

GEORG BALTHASAR VON NEUMAYER: MARINE SCIENCES IN SERVICE OF SEA TRADE

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Georg von Neumayer took over the lead of the Deutsche Seewarte as its first director in 1876. Holding this position for 27 years until 1903 he transformed the small institute into an overall accepted institution for marine meteorological and oceanographic research and analysis. During his tenure in office, sailing directions for all three oceans were compiled as well as the corresponding atlases, giving an overall view of the meteorological and oceanographic conditions as support to the growing German shipping. When steam shipping became more and more important he started the compilation of a handbook which was published two years after his retirement. As further support he created a new journal *Der Pilote* in which captains expressed the experiences made on their journeys and presented more scientific oriented papers in *Annalen der Hydrographie und Maritimen Meteorologie*. With increasing deep water sailing the three sailing directions were published as reprints in the early nineties of the last century, still being the best information for yachtsmen available, testifying the quality of the work done a hundred years before.

Key words: Deutsche Seewarte, marine meteorology and oceanographic research, sailing directions, ocean atlases

GEORG Balthasar von Neumayer (21 June 1826–24 May 1909)¹ (Figs 1, 2) had a deep passion for the sea and for seafaring life, which first became apparent in 1848 when he tried to enlist in the German Navy but was rejected because he was already 22 years old and had not had any navigational training or seagoing service². He then tried to enlist first in the Dutch, then in the American Navy, again without success³. These unsuccessful attempts did not discourage him in any way, and he decided to make a career in commercial shipping. He attended the Hamburg School of Navigation of the astronomer Charles Rümker (1788–1862)⁴, where he acquired his mate's certificate after a study time of just a few weeks.

During his stay in Australia, where he worked as a gold digger for some time and made an expedition to the Murray River, he conceived the project of building a geophysical/astronomical observatory in the area.

Neumayer returned to Europe to take practical steps toward putting his ideas into practice and find sponsors for his project. He received support from celebrities of his time: both Alexander von Humboldt (1769–1859)⁵ and Michael Faraday (1791–1867)⁶ advocated the project. When Justus von Liebig (1803–1873)⁷ also recommended that the project be realised, King Maximilian II of Bavaria also agreed and provided the required funds.

In early 1857, Neumayer built the privately financed Flagstaff Observatory in Melbourne, which was put under state control in 1859. Neumayer headed the observatory as its Director until 1864. He then returned to Germany, hoping to establish a similar institution, which was to provide services to shipping, in his home country. At the same time, he evaluated the measurement data from the observatory⁸. Today, Neumayer's original documents are stored at the library of Bundesamt für Seeschifffahrt und Hydrographie (BSH).

Back in Germany, during the first national Geographers' Day held in Frankfurt on 23/24 October 1865, Neumayer presented his plans for the establishment of a German centre of hydrography and maritime meteorology, and for a scientific expedition to the South Pole.

Although his plan to build a centralised agency for hydrography and maritime meteorology—to be termed Seewarte (marine observatory) as proposed by the geographer Otto Volger (1822–1897)⁹—met with approval, Neumayer was unable to put his plan into practice. It was Wilhelm von Freeden (1822–1894)¹⁰ who, in 1868, finally succeeded in establishing the Norddeutsche Seewarte (North German Marine Observatory), a private institution supported by the Chambers of Commerce at Bremen and Ham-



Fig. 1. George von Neumayer, hydrographer of the admiralty, 1872. (BSH).

burg which set itself more modest goals. Norddeutsche Seewarte was located at the Seafarers' House in Hamburg, which still exists as part of the hotel Hafen Hamburg. Bundesamt für Seeschifffahrt und Hydrographie, successor to Deutsche Seewarte, has its Hamburg headquarters directly adjacent to the Seafarers' House.

Both von Freeden and Neumayer were fully aware of the fact that the foundation of the private Norddeutsche Seewarte was only a temporary solution. The foundation of the German Reich on 18 January 1871 in the Hall of Mirrors at the Palace of Versailles created a federation of states whose centralised structures were in charge of supreme tasks on behalf of all federal states. This opened up the possibility of establishing the Norddeutsche Seewarte under Reich law. In May of this year, von Freeden and Neumayer presented a 16-page draft of an organisational plan for the nautical/meteorological and hydrographic institute, the Deutsche Seewarte, to be established on the basis of the existing Norddeutsche Seewarte in Hamburg. They proposed, without success at first,



Fig. 2. Georg von Neumayer at the time of his retirement 1903. (BSH).

that the new institute should become a Reich institution supervised by the Reich Chancellery¹¹.

In the following year, General von Stosch, head of the Imperial Admiralty, became aware of Neumayer's outstanding achievements when he listened to his lecture on magnetism in iron ships. Neumayer had not only the theoretical expertise needed for an effective development of the German Navy's hydrographic basis but, a sailor himself, he was familiar with the work and problems on board a ship. Against this background, General von Stosch appointed him to the Hydrographic Bureau of the Imperial Admiralty on 1 July 1872, and he became Hydrographer of the Admiralty on 24 December in the same year. In the years following his appointment, he embarked on a number of activities in the fields of ship magnetism, development of reliable fluid compasses, checking of hydrographic survey reports, and preparation of special scientific instructions for foreign missions of the Imperial Navy's fleet¹².

In the meantime, plans for changing the private institution Norddeutsche Seewarte (North German

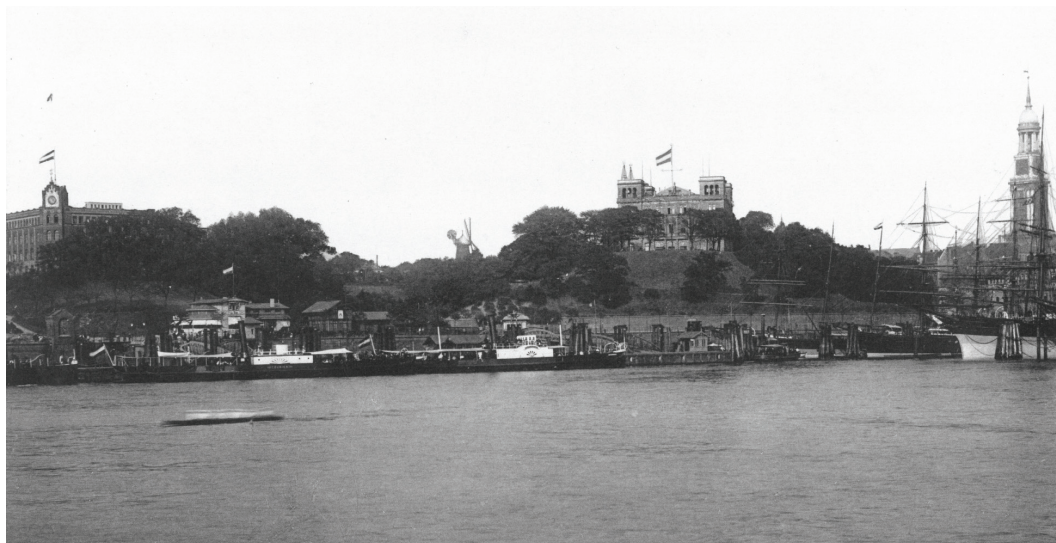


Fig. 3. Deutsche Seewarte (1868–1881) left, the new building (1881–1945) centre right. (BSH).

Marine Observatory), which from 1872 was called Deutsche Seewarte (German Marine Observatory), to a state-owned institution were becoming more concrete. As von Freeden's hopes of being appointed Director of the national Deutsche Seewarte had been frustrated—he had only been offered the post of Head of Department, while someone else was to be appointed Director—von Freeden, annoyed and thoroughly disgruntled, sold the whole inventory of Deutsche Seewarte to the German Reich at a price of 21,000 Reichsmark. Three of his employees—K. Koldewey, W. Reinert, and E. Mewes—continued working at the national institute, and three additional employees—M. Kirstein, A. Schück, and H. Eylert—were newly recruited. The Director's post remained vacant for some time. From 9 January 1875 to 12 January 1876, von Neumayer managed the affairs of the institute before being appointed Director of Deutsche Seewarte on 13 January 1876¹³. He remained in this position until his retirement as Privy Councillor on 30 June 1903¹⁴.

Von Neumayer, an avid admirer of Matthew Fontaine Maury (1806–1873)¹⁵ whom he quoted again and again in his prefaces to the publications of Deutsche Seewarte, adopted Maury's system of collecting and evaluating maritime meteorological and scientific data which were provided by ships' masters on a voluntary basis, without any remuneration. Navigators were later compensated for their efforts by reaping the fruits of their work in the form of

navigational charts and Sailing Directions, allowing easier and better cruise planning¹⁶.

In the interval between the foundation of the German Reich and the beginning of the First World War in 1914, the German Merchant Marine and the German Navy expanded from relatively modest beginnings to the second largest fleet in the world, second only to Great Britain.

The German Reich's growing economic potential and systematic provision of state aid to the shipping industry had made this upswing possible. A booming worldwide trade had laid the basis for this favourable development.

When the economic upswing in Germany began, knowledge about natural conditions in the oceans was very scarce. Germany was a state that did not really have a maritime tradition. Consequently, there was little public interest in maritime matters and, generally, in ocean research. With Germany's ocean research activities almost non-existent, it had to rely on research conducted by other maritime nations. Neumayer was planning to collect all relevant data available from foreign and German sources and to develop information material that would help to improve ships' cruise planning.

To obtain new data, he had to rely on navigators' voluntary co-operation. A meteorological logbook was developed for shipboard use into which masters entered all meteorological observations and their observations of ocean currents and sea conditions, sur-

face water temperatures and densities, as well as any unusual phenomena observed while en route. The logbooks later were collected and evaluated by Deutsche Seewarte (Fig. 4). The Hamburg meteorological office Seewetteramt Hamburg of Deutscher Wetterdienst (DWD), Germany's National Meteorological Service, owns a collection of some 37 000 meteorological logbooks covering the period from 1850 to 1930.

Additional information about ocean currents was available from bottle messages sent adrift. Upon Neumayer's instructions, the sailing ship *Norfolk* threw a bottle overboard off Cape Horn on 14 July 1864. Almost three years later, the bottle with its message was found by the worker Michael O'Donohue on the south coast of Australia, about 400 km west of Melbourne, and was sent back to Neumayer. This message in a bottle is one of the oldest of its type and forms part of a collection held at the library of Bundesamt für Seeschifffahrt und Hydrographie. This is one of the largest collections of bottle messages worldwide¹⁷ (Fig. 5).

After several years of intensive data collection and evaluation, an Atlas of the Atlantic Ocean was published in 1892. It consisted of 36 tables comprising one table showing ocean depths; nine tables with data on ocean water temperatures, densities, and currents; 21 tables covering meteorological conditions; two tables providing data on magnetism; one table each showing steamship and sailing ship routes; and one table showing the distribution and main whaling grounds of the most important whale species. Each of the tables contained detailed explanations¹⁸.

In 1902, one year before his retirement, Neumayer published the second edition of the Atlas. Its scope was largely unchanged but it now included 39 tables. However, the information provided in the individual tables had been improved considerably thanks to the availability of a much wider range of data¹⁹. Part of the tables covering oceanographic quantities had been prepared by an expert whom Neumayer had successfully invited to co-operate: Otto Krümmel (1854–1912)²⁰, who worked at Deutsche Seewarte in the summer of 1882. During his time at the observatory, he not only prepared the tables for the Atlas but also held lectures on physical ocean conditions to an audience of navigational teachers. Also after he had left for Kiel, he remained in contact with the observatory, particularly with Neumayer. He also contributed to the tables for the Atlas of the Indian Ocean, which was published in 1891.

In 1885, the Sailing Directions for the Atlantic Ocean supplementing the Atlas were published: 40 of its 595 pages dealt with physical conditions. In 1899, the second, revised edition was published, and in 1910, a few years after Neumayer's retirement, a revised third edition was issued which had 561 pages, 47 of which covered ocean conditions²¹. In this issue, reference is made to Krümmel's *Handbuch der Ozeanographie*, volume 1, as a comprehensive source of oceanographic knowledge.²²

Then, in 1891, the Atlas of the Indian Ocean comprising 35 tables was finally published (Fig. 6). It was structured exactly like that covering the Atlantic Ocean but only seven tables contained information about ocean temperatures, densities, and currents²³. The Sailing Directions supplementing it was issued one year later, in 1892. Of this volume of 812 pages, 28 pages dealt with oceanographic conditions in the Indian Ocean. In his preface, Neumayer attributed the delay in the publication of the Sailing Directions for the Indian Ocean—published a full eight years after publication of the Sailing Directions for the Atlantic Ocean—to several revisions that had to be made due to a wealth of new information that had to be included in the volume²⁴. There was no second edition to this volume. In the preface to the 1915 edition of Sailing Directions for the Indian Ocean issued by the observatory, a thin volume with only 107 pages, this fact is attributed to the virtual disappearance of sailing ships from this ocean. The change in the German title of the book (*Navigational Directions* instead of *Sailing Directions*) implies that it is no longer intended specifically for sailing ships or steamships but for the whole shipping fleet²⁵.

1896 saw the publication of the last atlas in this series—the Atlas of the Pacific Ocean comprising 31 tables. Eight of the tables contained data on sea water temperatures, densities, and currents²⁶. The Sailing Directions for the Pacific Ocean were issued one year later, in 1897, and had 916 pages, 62 of which covered oceanographic conditions in the Pacific Ocean²⁷ (Fig. 7). The main author of this part of the Sailing Directions was Gerhard Schott (1866–1961)²⁸, who started working at Deutsche Seewarte in 1893 and became head of the newly created oceanographic department on 1 April 1912. This underlined the growing importance of oceanography as part of the observatory's work, as compared to marine meteorology. Neumayer, aware of this development, had recruited Krümmel, a marine scientist, to work on the Atlas and Sailing Directions, though only for a short period

Erfolgtefert am 1. November 1882 № 1698 Beobachtungszeit 2. Mt. 28. Tge.

Meteorologisches Journal

an Bord des ^{holzernen} Schiffes Germania Kapitän A. J. B. Mählstedt
für die Zeit vom 28. Juni 1882 bis 23. Oktober 1882

Heimathshafen: Hamburg Rheider-Drehtschas-Beschüsse: 149 Reg.-T.

Korrekturen der Instrumente.

Barometer № 705 Verfertiger P. Tiefe Theilung nach mm (DS)

vor der Reise		während der Reise		während der Reise		nach der Reise	
bei		bei		bei		bei	
760	-0.58						
762	-0.46						
764	-0.34						
766	-0.22						
768	-0.10						
770	+0.14						
772	+0.31						
774	+0.49						

verglichen mit dem Normal-Barometer zu Hamburg
durch Laurentsen den 29. März 1882

verglichen mit dem Normal-Barometer zu _____
durch _____ den _____ 1882

Thermometer für Luft № 216 Verfertiger Wachtel Theilung 1/100 (DS)

vor der Reise		nach der Reise		vor der Reise		nach der Reise	
bei		bei		bei		bei	
10°	+0.0			0°	+0.0		
20°	+0.1			10°	+0.1		
				20°	+0.2		
				30°	+0.1		
				40°	+0.2		
				50°	+0.2		

verglichen mit dem Normal-Thermometer zu Hamburg
durch Sylbert den 1. Mai 1882

verglichen mit dem Normal-Thermometer zu _____
durch _____ den _____ 1882

Psychrometer. Verfertiger J. Wachtelmann Theilung nach 1/10 (DS)

trockenes Thermometer № <u>211</u>		feuchtes Thermometer № <u>212</u>	
vor der Reise		nach der Reise	
bei		bei	
10°	-0.1°		
15°	-0.2°		
20°	-0.3°		
25°	-0.4°		

verglichen mit dem Normal-Thermometer zu Hamburg
durch Laurentsen den 26. Juli 1881

trockenes Thermometer		feuchtes Thermometer	
vor der Reise		nach der Reise	
bei		bei	
10°	-0.1°		
15°	-0.2°		
20°	-0.3°		
25°	-0.4°		

verglichen mit dem Normal-Thermometer zu Hamburg
durch Laurentsen den 26. Juli 1881

Fig. 4. Meteorological journal *Germania* (polar research schooner), 28 June–23 October 1882, Hamburg–Cumberland Sound, Baffin Island, Canada, 1st International Polar Year.

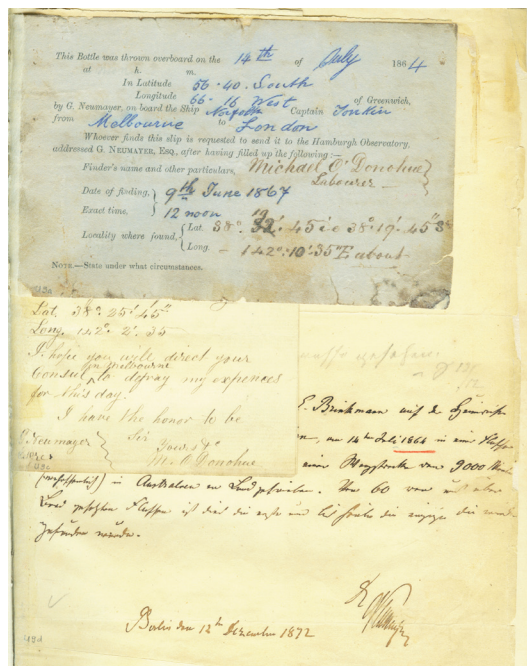


Fig. 5. Message in a bottle, first message initiated by Neumayer, 14 July 1864, sailing ship *Norfolk*. (See also page 15).

of time. Of this Atlas and of the Sailing Directions issue, no second editions were ever published. This was for the same reasons preventing further editions of the Indian Ocean Atlas and Sailing Directions: the effort and expense would not have been worthwhile because sailing ships had all but disappeared. The sequence in which they were published reflected their importance to German shipping.

Almost 100 years later, the three volumes of the Sailing Directions experienced an unexpected renaissance. As the number of sailing regattas around the world increased and High Seas sailing became an increasingly popular sport, information on oceanographic and meteorological conditions, which took into account the special route planning requirements of sailing boats, was needed. Current information about sailing routes was no longer available. Someone remembered the three volumes of Sailing Directions which had been published long ago by Deutsche Seewarte. In the early 1990s, reprints of all three books were published because demand far exceeded the availability of second-hand Sailing Directions²⁹. Despite latest state-of-the-art in meteorological forecasting, these three volumes published 100 years ago

still contained information and data that was invaluable to modern High Seas sailing.

By publishing its Atlases and Sailing Directions, Deutsche Seewarte and Neumayer had provided optimum support to the German merchant sailing fleet because the information provided allowed navigators to optimise their routes and choose the shortest route possible. But they were, of course, aware of the shipping industry's growing reliance on engine-powered ships, which would inevitably replace commercial sailing ships. Although engine-powered ships were affected less by meteorological conditions on the world's seas and oceans than sailing ships, they nevertheless needed special information tailored to their particular needs in order to be able to plan optimum routes and suitable seasons for their voyages.

Against this background, a steamship handbook for the Atlantic Ocean was issued in 1905, two years after Neumayer's retirement³⁰. Preparatory work for the handbook had been started while Neumayer still headed the observatory. Another handbook, this time for the Pacific Ocean, was published after the First World War, as late as 1922, after a 17-year interval³¹. Again 15 years later, in 1937, the steamship handbook for the Indian Ocean appeared in print³².

Other handbooks covered regional sea areas, but they will not be dealt with in detail here. The first of these handbooks, sailing directions for the western part of the Baltic Sea, was issued by the Hydrographic Office of the Imperial Navy in 1878, and all other handbooks that followed—until the end of the Second World War—were issued by military agencies³³. After the war, the civilian agency Deutsches Hydrographisches Institut (German Hydrographic Institute, DHI) was assigned the functions which Bundesamt für Seeschifffahrt und Hydrographie still has today.

In order to provide shipping with information supplementing that in the handbooks and atlases, Neumayer issued a new publication in 1881 under the title: *Der Pilote, ein Führer für Segelschiffe* (sailing directions for sailing ships)³⁴ (Fig. 8). This annual publication was a compilation of the cruise reports and meteorological logbooks of sailing ships. Over the years, the importance of the merchant sailing fleet declined further as steamships were taking their place. As a consequence, the content of *Der Pilote* was changed. In 1902, *Der Pilote* was edited as a new series. Its subtitle now was *contributions to coastal science*, and its focus was on issues that were of particular relevance to steamship operation. The journal contained information about harbour ap-

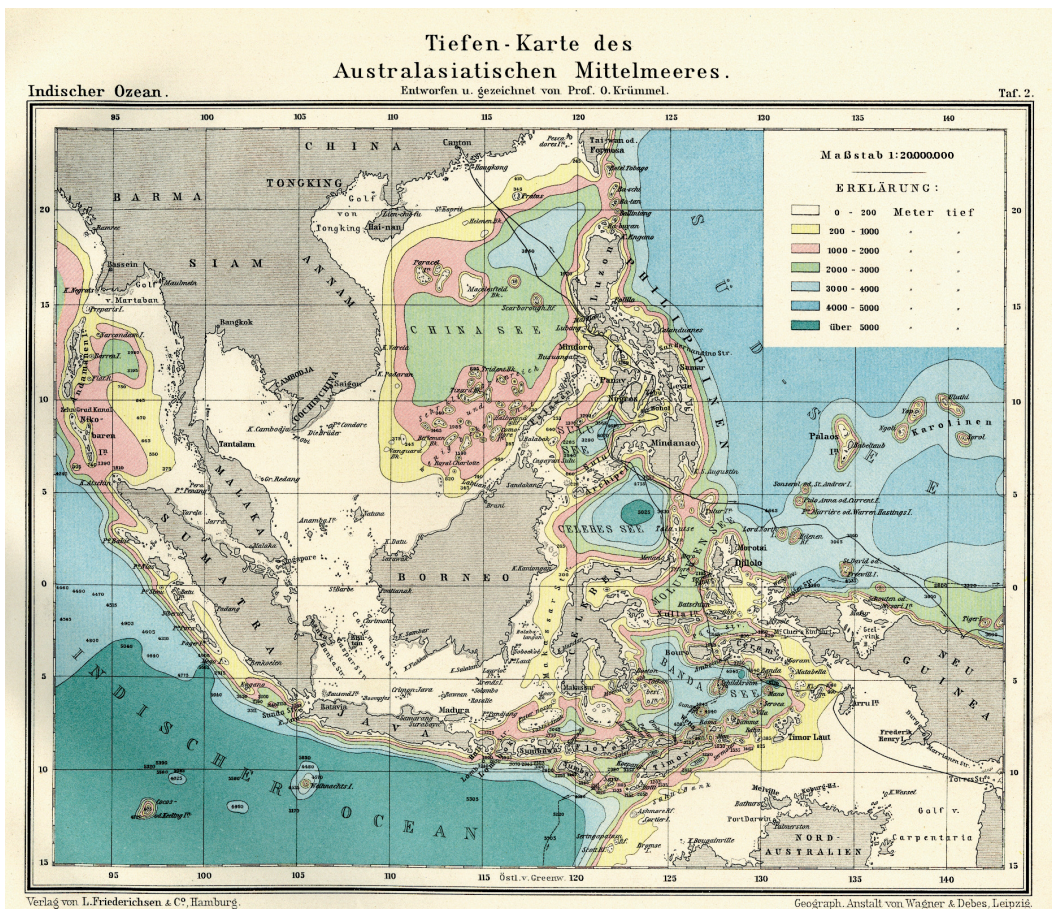


Fig. 6. Atlas of the Indian Ocean, 1891, depth-distribution Australian-Asian Mediterranean Sea compiled by O. Krümmel.

proaches and their natural conditions, customs and health regulations, available infrastructure, and description of steamship routes. The title of this publication was unchanged until 1931. At this time, it was decided to publish not only contributions to coastal science in the journal but also papers on navigational and observatory-related issues. Therefore, the title of the publication with its expanded scope was changed to *Der Seewart* in 1932. After the war, until 1983, it was published jointly by the German Hydrographic Institute and the Hamburg meteorological office of DWD, Germany's national meteorological service³⁵.

Besides these rather practice-oriented publications, there also existed a journal focusing on scientific matters: the *Hydrographische Mitteilungen* (hydrographic notices), first published by the Imperial Admiralty's Hydrographic Bureau in 1873 upon

Neumayer's initiative³⁶, and renamed *Annalen der Hydrographie und maritimen Meteorologie, Organ der Hydrographischen Bureaus und der Deutschen Seewarte* (annals of hydrography and maritime meteorology, publication of Hydrographisches Bureau and Deutsche Seewarte)³⁷ only two years later, in 1875, but still issued by the Imperial Admiralty (Fig. 9). This changed in 1892. From this year, Deutsche Seewarte assumed sole editorship of the journal and was responsible for its publication. The journal was published until 1944, and was discontinued after the Second World War³⁸. It was replaced by the *Deutsche Hydrographische Zeitschrift*³⁹ (German Journal of Hydrography), which in turn was merged into the journal *Ocean Dynamics* in 2000⁴⁰.

In 1875, when he started working at Deutsche Seewarte, Neumayer had just six co-workers, but he



Fig. 7. Sailing directions, Pacific Ocean 1897.

managed to raise the number of permanent employees to 54 during his long years of service at the observatory⁴¹. This figure does not include temporary personnel. This shows clearly that the scope of tasks and activities at the observatory increased steadily. In 1875, Deutsche Seewarte received a total of 111 meteorological logbooks: 85 logbooks were from sailing ships, and 26 from steamships. In 1878, the observatory received 149 logbooks, 139 from sailing ships, and only 10 from steamships⁴². In 1903, the last year Neumayer worked at Deutsche Seewarte, the Navy supplied 110 complete logbooks, the Merchant Marine 750— comprising 251 logbooks from sailing ships and 499 from steamships, two logbooks from the lightship *Adlergrund*, and 307 extracts of logbooks. A total of 544 943 sets of observation data had to be processed. During 1903, ships' masters and officers received a total of 507 publications such as Sailing Directions, Handbooks, Atlases, annual reports and annual volumes of the *Annalen der Hydrographie* free of charge, in recognition of their voluntary, unpaid co-operation, without which Deutsche Seewarte

would not have been able to guarantee the superior quality of its Sailing Directions and Atlases⁴³.

When Neumayer retired on 30 June 1903, he had successfully transformed Deutsche Seewarte from modest beginnings into a scientific institution of national and international standing, dedicated to maritime meteorological and oceanographic research. Neumayer himself had published little of his own research during these last years—except for his paper on hydrography and oceanography, which included findings on elevation surveys and magnetic observations at sea dating back as far as 1875⁴⁴—but had rather used his exceptional organisational talents and high scientific expertise to develop and expand the Deutsche Seewarte. His work was widely recognised and earned him many honours in his later years. Among other honours, he was conferred an honorary doctorate by the University of Tübingen in 1896,

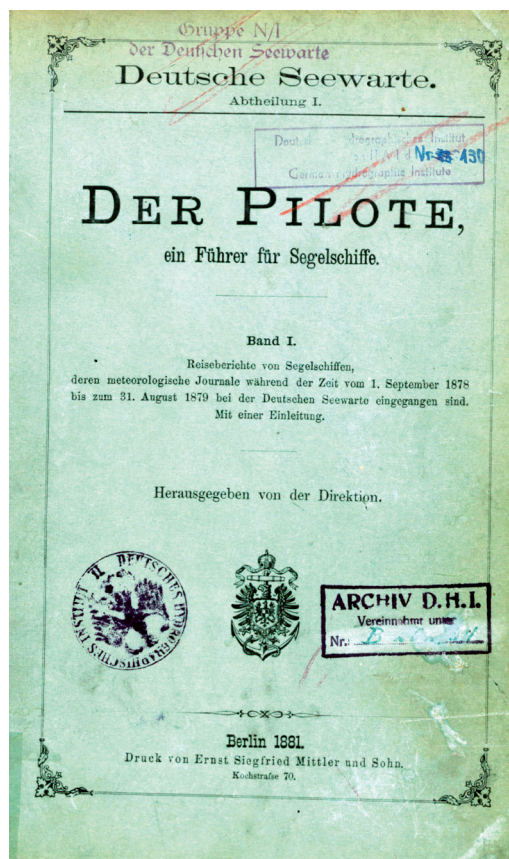


Fig. 8. *Der Pilote, ein Führer für Segelschiffe* (sailing directions for sailing ships), 1881.

on the occasion of his 70th birthday, and received the Order of Merit of the Bavarian Crown in 1900, which bestowed him nobility. After he had left the Seewarte, Neumayer returned to Neustadt, his home town, where he died on 24 May 1909 aged 83.

Today, Georg von Neumayer's achievements are still relevant to the work of Bundesamt für Seeschifffahrt und Hydrographie (BSH) which, like the German Meteorological Service, is a successor to Deutsche Seewarte. The system introduced by Neumayer, which consisted of routine data acquisition and evaluation of meteorological and oceanographic data as a basis for Sailing Directions and Atlases aimed at improving navigational safety and increasing the knowledge of physical ocean parameters, today is called operational oceanography. Considering the fact that also long-term changes in the measurement data were recorded, the work of Seewarte might even be interpreted as a precursor to ocean monitoring.

The storm warning service and routine weather reports introduced at the time were the basis for the

storm surge warning service and ice service established at a later date. These services today provide essential information to shipping and the coastal population.

As the safety of navigation depends crucially on the correct functioning of the nautical instruments used on board ships, Neumayer established a testing body to ensure their proper functioning. This testing body still exists, although the navigational equipment tested today differs considerably from that of Neumayer's time, thanks to technological progress. The BSH's certification label on navigational instruments is generally recognised as a mark of quality.

Another important aspect of Neumayer's work and that of the Seewarte was the commitment to international co-operation. Neumayer was always aware that the issues and problems to be solved were beyond the scope of single national institutions, and that a joint effort and co-operation between different institutions and countries was the approach to be taken.

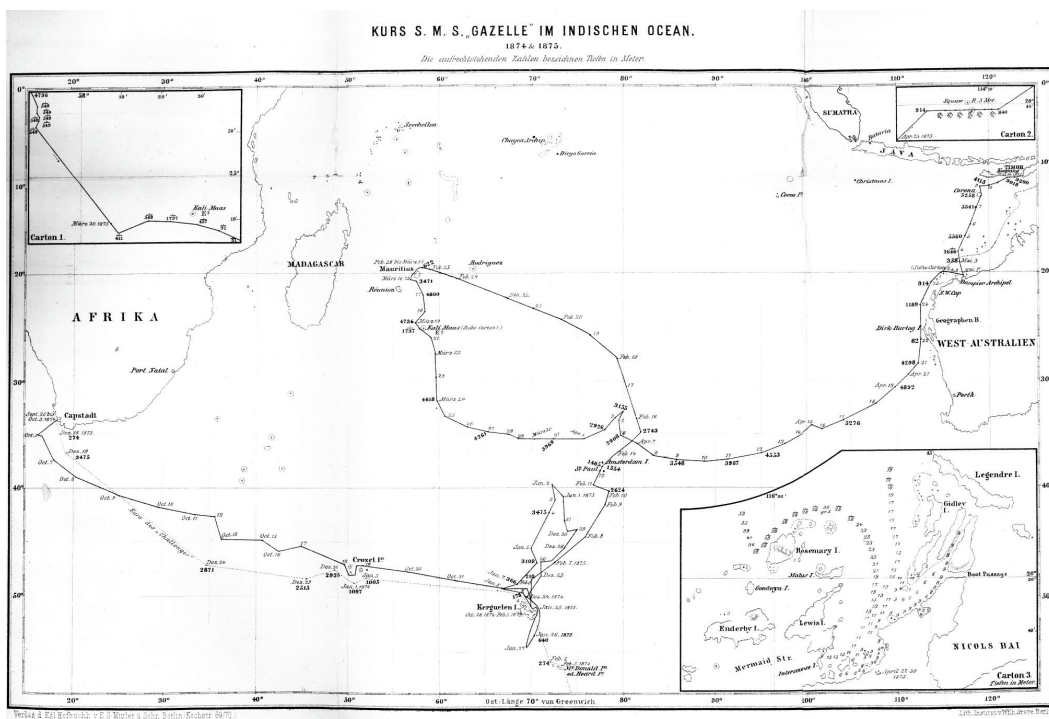


Fig. 9. *Annalen der Hydrographie und maritimen Meteorologie, Gazelle expedition, 1874–1876, trackplot.*

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