Meteorological Glossaries and Dictionaries

A Review of Their History and Current State

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ABSTRACT: The transformation of meteorology into a modern science raised needs for collections of scientific term definitions (glossaries) and of foreign language equivalents (dictionaries). The Meteorological Glossary (United Kingdom) and the Lexique météorologique (France) were the only meteorological glossaries issued separately until World War II. In 1959, a dozen of such works existed, half of which were due to individuals and the other half due to collective efforts, including the comprehensive Glossary of Meteorology (United States) and the provisional version of International Meteorological Vocabulary. Collective authorship has been shown to be more efficient and generally prevailed in recent decades. Regarding dictionaries, the language in which the terms are sorted tells a lot about the purpose of a dictionary. In the 1930s, the British, French, and German multilingual dictionaries were ordered alphabetically in their languages, which suggests that the dictionaries were intended mainly for foreign scholars. Since World War II, bilingual dictionaries have originated in many countries, with the terms usually being ordered in foreign languages, which is more useful for domestic scholars. Dictionaries continued to be compiled subsequently because the International Meteorological Vocabulary remained limited to English, French, Russian, and Spanish. Since 2000, some meteorological glossaries and dictionaries have obtained electronic versions because such versions enable them to be kept up-to-date and allow many practical functionalities, including full-text searches, links among terms, and the thematic filtering of terms. While the diversity of meteorological glossaries will probably remain in the future, a truly international meteorological dictionary could be created by connecting national databases.

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In ancient Greece, Aristotle (384–322 BC) introduced the term “meteorologia.” Although the word already existed at that time, Aristotle narrowed its scope to apply to phenomena taking place in the sphere between the solid Earth and the moon (Wilson 2013). Since then, an exciting story of the development of meteorological terminology has unfurled, which has been accompanied by a constant effort to specify the meaning of individual terms.

Due to Aristotle, Greek was the language in which the first meteorological terms emerged, and some of these terms are still used in meteorology today. Aristotle’s theory remained the basis of meteorology from the Middle Ages until the seventeenth century. At that time, Latin was the international medium of scholarly communication and thus the only language of meteorology. Nevertheless, weather-related terminology also gradually formed in national languages; in the seventeenth century, French, English, and German began to be used for publishing scientific discoveries, and these languages eventually replaced Latin in this regard prior to 1850 (Gordin 2015). Since then, the story of meteorological terminology has spread to a second major topic, namely, the search for equivalent terms between different languages.

Despite its long history, meteorology began to emerge as a modern science during the twentieth century (Fleming 2016). The transformation of meteorology into a modern science increased the need for precise terminology, both in terms of definitions of scientific terms and in terms of foreign language equivalents. The establishment of the International Meteorological Organization in 1873 gave the field its first chance to solve both problems at the international level. At the second International Meteorological Congress (IMC) held at Rome in 1879, C. Pittei, director of the Italian Nautical Meteorological Service, proposed that a meteorological dictionary be created. The Congress supported this idea with the following resolution: “The Congress is of opinion that it would be very useful that an international dictionary of meteorology should be published” (Met Office 1879, p. 22). Yes, it would have been very useful; however, no significant action was taken to implement the resolution.

At this point we begin to tell separate stories for two types of terminological works, namely, glossaries, which comprise terms with their definitions, and dictionaries, which comprise lists of equivalent terms in at least two different languages. The first part of the article is devoted to printed meteorological glossaries, with the main attention being paid to the format of their authorship and the motivations of their authors. With selected details from their lives, we show how unfortunate events can significantly affect the story. We also notice interesting features of some glossaries to provide inspiration to people who are currently dealing with meteorological terminology. The second part of the article concerns meteorological dictionaries. While authorship issues do not seem so important in this category, we focus on which of the languages the terms in the dictionaries were sorted by, because the order of the terms suggests the purpose of the dictionary. The third main section of the article is devoted to electronic glossaries and dictionaries because electronic media has enabled significant progress in the presentation of meteorological terms. In the conclusions, the general features of the history, the current state, and possible future developments of meteorological glossaries and dictionaries are summarized.

Naturally, only selected glossaries and dictionaries are mentioned in this article. We present all known works until 1950 and some newer ones to demonstrate later trends in the production of meteorological glossaries and dictionaries. To present them synoptically, these works are listed in tables and not referenced among other literature at the end of the article.

Alphanumeric codes are employed to refer to the printed glossaries (PG), printed dictionaries (PD), electronic glossaries (EG), and electronic dictionaries (ED) in the text, in the tables, and in the supplemental material, which allows the arbitrary sorting of items with respect to various criteria.

Printed glossaries

Until the end of the nineteenth century, explanations of meteorological terms could only be found in glossaries in combination with other scientific terms; the first glossaries dedicated solely to atmospheric science terms appeared at that point.

Until 1950: First glossaries due to meteorological services and individual efforts.

COLLECTIVELY AUTHORED BRITISH AND FRENCH GLOSSARIES. Although there were several brief glossaries in the United Kingdom before 1914 (Table 1, PG01 and PG02), the first systematic efforts took place during and after World War I, when a rapid rise in aviation required better weather monitoring and forecasting (Harper 2008). Thus, many people needed training in meteorology and explaining the related technical terms. W. N. Shaw, who was the director of the Meteorological Office, took advantage of the collaboration of at least nine members of his staff and combined his introduction to weather maps (Shaw 1916) with the *Meteorological Glossary* (Table 1, PG03), which was the world's first glossary of meteorological terms in the form of a separate volume. The glossary was so successful that the Meteorological Office issued it (with partial improvements) four times within 2 years (Crewe 2009). Nevertheless, C. F. Talman noted in a review that the glossary was in fact more of an encyclopedia because of the rather small number of entries and the length of some of them being up to several pages, including tables and figures. Since then, five more editions of the *Meteorological Glossary* have appeared with gradually increasing numbers of entries (Fig. 1) and figures.

Immediately after World War I, there was a second attempt at international cooperation regarding meteorological terminology. When the International Meteorological Organization resumed its agenda at a conference in Paris in 1919, with Shaw serving as the president, M. Rollet de l'Isle, who was director of the French Hydrographical Service, suggested appointing a commission for the preparation of an international meteorological vocabulary (Met Office 1921). Nevertheless, the idea of a new, international glossary did not take hold, probably because meteorological services faced many other challenges after the war. Thus, terminological activities remained at the national level only.

When the British glossary appeared, the French meteorologist E. Delcambre recognized the need for a meteorological glossary in French. Thus, when he became the director of the French meteorological service in 1921, he initiated work on the *Lexique météorologique* (Table 1, PG04). A. Baldit became the editor of this work and produced one-third of its entries; in addition, 15 other members of the meteorological service staff contributed to six of seven volumes of the glossary, which were issued between 1926 and 1929. Inspiration by the British glossary (Table 1, PG03) was evident, as some entries were also quite long and enriched with tables and figures.

Meanwhile, the professional staff of the British Met Office prepared the second edition of the *Meteorological Glossary*, which was substantially enhanced and rewritten with respect to the previous edition because many advances in meteorology had been made after World War I. The length of the entries remained very unequal due to the freedom given to the contributors. The third edition of the *Meteorological Glossary*, which was issued first in 1939, was also reprinted in the United States in 1940 because no similarly extensive glossary had been created there yet, despite the efforts of certain individuals.

EFFORTS OF INDIVIDUALS IN THE UNITED STATES AND IN OTHER COUNTRIES. The early history of American meteorological glossaries starts with H. A. Hazen, an assistant professor of meteorology

Table 1. Selected printed meteorological glossaries first issued before 1950. The glossaries are arranged in the order in which they are mentioned in the text and are referenced by the code. Footnotes to the column “Year” lead to free electronic copies of the glossaries if available. For the abbreviations of languages, see Table 2. Approximate numbers of entries are in italics.

Code	Title	Publisher, city (state)	Editor(s); author(s)	Edition	Year	Language	No. (range) of pages	No. of entries	Figures	Review
PG01	Glossary of Meteorological Terms. In: <i>Atlas of Meteorology</i> . Bartholomew's Physical Atlas	Edinburgh Geographical Institute, Edinburgh (United Kingdom)	Buchan, A.; Bartholomew, J. G., and A. J. Herbertson	1	1899 ^a	E	2 (appendixes 9–10)	114	No	Kimball (1902)
PG02	Glossary of Meteorological Terms. In: <i>Hints to Meteorological Observers</i>	Royal Meteorological Society, London (United Kingdom)	Marriott, W.	5	1902	E	5 (56–60)	No		Anonymous (1902)
				6	1906			275		Anonymous (1906)
				7	1911 ^b		7 (66–72)	313		
			Corless, R.; Marriott, W.	8	1924					Anonymous (1924)
PG03	<i>Meteorological Glossary</i>	Meteorological Office, London (United Kingdom)	Shaw, N.	1a	1916	E		302	Yes	
				1c	1917			371		
				1d	1918 ^c		358	402		Talman (1919)
				2	1930 ^d		233	670		W.E.W. (1932)
				3a	1939 ^e		253	738		
			McIntosh, D. H.	4	1963 ^f		288	1,800		Byers (1964)
				5	1972 ^g		319	1,900		Rigby (1972)
			Lewis, R. P. W.	6	1991 ^h		335	2,100		Baum (1992)
		Chemical Publ. Com., New York (United States)		3b	1940		251	738		Stone (1941)
PG04	<i>Lexique météorologique</i> [Meteorological Lexicon]	Office national météorologique de France, Paris (France)	Baldit, A.; 16 contributors	1	1926–1931	F	495	610	Yes	Varney (1926)
PG05	Glossary. In: Talman, C. F.: <i>Meteorology: The Science of the Atmosphere</i> , 384 pp.	P. F. Collier and Son Company, New York (United States)	Talman, C. F.	1	1922 ⁱ	E	20 (365–384)	285	No	McArdie (1925)
PG06	Glossary. In: <i>Instructions to Marine Meteorological Observers</i>	U.S. Weather Bureau, Washington DC (United States)	Talman, C. F.	4	1925 ^j	E	15 (64–73)	298	No	
				5	1929 ^k		12 (51–62)	305		Talman (1933)
				6	1938 ^l		15 (96–110)	322		
				7	1941 ^m		15 (90–104)	322		

Table 1. (Continued).

Code	Title	Publisher, city (state)	Editor(s); author(s)	Edition	Year	Language	No. (range) of pages	No. of entries	Figures	Review
PG07	<i>Glossary of Meteorological Terms</i>	U.S. Weather Bureau, Washington DC (United States)		1	1939 ⁿ	E	18	322	No	
PG08	<i>Weather Glossary</i>	U.S. Weather Bureau, Washington DC (United States)	Thiessen, A. H.	1	1946 ^o	E	299	2,000	No	Miller (1947)
PG09	<i>Assaig d'un vocabulari meteorològic català</i> [Essay on a Catalan meteorological vocabulary]	Institut d'Estudis Catalans, Barcelona (Catalonia, Spain)	Fontserè, E.	1	1948 ^p	Cat	82	870	No	
PG10	<i>Iniciación a un diccionario meteorológico</i> [Initiation to a meteorological glossary]	Ministerio de Agricultura y Ganadería, Bogotá (Colombia)	Osorio, L. H.	1	1948	S	50	800	No	

^a <https://doi.org/10.3931/e-rara-71030>^b <https://babel.hathitrust.org/cgi/pt?id=uc2.ark:/13960/t1f2bf3s>^c <https://babel.hathitrust.org/cgi/pt?id=uc2.ark:/13960/t4dn41k35>^d https://digital.nmla.metoffice.gov.uk/IO_2c9f9aec-e469-485c-bd0d-f1b4ea51eb83/^e https://digital.nmla.metoffice.gov.uk/IO_311dce15-970f-498d-9cbb-a53efe386e15/^f https://digital.nmla.metoffice.gov.uk/IO_6b792f5a-7c33-49d6-b8a3-d3dc59f99597/^g https://digital.nmla.metoffice.gov.uk/IO_37e3f060-6015-40e8-938b-e3e28856a384/^h https://digital.nmla.metoffice.gov.uk/IO_067d700e-cb0b-4296-a8f6-65af9e0a83ea/ⁱ <https://babel.hathitrust.org/cgi/pt?id=wu.89099045148>^j <https://aquadocs.org/handle/1834/5222>^k <https://aquadocs.org/handle/1834/5237>^l <https://aquadocs.org/handle/1834/5238>^m <https://aquadocs.org/handle/1834/5239>ⁿ <https://babel.hathitrust.org/cgi/pt?id=uc1.a0007849979>^o https://books.google.cz/books?id=RC_QltSFjDgC^p <https://books.google.cz/books?id=AGQgk-ZNzj0C>

in the Signal Office, who reported the preparation of a glossary of meteorological terms as early as 1888 (U.S. Army 1889) and its completion 1 year later (U.S. Army 1890). However, his product was probably never published and was perhaps even lost after Hazen's sudden death in January 1900 (Abbe 1900).

Thus, it was C. F. Talman, who had been a librarian at the Central Office of the U. S. Weather Bureau in Washington, D.C., since 1908 (Humphreys 1936), who laid the foundations of meteorological lexicography in the United States. For almost 30 years, Talman collected any possible meteorological terms from the literature and was also interested in their etymology. He obviously felt alone in his activities, which is clear from the last sentence of one of his articles: "I only regret that I have, apparently, the whole field to myself" (Talman 1925, p. 144).

Although Talman repeatedly stated his intention to publish the product of his efforts, for which the president of the American Meteorological Society (AMS) declared support, calling Talman's work one of "meteorology's frozen assets" (Humphreys 1929), the work remained in the form of a manuscript card catalog with more than 15,000 entries until 1936 (Brooks and Stone 1936), when Talman shot himself in his bathroom (New York Times 1936). Talman managed to publish only small parts of his work, namely, a list of meteorological isograms (Talman 1915) and a brief glossary (Table 1, PG05) that supplemented his book on meteorology. This glossary became the basis for the glossary that was added to Instructions to Marine Meteorological Observers (Table 1, PG06); a later version was also reprinted separately (Table 1, PG07).

Ten years after Talman's death, A. H. Thiessen completed Talman's effort in the *Weather Glossary* (Table 1, PG08). He selected almost 2,000 terms from Talman's catalog, added new terms and provided definitions for the terms. Although the glossary can still be considered an individual work, Thiessen acknowledged several persons for their assistance, namely, C. W. Thornthwaite, H R. Byers, and others.

In several other countries, individual efforts in meteorological terminology also appeared before 1950. Although Catalan was only an unofficial language in Spain at that time, its meteorological terminology had a remarkably long tradition due to E. Fontserè. Motivated by efforts to raise Catalan into a scientific language, Fontserè (1948) wrote a work which consisted of a review of the existing terminological works, a brief Catalan meteorological glossary (Table 1, PG09; Table 2), and two dictionaries. According to the preface, Fontserè completed his work in 1941; however, due to political issues, it could not be published until 1948. In the Czech Republic, B. Hrudíčka published an index of approximately 1,100 Czech meteorological terms in 1941 and declared his intention to continue his terminological work; unfortunately, he was imprisoned by the Nazis and died in a concentration camp. In Colombia, what was most likely the first Spanish meteorological glossary originated in 1948 due to L. H. Osorio (Table 1, PG10); the word "iniciación" in the title seemed to indicate that a more comprehensive glossary would soon come.

Fig. 1. Evolution of the number of terms included in editions of selected printed meteorological glossaries: United Kingdom (UK), *Meteorological Glossary* (Table 1, PG03); United States (USA), *Glossary* (Table 3, PG05), *Glossary of Meteorological Terms* (PG07), *Weather Glossary* (PG08), *Glossary of Meteorology* (Table 3, PG17); Russia (RUS), *Meteorologicheskij slovar* (Table 3, PG12); Japan (JAP), *Kishō jiten* (Table 3, PG15), *Kishō no jiten* (PG16); World Meteorological Organization (WMO), *International Meteorological Vocabulary* (Table 3, PG18).

The 1950s: Comprehensive glossaries due to both individual and collective efforts.

When Quiroz (1958) and later Marton (1964) presented lists of available meteorological glossaries and dictionaries, they mentioned eight glossaries that had originated in the 1950s. Four of them were due to individual efforts, and the other four were compiled collectively, including the preliminary version of an international vocabulary.

GLOSSARIES IN INDIVIDUAL COUNTRIES. Two more languages, namely, German and Russian, acquired new meteorological glossaries in the 1950s due to the individual efforts of outstanding meteorologists K. Keil and S. P. Chromov (Table 3, PG11 and PG12); another German glossary was published in Austria (Table 3, PG13). Keil's and Chromov's glossaries were significantly more comprehensive than any other previous glossary. The new Spanish glossary (Table 3, PG14) was also much more comprehensive than its predecessor (Table 1, PG10); interestingly, both glossaries appeared in South America but not in Spain.

Japanese acquired two meteorological glossaries due to collective efforts (Table 3, PG15 and PG16). The latter work was originally more like an encyclopedia, as its name suggests, with long entries, and was rather similar to first three editions of the British glossary (Table 1, PG03). Each entry was signed by one of the contributors, of whom this glossary boasted more than any other glossary up to that point.

A change from the individual to the collective concept of terminological work occurred in the United States. In 1952, only 6 years after A. H. Thiessen published his *Weather Glossary* (Table 1, PG08), the American Meteorological Society (AMS) initiated work on a new meteorological glossary, with the editor R. E. Huschke coordinating the efforts of as many as 41 contributors. After 7 years, their work resulted in the publication of the *Glossary of Meteorology* (Table 3, PG17), which had more entries than any other glossary in the world at that time (Fig. 1).

INTERNATIONAL METEOROLOGICAL VOCABULARY. The last of the glossaries from the 1950s was a work produced by the Commission for Bibliography and Publications (CBP) of the World Meteorological Organization (WMO). The French delegation prepared the first draft of a new glossary for the first session of the CBP, which was held in Paris in 1953 (WMO 1954). The draft had the title "Lexique météorologique," which suggests that French meteorologists considered this work a continuation of the French glossary (Table 1, PG04) that had been published a quarter of a century earlier. The CBP selected five people from various countries to form a working group on terminology and gave them the task of creating the text of the lexicon "by year and by day." In fact, it took 4 years for the working group to propose a preliminary version of the lexicon, both in French and English. In the second session of the CBP, which was held in Paris again, the glossary received a new title,

Table 2. Abbreviations of languages, used in other tables.

Abbreviation	Language
Afr	Afrikaans
Cat	Catalan
Cz	Czech
Da	Danish
Du	Dutch
E	English
Es	Esperanto
F	French
G	German
Hu	Hungarian
It	Italian
J	Japanese
No	Norwegian
Pol	Polish
Por	Portuguese
Ro	Romanian
S	Spanish
Se	Serbian
Sk	Slovak
Sw	Swedish

Table 3. As in Table 1, but for printed glossaries first issued in the 1950s. Approximate numbers of entries are in italics.

Code	Title	Publisher, city (state)	Editor(s); author(s)	Edition	Year	Language	No. (range) of pages	No. of entries	Figures	Review
PG11	<i>Handwörterbuch der Meteorologie</i> [Concise Glossary of Meteorology]	Verlag Fritz Knapp, Frankfurt am Main (Germany)	Keil, K.	1	1950	G	604	<i>3,500</i>	Yes	Rigby (1951)
PG12	<i>Meteorologicheskij slovar</i> [Meteorological Glossary]	Gidrometeoizdat, Leningrad (Russia, Soviet Union)	Chromov, S. P., and L. I. Mamontova	1	1955	R	455	<i>4,000</i>	Yes	Anonymous (1956)
				2	1963		619	<i>5,000</i>		
				3	1974 ^a		568	<i>Over 6,000</i>		
PG13	<i>Meteorologisches Wörterbuch</i> [Meteorological Glossary]	Leitner, Wels (Austria)	Schindler, G.	1	1953	G	131	<i>1,900</i>	Yes	
PG14	<i>Diccionario de meteorología</i> [Dictionary of Meteorology]	Casa del Estudiante, Montevideo (Uruguay)	Hernández, H., and R. Wittenberger de Apai	1	1953	S	328	<i>3,000</i>	No	
PG15	<i>Kishō jiten</i> [Dictionary of Meteorology]	Tennensha, Tokyo (Japan)	Wadachi, K.	1	1954	J	436	<i>2,500</i>	Yes	
				2	1957		477	<i>3,000</i>		
PG16	<i>Kishō no jiten</i> [Encyclopedia of Meteorology]	Tōkyōdō, Tokyo (Japan)	Wadachi, K.; 42 authors	1	1954	J	572	<i>1,072</i>	Yes	
				2	1964		640	<i>1,184</i>		
			Wadachi, K.; 39 authors	3	1974		704	<i>4,000</i>		
			Wadachi, K.	4	1993		607	<i>4,000</i>		
PG17	<i>Glossary of Meteorology</i>	American Meteorological Society, Boston (United States)	Huschke, R. E.; Brooks, C. E. P., J. E. McDonald, M. G. Wurtele, and other 38 contributors	1	1959 ^b	E	638	<i>7,247</i>	No	Namias (1960)
			Glickman, T. S.; 41 main contributors	2	2000		855	<i>Over 12,000</i>		
PG18	<i>International Meteorological Vocabulary</i>	World Meteorological Organization, Geneva (Switzerland)	(Vandenplas, A., D. J. Bouman, G. A. Bull, I. Font, S. P. Chromov, M. Rigby)	0	1959	E, F	521	<i>2,000</i>	No	
			(Vandenplas, A., A. G. Fordyke, S. P. Chromov, L. Malet, D. M. McIntosh, M. Mézin, N. Rosenan)	1	1966		276	<i>2,200</i>		
				2	1992 ^c	E, F, R, S	784	<i>3,517</i>		

^a http://elib.rshu.ru/files_books/pdf/img-0905101.pdf

^b <https://babel.hathitrust.org/cgi/pt?id=uc1.31822003869435>

^c https://library.wmo.int/?lvl=notice_display&id=220#.YTgWp1KiUl

i.e., the *International Meteorological Vocabulary* (WMO 1958), which was reminiscent of the proposal made by the Paris conference in 1919.

Under the chairmanship of the Belgian meteorologist A. Vandenplas, the working group on terminology completed a provisional edition of the vocabulary (Table 3, PG18) in 1959. The glossary contained over 2,000 entries, with short definitions in both English and French, and equivalents of the terms given in Russian and Spanish. Instead of the alphabetic order, the entries were organized with respect to the universal decimal classification (UDC), with the indexes being presented in all languages.

Thus, 1959 can be considered an important milestone in the history of meteorological terminology because of the origin of both the AMS glossary and the first international glossary, although it took 7 more years for the latter work to be published in its final version.

Since 1960: Increasing dominance of collective efforts.

THE 1960s AND 1970s. The rapid progress that was being made in many meteorological disciplines, such as satellite meteorology, quickly made all the existing meteorological glossaries outdated. Three of them, namely, the British (Table 1, PG03), Russian (Table 3, PG12), and Japanese (Table 3, PG16) glossaries, received new editions in 1963/64 and again between 1972 and 1974. Nevertheless, two of the glossaries also underwent significant changes then.

In the United Kingdom, a change from the collective to the individual concept of terminological work occurred, which was opposite to what occurred in the United States. Only one author, D. H. McIntosh from the University of Edinburgh, significantly revised the *Meteorological Glossary* for its fourth edition in 1963. Apart from creating new entries, he substantially reduced the differences in the lengths of the existing entries; thus, their number increased by more than twofold. Nevertheless, the collective effort did not completely disappear; before finalization, each entry was read by at least one member of the scientific staff of the Met Office. The Japanese *Kishō no jiten* [Encyclopedia of Meteorology] (Table 3, PG16) underwent a similar change in structure in its third edition; however, it continued to be compiled by a high number of authors.

Regardless of the existence of the *International Meteorological Vocabulary*, the finalization of which McIntosh significantly contributed to, some new meteorological glossaries also originated, especially in languages not covered by the international glossary, such as Romanian (Table 4, PG19). Individual and collective efforts continued to coexist but more comprehensive glossaries were usually due to at least a small collective of authors, such as the French glossaries from Quebec, Canada (Table 4, PG20).

THE 1980s AND EXTENDED 1990s. In the 1980s and 1990s, new meteorological glossaries continued to emerge in many countries worldwide. For example, five members of the staff of the German Weather Service compiled a new German glossary (Table 4, PG21); apart from meteorological explanations of the terms, the glossary also contained etymological notes on them. After several decades of efforts, the Czech meteorological glossary (Table 4, PG22) was published in 1993; due to the role of the Czechoslovak Meteorological Society and the high number of authors, it was reminiscent of the *Glossary of Meteorology* (Table 3, PG17) by the AMS.

Another group of glossaries from this period consists of works that were intended for the general public. Such works appeared in many languages; in English, for example, popularly oriented glossaries were compiled both in the United States (Table 4, PG23) and in the United Kingdom (Table 4, PG24).

In addition to the general glossaries, specialized meteorological glossaries also started to appear at that time. These glossaries could be released not only in the form of separate publications (Table 4, PG25 and PG26) but also as supplements to other books (Table 4, PG27) or as journal articles (Table 4, PG28).

Table 4. As in Table 1, but for printed glossaries first issued since 1960. Approximate numbers of entries are in *italics*.

Code	Title	Publisher, city (state)	Editor(s); author(s)	Edition	Year	Language	No. (range) of pages	No. of entries	Figures	Review
PG19	<i>Dicționar meteorologic</i> [Meteorological Dictionary]	Institutul Meteorologic, București (Romania)	Țășteu, D., D. Bacinschi, and R. Nor	1	1965	Ro	319	1,889		
		Societatea Meteorologică Română, București (Romania)	Runcanu, T., D. Bacinschi, V. I. Pescaru, G. Makkai, and T. Tănczer	2	2014		1525	4,030		
PG20	<i>Glossaire climatologique</i> [Climatological Glossary]	Service de la Météorologie, (Canada)	Villeneuve, G. O., M. Ferland, J. G.	0	1971	F	514	5,000	No	
	<i>Glossaire de météorologie et de climatologie</i> [Glossary of Meteorology and Climatology]	Les Presses de l'Université Laval, (Canada)	Frechette, R. Gagnon, P. Gosselin, and R. Perrier	1	1974		560	6,000		Rigby (1975)
			Villeneuve, G. O.	2	1980 ^a		651	6,000		
PG21	<i>Meyers kleines Lexikon Meteorologie</i> [Meyer's Little Lexicon of Meteorology]	Meyers Lexikonverlag, Mannheim (Germany)	Schirmer, H., W. Buschner, A. Cappel, H. G. Matthäus, and M. Schlegel	1	1987	G	496	3,800	Yes	
PG22	<i>Meteorologický slovník výkladový a terminologický</i> [Meteorological glossary interpretive and terminological]	Academia, Praha (Czechia)	<i>Sobišek, B.</i> ; 37 contributors	1	1993	Cz	594	4,111	No	
PG23	<i>Glossary of Weather and Climate</i>	American Meteorological Society, Boston (United States)	<i>Geer, I. W.</i> ; Ginger, K. M., J. M. Moran, E. J. Hopkins, R. S. Weinbeck, and D. R. Smith	1	1996	E	272		No	
	<i>Glossary of Weather, Climate and Ocean</i>	American Meteorological Society, Boston (United States)	<i>Brey, J. A., and I. W. Geer</i>	2	2014		263	3,500	No	

Table 4. (Continued).

Code	Title	Publisher, city (state)	Editor(s); author(s)	Edition	Year	Language	No. (range) of pages	No. of entries	Figures	Review
PG24	<i>Dictionary of Weather</i>	Oxford University Press, Oxford (United Kingdom)	Dunlop, S.	1	2001	E	266	Over 1,800	Yes	Anonymous (2002)
PG25	<i>Glossary of Terms Used in Agrometeorology</i>	World Meteorological Organization, Geneva (Switzerland)		0	1984 ^b	E, F	134	366	No	
				1	1990 ^c	E, F, S	223	428		
PG26	<i>A Comprehensive Glossary of Weather Terms for Storm Spotters</i>	National Weather Service, Norman (United States)	Branick, M. L.	1	1992	E		233		
				2	1996 ^d		37	313	Yes	
PG27	<i>Glossary. Global guide to tropical cyclone forecasting</i>	World Meteorological Organization, Geneva (Switzerland)	Holland, G. J.	1	1993 ^e	E	9 (9.5–9.13)	82	No	
				2	2017 ^f		13 (384–396)	95		
PG28	<i>A Glossary for Biometeorology</i>	<i>Int. J. Biometeor.</i> , 58, 277–308.	Gosling, S. N., et al.	1	2014 ^g	E	32	171	Yes	
PG29	<p> <i>Dicționarul fenomenelor atmosferice</i> [Dictionary of Atmospheric Phenomena]. In: <i>Terminologia meteorologică românească a fenomenelor atmosferice (științific vs popular)</i>, 711 pp. </p> <p> <i>Dicționarul fenomenelor atmosferice</i> [Dictionary of Atmospheric Phenomena] </p>	<p> Editura Universității "Alexandru Ioan Cuza," Iași (Romania) </p>	<p> Florescu, C.; Florescu, C., L. Manea, E. Tamba, A. Pricop, C. Cărbuș, L. Apostol, F. Olariu, and M. I. Patrașcu </p>	1	2015	Ro	354 (325–678)	1,500	No	Butnaru (2017)
				2	2018		506	1,500		

^a <https://books.google.cz/books?id=ajk1Y5VdbrAC>^b https://library.wmo.int/index.php?lvl=notice_display&id=12153#_YtgI851KiUl^c https://library.wmo.int/index.php?lvl=notice_display&id=10872#_YtgI851KiUl^d <http://w1npp.org/wx1gyx.org/manuals/glossary.pdf>^e https://library.wmo.int/doc_num.php?explnum_id=9598^f https://library.wmo.int/doc_num.php?explnum_id=5736^g <https://link.springer.com/article/10.1007%2Fs00484-013-0729-9>

Nevertheless, new editions of existing glossaries were even more important in this period. While the Russian glossary (Table 3, PG12) was no longer updated after Chromov's death, the British (Table 1, PG03) and Japanese (Table 3, PG16) glossaries received one more re-edition at the beginning of the 1990s. In 1992, the WMO published the second edition of its *International Meteorological Vocabulary*; until his death, the American meteorologist M. Rigby chaired the works on this volume, and Canadian meteorologists played an important role in its completion. In comparison with the previous edition, the structure was substantially simplified; the UDC was abandoned and the entries with definitions in four languages were arranged in English alphabetical order.

Only 1 year later, a past president of the AMS, W. A. Baum, initiated the foundation of the Committee on the New *Glossary of Meteorology* by the AMS. The work lasted for 7 years, and the number of main contributors to the second edition was exactly the same as that to the previous edition. Nevertheless, the main editor, T. S. Glickman, mentioned several hundred other contributing people in his acknowledgments. The result of such extensive cooperation was impressive: the second edition, which was published in 2000, comprised more than 12,000 entries (Table 3, PG17). With its simultaneously released searchable CD-ROM (Seitter et al. 2019), the history of electronic meteorological glossaries had also started.

However, the history of printed glossaries did not end. Updated editions or even new printed glossaries have still appeared in some countries, even in recent years. For example, in Romania, C. L. Florescu and seven coauthors published a linguistic study that was accompanied by a completely new, noteworthy glossary (Table 4, PG29), whose enlarged version was also issued separately in 2018. Due to the cooperation between meteorologists and linguists, this work contained not only meteorological explanations of terms but also notes on their origin, development, etc. Only 1 year before, an older Romanian glossary (Table 4, PG19) had been significantly updated. Like some other glossaries, it contained, in addition to definitions, equivalents in foreign languages; thus, it could also serve as a meteorological dictionary.

Printed dictionaries

The demand for the conversions of meteorological terms into different languages was perceived at the end of the nineteenth century. The authors of any meteorological dictionary had to deal with the question of the order in which the terms should be sorted. If the terms were arranged alphabetically in the language of the country in which the dictionary was published, this helped scientists publish in the foreign language and/or facilitated access to the domestic literature for people from other nations. In contrast, if the terms were arranged alphabetically in the language of a foreign country, then the dictionary was useful mainly as a tool for translating foreign language publications.

Initially, Western countries were slow to create any meteorological dictionary, despite the abovementioned IMC's 1879 resolution in Rome. It was halfway around the world, in Japan, that the first dictionary emerged (Table 5, PD01); K. Nakamura published it in parts between December 1893 and April 1895 in 13 issues of the *Journal of the Meteorological Society of Japan*. The alphabetical order of terms according to English reveals that the dictionary was an aid in reading English texts. For a long time, this work remained the only known meteorological dictionary.

Two decades later, Talman (1913) called for the creation of an international commission on terminology to be housed under the International Meteorological Committee, but World War I froze any such initiative. As already mentioned, this idea reappeared in 1919 at the subsequent conference in Paris. At this conference, directors of meteorological services were asked to compile lists of equivalents in their languages to the English terms given in the *Meteorological Glossary* (Table 1, PG03). However, as only Danish, Dutch, and Swedish directors fulfilled the task (Fontserè 1948), the dream of a universal international dictionary faded

Table 5. As in Table 1, but for printed dictionaries first issued until 1939. Approximate numbers of terms with equivalents are in italics.

Code	Title	Publisher, city (state)	Editor(s); author(s)	Edition	Year	Language	No. (range) of pages of the dictionary	No. of terms with equivalents	Languages of equivalents	Review
PD01	Kishō-gaku no yōgo [Meteorological Terminology]	<i>Journal of the Meteorological Society of Japan</i> , vol. 12–14.	Nakamura, K.	1	1893–1895 ^a	J	30	785	E–J	
PD02/ PG03	<i>Meteorological Glossary</i>	Meteorological Office, London (United Kingdom)		2	1930 ^b	E	32 (202–233)	319	E–Da, Du, F, G, It, No, Por, S, Sw	W.E.W. (1932)
		Chemical Publ. Com., New York (United States)		3a	1939 ^c		28 (226–253)			Stone (1941)
				3b	1940					
PD03/ PG04	<i>Lexique météorologique</i> [Meteorological Lexicon]	Office national météorologique de France, Paris (France)	<i>Baldit, M.</i>	1	1931	F	36 (vol. 7)	500	F–Cz, E, Es, G, It, Pol, Por, Ro, S, Se, Sw	
PD04	Meteorologisches Wörterbuch [Meteorological Dictionary]. In: Linke, F. (ed.): <i>Meteorologisches Taschenbuch</i> , 2nd vol., 336 pp.	Akademische Verlagsgesellschaft, Leipzig (Germany)	Kassner, C., C. F. Talman, and P. Wehrle	1	1933	G	17 (266–282)	620	G–E, F	Anonymous (1934)
PD05	Sechssprachisches meteorologisches Wörterbuch [Meteorological Vocabulary in Six Languages]. In: Linke, F. (ed.): <i>Meteorologisches Taschenbuch</i> , 3rd vol., 268 pp. ... In: Baur, F. (ed.): <i>Linkes meteorologisches Taschenbuch</i> , the new series, 1st vol., 360 pp. ... In: Baur, F. (ed.): <i>Meteorologisches Taschenbuch</i> , the new series, 1st vol., 2nd ed., 806 pp.	Akademische Verlagsgesellschaft, Leipzig (Germany)	Bergeron, T., C. E. P. Brooks, W. Mörikofer, G. Lincke, W. Knoche, and V. Romanovskaja–Bergeron	1a	1938	G	124	2,251	G–E, F, It, R, S	Anonymous (1939)
				1b	1951		124 (142–265)	2,251		Anonymous (1952)
			Zimmerschild, W., E. Unglaube, N. L. Veranneman, O. Vannini, and A. M. Megenine	2	1962		204 (417–620)	2,472	G–E, F, It, R, S; E–G	Lettau (1964)

^a https://doi.org/10.2151/jmsj1882.12.12_549^b https://digital.nmla.metoffice.gov.uk/IO_2c9f9aec-e469-485c-bd0d-f1b4ea51eb83/^c https://digital.nmla.metoffice.gov.uk/IO_311dce15-970f-498d-9cbb-a53efe386e15/

again. Nevertheless, the initiative was taken over by three European countries that represented the three languages of the science of the time: English, French, and German (Gordin 2015).

First multilingual dictionaries until the outbreak of World War II. After the failed attempt at creating an international meteorological vocabulary, the International Meteorological Committee asked the British Met Office to add a multilingual dictionary to a possible future edition of its *Meteorological Glossary*. This occurred in 1930, when the Met Office supplemented the second edition of the glossary with a list of the equivalents of some English terms in nine other languages (Table 5, PD02). However, finding the equivalents themselves was almost impossible because the terms were arranged alphabetically only in English.

Meanwhile, the French meteorological service started to publish its *Lexique météorologique* [Meteorological Lexicon]. In the preface, E. Delcambre announced that the work would contain a dictionary in six languages. Finally, the seventh volume, issued in 1931, became the dictionary that claimed alphabetically arranged French terms with equivalents in 11 other languages (Table 5, PD03). Instead of Dutch and Scandinavian terms presented in the British glossary, the French lexicon included terms in Eastern European languages and in Esperanto, which at that time was still believed to become the international scientific language.

In the same year, F. Linke started to publish his famous series of handbooks, *Meteorologisches Taschenbuch*, in Germany, with two multilingual dictionaries (Table 5, PD04 and PD05) implemented into the second and third volumes in 1933 and 1938, respectively. The latter dictionary became the most comprehensive meteorological dictionary at that time, with as many as 2,251 German terms with equivalents in five other languages.

The arrangement of all the multilingual dictionaries in alphabetical order of their languages suggests that their authors intended primarily to make the texts in their languages available to other nations. Nevertheless, when W. Zimmerschild updated and enhanced the German multilingual dictionary (Table 5, PD05) in 1962, he added to it an alphabetical index in English which proved the increasing dominance of English after World War II.

War and postwar dictionaries. During World War II, the demand for understanding weather reports by other nations motivated the creation of bilingual dictionaries, which were sometimes arranged in both languages (Table 6, PD06), but were more often only in the alphabetical order of foreign languages (Table 6, PD07, PD08, and PD09). Another such motivation was declared by E. Fontserè, who intended to enable Catalan scholars to understand English and French texts through respective dictionaries (Table 6, PD10), which were added to his glossary. An analogous motivation mentioned W. A. Baum in the preface to his comprehensive Russian–English dictionary (Table 6, PD11). Bilingual dictionaries also started to appear in bilingual countries, with terms being ordered according to both the respective languages (Table 6, PD12 and PD13).

At least one new multilingual dictionary also originated shortly after World War II. A. Bellisario published his Italian dictionary in the journal *Rivista di Meteorologia* (Table 6, PD14). Due to the arrangement of terms with respect to Italian only, the dictionary resembles dictionaries from the 1930s.

In 1955, in Argentina, D. Brazol compiled a Spanish and English dictionary (Table 6, PD15) whose structure is worth mentioning. Purely meteorological terms were contained only in the first chapter, which accounted for more than half of the content. The chapter was further thematically divided into 19 sections, which made it possible to check related terms. Only in these sections were the terms arranged alphabetically; thus, it was difficult to find some terms, as stated in the review of the dictionary. This attempt at a thematic arrangement of the terms was reminiscent of international activities that had already been in progress at that time.

Table 6. As in Table 1, but for printed dictionaries first issued between 1940 and 1958. Approximate numbers of terms with equivalents are in *italics*.

Code	Title	Publisher, city (state)	Editor(s); author(s)	Edition	Year	Language	No. (range) of pages of the dictionary	No. of terms with equivalents	Languages of equivalents	Review
PD06	<i>Polish meteorological compendium</i>	Meteorological Office, London (United Kingdom)		1	1941	E	64	1,500	E-Pol; Pol-E	
PD07	<i>Rowa kishō yōgo jiten</i> [Russian-Japanese Meteorological Dictionary]	Tōa Kenkyūjo, Tokyo (Japan)		1	1942	J	141	4,000	R-J	
PD08	<i>Russian-English Dictionary of Meteorological and Related Terms</i>	U. S. Weather Bureau, Washington DC. (United States)		1	1943 ^a	E	65	2,000	R-E	Schell (1943)
PD09	<i>Japanese-Chinese-English Dictionary of Aeronautical and Meteorological Terms</i>	G. E. Stechert and Co., New York (United States)	Gerr, S.	1	1945	E	439	2,000	J-E	Frauchiger (1946)
PD10/ PG09	<i>Assaig d'un vocabulari meteorologic català</i> [Essay on a Catalan meteorological vocabulary]	Institut d'Estudis Catalans, Barcelona (Catalonia, Spain)	Fontserè, E.	1	1948 ^b	Cat	11 (71-81)	552 (E), 298 (F)	E-Cat; F-Cat	
PD11	<i>Russian-English Dictionary of Meteorological Terms and Expressions</i>	Hobart, Washington DC. (United States)	Baum, W. A.	1	1949 ^c	E	126	6,000	R-E	
PD12	<i>Tweetalige weekkundige woordelys: Engels-Afrikaans; Afrikaans-Engels</i> [Bilingual Meteorological Glossary: English-Afrikaans; Afrikaans-English]	South Africa Weather Bureau, Pretoria (South Africa)	Büning, Tj.	1	1949	Afr	68	1,800	E-Afr; Afr-E	
PD13	<i>Meteorologische woordenlijst nederlands-frans; Vocabulaire meteorologique français-néerlandais</i> [Meteorological Vocabulary Dutch-French, French-Dutch]	L'Avenir, Koninklijk Meteorologisch Instituut van België, Bruxelles (Belgium)	van Mieghem, J.	1	1951	Du, F	84	1,200	Du-F; F-Du	
PD14	<i>Terminologia meteorológica</i> [Meteorological Terminology]	<i>Rivista di Meteorologia: aeronautica</i> , 11 (2)	Bellisario, A.	1	1951	It	17	700	It-E, F, S	
PD15	<i>Diccionario de términos meteorológicos y afines</i> [Dictionary of Meteorological and Related Terms]	Librería Hachette, Buenos Aires (Argentina)	Brazol, D.	1	1955	S	557	8,000	S-E; E-S	J.M.R. and O.M.A. (1956)

^a https://books.google.cz/books?id=05k_AAAAIAAJ

^b <https://books.google.cz/books?id=AGQgk-ZNzj0C>

^c <https://babel.hathitrust.org/cgi/pt?id=coo.31924002957151>

Indexes of foreign language equivalents in meteorological glossaries since 1959. Hopes for an international multilingual dictionary shone again at the beginning of the 1950s, when the CBP by the WMO intended to compile a dictionary as an extension to an international meteorological glossary. The first draft of the dictionary, which was called the “Polyglot Meteorological Vocabulary” at that time, was prepared by the French delegation for the first session of the CBP in 1953. In the second session of the CBP in 1957, the name of the intended dictionary changed to “Multilingual Meteorological Nomenclature” (WMO 1958); however, it has never been produced in fact. The working group on terminology only managed to create the abovementioned glossary named the *International Meteorological Vocabulary* with thematically ordered terms. It contained alphabetically arranged indexes of terms in English, French, Russian, and Spanish; thus, it could also be used as a dictionary (Table 7, PD16).

Nevertheless, because the international vocabulary remained limited to only four languages, other works were necessary to cover the gap. As already mentioned, many meteorological glossaries were used for translations between languages because their entries contained equivalents in at least one other language; to enable searching for the equivalents, the authors usually added indexes at the end of their works. For example, Japanese glossaries edited by K. Wadachi (Table 7, PD17 and PD18) as well as French glossaries from Quebec (Table 7, PD19) contained English equivalents of the terms within the entries; indexes in the English alphabetical order were added at the end. Moreover, in some countries, contacts with other languages were also important for historical or political reasons. For example, both the Romanian and Czech glossaries from 1965 and 1993, respectively, contained the equivalents of terms in five other languages (Table 7, PD20 and PD21). Not only general but also specialized meteorological glossaries could contain equivalents in other languages (Table 7, PD22).

Bilingual dictionaries since 1959. Separately issued bilingual dictionaries continued to be published as well. In his inventory of meteorological glossaries and dictionaries, Quiroz (1958) mentioned 13 such works, Marton (1964) added 7 more, and many others have appeared since then. In such dictionaries, terms used to be arranged in the alphabetical order of the foreign language if both indexes were not present. For example, three dictionaries between Russian and English appeared in 1959, namely, a Russian–English dictionary (Table 8, PD23) in the United States and two English–Russian dictionaries (Table 8, PD24 and PD25) in the Soviet Union; another dictionary appeared 10 years later (Table 8, PD26). Similar dictionaries were compiled for other languages as well, for example, German–Russian dictionaries in 1959 and in 1973 (Table 8, PD27 and PD28) and a French–Russian dictionary in 1978 (Table 8, PD29).

A specific situation occurred in Quebec, Canada, in the 1970s due to new Canadian laws that required equal treatment in all government publications for both French and English (Rigby 1975). Thus, not only did G. O. Villeneuve add an English–French dictionary (Table 7, PD19) to his abovementioned glossary, but G. J. Proulx also compiled another even more comprehensive dictionary in the same year (Table 8, PD30). To allow mutual translations between the two languages, the dictionary consisted of two parts, with the terms alphabetically arranged according to both languages.

Electronic glossaries and dictionaries

Repeated updates or even compilations of new meteorological glossaries and dictionaries clearly show that meteorological terminology in any language is a living organism; new terms constantly appear, while others gradually become obsolete. Thus, the start of the electronic era in the new millennium was as important in the history of meteorological terminology as the invention of book printing was in the history of literature. Whereas printed glossaries and dictionaries can

Table 7. As in Table 1, but for foreign-language indexes presented in printed meteorological glossaries since 1940. Approximate numbers of terms with equivalents are in *italics*.

Code	Title	Publisher, city (state)	Editor(s); author(s)	Edition	Year	Language	No. (range) of pages of the dictionary	No. of terms with equivalents	Languages of equivalents	Review
PD16/ PG18	<i>International Meteorological Vocabulary</i>	World Meteorological Organization, Geneva (Switzerland)	(A. Vandenplas) (A. Vandenplas)	0 1 2	1959 1966 1992 ^a	E, F E, F, R, S	 58 (219–276) 784	2,000 2,200 3,517	E–F–R–S	Sutcliffe (1967) Anonymous (1993)
PD17/ PG15	<i>Kishō jiten</i> [Dictionary of Meteorology]	Tennensha, Tokyo (Japan)	Wadachi, K.	1 2	1954 1957	J J	20 24	2,000 2,400	J–E; E–J	
PD18/ PG16	<i>Kishō no jiten</i> [Encyclopedia of Meteorology]	Tōkyōdō, Tokyo (Japan)	Wadachi, K.; 39 authors	3	1974	J	46 (659–704)	3,344	J–E; E–J	
PD19/ PG20	<i>Glossaire climatologique</i> [Climatological Glossary] <i>Glossaire de météorologie et de climatologie</i> [Glossary of Meteorology and Climatology]	Service de la Météorologie, (Canada) Les Presses de l'Université Laval, (Canada)	Villeneuve, G. O., M. Ferland, J. G. Frechette, R. Gagnon, P. Gosselin, and R. Perrier Villeneuve, G. O.	0 1 2	1971 1974 1980 ^b	F F	138 (4th vol.; 377–514)	5,000 6,000 6,000	F–E; E–F	Rigby (1975)
PD20/ PG19	<i>Dictionar meteorologic</i> [Meteorological Dictionary]	Institutul Meteorologic, București (Romania)	Țăstea, D., D. Bacinschi, and R. Nor	1	1965	Ro		1,889	Ro–E, F, G, R, S; E, F, G, R, S–Ro	
PD21/ PG22	<i>Meteorologický slovník</i> [Meteorological glossary interpretive and terminological]	Societatea Meteorologică Române, București (Romania)	Runcanu, T., D. Bacinschi, V. I. Pescaru, G. Makkai, and T. Tânczer	2	2014	Ro	329 (1169–1497)	4,030	Ro–E, F, G, Hu, R, S; E, F, G, Hu, R, S–Ro	
PD21/ PG22	<i>Meteorologický slovník</i> [Meteorological glossary interpretive and terminological]	Academia, Praha (Czechia)	Sobíšek, B.; 37 contributors	1	1993	Cz	164 (431–594)	4,000	Cz–E, F, G, R, Sk; E, F, G, R, Sk–Cz	
PD22/ PG25	<i>Glossary of Terms Used in Agrometeorology</i>	World Meteorological Organization, Geneva (Switzerland)		0 1	1984 1990	E, F E, F, S	134 223	366 428	E–F, F–E E–F–S	

^a https://library.wmo.int/?I/=notice_display&id=220#.YTiKt51KiUl^b <https://books.google.cz/books?id=ajk1Y5VdbrAC>

Table 8. As in Table 1, but for printed dictionaries first issued since 1959. Approximate numbers of terms with equivalents are in italics.

Code	Title	Publisher, city (state)	Editor(s); author(s)	Edition	Year	Language	No. (range) of pages of the dictionary	No. of terms with equivalents	Languages of equivalents	Review
PD23	<i>Russian–English Glossary of Physics of Fluids and Meteorology</i>	Interlanguage Dictionary Publishing Corp., New York (United States)	Emin, I., and S. Noveck	1	1959 ^a	E	93	3,500	R–E	
PD24	<i>Anglo–russkij meteorologicheskij slovar</i> [English–Russian Meteorological Dictionary]	Gidrometeoizdat, Leningrad (Soviet Union)	Mamontova, L. I., and S. P. Chromov	1	1959	R	172	6,000	E–R	
PD25	<i>Anglo–russkij meteorologicheskij slovar</i> [English–Russian Meteorological Dictionary]	Gosudarstvennoye izdatel'stvo fizicheskoy i matematicheskoy literatury, Moscow (Soviet Union)	Astapenko, P.; Ainbinder, M., N. Allenova, N. Gall, and L. Savina	1	1959	E, R	244	7,000	E–R; R–E	
PD26	<i>Anglo–russkij meteorologicheskij slovar</i> [English–Russian Meteorological Dictionary]	Gidrometeoizdat, Leningrad (Soviet Union)	Gejber, I. P.	1	1969	R	448	25,000	E–R	
PD27	<i>Nemecko–russkij meteorologicheskij slovar</i> [German–Russian Meteorological Dictionary]	Gidrometeoizdat, Leningrad (Soviet Union)	Belinskij, V. A.	1	1959	R	237	14,000	G–R	
PD28	<i>Nemecko–russkij meteorologicheskij slovar</i> [German–Russian Meteorological Dictionary]	Gidrometeoizdat, Leningrad (Soviet Union)	Marcenko, V. G.	1	1973	R	392	28,000	G–R	
PD29	<i>Francuzsko–russkij meteorologicheskij slovar</i> [French–Russian Meteorological Dictionary]	Gidrometeoizdat, Leningrad (Soviet Union)	Silvestrov, P. V.	1	1978	R	191	12,000	F–R	
PD30	<i>Standard Dictionary of Meteorological Sciences, English–French, French–English</i>	McGill–Queen's University Press, Montréal (Canada)	Proulx, G. J.	1	1971	E, F	307	Over 12,000	E–F; F–E	Rigby (1971)

^a <https://babel.hathitrust.org/cgi/pt?id=uc1.31822006511471>

only be updated with a new edition, electronic publishing on the Internet enables constant updates. Thus, the works become easily accessible for any user in the most recent form.

Online glossaries and dictionaries can remain static documents or become fully digitalized, which further significantly simplifies the work due to interactive links between terms and full text searches. The latter function also partly solves the problem of uncertain ordering of words in compound terms. In general, Romance languages use the form of placing adjectives behind the noun, while the opposite is true in English, German, and many other languages (e.g., “humidité absolue” in French vs “absolute humidity” in English). However, the direct format inappropriately prevents related terms (e.g., absolute, relative, and specific humidity) from being arranged one after another. A full-text search of a noun within the available terms enables the display of such a group of terms. Even better progress in this matter can be achieved through the thematic filtering of terms; however, this function is not yet very widespread among meteorological glossaries.

Electronic glossaries. The tendency toward the collective authorship of meteorological glossaries has further intensified in the electronic era. The online *Glossary of Meteorology* by the AMS (Table 9, EG01) is undoubtedly the most comprehensive meteorological glossary in the world; it originated when the second edition of the *Glossary of Meteorology* (Table 3, PG17) was published in 2000 both as a book and a searchable CD-ROM (Seitter et al. 2019). Placed on the Internet, this version was initially available to AMS members only; however, since 2012, it has become fully accessible to everyone. The online glossary is now a living document that is administered by an editorial staff that is led by a chief editor and an assistant who coordinates the efforts on updating and revising the existing terms and adding new terms according to the 36 scientific and technological activities commissions of the AMS. Some recently added entries contain not only explanations of terms with links to related terms but also references to the literature or even a figure [see an example documented by Ralph et al. (2018)].

Many other electronic glossaries also exist in English. Most of them are more popularly oriented, such as the National Weather Service (NWS) Glossary (Table 9, EG02), which is motivated by the effort to increase the understanding of NWS products and services by the general public. Similarly, although less comprehensive glossaries are usually compiled by the meteorological services of other English-speaking countries, such as Australia and Canada (Table 9, EG03 and EG04), the latter enables switching between the English and French versions. The Glossary of Meteorology on Wikipedia (Table 9, EG05) and the electronic version of the glossary by S. Dunlope (Table 9, EG06) can also be counted in this group of glossaries. Moreover, specialized electronic meteorological glossaries, such as the glossary of terms related to tropical cyclones by the National Hurricane Center (Table 9, EG07) or the online version of the printed “Spotter Glossary” (Table 9, EG08), also exist.

As in the United States, online glossaries in other countries used to be administered most frequently by weather services or meteorological societies due to the collective efforts of their staff or members, respectively. The French glossary by MétéoFrance (Table 9, EG09) and the Wetter- und Klimalexikon by the Deutscher Wetterdienst (Table 9, EG10) have several common features. The number of explained terms is not very high, but many entries are very comprehensive. Some entries in the French glossary are interestingly structured into two or even three parts that are designed for general, advanced, and expert readers. The German glossary is supplemented with figures, tables, and links for further reading. Unfortunately, neither of the glossaries contains the English equivalents of the terms.

Regarding less common languages, some of them have online meteorological glossaries as well. For example, an updated Czech glossary was published online in 2015 and became fully electronic 3 years later (Table 9, EG11). The efforts of a terminological group of the Czech Meteorological Society enabled a substantial improvement in the electronic version compared

Table 9. Selected electronic meteorological glossaries. The glossaries are arranged in the order in which they are mentioned in the text and referenced by the code. For the abbreviations of languages see Table 2.

Code	Title	Publisher	Country	Language
EG01	Glossary of Meteorology ^a	American Meteorological Society	United States	E
EG02	National Weather Service Glossary ^b	NOAA/National Weather Service	United States	E
EG03	Glossary ^c	Australian Government, Bureau of Meteorology	Australia	E
EG04	Weather and Meteorology Glossary ^d	Government of Canada	Canada	E, F
EG05	(Wikipedia) Glossary of Meteorology ^e	Wikipedia, the free encyclopedia		E
EG06	Dictionary of Weather ^f	Oxford University Press	United Kingdom	E
EG07	Glossary of NHC Terms ^g	NOAA/National Hurricane Center	United States	E
EG08	A Comprehensive Glossary of Weather Terms for Storm Spotters ^h	NOAA/National Weather Service	United States	E
	Diccionario de Términos Meteorológicos para Observadores de Tormentas [A Comprehensive Glossary of Weather Terms for Storm Spotters] ⁱ	NOAA/National Weather Service, Miami, South Florida Weather Forecast Office	United States	S
EG09	Glossaire [Glossary] ^j	Météo France	France	F
EG10	Wetter- und Klimalexikon [Lexicon of Weather and Climate] ^k	Deutscher Wetterdienst	Germany	G
EG11	Elektronický meteorologický slovník [Electronic Meteorological Glossary] ^l	Czech Meteorological Society	Czechia	Cz

^a <https://glossary.ametsoc.org/wiki/Welcome>

^b <https://w1.weather.gov/glossary/>

^c www.bom.gov.au/lam/glossary/

^d www.canada.ca/en/environment-climate-change/services/weather-general-tools-resources/glossary.html

^e https://en.wikipedia.org/wiki/Glossary_of_meteorology

^f www.oxfordreference.com/view/10.1093/acref/9780199541447.001.0001/acref-9780199541447

^g www.nhc.noaa.gov/aboutgloss.shtml

^h www.weather.gov/oun/spotterglossary

ⁱ www.weather.gov/oun/diccionario_terminos_meteorologicos

^j <http://files.meteofrance.com/files/glossaire/FR/glossaire/>

^k www.dwd.de/DE/service/lexikon/lexikon_node.html

^l <http://slovník.cmes.cz/>

to the printed glossary. Apart from the alphabetic order presentation of more than 4,500 terms, the glossary also enables the thematic filtering of terms. Its classification consists of more than 250 classes of terms, which are organized into up to six hierarchical levels. Moreover, the glossary recently introduced another additional feature. In cooperation with linguists, entries now include remarks on the origin of the terms both from the historical and the etymological point of view. The glossary is also supplemented by indexes of equivalents in five languages; thus, it can also play the role of an electronic dictionary.

Electronic dictionaries and terminological databases. Like glossaries, meteorological dictionaries can also benefit from conversion into electronic versions because doing so enables the continuous addition of new terms with equivalents and makes the searching of terms much easier. Moreover, using a database system solves the problem of ordering the terms; thus, the dictionary becomes universally useful.

In 2010, the WMO published its terminological database, called Meteoterm (Table 10, ED01). Meteoterm comprises terms in six WMO working languages (Arabic, Chinese, English,

Table 10. As in Table 9, but for electronic dictionaries.

Code	Title	Publisher	Country	Language
ED01	Meteoterm ^a	World Meteorological Organization		E–Ar–Ch–F–R–S
ED02	UNTERM ^b	United Nations		E–Ar–Ch–F–R–S
ED03	English–Spanish Dictionary ^c	NOAA/National Weather Service, Miami, South Florida Weather Forecast Office	United States	E–S
ED04	COMET English–Spanish Glossary of Meteorology and Hydrology Terms ^d	University Corporation for Atmospheric Research	United States	E–S
ED05	TERMIUM Plus ^e	Government of Canada	Canada	E–F–Por–S
ED06	Base de datos de glosarios trilingües [Trilingual glossary database] ^f	Asociación de Autores Científico-Técnicos y Académicos	Spain	E–F–S
ED07	Diccionario de meteorologia [Dictionary of Meteorology] ^g	TERMCAT, Centre de Terminologia	Catalonia, Spain	Cat–E–F–S

^a <https://public.wmo.int/en/resources/language%20resources/meteoterm>

^b <https://unterm.un.org/unterm/portal/welcome>

^c www.weather.gov/mfl/EngSpaDict

^d www.meted.ucar.edu/resources_gloss.php

^e www.btb.termiumpius.gc.ca/

^f www.acta.es/recursos/glosarios-especializados/glosarios-trilinguees

^g www.termcat.cat/en/diccionaris-en-linia/249

French, Russian, and Spanish); the total number of terms (in all the languages) was approximately 42,500 at the time of its release. The main source of the meteorological content was the *International Meteorological Vocabulary* (Table 3, PD16); many terms also came from the dictionary by G. J. Proulx (Table 8, PD30). Depending on the source, the entries contain either brief definitions or only their equivalents in other languages. Since 2020, Meteoterm has been implemented in a general terminological database called UNTERM that is controlled by the United Nations (Table 10, ED02).

Bilingual or multilingual electronic meteorological dictionaries have also originated in individual countries. For example, the U.S. National Weather Service publishes the English–Spanish Dictionary (Table 10, ED03); however, this work only partially corresponds to the electronic glossary in English (Table 9, EG02). Additionally, a much more comprehensive COMET English–Spanish Glossary of Meteorology and Other Terms (Table 10, ED04) has been created by the University Corporation for Atmospheric Research. Although this work still has the form of a Microsoft Word file, it is very interesting, among other things, because it distinguishes its entries according to topics.

Apart from exclusively meteorological dictionaries, some countries maintain general databases of terms in their languages, in which meteorological terms can form one thematic part of the database. For example, the government of Canada maintains not only an online meteorological glossary (Table 9, EG04) but also a terminology and linguistic data bank, TERMIUM Plus (Table 10, ED05), which offers equivalent terms in English, French, Spanish, and Portuguese and is divided into 24 thematic groups. One of the groups is environmental sciences, with meteorology as a subgroup. Another such general dictionary exists in Spain (Table 10, ED06), with meteorology as one of approximately one hundred specializations.

In Catalonia, many online dictionaries are administered by TERMCAT. Catalan meteorological terms with their equivalents in English, French, and Spanish can be accessed either through the general dictionary called CERCATERM or in a separate “Diccionario de meteorologia” (Table 10, ED07). Apart from the alphabetical order in one of the four languages, this

dictionary also enables thematic access to the terms. It distinguishes 35 classes of terms; most of the classes are defined by individual meteorological variables.

Conclusions.

After looking back at more than a century of the history of meteorological glossaries, we can conclude that both collective and individual efforts have contributed to their fascinating diversity. While collectively compiled British and French glossaries were the only separately issued meteorological glossaries until World War II, surprisingly, Catalan was the world's third language to have its own meteorological glossary due to an individual effort. The number of meteorological glossaries rapidly increased in the 1950s when individual authors compiled comprehensive German and Russian glossaries; however, dozens of authors contributed to glossaries in Japan and in the United States. The collective authorship approach proved to be more efficient due to the huge expansion of meteorological knowledge and terminologies that can hardly be covered by an individual.

Some meteorological glossaries could also be used for translations because they contained equivalents in at least one other language. More frequently, equivalent terms were collected in special dictionaries, among which we can distinguish two main types: multilingual dictionaries arranged alphabetically in the language of their country of origin and bilingual dictionaries with terms usually arranged in alphabetical order of a foreign language. The first type was only typical during the 1930s, when English, French, and German competed for dominance among the scientific languages. The very first meteorological dictionary, which was compiled in the 1890s in Japan, belonged to the latter type of dictionary, which has become dominant since World War II. In the 1950s, the WMO sought an international solution; however, its *International Meteorological Vocabulary* remained limited to four languages.

In 2000, the searchable CD-ROM that accompanied the second edition of the *Glossary of Meteorology* by the AMS sparked the electronic era of meteorological terminology. Since the 2010s, online versions of meteorological glossaries and dictionaries have appeared. In comparison with printed works, electronic glossaries and dictionaries cannot only be easily accessed but also, more importantly, allow the work to be constantly updated. Moreover, many practical functionalities can be implemented. The main benefits of digitalization include interactive links between terms and full-text searches, both of which make working with the glossary more comfortable. The digitalization of meteorological glossaries further strengthened the dominance of these collective efforts with respect to meteorological terminology. In most countries where online glossaries exist, the staff of the weather service or members of the meteorological society compile the national meteorological glossary. Based on the presented review and our own experiences with the Czech meteorological glossary, we present the following remarks on the possible future development of terminological works.

Regardless of the form of the glossary, authors can enrich its entries in several ways. For example, to make the glossary useful for both experts and the general public, the entries can be organized into more levels and enhanced by figures and references to offer more comprehensive reading. To enhance the understanding of the meanings of terms, the entries of the glossary can be extended with historical and etymological remarks. For these purposes, meteorological terminology can substantially benefit from interdisciplinary cooperation with those involved in the emerging field of atmospheric humanities.

We are convinced that the dominance of electronic glossaries and dictionaries will globally increase in the near future because of all the advantages mentioned above. Even technically simple solutions enable some additional functions. To update a glossary that is not fully digitalized, improvements can only be made offline, and then, the previous version is simply replaced by the new version. However, even much more advantageous is full digitization in

the form of a database. The updating of such a system can be continuous. Each entry gets a unique code, which allows one to reference it not only from other entries but also from any online documents, presentations etc. Apart from the definition, many other kinds of information can be included in the database, including the abovementioned historical and etymological notes. Moreover, digitalization has made the question of thematic access relevant again. Our opinion is that thematic filtering is a highly useful functionality not only for users but also for administrators because its use enables the improvement of relations among entries. Thus, the thematic classification of terms seems to be another way in which meteorological glossaries can be further usefully developed.

Digitalization has also opened up completely new possibilities for organizing terminological works. A wide group of contributors can be involved in the process. A web interface allows draft proposals to be commented on by the editorial board and then approved by the editor-in-chief.

International cooperation in meteorological terminology remains a major challenge. Based on the presented historical experience, we are convinced that the main efforts will remain at the national level in the future. Thus, electronic meteorological glossaries in various countries will continue to be as diverse as printed glossaries. Nevertheless, with expanding digitalization, the chances of creating a truly international meteorological dictionary are increasing due to possible linking of the codes for terms from individual national databases. We hope that in 2030, 100 years after the publication of the first multilingual meteorological dictionary, there will already be an electronic international dictionary that allows not only translations of meteorological terms, but also comparisons of their explanations in dozens of languages. We are ready to take part in this challenge.

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