

ON THE VERGE OF A NEW SCIENCE:
METEOROLOGY IN JOHN HERSCHEL'S TERRESTRIAL PHYSICS

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In the mid-nineteenth century, many scientists were actively developing a new approach to the earth sciences, one which would ultimately encompass the globe. This new science had one foot in natural history and the other in natural philosophy, and it was to include ultimately all terrestrial phenomena from Earth's center to its upper reaches, the realm of the auroras and aerolites. This article singles out one especially important proponent of this terrestrial physics, John Herschel (1792-1871), and concentrates on his writings on meteorology as part of this new science. Herschel was an active node in a network of scientists that included Alexander von Humboldt (1769-1859), François Arago (1786-1853), Ludwig Kaemtz (1801-1867), and Heinrich Dove (1803-1879). These researchers were bringing the advantages of physics and especially dynamics to the study of Earth's atmosphere. John Herschel, who as an astronomer and mathematician had a firm grasp of dynamics and its use in studying physical systems, saw more clearly than most both the promise and the challenge of a dynamics of the atmosphere.

Herschel's active interest in meteorology began at least in the early 1820s, when he toured Europe several times. In 1821 and 1822 he traveled through the Alps, climbing mountains, collecting minerals for optical research, and taking his first measurements of the intensity of solar radiation. Indeed, he invented the actinometer for this purpose and published the first account of it in 1825. He was especially interested in the balance between the internal heat of the Earth and heat received from the Sun. He combined this interest with detailed experimental and theoretical understanding of the behavior of gases when heated, the basis of his understanding of many atmospheric phenomena.

Herschel is best known as an astronomer, but he published extensively on what we now term geophysical phenomena. Of the 152 articles and memoirs listed in the Royal Society Catalog of Scientific Papers for Herschel, thirty concern some aspect of terrestrial science. Of these, seventeen relate to meteorology, climatology, or the atmosphere generally. Moreover, Herschel discussed meteorological questions in many of his major publications: A Preliminary Discourse on the Study of Natural Philosophy (1830), Astronomy (1834), "Whewell on the Inductive Sciences" (1841), Physical Geography (1859), and of course his Meteorology (1859). These last two long works were originally published in the Encyclopedia Britannica, but were soon released as books.

Throughout these publications, and in other venues as a public speaker and writer and as President of the British Association for the Advancement of Science in 1845, Herschel maintained a vision of meteorology as physical science. He argued that meteorology – like other terrestrial sciences – must marry inductive methods with the deductive methods of dynamics and other areas of physics. He explored the relevance of gravity, heat, electricity, magnetism, and chemical combination to atmospheric

phenomena. He lamented that the motion of elastic fluids resisted dynamical treatment, even though the causes of that motion were “known and calculable.” Still, he held out hope that such treatment was possible.

Herschel exerted his greatest influence on meteorology through chairing the Committee on Terrestrial Magnetism and Meteorology during the late 1830s and 1840s. This Committee drew up procedures for a global network of magnetic and meteorological observatories, lobbied for the establishment and maintenance of these observatories, and tested and commissioned the construction of new instrumentation. In short, he saw the inductive side of meteorology as the essential route toward the goal of a mature physical science. As he wrote in the article “Meteorology” in the Admiralty’s Manual of Scientific Enquiry (which he edited, 1851), “. . . it is to the regular meteorological register, steadily and perseveringly kept . . . that we must look for the development of the great laws of this science.”

Although John Herschel contributed no single notable discovery in meteorology, he was an important agent in shaping the direction that the science traveled in the late nineteenth century. Partly through his efforts and those of a small group of colleagues, meteorology became a part of terrestrial physics.