

Heinrich Wilhelm Dove's position in the history of meteorology of the 19th century

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H. W. Dove (1803-1879) was a dominant person in the German meteorology of the 19th century. After studies of philosophy, history and natural sciences, astronomy included, at the universities of Breslau (now Wroclaw) and Berlin (1821-1824 and 1824-1826, resp.) he was appointed to an associate professorship (außerordentliche Professur) of physics at the universities of Königsberg (Kaliningrad) and Berlin (1828 and 1829, resp.). In Berlin he was also a reader at several civil and military high schools. In 1845, he was appointed to a full professor (ordentlicher Professor) of physics at the Friedrich Wilhelms University, later elected to be rector for the periods 1858/59 and 1871/72 and also elected to a member of the Prussian Academy of Sciences (PAS) already in 1837. Beginning from 1849, in addition to his university duties he worked as the director of the Prussian Meteorological Institute (PMI) which had been founded in 1847 (for details, see Körber 1997 with references to several biographies about Dove).

Dove has published more than 300 papers, among them more than 100 articles on topics of experimental physics, especially of optics and electromagnetism. 5 volumes of an eight-volume repertory of physics (Repertorium der Physik) was edited by Dove (vol. I jointly with L. Moser) and published from 1837 to 1844. Dove himself has written the introductory section of vol. I and two parts of the comprehensive 11th section (vol. III, IV) titled "meteorology" and containing a description of the temperature regime of the earth (including soils, springs, oceans, air!) as well as explanations about storms, rain, air pressure and other phenomena. A third part of this section which deals with the temperature distribution over the earth's surface was written by W. Mahlman (1812-1848), who became in 1847 the first director of the PMI.

Dove's role in the history of meteorology was evaluated very controversially by his contemporaries as well as by meteorologists of the 20th century. A. v. Humboldt 1848 has considered Dove to be "the founder of the present day meteorology" and regarded him as the main authority in this field of science. Dove was styled "the Father of Meteorology" in an obituary note published in Nature, cited immediately in the necrologue printed by the Journal of the Austrian Meteorological Society (1879) and also two decades later in the famous History of the Prussian Academy of Sciences (Harnack 1900, vol. I/2). The physicist G. Kirchhoff in his election proposal for W. v. Bezold in 1886 has Dove called retrospectively the "single representative (within the PAS - Bh.) of the meteorology, this new science which was founded essentially by Dove" (Kirsten, Körber 1975).

J. v. Hann had awarded Dove to have achieved excellent results also in all purely physical fields (Hann 1868) and agreed to Dove's law of turning (Drehungsgesetz) yet in 1873. However, according to Hann 1885 "hardly can be denied that Dove's quite unphysical theories have retarded the progress of meteorology for a long time". Köppen 1921 expressly agreed to this

opinion, polemizing against Myrbaach 1921 who had appreciated Dove as a precursor of the polar front theory.

More extremely, Kassner 1933 wrote in his brief history of the German Meteorological Society on the occasion of its fiftieth anniversary that Dove "did not want anything from progress and fought against all new research results", so that the nightmare ("Alpdruck") left from Germany only after Dove's death. In contrast, Chromow 1931, Weickmann 1954, Bergeron 1959, Scherhag 1959 and other authors again have emphasized Dove's merits in his time.

To understand the reason for these contradictory assessments, Dove's various spheres of work, his theoretical concepts and scientific methods, their development against the background of the development of meteorology during the 19th century, and, finally, some conditions for meteorological activities in Prussia during Dove's lifetime should be considered.

Dove's main field of work was the climatology as essentially founded by A. v Humboldt as a descriptive science based on observations and measurements. 61 out of 84 meteorological papers, published by Dove in the Proceedings of the PAS from 1837 to 1876 (Harnack 1900, vol. III) are dedicated to climatological problems.

Humboldt had introduced the isothermal lines to describe the global distribution of the mean annual temperatures, had defined the climate as a totality of atmospheric "changes" (variables) affecting the biosphere and had expressed some insight into the structure of the climatic system (Bernhardt 2003). Following these ideas, Dove has mainly dealt with the climatology of the temperature field (1848a) and its influence on the growth of plants. In sense of a "dynamic" climatology, Dove has used for the first time monthly mean values (1848b), ten- and five-day means, deviations of the mean temperature from the latitudinal mean values ("Isanomalien", 1851) etc. Further, he has studied diurnal and annual changes of air temperature, air pressure, precipitation, and wind direction, but also non-periodic long time temperature changes over extended areas and, last not least, the mean course of weather over the year including pronounced singularities, as cold spells in May, and a number of various weather events.

Dove as the head of the PMI has published climatic dates regularly since 1851 from an observational network consisting of 37 stations in 1849, but up to 120 Prussian stations at the end of the sixties. Following this example, meteorological stations were established also in other German states beginning in the fifties of the 19th centuries. Their observation data were collected and published also by the PMI under Dove's leadership (Hellmann 1887) and used by him for investigations into the climatology of Germany (Dove 1874, e. g.). This way, Dove has promoted the progress of descriptive climatology over some decades by new approaches as well as by his efforts for network organization and data publication despite the fact that he has calculated only the very simplest parameters, as mean and extreme values, and published more voluminous tables than impressive graphs.

The method of local observations and their statistical treatment was also the starting point of Dove's view on atmospheric dynamics, first of all on the theory of storms. Dove deduced the counteraction of conflicting equatorial and polar currents in mid latitudes from the shape of wind-roses at mid-latitude stations, and he derived the turning law ("Drehungsgesetz") from the

statistics of local wind direction changes in time (beginning from Dove 1827). The same way, the behaviour of air pressure, temperature, and water vapour pressure within the both air currents as well as in cases of their displacement each other was derived by Dove from corresponding (barometric, thermic, hygric) wind-roses which show the mean values of those parameters in dependence on wind direction (Dove ib.).

Nevertheless, Dove has not confined himself to such local observations. Moreover, at the beginning of his scientific work he was even a pioneer of the synoptic method, as emphasized already by Scultetus 1943. For example, in 1828a he has graphically presented qualitative wind observations ("currents") of the same synoptic situation (Dec. 24, 1821) as described by Brandes in connection with his so called "first weather map". Moreover, an idealized circular vortex (streamlines) over western Europe was drawn by Dove in vol. IV (1841) of the above mentioned repertory of physics, very similar to Redfield's map (1843, reproduced, for example, by Kutzbach 1979, p.17) and five years earlier than the publication of a weather map by Loomis 1846 which contains isobaric and isothermal lines. Finally, a synoptic map (isobars, wind arrows, thunderstorms) was published by Dove 1873 (Plate II) for Jan. 20, 1863. That means, even the old Dove was not such a strict enemy of the synoptic method as said by his critics!

On the other hand, Dove has used synoptic approaches very sporadically only. His view on atmospheric dynamics was a global one, but highly empirical and based on the paradigm of conflicting with each other polar and equatorial currents which are deflected due to earth's rotation eastward/westward only in case of equatorward/poleward motions, as Hadley had postulated already in 1735 (see also Dove 1835 for a theoretical explanation of his turning law). At the start, Dove 1828b had regarded all storms as whirlwinds (vortices) and supported the conception of a circular flow around the barometric minimum (Redfield, Reid) against that of a centripetal inflow (Brandes, Reye). Later (Dove 1873, e.g.), he distinguished between circular vortices and straightlined storms ("gales"). In any case, however, Dove considered high and low pressure areas to be constituent parts of polar and equatorial currents, respectively.

He has never paid attention to pressure gradient/wind relationships (baric law) as derived during the second half of 19th century both empirically and theoretically. The same way, Dove (1867, e.g.) didn't take note of the thermodynamic theory of foehn, developed by Reye, Helmholtz, Hann and other authors, although he had himself expressed some such ideas in early papers. Generally, he lagged behind the development of meteorology which has undergone a fundamental change during Dove's lifetime to a physically based science, later characterized as atmospheric physics. This progress of meteorology can be clearly seen, for example, by a comparison of the textbooks published by Kämtz 1831-36 and by Sprung 1885.

Therefore, Dove's formerly strong influence on the contemporary meteorological thought (Fitzroy, Spasskii et al.) diminished markedly. The pacemakers of the modern synoptical and dynamical meteorology had to free themselves from the doctrine of their former teacher, as Hann and Köppen have done (see also Kirsten, Körber 1979).

Concerning the social conditions for Dove's activities let us refer to Hellmann 1887, Körber 1997 and to Kopatz 1999, especially. Dove's work at the PMI was for a long time in fact an one-man business - from the periodical inspection of the observation stations to the data processing and

publication. A scientific assistant was employed for the first time in 1866. On the other hand, not any weather service was established at the PMI, whereas the issue of daily weather maps and forecasts in many other European countries started in the sixties/seventies of the 19th century and promoted the development of new synoptical methods and theoretical approaches. Chancellor Bismarck, however, declared himself against a governmental weather service even in 1883 (see Kopatz 1999)!

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