NEUMAYER'S IMPACT ON METEOROLOGY IN GERMANY

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When Georg von Neumayer (1826–1909) had a practical training with Johann von Lamont (1805-1879) at the observatory at Bogenhausen (today part of Munich), he learnt not only about astronomical observations and the construction of instruments, but also about magnetic and meteorological measurements, as well as the organisation of networks of stations and the importance of publication of measured data and their analysis. When he became first Director of the Deutsche Seewarte (German Maritime Observatory) in Hamburg (1876–1903) he subsequently introduced weather telegraphy and synoptic meteorology and installed a workshop for the development and calibration of meteorological and magnetic instruments and compasses. He also initiated the establishment of a weather service in Bavaria and the aerological (kite) station at Groß Borstel close to Hamburg (1903). Under his guidance the Deutsche Seewarte soon took over a leading role in Germany, which was confirmed in Neumayer's membership in the International Meteorological Committee (1879–1888). Finally he became the founding President of the Deutsche Meteorologische Gesellschaft (German Meteorological Society) in 1883. This can be regarded as a further important step for the institutionalisation of meteorology as a discipline in Germany.

Key words: aerological station at Groß Borstel, Johann von Lamont, German Meteorological Society, synoptic meteorology, weather telegraphy

GEORG Balthasar von Neumayer was born on 21 June 1826 in Kirchheimbolanden (Palatinate), which at that time belonged to Bavaria. This may have caused his decision to go to the Polytechnical School and Engineering School in Munich for his academic education from 1845 to 1849 (Neumayer 1901). Afterwards he planned to dedicate himself to study the Earth's magnetic field especially on the southern hemisphere. This led him to some additional practical training with Johann von Lamont (1805-1879), director of the observatory at Bogenhausen (today part of Munich) during winter 1849/50. Lamont had been a member of the Göttinger Magnetischer Verein (Göttingen Magnetic Association, 1836-1841) and had just published his textbook on earth-magnetism (Lamont 1849a).

PRACTICAL TRAINING AT THE OBSERVATORY IN BOGENHAUSEN

During his stay at the observatory in the little village of Bogenhausen east of Munich, Neumayer was trained by Lamont not only in astronomical observations and magnetic measurements but also in meteorology. Since 1 August 1840 Lamont and his assistants performed hourly magnetic and meteorological observations throughout the whole day, which included temperature, pressure, haze pressure (a measure of air humidity) and wind direction (Lamont 1849b). Already in 1838 Lamont had developed registering instruments like barograph, thermograph, hygrograph and magnetometers, using a cylinder made of tin with a layer of black soot, on which the data were inscribed as dots. Neumayer could learn something about the construction of these instruments and the evaluation of data measured, when he was working at the observatory. At that time Lamont was planning to perform a magnetic and meteorological survey of the kingdom of Bavaria (Lamont 1849c). Within three summers he wanted to make two cross-sections, one from south to north and the other from west to east. This may have become an example for Neumayer's later investigation of Victoria (Australia). We can also act on the assumption that Neumayer was familiar with Lamont's recent publications and that he also knew about the contents of Lamont's annual report for 1850, printed in 1852. In one of his papers in these publications, Lamont described the temperature conditions in Bavaria (Lamont 1849d). In the introduction he discussed the difference of temperature measurements at various places in the shadow on the north side of the observatory, which resulted in differences

up to over 2°R. This was interpreted as very slow compensation of the air. Lamont concluded that single measurements or short time series were useless and that long-time measurements at one location were needed to compensate an accidental deviance. Besides, he recognised a temperature difference between big cities and open landscapes, with higher temperatures and smaller variations in the city of Munich in comparison with the village of Bogenhausen, which averaged 1.45°R. Nevertheless, Lamont knew that the yearly variance could be much higher, which he underlined by the publication of the most comprehensive temperature observations known in those days, performed at Regensburg from 1774–1834. The yearly mean value ranged between 5.09°R in 1815 and 8.33°R in 1794. Lamont concluded that long-term series of simultaneous temperature measurements at different locations are needed to determine local influences in respect to a central station like his observatory at Bogenhausen. In this context he published meteorological observations from Hohenpeißenberg, a mountain 977 m high, south of Munich in the foothills of the Alps, and some other data from Bavarian stations of the former Societas Meteorologica Palatina (Palatine Meteorological Society) of 1780-1795, which had been founded recently (Lamont 1849e). Besides, Lamont also published actual meteorological observations at 12 Bavarian stations, including a description of the instruments and their calibration, and some mean values of pressure and temperature in respect to measurements in Munich (Lamont 1852a). He concluded that the publication of mean values and monthly extreme values as practised by the Bavarian Academy of Sciences for the period (1781–1789) was not useful at all to investigate the propagation of atmospheric movements (Baierische Ephemeriden 1782-1794). Finally, he gave a short report on a telegraphic connection between the observatory and the Central Station of Telegraphy in Munich, which had been realised recently (Lamont 1852b). An extended list of Lamont's meteorological publications is given in Hellmann (1883). Lamont's influence can be clearly seen in the foundation of the Flagstaff Observatory in Melbourne, which Neumayer directed from 1857–1864.

IMPERIAL ADMIRALTY IN BERLIN

After his return from Australia, Neumayer participated in the first meeting of German geographers in Frankfurt in 1865. This gave him a good opportunity to suggest the foundation of a nautical-meteorological institute for Northern Germany after the model of the Flagstaff Observatory (Neumayer 1865, 1901: 34-42), but at that time no action was taken. A new attempt was made after the Foundation of the German Reich, when Neumayer and his colleague Wilhelm von Freeden (1822–1894), founder of the Norddeutsche Seewarte (Northern German Maritime Observatory), published a plan for the establishment of a German Maritime Observatory (Neumayer & Freeden 1871). But in 1875, before this could be realised, Neumayer became hydrographer at the Hydrographic Bureau of the Imperial Admiralty in Berlin on 1 July 1872 due to his expertise in compensation of compasses for ship navigation (Köppen 1909). Although working in a military office Neumayer as a civilian had all the freedom he needed to develop his ideas, which showed his pronounced organisational talent. In 1873 he started the series *Hydrographische Mitteilungen* (Hydrographic Messages), which was instrumental to develop a scientific base for hydrography in Germany. His most important contribution to the Admiralty of the young German Navy became the organisation of the circumnavigation of the world with the *SMS Gazelle* (1874–1876). He wrote the instructions for various scientific investigations, among them the observation of the transit of Venus on 9 December 1874 on Kerguelen in the southern Indian Ocean. From discussions with Lamont, Neumayer knew about the importance of this observation to determine the distance between the Sun and the Earth called Astronomical Unit. Later on Neumayer planned the exploration of the coast of Kerguelen, when meteorological and magnetic measurements were taken during a period of three months at a temporary station on land. Besides these official activities, Neumayer helped to establish the firm of the meteorological instrument maker Greiner & Geißler in Berlin, which later was taken over by the well-known optical industry R. Fuess.

When a meeting of meteorologists was organised at Leipzig in 1872, Neumayer was among the 52 participants to share their opinions on introducing greater uniformity in meteorological measurements on an international basis (Bericht 1872). The agenda covered observation techniques including calibration of instruments, hours of observation, scales and units, as well as the calculation of mean values, publication of the results and data exchange by telegraph. Neumayer participated actively in the discussions by

giving many examples from his own experiences in Australia (Fig. 1).

In 1873, during the 1st International Meteorological Congress in Vienna, 32 delegates of meteorological services discussed instruments and the international organisation of observation. Neumayer was among seven German delegates and acted as secretary, having to prepare the German report of the conference (Bericht 1873). Besides, he became a member of the Commission on Weather Telegraphy and Gale Warning and gave a report of the results of its meeting. During this conference Neumayer met the Norwegian meteorologist Hendrik Mohn (1835–1916) from Christiania (today Oslo) and the young German-Russian Wladimir Köppen (1846–1940), who was assistant at the Physical Central Observatory in St. Petersburg and participated as a guest.

Fig. 1. Georg Neumayer at about 1879 (Source: BSH, Hamburg).

Neumayer's meeting with Mohn during the congress was a very lucky coincidence. By intuition Neumayer knew that Mohn's recent textbook with the Dutch title *Om Vind og Veir* would be very important for improving meteorology in Germany. Thus he could convince Mohn to prepare a new German edition, which finally was published in Berlin under the title *Grundzüge der Meteorologie* (Main Features of Meteorology) (Mohn 1875). This became, so to speak, the bible for modern meteorology in Germany. It helped to introduce synoptic meteorology on the basis of weather telegraphy, which had been blocked by the old fashioned Heinrich Dove (1803–1879), director of the Royal Prussian Meteorological Institute in Berlin. No wonder that Mohn's textbook was printed in several improved and extended editions until 1898.

DEUTSCHE SEEWARTE (GERMAN MARITIME OBSERVATORY) IN HAMBURG

On 9 January 1875, the Deutsche Seewarte (German Maritime Observatory) was launched in Hamburg and Neumayer was appointed to organise its establishment (Neumayer 1889a). The Seewarte was housed in the Seemannshaus (Mariner's House), close to the landing bridges at the harbour to facilitate the contact between ship captains and the observatory to support sailing by providing sailing directions (Fig. 2**)** (Wegner 1993). Neumayer knew that a fast exchange of meteorological observations was crucial for providing actual information on weather conditions. Consequently he organised a first international meeting devoted to weather telegraphy at the Deutsche Seewarte on 11 December 1875 to which all directors of north-west European central stations were inivited (Neumayer 1889a).

When nobody else could be found, Neumayer himself finally was appointed to become the first director of the Seewarte on 13 January 1876. Besides the introduction of weather telegraphy to support synoptic meteorology, Neumayer installed a workshop for the development and calibration of meteorological and magnetic instruments and compasses. This would make him, like Lamont before, independent of others. Additionally Neumayer had a lucky hand to employ Köppen, who left the Central Observatory in St Petersburg for a new start with a challenging job in Hamburg (Direktion 1878, 1879). Adolf Sprung (1848–1909) became Köppen's assistant to prepare weather forecasts. At that time the

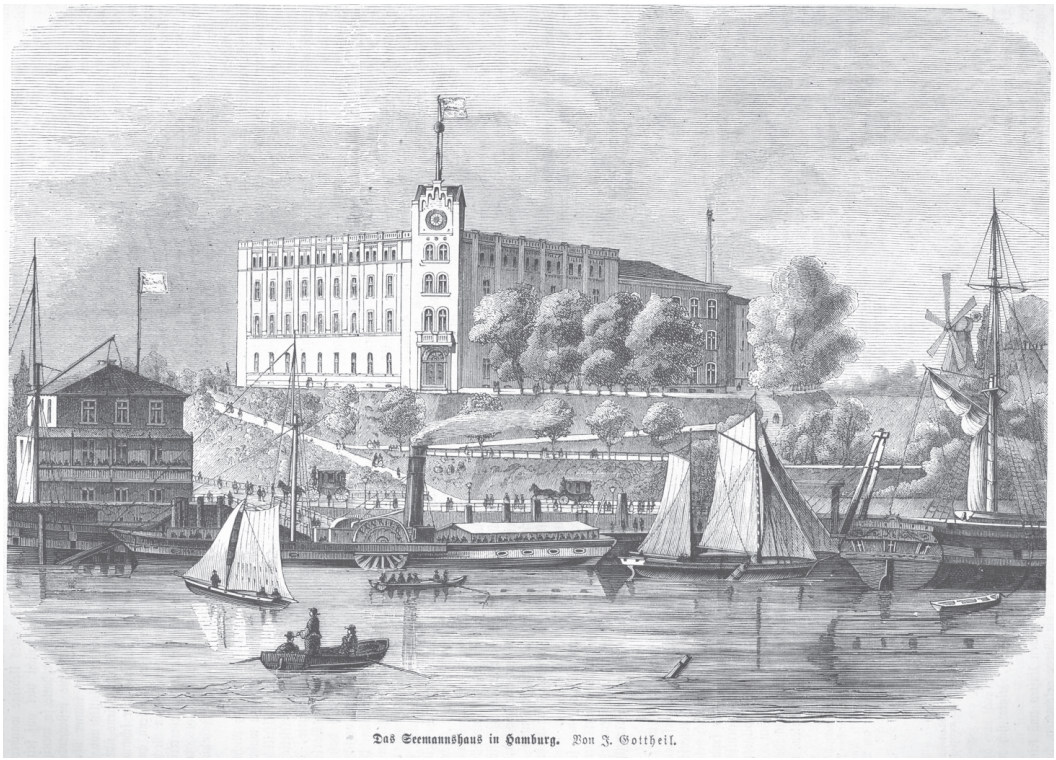

Fig. 2. Deutsche Seewarte in Seemannshaus, Hamburg (1875–1880) (Deutscher Hausschatz 1877: 444).

weather service in Germany generally was 20 years behind compared with European neighbours, because Dove did not want to know anything about synoptic meteorology (Köppen 1926). This was a hard burden to cope with, because, besides maritime meteorology, Neumayer was also in charge of land meteorology for northern Germany. He set up a network of seven meteorological observing stations along the coast, which worked according to his instructions based on the decisions of the International Meteorological Congress in Vienna (1873) and Mohn's textbook of 1875 (Neumayer 1878). This network became very important for gale warning along the coast.

In 1876 the network of the Deutsche Seewarte comprised 11 stations, while altogether 31 stations were projected (Neumayer 1880b). Some stations already had registering instruments provided by the Seewarte, which were inspected annually. Observers employed by the Admiralty measured at 8 am, 2 pm, 4 pm (for weather telegrams only), and 8 pm. Publications comprised daily weather reports, a monthly summary of the weather, a year book, annual reports, and various papers in the *Annalen der Hydrographie und Maritimen Meteorologie* (Annals of Hydrography and Maritime Meteorology), which were the sequel of the *Hydrographische Mitteilungen*.

The first weather report with a list of data received from 93 German and European stations was published on 1 January 1876. Among the stations we also find Munich with professor Lamont as observer. The first weather chart together with additional descriptions of the weather conditions prepared by Köppen followed on 16 February 1876 (Fig. 3), while the first weather forecast was provided on 1 September that year.

From 20-23 September 1876, German meteorologists met at the Deutsche Seewarte for a conference to discuss the organisation of meteorology in the German Reich (Neumayer 1889a). They agreed on the publication of observations at 17 meteorological stations of second order. This led to the publication of data for the years 1876 and 1877 (Beobachtungen 1878a, 1879).

The weather chart, together with port telegrams (i.e. information on weather from German ports) were presented in a public weather box close to the

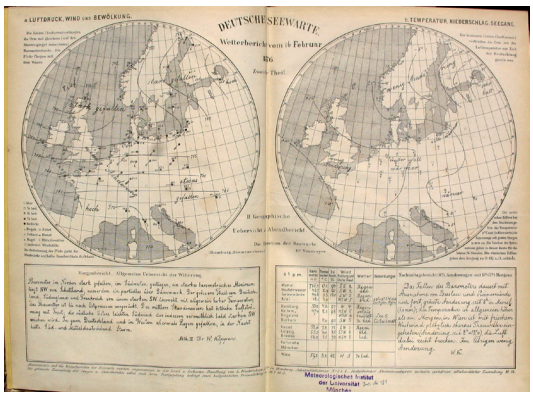

Fig. 3. First weather chart of 16 February 1876 issued by the Deutsche Seewarte (Source: Meteorological Institute, Munich). (See also page 34).

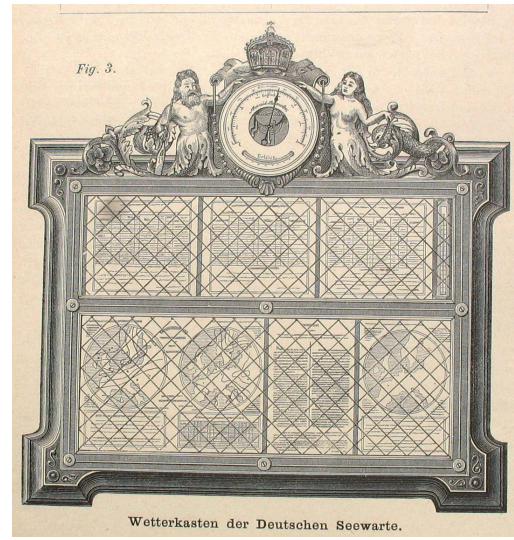

Fig. 4. Weather box (Instruktion 1879: 4).

landing bridges of the harbour of Hamburg (Direktion 1878; Instruktion 1879). On the top the iron weather box also included an barometer (aneroid) and thermometer to show the actual weather conditions (Fig. 4). The weather box may have been the origin for the weather pillars, which were set up in market places of other important towns in Germany from the 1880s.

Besides the daily publication of information on the weather condition, Neumayer paid very much attention to the publication of all meteorological data measured, which soon became an example for the publication of data from other countries. After the first two full years of observation he discussed the quality of weather prediction, which improved from 78.5% of correct forecasts in 1877 to 79.7 % in 1878 in the yearly mean (Direktion 1878: 121).

Detailed instructions for the meteorological service at the Deutsche Seewarte were published in 1879, including a description of the use of the instruments and the correct observation (Instruktion 1879). Neumayer also added figures of characteristic clouds according to Luke Howard's (1772-1864) cloud classification of 1802. But Neumayer preferred to use the name 'Strato-cumulus' given by Ludwig Friedrich. Kämtz (1801-1867), former director of the Physical Central Observatory in St Petersburg, instead of 'Cumulo-stratus' as used by Mohn in the second edition of his *Grundzüge*.

As well, Neumayer helped to establish the Royal Bavarian Central Station in Munich (Kingdom of Bavaria) in 1878 with the professor of physics at the Polytechnical School (later Technical University), Wilhelm von Bezold (1837–1907), as first director (Messerschmidt 1909). The activities of the new station developed fast and very well thus providing an important focus of meteorology in the south of the German Reich at a time, when meteorology and forecasts still were not accepted by the broad public.

In September 1878 a conference took place in Kassel, on which experts and other people interested in the use of meteorological knowledge in practical life met to discuss how this could be realised on behalf of agriculture and forestry (Neumayer 1889a).

There was a great change in German meteorology in the year of 1879. Dove died in Berlin on April 4 and Lamont followed him in Bogenhausen (Munich) on August 6. Later in the year the German government bought Dove's library for the Deutsche Seewarte, which proved to be a wonderful source for climatological investigations (Neumayer 1880b). And finally, from 1 April 1879, Köppen held the position of 'meteorologist' in the directory next to Neumayer (Fig. 5), which gave him the freedom to follow his research interests, while Wilhelm Jacob Bebber (1841-1909) took over Köppen's former position as head of department III, in charge of weather telegraphy (Direktion 1879).

During the following years, Bebber became famous for his analysis of the movements of low pressure systems, which he published in monthly charts (Direktion 1882). He summarised his detailed weather analysis of European pressure fields in survey charts of the first five years of data collection (1876–

Fig. 5. Wladimir Köppen (source: BSH, Hamburg).

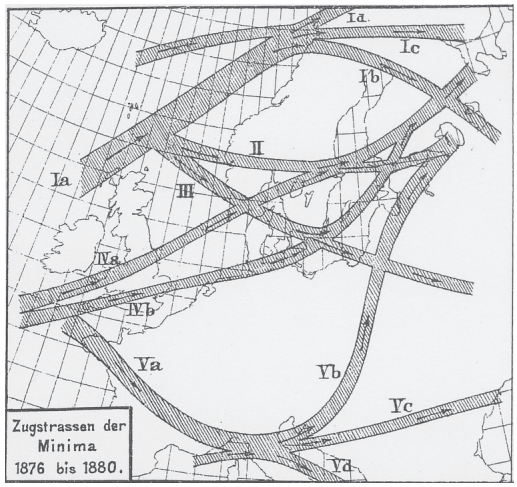

Fig. 6. Tracks of low pressure systems in Middle Europe (Bebber 1882).

1880) for the winter half year (October to March) and the summer half year (April to September) (Bebber 1882). The final result of his work is given in Figure 6, which shows the main tracks of low pressure systems in Europe.

Today Bebber's analysis is no longer important and the description of low pressure tracks has vanished except for the expression 'Vb depression', which is mentioned once in a while, when a low pressure system moves northeast over Hungary to the Baltic states with unusual high temperatures at the front (Keil 1950). This happens mostly in spring or autumn and is connected with heavy precipitation at the cold air side of the cyclone, causing floods on the north side of the East Alps.

A new means of popularisation of meteorology came in 1880, when a special printing kit for weather maps in newspapers was offered for the reasonably cheap price of M 160 (Neumayer 1880a). With this kit the printer was able to prepare a weather chart with information from weather telegrams. One of the first to use this kit was the physician and meteorologist Richard Aßmann (1845–1918) in Magdeburg (Steinhagen 2005). On 29 October 1880 he had founded the Meteorological Institute of the *Magdeburgische Zeitung* (Magdeburger Newspaper), where he published the first weather chart on 12 December 1880 (see Fig. 7).

These weather charts were very useful for agriculture and improved the general understanding of meteorology. The Deutsche Seewarte was expanding at that same time, not only with tasks but also with employees. The building used hitherto became much too small and finally a new building on the hill next to the first building was inaugurated by Emperor Wilhelm I (1797–1888) on 14 September 1881 (Wegner 1993). During this event Wilhelm I finally announced funds for the German participation in the International Polar Year (1882–1883).

Neumayer designed a new weather screen, which would be placed together with rain gauges in the garden of the new meteorological station (Fig. 8) (Direktion 1879). The idea was to provide a shelter for thermometers against radiation and precipitation, while the air still could circulate. The smaller weather screen now used by weather services all over the world were introduced later.

In April 1880 a conference of directors of German meteorological institutes was organised in Hamburg (Neumayer 1889a, Wege 2002). The participants suggested that on behalf of agriculture the Deutsche Seewarte should become the main office for the meteorological service for the entire German Reich. Besides, the Seewarte should also become the central office for weather telegraphy in Germany. Towards the end of the 19th century, weather telegraphy

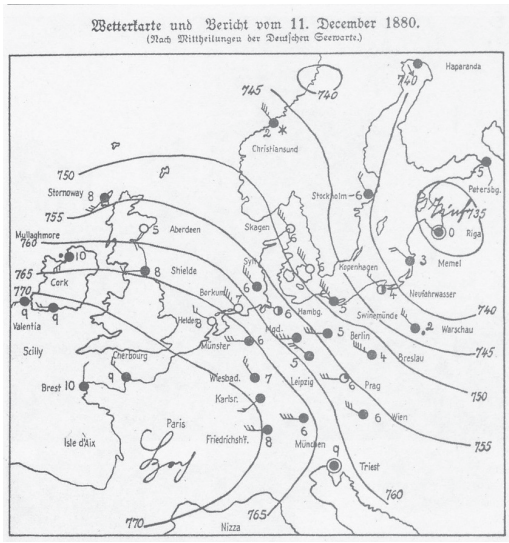

Fig. 7. First weather chart of 11 December 1880 published in *Magdeburgische Zeitung* (Steinhagen 2005: 201).

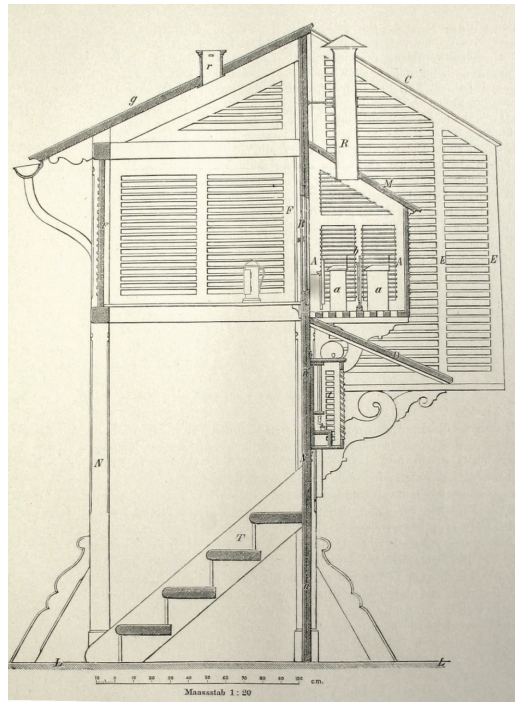

Fig. 8. New design of a weather screen (Direktion 1879: 9).

became the basis for the daily exchange of weather data (Direktion 1901). The first idea had been to incorporate the American 'circuit system' introduced by the United States Army Signal Corps to distribute weather telegrams of 47 European stations. But it failed because the European telegraphy system did not work on the basis of quiescent current. Due to this a so-called 'radial system' was introduced in Germany, in which single stations or small groups of stations sent their data at a defined time to the central station, i.e. the Deutsche Seewarte, where the data were put together or processed and communicated to the public. With the cooperation of the German Reich Post Office all telegraph lines needed for the transmission were blocked between 08:30 and 09:00 each morning to send meteorological data measured at 8:00 Central European Time (C.E.T.).

This worked quite well for some, but not all European countries, because traditionally climatological observations were made at local time. There was no definition of a simultaneous time for morning observations. The Dutch and British observed at 07:00 Greenwich time and the French at 07:00 Parisian time, which corresponded more or less to C.E.T. Under these circumstances the telegrams should be delivered to the telegraph offices and immediately sent to Hamburg arriving before 09:00 C.E.T. Here at the Main Telegraph Office all single telegrams were assembled and sent together to the Deutsche Seewarte in one cable, where the data were handled immediately. This summarised telegram from the Telegraph Office allowed subscribers to construct a weather chart.

Unfortunately the network of stations participating in the exchange of data by telegraphy was not yet dense enough in Great Britain and France, while Spain, Italy, Austria-Hungary and Russia were missing totally. In consequence Neumayer proposed a radial network of telegraphy stations with a centre in each of the 12 European countries, collecting data from 89 stations before 08:30 C.E.T. (Fig. 9).

Data from these centres should be sent to a central station, where the 12 telegrams would be combined to one single telegram and sent back to the 12 national centres within the next hour. Hamburg had been proposed to become the central station for weather telegraphy, which would be a great step towards international gale warnings as well as support for agriculture and working life in general.

During the last years of Neumayer's directorship, Köppen had started experiments with aerological ascents in 1899. He used different versions of kites to investigate meteorological conditions of the upper air

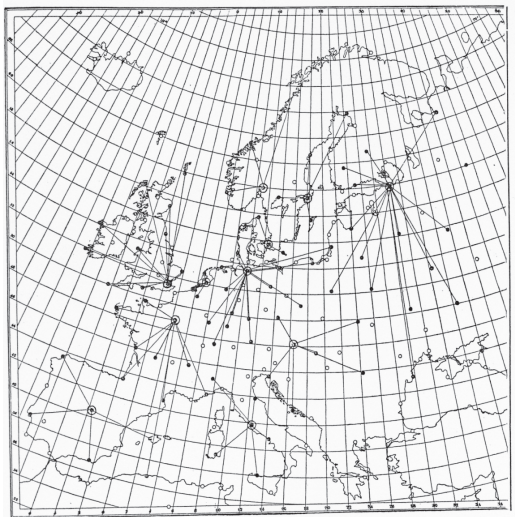

Fig. 9. Neumayer's new design of an European network of weather telegraphy (Direktion 1901: 48).

with registering instruments for recording temperature, humidity and pressure, the latter also indicating the altitude, where the measurements were taken (Direktion 1901). This new technique seemed to be very promising to extend meteorological observations to the third dimension. Previously, information about the upper atmosphere could be derived only from manned balloons or the movements of clouds, indicating the wind direction in upper levels. The first small kite station ('Drachenstation') was established in Eimsbüttel (now part of downtown Hamburg) in 1902, but in the end it moved to Groß Borstel (today part of Hamburg north of the city centre) in 1903 (Fig. 10) (Wege 2002).

Finally it took until 1902 (more than 20 years) to install an agricultural weather service in department III and to publish a 10-day weather report for agriculture since then (Wege 2002). After 27 years of work at the Deutsche Seewarte and after 31 years in service of the Imperial Navy, Neumayer retired in the following year and he was honored with a splendid farewell party at Wiesel's Hotel on 21 March 1893 (Kaiserliche Marine 1904).

REPRESENTATIVE AT THE INTERNATIONAL METEOROLOGICAL COMMITTEE

Under Neumayer's guidance the Deutsche Seewarte soon took over a leading role in Germany after Dove's death. This was underlined by his appointment to the

Fig. 10. Kite station at Groß Borstel (Source: BSH, Hamburg).

group of three delegates from the German Reich besides Carl Bruhns (1830–1881, director of the Royal Observatory in Leipzig) and Arthur Auwers (1838–1915, permanent secretary of the Royal Academy of Science in Berlin) and Bezold representing the Kingdom of Bavaria for the 2nd International Meteorological Congress in Rome. During the congress, Neumayer not only became responsible for providing the German edition of the proceedings (Fig. 11), but also became president of Commission IV (weather telegraphy, agricultural meteorology, maritime meteorology) and member of Commission V (observation of changes of glaciers) (Neumayer 1880b). Among other topics concerning the scheme of weather telegrams Commission IV discussed the importance of synoptic charts based on simultaneous observations, because the use of data measured one to four hours apart would lead to incorrect results. One of the topics of Commission V had been the support of Carl Weyprecht's (1838–1881) idea to organise several expeditions to the Arctic for simultaneous magnetic and meteorological measurements (Neumayer 1880b). Finally this commission drafted a recommendation, which was adopted by the general assembly, to establish an International Polar Commission which would meet in Hamburg (at the Deutsche Seewarte) on 1 October 1879 to discuss further actions (Wild 1882).

At the end of the congress a new International Meteorological Committee (IMC) was elected to manage business and international relations until the next congress would take place within five years at the latest. Neumayer was elected by the other 35 delegates as one of nine members of this committee and held this position until 1888. Subsequently Neumayer published the German edition of the reports of the meetings of the IMC, which took place in Bern

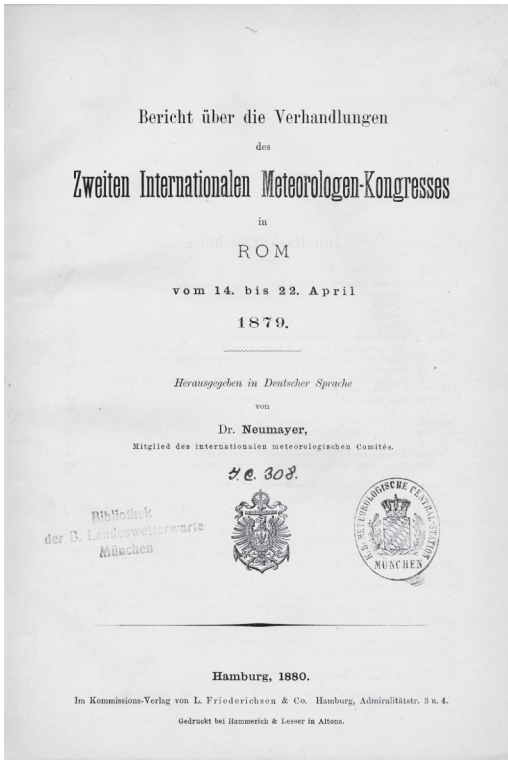
Bericht über die Verhandlungen
des
Zweiten Internationalen Meteorologen-Kongresses
in
ROM
vom 14. bis 22. April
1879.
Herausgegeben in Deutscher Sprache
von
Dr. Neumayer,
Mitglied des internationalen meteorologischen Comités.
H.C. 308.
Bibliothek der B. Landeswetterwarte München
K. B. METEOROLOGISCHE CENTRAL-STATION MÜNCHEN
Hamburg, 1880.
Im Kommissions-Verlag von L. Friederichsen & Co. Hamburg, Admiralitätstr. 3 u. 4.
Gedruckt bei Hammerich & Lesser in Altona.

Fig. 11. German edition of the proceedings of the 2nd meteorological conference in Rome (1879) (Neumayer 1880b).

(1880), Copenhagen (1882), Paris (1885), and Zurich (1888) (Bericht 1881, 1884, 1887, 1889). In the first year of its existence the IMC also organised an international conference on agricultural and forest meteorology in Vienna on 6 September 1880 (Neumayer 1889b). During the IMC meeting in Paris, Neumayer discussed the problem of local times of observations in Europe, which varied between one to three hours from simultaneous observations (Bericht 1887). This had to be changed at a time when telegraphy was revolutionising the construction of weather charts. Although the Committee made no recommendation, times of observation converged to 7 am, 2 pm and 9 pm. Neumayer also pleaded for the publication of meteorological data collected in the United States of America, Canada, and Middle and South America according to the European scheme. Additionally, he brought forward a motion to prepare a nomenclature for cirrus clouds, which should be observed referring to their movement to indicate wind direction of the upper atmosphere up to the tropopause at an altitude of about 10 km. The motion was carried due to its importance in expanding the observations to the third dimension.

Finally in 1889 during the meeting in Zurich, Neumayer succeeded with his demand for a standard classification of clouds, which was adopted by the IMC (Bericht 1889). The recommendation included not only the wish to add black and white photographs as provided in the cloud atlas by the Swede Hugo Hildebrand Hildebrandsson (1838–1925) and the British cloud photographer Ralph Abercromby (1842–1897), but also to add coloured pictures. Besides, Neumayer initiated 'the publication of hourly observations *in extenso* for a limited number of stations in each country ... which have to be chosen referring to the physical conditions of the country' (Bericht 1889: 4).

When the first Meeting of Directors of Meteorological Services took place in Munich in 1891 (Fig. 12), Neumayer could report about the recent publication of a new cloud atlas by Hildebrandsson, Köppen and himself according to the recommendations of the IMC, which was very much appreciated by the participants (Bericht 1891; Hildebrandsson et al. 1890). And Neumayer succeeded in the adoption of his proposal to use the cloud classification by Hildebrandsson and Abercromby as standard. He also could implement the definition and symbol for corona and halo, while his recommendation of general times of observation at 7 am, 2 pm and 9 pm was decided to be desirable (but not obligatory) as well as his promotion of a similar scheme of data publication by all weather services (Bericht 1891).

At the end of the meeting, when a new IMC should be elected by the participants, Neumayer resigned from re-election in respect of his impending pressure of work (Bericht 1891). After the conference on 3 September 1891, the members of the International Polar Commission gathered for the last time, before it was dissolved (Protokoll 1891). This also finished Neumayer's active involvement in the IMC.

FOUNDATION OF THE GERMAN METEOROLOGICAL SOCIETY

When the two German expeditions returned from Baffin Island (Canadian Arctic) and South Georgia (Sub-Antarctic) after the end of the Polar Year (1882–1883), a meeting of the German Polar Commission together with expeditions members took place at the Deutsche Seewarte from 14 to 16 November 1883.

Fig. 12. Participants of the First Conference of Directors of Meteorological Services in Munich (1891) (WMO 1973: between page 14 and 15).

Lessons from the Polar Year comprised one topic on the agenda. Neumayer explained that he had had a lot of difficulties raising financial support for the expeditions, which was only given on short notice. Due to this experience Köppen had developed a plan for a better representation of meteorological interests at the various ministries of the German Reich. This could be best realised by the foundation of a meteorological society (Neumayer 1889a; Lüdecke 2008). Köppen knew the procedure quite well, because he was one of the founding members of the Österreichische Gesellschaft für Meteorologie und Erdmagnetismus (Austrian Society of Meteorology and Earth-Magnetism) in 1865. Many German meteorologists had become members of the Austrian society, so some negotiations had to be done before the German foundation. Finally they chose Hamburg with the Deutsche Seewarte as business address, because the Prussian Meteorological Institute in Berlin was still at a turning point after Dove's death. Köppen had prepared the statutes and after some discussion the Deutsche Meteorologische Gesellschaft (DMG, German Meteorological Society) was founded on 18 November 1883, to 'support meteorology as science, as well as in its connections to practical life' (Hellmann 1923). Neumayer was elected president and Bezold in Munich became vice president. Also a German meteorological journal, *Meteorologische Zeitschrift* was established, and the first issue was published in January 1884. Neumayer had the honour of writing the first article, on the eruption of the volcano Cracatoa in 1883 (Neumayer 1884).

From the beginning, the idea was to combine the Austrian journal *Meteorologische Zeitschrift* of the same name with the German one, because it made no sense to have two meteorological journals in German language competing for good papers (Lüdecke 2008). In 1886 both journals finally merged into one, which was published jointly by both societies. Another idea was to establish several branch societies in big cities like Berlin, Munich, Hamburg-Altona or at other places, where certain meteorological organisations already existed, to foster scientific exchange through lectures and discussions.

Meetings of the executive board of the DMG were organised the day before the General Assemblies, as they called the meteorological conferences, which usually took place in connection with assemblies of the Society of German Naturalists and Physicians or German Geographer Days. In the beginning, 200 members were also members of branch societies and 51 members were members of the Austrian mete-

orological society at the same time. The first meeting of the DMG took place in Magdeburg (1884), where Aßmann worked in the meteorological tower of *Magdeburger Zeitung*. During the conferences very lively scientific discussions developed. These may have deterred meteorological amateurs, who had been a great part of the early membership, because there was a gradual decrease in membership.

Maximum membership occurred in 1885 with 486 members, among them 41 corresponding members and 16 honorary members. A year later (1886) Neumayer was elected president of the German Geographer Day, a position which he held until 1905. This seemed to be a better base of operation for him, because he still wanted to promote a German Antarctic expedition. When the next meteorological conference took place in Karlsruhe (1887) before the VIIth Geographer Day, Neumayer asked Bezold to stand for the presidency of the DMG, but Bezold had just become the new director of the Prussian Meteorological Institute in Berlin and worked hard to reorganise and to modernise the Prussian weather service. So Neumayer had to wait until the following conference in Berlin to which Bezold was invited in 1889. Here Neumayer finally resigned and Bezold was elected as new president, while Neumayer stayed vice president until 1897. Then Neumayer left a viable society, which became an important milestone in the development of the discipline of meteorology.

In 1900 Neumayer was ennobled by the Bavarian King for his scientific achievements and was allowed to call himself Georg 'von' Neumayer. He retired in 1903 and died on 24 May 1909 in Neustadt/Hardt.

SUMMARY OF NEUMAYER'S IMPACT ON METEOROLOGY IN GERMANY

After 27 years of being director of the Deutsche Seewarte, Neumayer could look back to many achievements (Günther 1906). He introduced synoptic meteorology in Germany, when he initiated a German edition of Mohn's textbook on main features of meteorology. Then he installed a telegraphy system to receive and distribute actual meteorological data. He also popularised weather reports and later also forecasts by their public presentation in weather boxes in Hamburg, which gave the impulse to have so-called weather pillars at prominent places in German cities. He also facilitated the print of actual weather charts in newspapers. Within the Deutsche Seewarte he started various publication series, among them publications of meteorological data of Germany and overseas. Finally he founded the German Meteorological Society and retired from the Deutsche Seewarte in 1903, when the aerologcal station in Groß Borstel was established. Neumayer's contribution was very important for the institutionalisation of meteorology in Germany.

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