



Katharine Anderson. *Predicting the Weather: Victorians and the Science of Meteorology.* Chicago: University of Chicago Press, 2005. x + 331 pp. \$45.00, cloth, ISBN 978-0-226-01968-0.



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Thomas Huxley, outspoken advocate of science and reformer of Victorian scientific culture, was never one to shy away from grand claims for the predictive power of scientific investigation. In a review of a work by Ernst Haeckel, that other great advocate for the omniscient reach of scientific inquiry, Huxley made a characteristically bold claim. Huxley ventured that "a sufficient intelligence could, from a knowledge of the properties of the molecules of [primitive cosmic] vapor, have predicted, say the state of the Fauna of Britain in 1869, with as much certainty as one can say what will happen to the vapor of the breath in a cold winter's day." [1] Huxley's purpose was to qualify Haeckel's concept of dysteleology or purposelessness discerned in living organisms. His half-serious comment about the predictive potential of a sufficient intelligence revealed the significance attached to successful prediction as a characteristic of advanced science.

That prediction was a key category in mid-Victorian debates about the nature and scope of scientific (and other forms of) knowledge is amply demonstrated and explored by Katharine An-

derson's book on the study of another apparently dysteleological natural phenomenon, the weather. As Anderson shows, the possibility of determining the order behind the chaos or "anarchy" of British weather was the epistemological pivot around which the sprawling debates about weather knowledge hinged. These debates were, of course, grounded in particular social and cultural contexts. By focusing on the development of meteorology with its at once complex and accessible subject matter, Anderson is able to tease out the specific and sometimes fraught relations between the consolidation of scientific expertise through institutionalization and professionalization, on the one hand, and the popular appeal and practical utility of natural knowledge, on the other. Anderson thereby registers in impressive detail the subtle and fragile mid-Victorian equipoise between mass participation and elite science and the cultural spaces in which that equipoise was forged or threatened. Victorian meteorology cannot be understood, Anderson argues, without understanding its connections with religion, astrology, visual and print culture, observational networks, imperial governance and a host of other

cultural and political practices. To give a sense of the richness of Anderson's account a number of these connections are outlined and commented upon here.

Anyone concerned with the reverberations of science in culture and culture in science in the Victorian period cannot ignore the pervasive presence of religion, and it is the subject of religious prophecy that provides Anderson with her first example of the connections between meteorology and religion. Anderson identifies, beneath the intricacies of debate over the nature and meaning of prophecy, a shared sense that the power to foretell conferred cultural authority and leadership. For religious critics of scientific culture true prophecy was possible only through supernatural revelation or the bestowal of divine authority. Claims like those of Huxley about the "retrospective" prophetic potential of science (tied as they were perceived to be to a thorough-going materialism) were thus deemed unwarranted and hubristic. This was, perhaps, one reason why Robert Fitzroy distanced his weather forecasts, issued by the Meteorological department after the *Royal Charter* storm of 1859, from prediction as such. As Anderson notes, Fitzroy's religious beliefs were those of the evangelical critics of Huxley-style science. Fitzroy's insistence that his forecasts were not prophecies was driven by a desire to prevent unflattering comparisons with astrologists and religious enthusiasts, as well as, perhaps, by a desire to avoid claiming for science the authority that belonged to revealed religion. His newly coined term "forecast" suggested a modesty of purpose designed to satisfy the religious and scientific audiences that mattered professionally and personally to him. That this modesty failed to convince a number of scientific and religious commentators of the value of his forecasts and failed to prevent comparisons with astrological predictions, reveals just how tricky a balancing act Fitzroy's forecasting enterprise was.

Though it would have been necessary to delve further into the fissiparous and variegated world of Victorian evangelicalism, it would have been interesting to learn more about the nature of Fitzroy's religious beliefs if only to better understand how Fitzroy himself might have separated or assimilated his theological and scientific worries over prophecy and prediction. It is interesting to note in this regard that the other prominent Victorian meteorologist introduced by Anderson, who shared Fitzroy's conservative brand of Christianity with its distaste for scientific certainty, was also an advocate of weather forecasts. The enthusiasm for weather forecasts shared by Fitzroy and Charles Piazzi Smyth (Astronomer Royal of Scotland) might be explained as the result of that interesting mix of other worldly beliefs and practical activism that animated much Victorian evangelicalism. Forecasts, as Anderson shows so well, were regarded by Fitzroy and later Smyth as one way of fulfilling the moral duty of meteorologists to apply their science in ways that served the practical needs of a wider public.

The specific entanglements of religion and meteorology are further explored by Anderson with reference to discussions about forecasting the weather which evoked or entered metaphysical deliberations about free will, divine action and determinism. Such debates were provoked by the wider development of statistics, a scientific enterprise often associated with the kind of scientific hubris that religious critics saw in more general claims for the predictive power of scientific inquiry. The prayer gauge debate of the 1860s, which began, as Anderson notes, with rain, provides one particularly public example of the cultural contest between supporters of statistical science and advocates of religious authority. Supplementing Frank Turner's analysis, Anderson notes that the prayer gauge debate was also a dispute about the nature of evidence and testimony, a dispute which was of concern to religionists and scientists alike.

In her discussions around theology and meteorology, Anderson does not attempt to supply a model of the relations between nineteenth-century science and religion that can be applied universally. Anderson notes, for example, that the meteorological career of Charles Piazzzi Smyth warns against the automatic applicability of a "religious versus scientific authority" explanation to mid- to late Victorian Britain. The example of Smyth, Anderson suggests, works "against the picture of a professional scientific culture that was coherent, secular, and naturalistic" (p. 228), confirming through a particular case the more general arguments recently made by other historians of Victorian science about the lack of consensus about the best ways to support and promote science.

If theological concerns were never wholly expunged from mid-Victorian meteorology, neither were associations with astrology. Anderson demonstrates in some detail that astrology was "much more than a shadowy presence" among those concerned with developing the scientific study of the weather (p. 42). Astrology was perhaps unique among Victorian investigations into natural phenomena in being illegal, a fact that made proponents of a scientific and formally organized study of the weather even more anxious to remove the faintest whiff of astrological speculation in meteorological science. Yet what they had to contend with was a popular study of natural phenomena thoroughly embedded in the rapidly expanding print culture that was so vital to any successful attempt to establish and consolidate a scientific discipline. More than this, astrologists themselves refused to concede to an elite group of metropolitan gentlemen the descriptor "scientific" (or, indeed, "gentleman"). As Anderson explains, astrologists regarded their theories about astronomical influences on the weather as the best route to establish their own scientific and social credibility.

As well as allowing Anderson a kind of cultural traction useful for tracing the difficulties of es-

tablishing a distinct place for meteorological science in print culture, astrology provides a way of demonstrating the difficulties of resolving a central dilemma of mid-Victorian scientific culture, namely the role of character and personality in scientific work. A forceful but respectable character was useful for pushing reforms favorable to scientific expansion, but sat uncomfortably with an image of science, gaining in currency from the mid-Victorian period, as an enterprise fundamentally distinct from the character of the scientist. Anderson does not take this latter image as a given, but instead shows how fragile it was in contexts such as the courtroom and other public spaces where upholding the reputable character of science and scientists mattered a great deal.

Although Anderson's account remains constantly alert to the interplay between meteorology and culture, and is never straightforwardly chronological, it is possible to detect a shift in emphasis in the later chapters of the book from the imprint of culture on meteorology to the more confident assertions of meteorologists. One way this shift is accomplished is by switching attention from "weather prophets" to "weather networks," or from what were perceived as external threats to scientific credibility to the machinations of a more coherent scientific enterprise. The establishment of such networks involved the securing of productive alliances with scattered but dedicated scientific observers, such data gathering being regarded as crucial if meteorology was to mature as a scientific discipline. How such networks were funded, regulated and maintained differed and, through attention to these differences, Anderson offers keen insight into the culture of observant science in the Victorian period.

Fitzroy's gale warnings and weather forecasts, issued regularly from 1861 until shortly after Fitzroy's death in 1865, provide Anderson with material to explore the changes in government-sponsored weather observation. The expense incurred by issuing daily forecasts based on obser-

vations sent to the Meteorological Department of the Board of Trade by telegraph clerks were too high for forecasts that were too often mistaken. That was, at any rate, the opinion of the Royal Commission set up to investigate the matter after Fitzroy's death in 1865. What was needed was a much more rigorously controlled system of weather observations whose value would be assured through standardization of instruments and observers. This judgment significantly altered the geography of government-sponsored weather observations from offices of telegraph clerks to the carefully managed first order meteorological stations set up at strategic positions around the British Isles.

That was one emergent model of how to best control the collection of reliable weather statistics. Another was the scheme championed by the indefatigable George Symons which took institutional form in the British Rainfall Organisation (BRO). Rather than emulate the closely regulated and hierarchical meteorological observatories, Symons promoted the exchange of meteorological data among volunteer recorders whose participation was managed not through centrally imposed controls but governed instead in a more democratic and self-regulatory fashion. This was a particular form of civic rather than state science. The tensions generated by these different models for organizing weather observations were evident in comments made by Charles Piazzzi Smyth. Smyth, like Symons, argued for a more "democratic" and devolved arrangement for collecting and assessing weather data, and criticized government meteorology for imposing a model insensitive both to local conditions and international cooperation.

Anderson's analysis of the co-ordination of collective observation is interesting on another count. Aside, perhaps, from the less-than-respectable "astro-meteorological societies," it is curious that meteorological associations did not appear to play as significant a role in provincial civic culture as other scientific bodies. Symons's

BRO was more like Hewett Cottrell Watson's national botanical exchange club than the locally engaged and numerous natural history societies. To be sure, naturalists' associations encouraged observations of local weather as well as regional flora and fauna, but "civic" meteorology does not appear to have flourished in the way that "civic" natural history did. In Anderson's account, Victorian meteorology oscillates between "popular knowledge" and "scientific authority" without any significant mediation by local scientific societies. Popular knowledge about the weather more frequently equates in Anderson's account to the "weather wisdom" of seamen and the astrological theories of almanac readers rather than, say, public house discussions of Luke Howard's binomial classification of clouds or papers by members of scientific societies on local meteorological phenomena. Whether and why scientific meteorology did or did not become as entangled in local civic culture as other sorts of scientific activities is not an issue that Anderson explores.

In the penultimate chapter Anderson continues her patient excavation of the exchange between scientific meteorology and its cultural "others" by exploring ways in which meteorologists tackled the problem of data saturation. The accumulating mass of data on the weather had already made its presence felt before the founding of the BRO or the government-sponsored meteorological observatories. This piling up of information prompted a concern to find the best methods of analysis and graphic representation. Here Anderson again discerns the two-way exchange between popular culture and meteorology indicating that meteorological maps attempted to replicate the "at a glance" weather wisdom of sailors, a wisdom that retained a degree of mystique and authority despite the rise of scientific meteorology. Representing the weather connected meteorology to artistic convention and to visual technologies, a point illustrated by a study of the work of Charles Piazzzi Smyth and an examination of influential utterances made by John Ruskin. In consid-

ering Ruskin's much studied critique of the aesthetic poverty of scientific culture, Anderson offers in passing an alternative reading of Ruskin's famous "Storm Cloud" lecture. Ruskin's evocations of meteorological phenomena are read not only as allegorical, but also as having a literal sense used by Ruskin to reinforce his critique of the prevailing model of scientific observation (including observation of the weather).

Anderson completes her detailed survey with an account of what some meteorologists saw as a solution to the limitations and compromised position of the science of the weather. Weather observatories and controlled observation in India would provide, they believed, a space big enough and climatic conditions suitable enough to help fulfill the global and scientific ambitions of British meteorologists. The development of meteorology was thus tied not only to cultural contests within Britain, but also to questions of imperial governance and colonial relations. In a fascinating chapter, Anderson traces, among other things, the place of meteorology in the British survey and colonial rule of India. It is a subject that surely deserves a book-length account of its own, but Anderson deftly introduces the topic providing some fascinating material on the connections between imperialism, politics and meteorology in the context of debates about famine in mid-Victorian India.

There is no doubt that Anderson's book makes a significant contribution to our understanding of Victorian meteorology. More than this, by exploring together sometimes esoteric and other times popular Victorian debates about the weather, Anderson has generously supplemented our appreciation of Victorian science-in-culture. She has also held together and in tension a history of ideas or of a scientific discipline and a history of popular culture that refuses to resolve the two into one explanatory scheme. From reading Anderson's book, even given a sufficient intelligence, one is left doubting whether the state of meteorol-

ogy in the Victorian period could be predicted from a knowledge of the combinations of science, culture and politics that Anderson so scrupulously presents.

Note

[1]. Thomas Huxley, "Review of *The Natural History of Creation*," *Academy* 1 (1869): p. 13.

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