction for weather observation by Prague astronomer Professor A. DAVID issued in 1817	336
3 Guidelines for weather observation and for elaboration of agricultural and forest annual reports from 1827	340
4 Proposal for a system of meteorological observations in the Austrian Monarchy 1848–1850 compiled by Professor K. KREIL	340
5 Conclusion	343
6 References	343

Zusammenfassung

Die ältesten Instruktionen für Wetterbeobachtungen in Böhmen aus der ersten Hälfte des 19. Jahrhunderts (Historische Notiz)

Dieser Beitrag widmet sich der Geschichte der meteorologischen Beobachtungen in Böhmen in der 1. Hälfte des 19. Jahrhunderts im Kontext solcher Beobachtungen im damaligen Mitteleuropa. Der Beitrag betrifft den Zeitraum zwischen den Beobachtungen der Mannheimer meteorologischen Gesellschaft und der Gründung der Zentralanstalt für Meteorologie und Erdmagnetismus in Wien. In diesem Zeitraum wurden in Prag zwei Anleitungen zur Beobachtungen des Wetters in deutscher Sprache (in jener Zeit die einzige Amtssprache der Österreichischen Monarchie) publiziert. Die erste erschien im Jahr 1817 von A. DAVID, Direktor der Prager Sternwarte in Klementinum. Die zweite stammt aus dem Jahr 1827, wurde durch die k. k. Patriotisch-ökonomische Gesellschaft im

¹⁾ The paper was written with the support of the Institute of Geonics, Academy of Sciences of the Czech Republic, No. RVO: 68145535.

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Königreiche Böhmen herausgegeben und auch der Beziehung des Wetters zur Land- und Forstwirtschaft gewidmet. An ihrer Bearbeitung waren mehrere Autoren beteiligt, die nicht angegeben sind. Der Meteorologieteil ist zweifellos auch das Werk von Professor DAVID.

Es hat sich herausgestellt, dass sich die Anleitung aus dem Jahr 1817 unter anderem auf die Instruktion von J. J. HEMMER aus dem Jahr 1780 stützt. Diese wurde für den Bedarf der Beobachter der Mannheimer meteorologischen Gesellschaft (Societas meteorologica Palatina) ausgearbeitet. In deren Beobachtungsnetz haben sich aus der ganzen Österreichischen Monarchie nur zwei Einrichtungen eingeschaltet: die Sternwarten in Prag-Klementinum und in Ofen (ein Teil des heutigen Budapest).

Die nächste auch in Prag entstandene Anleitung für meteorologische Beobachtungen wurde vom oberösterreichischen Professor K. KREIL, Direktor der Prager Sternwarte in den Jahren 1845–1851, bearbeitet. Es handelte sich um die erste Anleitung mit gesamtösterreichischer Geltung, die für den Bedarf eines einheitlichen Systems meteorologischer Beobachtungen in der Österreichischen Monarchie entstanden ist. Publiziert wurde sie nach und nach in den Jahren 1848 bis 1850 in Wien. Als im Jahr 1851 die Zentralanstalt für Meteorologie und Erdmagnetismus in Wien gegründet wurde, hat KREIL Prag verlassen und wurde ihr erster Direktor.

Summary

The paper is devoted to the history of meteorological observations in Bohemia in the first half of the 19th century in the context of such observations in the then Central Europe. It concerns the time period between observations conducted by the Mannheim Meteorological Society and the foundation of the Central Institute for Meteorology and Geomagnetism in Vienna. In this period, two guidelines for weather observation were published in Prague in German (at that time the only official language in the Austrian Monarchy). The first one was issued in 1817 and its author was A. DAVID, director of the Prague astronomical observatory Klementinum. The second one was issued in 1827 by the Imperial-Royal Patriotic-Economic Society in the Kingdom of Bohemia, and is devoted among other things also to the relation of weather to agriculture and forestry. It was compiled by a multitude of authors who are not mentioned though. The meteorological part is doubtlessly a work of Professor DAVID, too.

It appeared that the guideline from 1817 was dwelling among other things on instructions compiled by J.J. HEMMER for the need of observers from the Mannheim Meteorological Society (Societas meteorologica Palatina) in 1780. Only two stations from the Austrian Monarchy became involved in observations conducted by its observation network: The observatory Prague-Klementinum and the observatory in Ofen (municipal part of today's Budapest).

The other guideline for meteorological observations originates from Prague, too, and was compiled by Professor K. KREIL, native from Upper Austria and director of the Prague observatory in 1845–1851. This was the first instruction valid for the entire Austrian Monarchy, issued for the purpose of a uniform system of meteorological observations, which was gradually published in Vienna in the period 1848–1850. After the establishment of the Central Institute for Meteorology and Geomagnetism in Vienna, KREIL left Prague to become its first director.

1 Introduction

No serious climatological research can do without the knowledge of the history of weather observations. A must is the history of individual stations including the development of measuring and ob-

servation methods because a necessary condition for the processing of the long series of measured data is verification of their homogeneity, which would be very difficult without the knowledge of history.

Regular meteorological measurements in Central Europe started usually at the end of the 18th century. An essential role in their organisation played the foundation of the Mannheim Meteorological Society (*Societas meteorologica Palatina*) in 1780. Representatives of the Society addressed a number of observatories and other institutions in various countries with the invitation to participate in the project of the supranational network of meteorological stations with using the same methods of observation and measurements by the same measuring instruments.

In the Habsburg Empire, only two stations took part in the newly emerging network of observations, i.e. the observatory in Prague [Praž]–Klementinum and the observatory in Ofen [Buda] – a municipal part of today's Budapest. (The authors have failed to find out why the observatory in Vienna [Wien], which had been conducting meteorological observations already for many years by that time too, did not join this international project.)

In order to provide a uniform methodology of observations for institutions cooperating with the "Mannheim network", Secretary of the Society Johann Jakob HEMMER worked out instructions written in Latin in 1780 (HEMMER 1780). These were published as part of the first "Mannheim" annual report, which included results of observations from 16 European stations in 1781 (*Ephemerides Societatis Meteorologicae Palatinae*) and was issued in Mannheim in 1783 (HELLMANN 1883). The instructions were used by Professor Antonín STRNAD (STRNADT), pioneer of Czech meteorology, working at the Prague observatory in 1781–1791.

These "Mannheim" instructions became later a model for the elaboration of the oldest guideline for meteorological observations in Bohemia [Čechy] from 1817.

2 Instruction for weather observation by Prague astronomer Professor A. DAVID issued in 1817

The first instruction for meteorological observation in Bohemia was compiled by professor of the Prague University and fourth director of the observatory in Prague-Klementinum Alois (Aloys) DAVID (1757–1836). It was issued in Prague in 1817 (DAVID 1817). Its publication was induced by the need to unify the hitherto used observation methods. The short document written by Professor DAVID in German specifies reasons and regulations why and how to do the weather observation (Fig. 1).

A short introduction into the issue of meteorological observations and their significance is followed by an explanation how and when air temperature and pressure is to be measured and how to observe changes in the atmosphere and changes of phenomena in nature. Recommended are three observations per day with air temperature being recorded in the morning at sunrise, in the afternoon at 15 o'clock in the warm period of the year (one hour earlier in the cold period of the year), and in the evening at sunset. An important complement of instrumental measurements is wind observation: Wind formation, direction, intensity and duration. (The only four degrees of wind intensity include Degree 1 for light wind and Degree 4 for windstorm.) The condition of the atmosphere is documented by the formation, colour, form and movement direction of clouds. Recording of the occurrence of hydro-, litho-, photo- and electrometeors is desirable (although the today's terminology is not used). Useful is also the monitoring of weather impacts on animals and vegetation.

The interpretation of old records is possible if a list of symbols and abbreviations is available, that were used to capture the state of the atmosphere and cloudiness, i.e. degrees of sky coverage by clouds etc. (Fig. 2). Similarly, as the classification of wind power by four degrees, the symbols were apparently taken over from J.J. HEMMER (1780).

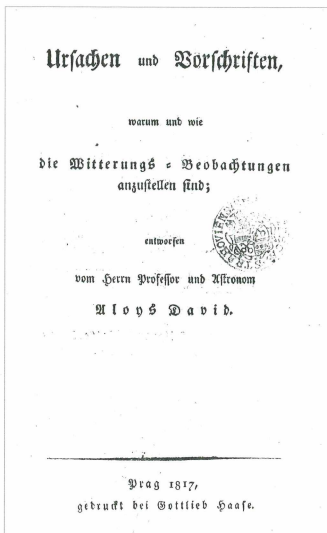


Fig. 1: Title page of the instruction for weather observations by A. DAVID (1817)

The context of DAVID's instructions suggests some interesting information extending our hitherto knowledge about meteorology in Bohemia, possibly also in foreign countries before the year 1820. For example, that the amount of rain and snow was gauged only at three places in Bohemia so far – in Prague, Štáhlavy (in German *Stahlaue* – a small village near Plzeň in western Bohemia) and in the Praemonstratensian monastery in Teplá (in German *Tepl*). Therefore, an expansion of this modest rain-gauging network was desirable.

Many authors devoted their publications to the life and work of Professor DAVID, for example PEJML (1975), KRŠKA & ŠAMAJ (2001) or the latest article published by HLINOMAZ & MILDORFOVÁ (2008). The latter brings more details about his biography. DAVID was born in 1757 in the small, not

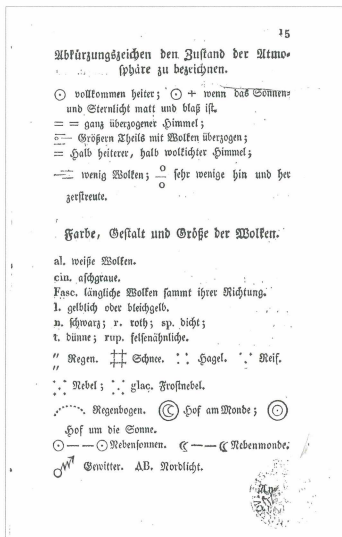
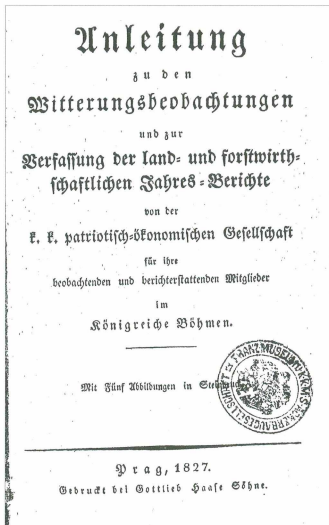


Fig. 2: Abbreviations and symbols for the meteorological phenomena, which should be used for recording the weather conditions according to A. DAVID (1817)

anymore existing, village of Dřevohryzy (in German *Zeberheisch*), belonging to the estates of the Teplá Praemonstratensian monastery in the southeastern part of the Cheb (German *Eger*) historical region (West Bohemia). The abbot of the monastery noticed the gifted boy born in a poor family and took charge of his education.

A. DAVID became a prominent Czech astronomer, meteorologist and mathematician. In 1789, he joined as an adjunct to the Prague observatory and was appointed professor at the Prague University. Ten years later in 1799, he became director of the Prague observatory and held the post until his death. One of his meteorological merits to be mentioned at the first place is that he was a pioneer



Source: K.K. PATRIOTISCH-ÖKONOMISCHE GESELLSCHAFT IM KÖNIGREICH BÖHMEN 1827

Fig. 3: Title page of the instruction for weather observations etc. of the I.R. Patriotic-Economic Society in the Kingdom of Bohemia

of field measurements, which he systematically conducted in Bohemia as well as in neighbouring countries for more than 30 years. Thanks to his efforts, a meteorological network came to existence in Bohemia in 1817 within the Imperial-Royal Patriotic-Economic Society residing in Prague. Proceedings of the Society published not only results of measurements from the Klementinum but also weather overviews from Bohemian regions. Under DAVID as editor, results from the years 1817–1829 and 1831 were published.

By the way, it should be pointed out that his name was entered incorrectly practically in all publications about him as Martin Alois DAVID. However, Martin was DAVID's Christian name and Alois was the religious name, which he adopted upon entering the order of Praemonstratensians in Teplá in 1780. He used the latter name in all his later works because it was more important for him as a monk than the Christian name.

3 Instruction for weather observation and for elaboration of agricultural and forest annual reports from 1827

The second extended instruction was issued in 1827 in Prague by the I.R. Patriotic-Economic Society in the Kingdom of Bohemia. Among other things, it is also devoted to the relation of weather to agriculture and forestry (K.K. PATRIOTISCH-ÖKONOMISCHE GESELLSCHAFT IM KÖNIGREICH BÖHMEN 1827). It was compiled by a multitude of authors who are not mentioned though. The meteorological part is doubtlessly a work of Professor DAVID, too (Fig. 3).

The size of the publication is more than a double of that issued in 1817 (38 pages and 5 figures in the annex). A brief introduction is followed by the longest Section I "Instruction for meteorological observations" (pp. 5–21). It contains first a brief list of meteorological elements and phenomena that have to be measured and observed, which is followed by characterisations of barometer, thermometer and rain gauge along with instructions for their use. A list of abbreviations and symbols for recording the observed atmospheric phenomena is missing in this instruction. It was apparently presumed that DAVID's instruction issued ten years ago was available to observers. Besides, a small reference is made in the text to the instruction from 1817.

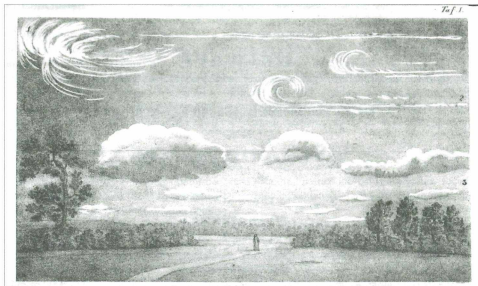
The following section concerns wind observations. An important contribution as compared with the preceding instruction is the other section devoted to the classification of clouds and their forms. The author builds on the basic classification by Englishman Luke HOWARD, which was first issued in 1803 (HOWARD 1803). His essay includes, e.g., the characterisation of three basic genera of clouds (*Cirrus*, *Cumulus* and *Stratus*) and the other four types (*Cirrocumulus*, *Cirrostratus*, *Cumulostratus* – today's *Stratocumulus*, and *Nimbus*). The characterisation of the individual clouds genera and forms of clouds is very exhaustive and complemented with five illustrations (lithographs) with their images, e.g., in the first one cumuli are depicted together with cirri (Fig. 4).

Section II "Guideline for the preparation of economic reports" (pp. 22–34) focuses on the growing of field crops, livestock breeding, fish farming, bee keeping, growing of fruit, vine and hops. A sub-chapter called "harvest yields" brings weather characterisation in the individual months in relation to individual phonological stages.

The final Chapter III "Guideline for the preparation of forest reports" (pp. 35–38) contains 16 main questions to be answered in the annual report together with 15 sub-questions (see also von WILAMOWITZ-MOELLENDORFF 1990).

4 Proposal for a system of meteorological observations in the Austrian Monarchy from 1848–1850 compiled by Professor K. KREIL

Another guideline for meteorological observations, again from Prague, was elaborated by Professor Karl (Carl) KREIL (1798–1862). This was the first instruction valid for the entire Austrian Monarchy, issued for the purpose of a uniform system of meteorological observations, which was gradually published in Vienna in the period 1848–1850. The prominent Austrian meteorologist, as-



Source: K.K. PATRIOTISCH-ÖKONOMISCHE GESELLSCHAFT IM KÖNIGREICH BÖHMEN 1827

Fig. 4: The example of clouds' genera and forms illustration in the instruction from the year 1827, where are depicted cumuli together with cirri

tronomer and geophysicist K. KREIL was born in Ried im Innkreis (Upper Austria [Oberösterreich]). He came to Prague in 1838 and became adjunct at the Prague observatory. Seven years later, in 1845, he was appointed professor of astronomy and director of the observatory. After the establishment of the Central Institute for Meteorology and Geomagnetism [Zentral Anstalt für Meteorologie und Erdmagnetismus] in Vienna, KREIL left Prague to become its first director.

He played a very important role in the further progress of meteorological observations. As far as his above-mentioned proposal for a system of meteorological observations, he worked and published it in parts in the periodical "Session Reports of the Imperial Academy of Sciences" [Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften] in Vienna. The first and second parts were published together in 1848 and were devoted to the establishment of meteorological stations and observation methods (KREIL 1848). The third part, describing the procedure for publishing the results of observations, followed a year later (KREIL 1849). The last part from 1850 (see Fig. 5) concerned predominantly magnetic measurements and includes an appendix with the characterisation of meteorological registration devices for measuring wind direction, wind pressure, liquid and solid precipitation (KREIL 1850). The collected edition emerged in Vienna in 1851 under the name "Instruction to the meteorological observations in Austrian Monarchy" [Anleitung zu den meteorologischen Beobachtungen in der österreichischen Monarchie] as one of the first publications of the new Central Institute for Meteorology and Geomagnetism.

One of KREIL's achievements in meteorology bound to ten years of his work in Prague (1838–1851) is the monograph "Climatology of Bohemia" [Klimatologie von Böhmen], which ranked with master works of climatology on a global scale at the time. However, it was published only after his death under edition of his colleague K. JELINEK in Vienna in 1865. (Professor KREIL intended



Fig. 5: The offprint's title page of the "Proposal for a system of meteorological observations in the Austrian Monarchy" (IVth Part) by Carl KREIL (1850)

to characterise the climate of all lands in the Monarchy as a work comprising several volumes but was unfortunately not given time enough for its realisation.) By the mathematical and statistical processing of measured data in this monograph, he was ahead his time and displayed possibilities of the so-called classical climatology in spite of the fact that the lengths of the observation series were different and the material considerably non-homogeneous. The climatological characteristics were calculated from 52 meteorological stations in Bohemia with the Prague series being used as a basis for relevant reductions (KRŠKA & ŠAMAJ 2001).

5 Conclusion

Personality and work of Professor KREIL demonstrate how tight the relations between Prague and Vienna, Bohemian and Austrian Lands, were in the 19th century. It is no coincidence that his remarkable monograph concerns precisely Bohemia. Because in its compilation, he could build on the meteorological observations recorded by the observation network of the I.R. Patriotic-Economic Society established in 1817 thanks to Professor A. DAVID. (Although his above-mentioned two instructions issued in the first half of the 19th century are written in German, they can be considered the first Czech instructions as they were meant exclusively for the voluntary observers in Bohemia.)

BĚLÍNOVÁ & BRÁZDIL (2012) recently resumed these historical meteorological observations in Bohemia with a view to analyse and evaluate them from the today's perspective. Having managed to find the results of measurements published during the first half of the 19th century, they focused closer on the period from 1817–1847. In their paper, they presented a detailed analysis of the course of basic climatic elements in Bohemia in those years.

It appeared there were several important climatic anomalies and hydrometeorological extremes occurring during those more than 30 years. Of published measurements conducted by the I.R. Patriotic-Economic Society, the extraordinarily harsh winter was confirmed recorded in the period 1829–1830, which seems as the coldest one in the Prague temperature series in the period from 1775 to 2000 (MUNZAR & KAKOS 2000). The extreme afflicted the entire Central Europe, which is documented among other things by measurements in Vienna (since 1775), in Kremsmünster (since 1796) and in Linz (since 1816). BĚLÍNOVÁ & BRÁZDIL (2012) mention also the warmest winter from the period from 1817 to 1847 recorded at the turn of the years 1833 and 1834, followed by a drought spell lasting several months. Another extreme anomaly was the drought spell, which lasted in Bohemia from April to August in 1842.

We can conclude by stating that the organisation and the results of meteorological observations in Bohemia conducted in the first half of the 19th century represent a valuable contribution to the study of climate history in Central Europe and its fluctuation in the studied period.

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Jahr/Year: 2016

Band/Volume: [158](#)

Autor(en)/Author(s): Munzar Jan, Ondracek Stanislav

Artikel/Article: [The earliest instructions for weather observations in Bohemia from the 1st half of the 19th century \(a historical note\) 334-344](#)