The Weather Watchers: Amateur Climatologists and Environmental Consciousness, 1810-20

Sean Munger
mmunger@uoregon.edu
University of Oregon

In the early nineteenth century, enthusiastic observers of weather phenomena, armed with freely-available meteorological instruments like thermometers, barometers and wind gauges, kept detailed and systematic records of weather conditions in various locations. These observers—who I term "weather watchers"—neither identified themselves as professional scientists nor were generally regarded as such by peers, yet they searched for broad patterns in their data and used it to construct scientific-sounding theories about how they thought weather and climate worked. The theories themselves were unpersuasive and bordered on the fanciful, but they did exemplify an interesting conception of the environment as existing in two interrelated layers with vastly different scope and construction. This dual-layered environmental consciousness becomes especially clear during the second decade of the nineteenth century, a period of temporary global climate change driven by a series of volcanic eruptions. Public fascination with the weather and climate events of this "Cold Decade" were both a motivating factor for the weather watchers' search for predictive patterns and also provided them a unique opportunity to address a largely unfilled demand for meteorological information in the press. This paper will explore these dimensions of the weather watchers and their thinking by profiling three particular examples from the United States and Britain: Thomas Jefferson, George Mackenzie and Luke Howard. In doing so, students of the history of meteorology and climatology may appreciate the usefulness of the Cold Decade as a lens to bring into clearer focus the environmental thinking of the era.

In February or March 1809, a large volcanic eruption deposited matching layers of volcanic fallout—principally sulfur dioxide, SO_2—on the ice sheets of both Greenland and Antarctica, which was discovered in ice cores taken two centuries later. Exactly which mountain erupted in 1809 is unknown, but only an eruption of considerable magnitude, and one occurring in the tropics, can account for the fallout observed at both poles.[1] Six years later an even greater volcanic event, the April 1815 blast of Mt. Tambora in the East Indies, filled the Earth's stratosphere with so much SO_2 that the resulting series of weather anomalies marked 1816 in

[1] Jihong Cole-Dai, David Ferris, Alyson Lanciki, Joël Savarino, Mélanie Baroni, Mark H. Thiemens, "Cold Decade (AD 1810-1819) Caused by Tambora (1815) and Another (1809) Stratospheric Volcanic Eruption, *Geophysical Research Letters*, Vol. 36, L22703 (2009), 1-2, 5.

Europe and America as the "Year Without Summer."[2] Yet as well-known as the 1816 anomalies are, the entire decade of the 1810s was characterized by significantly below-average temperatures worldwide; Mountain X and Tambora acted in tandem to plunge the world into a "Cold Decade" unmatched in meteorological history for the past 500 years.[3]

Observers and recorders of weather phenomena have been the subject of significant historical studies, often relating to how observers affected the development of the scientific disciplines of meteorology and climatology, or particular institutions related to weather study. The term "weather watchers" or "storm watchers" is often applied to such observers, whether or not they self-identified as scientific or meteorological professionals.[4] My use of the term "weather watchers" in this paper is generally evocative of these approaches, with a few important boundaries. What I term weather watchers are people defined largely by what they did—observe and record the weather for a significant period of time and in some systematic fashion, however imperfectly—and not by the status they held or how they were viewed by others. In the 1810s, an era before most of the institutionalization and specialization of science as we know it today developed, attempts to demarcate amateurs from professionals are largely arbitrary. Although the competence and usefulness of weather watchers to meteorology as a whole was hotly debated in the period, for example in Britain's Royal Society,[5] for purposes of my analysis the activity of weather observation and recording is significant because those who did it believed they were doing something useful or even revolutionary for science,[6] whether or not contemporaries or historians agreed with them.

The weather watchers of the 1810s were part of a long tradition. Observers and recorders of weather phenomena were quite active, for example, in Britain and on the continent from the middle of the 17th century and through the Enlightenment era. Many of the Enlightenment-era weather watchers, however—like John Locke or Petrus van Musschenbroek—tended to be natural philosophers who sought weather data specifically as a means to illustrate the functioning of broader natural laws.[7] The Cold Decade was different in two respects relevant to the context in which weather watchers operated. First, meteorology was in a transitional phase in the 1810s, moving from the traditional qualitative and descriptive approach of the Early Modern period toward a new emphasis, first advocated by science writers at the end of the 18th century, on quantitative measurement and the understanding of empirical data.[8] The weather watchers of this period were thus less inclined to use their data to validate philosophical notions about the universe, and more inclined to do the reverse: that is, to develop theories for the purpose of proving the significance of their data. Secondly, the anomalies of the Cold Decade coincided

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[2] Michael Rampino, Stephen Self & Richard B. Stothers, "Volcanic Winters," *Ann. Rev. Earth Planet. Sci.* 16 (1988): 73-99

[3] Cole-Dai, "Cold Decade," 5.

[4] *See, e.g.,* John D. Cox, *Storm Watchers: The Turbulent History of Weather Prediction from Franklin's Kite to El Niño* (Hoboken, NJ: John Wiley & Sons, 2002); David Day, *The Weather Watchers: 100 Years of the Bureau of Meteorology* (Melbourne: Melbourne University Publishing, 2007).

[5] Vladimir Janković, *Reading the Skies: A Cultural History of English Weather 1650-1820* (Chicago: University of Chicago Press, 2000), 161-62.

[6] *See, e.g.,* the summations of Thomas Jefferson in his "Weather Book" and George Mackenzie's reckoning of his own importance to the history of science, discussed below.

[7] Lorraine Daston, "Unruly Weather: Natural Law Confronts Natural Variability," in *Natural Law and the Laws of Early Modern Europe*, ed. Lorraine Daston and Michael Stolleis (Burlington: Ashgate, 2008), 233, 237-40.

[8] Janković, *Reading the Skies*, 158-64.

with an increased public demand for better understanding of meteorological phenomena, as will be discussed below.

The case studies I will present here exemplify how these weather watchers in the United States and Britain viewed the physical environment of the atmosphere, the heavens and the local world around them. The three men profiled here approached their activities from different backgrounds but they had significant commonalities. All were white and of generally high socioeconomic status. Though not strictly urban none were strangers to cities, yet most of their measurements were taken in the countryside. The basis of their meteorological knowledge stemmed not from devoted scientific study but from personal observation and experience rooted in their daily lives, similar to the post-World War II amateur meteorologists of Britain discussed in Alexander Hall's work.[9] Each of these weather watchers possessed most or all of the usual weapons from the meteorologist's arsenal: thermometer, barometer, rain gauge and clock. Although these weather watchers' environmental consciousness was shared by many people across American and English society, what distinguished a true weather watcher from the rest of the population was his diligence in keeping empirical weather observations and fashioning some theoretical argument from his data, or in Jefferson's case positing the data as the potential raw materials from which theory could be derived. Furthermore, each of Jefferson, Mackenzie and Howard were especially active during the Cold Decade and left behind uniquely colorful documentary records.

Case Study: Thomas Jefferson and his "Weather Book"

Early in his Presidency, on November 1, 1802, Thomas Jefferson began recording daily weather conditions in a small diary that has become known by archivists as his "weather book." He typically took readings from a household thermometer at sunrise and again at three o'clock in the afternoon, to which he added notations of the direction of the wind and often a short statement of the weather. Frequently he also recorded agricultural and horticultural events such as the blossoming of flowers or, quite particularly, the days of the year on which particular commodities became available. He wrote down in his weather book nearly every weather event that had a significant effect on his crops or garden yields, such as frosts, unusual rains or drought conditions. He continued to record data in the weather book for the next 14 years.[10] There were no pensions for public officeholders at this time, and after 1809 Jefferson's sole means of income—hampered by insurmountable debt incurred during and even before his period of public service—came from the produce of his farms.[11] Taken as a whole, his weather book crystallized into a record not only of the environmental history of his farms, but also an economic one.

Jefferson had the misfortune to return home just as the decade-long upheavals in the world's climate began. His weather book soon grew to contain notes on abnormally cool summers, the New Madrid earthquakes in 1811-12, a calamitous drought in 1813 that Jefferson judged the worst since 1755, and the unseasonable cold, killing frosts and cold snaps of the Year Without Summer. That year, 1816, was significant for Jefferson. He made the final daily entry in his weather book on December 31, 1816. Following this final entry he attempted to analyze and synthesize the data he had collected. He drew a table of the average number of days in each

[9] See Alexander Hall's paper in this issue.
[10] Thomas Jefferson, "Weather, 1802-1816," Massachusetts Historical Society, *passim*.
[11] Andrew Burstein and Nancy Isenberg, *Madison and Jefferson* (New York: Random House, 2010), 430; Barbara McEwan, *Thomas Jefferson: Farmer* (Jefferson, NC: McFarland & Company, 1991), 42.

month in which particular winds prevailed, spanning 3,905 observations between January 1810 and December 1816. Another table, derived from his fastidious attention to his rain gauge, reported mathematical averages of the frequency of rainy days and the tallies of cloudy versus "what astronomers call observing days in the week" for the purposes of watching celestial events.[12]

Jefferson's weather watching activities were aimed at more than simply the generation of knowledge for knowledge's sake. They served a specific purpose. In his summation he wrote:

> It is a common opinion that the climates of the several states of our Union, have undergone sensible change since the dates of their first settlements; that the degrees of both cold and heat are moderated. The same opinion prevails as to Europe; and facts gleaned from history give reason to believe that since the time of Augustus Caesar, the climate of Italy for example has changed regularly, at the rate of 1° of Fahrenheit's thermometer for every century. May we not hope that the methods invented in later times for measuring with accuracy the degrees of heat and cold, and the observations which have been, and will be made and preserved will at length ascertain this curious fact in physical history?[13]

Jefferson had written previously about climate change. In the 1780s he and his friend James Madison—who together made the first simultaneous, coordinated meteorological observations in American history, in 1778[14]— carried on a long intellectual rivalry with the Comte de Buffon, who argued that New World climates resulted in stunted animal and human development as compared to those of Europe. Jefferson was eager to refute these theories.[15] Arming himself with data to refute Buffon led in part to Jefferson's remarks in *Notes on the State of Virginia*, written in 1785, in which he declared that "[a] change in our climate…is taking place very sensibly"[16]— words he echoed almost verbatim 31 years later. He admitted however that no "regular evidence" other than the possibly faulty recollections and general observations of individuals could prove the theory of climate change.[17] His views on climate change were influenced by North Carolina physician and fellow revolutionary Hugh Williamson with whom Jefferson corresponded for 30 years and whose work he recommended to the public after Williamson's death in 1819.[18] In his 1811 book *Observations on the Climate in Different Parts of America*, Williamson set out a theory of anthropogenic climate change, arguing that deforestation and agricultural development increased heat reflected by the Earth and resulted in higher temperatures and more moderate winters.[19] Jefferson and Williamson's theories on climate change—the moderation of seasons,

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[12] Jefferson, "Weather," 34-80, 81-85.
[13] Ibid., 83.
[14] James Rodger Fleming, *Meteorology in America, 1800-1870* (Baltimore: Johns Hopkins University Press, 1990), 9.
[15] Daniel L. Druckenbrod, Michael E. Mann, David W. Stahle, Malcolm K. Cleaveland, Matthew D. Therrell and Herman H. Shugart,"Late-Eighteenth-Century Precipitation Reconstructions from James Madison's Montpelier Plantation," *Bulletin of the American Meteorological Society* 84 (2003): 57-71.
[16] Thomas Jefferson, *Notes on the State of Virginia* (Gloucester, MA: Peter Smith, 1976), 79.
[17] Thomas Jefferson to Nathaniel Chapman, December 11, 1809, in *The Papers of Thomas Jefferson: Retirement Series*, ed. J. Jefferson Looney (Princeton: Princeton University Press, 2005) II:70-71.
[18] George Sheldon, *Hugh Williamson: Physician, Patriot and Founding Father* (Amherst, NY: Humanity Books, 2010), 252-53.
[19] Hugh Williamson, *Observations on the Climate in Different Parts of America, Compared with the Climate in Corresponding Parts of the Other Continent* (New York: T. & J. Swords, 1811), 9-10.

decrease in snow cover and anthropogenic causation—were, if not fully congruent, closely aligned.

Jefferson's weather book was a living testament to his ability to view the physical and environmental world on a dualistic level. The first level was the very local world of his crops, Monticello's brown soil and green gardens, the fields of wheat and corn, Poplar Forest's tobacco acreage, and the day-to-day concerns of plowing, hoeing, reaping and harvesting. On this level, minute concerns such as the temperature of the soil and the exact measurements of rainfall were of paramount importance, because they affected the economic well-being of both the slave and free residents of Jefferson's domains. Yet hovering above this world in a sort of conceptual twilight was nothing less than the broad scope of Earth, its atmosphere and natural rhythms, as a planetary and even cosmic system with all its constituent parts intimately connected. Jefferson remarked upon comets, earthquakes, lightning, animal die-offs, snows in Canada, and the ambient temperature of Italy nearly two thousand years before.[20] The casual coexistence of minute environmental detail with broad strokes of planetary climatology demonstrate both the limits and the limitlessness of the physical worlds Jefferson saw himself as inhabiting.

Jefferson made the ultimate summation of his data in December 1816, following his extensive observations on the Year Without Summer phenomena—the most visible manifestation of Cold Decade anomalies. He ceased keeping systematic weather observations after this date. The decade of the 1810s was, for Jefferson, largely a period of completing various long-term projects in his life, such as an extensive program of planting and landscaping at Poplar Forest, begun in 1782, which was concluded in 1819. He may have been clearing the decks to concentrate on the project he regarded as the last service of his life, the establishment of the University of Virginia.[21] He might have brought his 30-year study of climate to a close at this time because of this desire to settle accounts, or it is possible that the impetus to summarize his data in a form that might lend itself to proving climate change may have been a response to the weather events of 1816. The documentary evidence cannot clearly tell us one way or another. Nevertheless, regardless of Jefferson's reason for ceasing his weather watching in 1816, his notes are an interesting illumination of how some Cold Decade weather watchers viewed the planetary environment.

Case Study: George Mackenzie and the "System" of the Winds

On November 1, 1802—coincidentally the same day Jefferson began keeping his weather book in Virginia—an eccentric Scotsman named George Mackenzie, a tacksman of Caithness in the far north of Scotland, began keeping his own chronicle of weather data. A local militia officer who served in various places in the British Isles during the Napoleonic Wars, Mackenzie kept his weather observations for many years, noting particularly wind speed and direction, the length of rains and daily temperature.[22] His observations formed a rich record of weather in Britain during the early years of the 19th century and especially the Cold Decade. From this source text Mackenzie began writing a hefty tome about British weather patterns, evidently consisting mostly of his opinions and observations drawn from his weather data. Then in the final stages of completion of his manuscript came the strange wet summer of 1816, and with it the discovery

[20] Jefferson, "Weather," 34-80.
[21] McEwan, *Thomas Jefferson: Farmer*, 187-90.
[22] Robert Fittis, *Illustrations of the History & Antiquities of Perthshire* (Perth, UK: Constitutional Office, 1874) [no page number]. A "tacksman" is a leaseholder of an estate, treated as sort of a minor nobleman.

that George Mackenzie believed defined his life and would secure his place in the history of science.[23] The events of the Cold Decade were unmistakably a motivator of Mackenzie's theoretical endeavors.

"Summer 1816 came," Mackenzie wrote, "and…its character was such, that [I] could not resist making an attempt to find out the cause of such severe changes." To this end he revised his manuscript extensively. Discarding external factors such as sunspots or global cooling—subjects much-discussed in the press and public arena in 1816 as potential causes of the anomalies[24]—Mackenzie believed the explanation lay in the data he'd already observed. In July 1817 he discovered what he thought was the answer: the directions of the winds and the total numbers of days on which they blew from each quarter formed a 54-year cycle, same the world over. The result, published in Edinburgh in 1818, was a book entitled *The System of the Weather of the British Islands; Discovered in 1816 and 1817 from A Journal Commencing November 1802*. According to Mackenzie the "System" was an infallible method of predicting long-term weather trends—in essence, the distillation of weather into climate.[25]

Mackenzie classified each day in the weather year, which lasted from November 1 to October 31, according to the prevailing directions of its winds. If a wind blew east consistently during a day, he classified that as a day of east wind; if west, it was a day of west wind; if he recorded both east and west winds over the course of a day, or if at any time the winds shifted to northerly or southerly winds, he classified it as a "variable day." His years of data told him that each year had an average of 216 days of westerly winds and 135 days of easterly winds. The ratio of these averages was Mackenzie's ultimate baseline, and each individual year was measured against it, resulting in its declaration as an "excess" or "deficiency." Mackenzie also counted days of rain. From these classifications evolved the curious vocabulary Mackenzie used throughout his work, in which he repeats phrases like "wet cold summer," "mild wet winter" and "extreme dry" (used as a noun, as in, *winter 1803-04 is an extreme dry*). He also spoke of "storms," which usually meant wind excesses that lasted several years in succession; winter 1812, for instance, was the "second winter of a storm."[26]

To Mackenzie the most important feature of the System was the repeatability of the 54-year cycle. Deficiencies and excesses, storms, wets and drys followed in an immutable pattern. "[T]he weather of one 54 years, is the same as the weather of the next 54 years, or any other 54 years corresponding in the order of the series."[27] Yet this did not mean that every individual point-source weather observation would correspond exactly to the same point-source observation taken exactly 54 years later. The excess and deficiencies of the winds would naturally vary during an individual year, breaking any correlation between specific times and places. Put another way, Mackenzie argued that the average weather patterns for the year 1816 as a whole, measured in terms of excess/deficiency, dry/wet and mild/severe, would correspond to those for 1870 as a whole. "It must therefore become desirable," Mackenzie wrote, "to ascertain how far

[23] George Mackenzie, *The System of the Weather of the British Islands; Discovered in 1816 and 1817 from a Journal Commencing November 1802* (Edinburgh: William Aitken, 1818), b, x-xxv, 3-6.
[24] *See, e.g.,* "On the Cold of the Late Summer," *New York Weekly Museum*, December 14, 1816.
[25] Mackenzie, *System*, 3-5.
[26] Ibid., b-xxv, 10, 69, 71-72.
[27] Ibid., 5.

one revolution of the system of the weather corresponds with another in every particular." He expected that future weather observations would work out this wrinkle.[28]

George Mackenzie's significance to the climate history of the Cold Decade lay not in the substantive accuracy of his System but in his efforts to develop it and his thinking about climate and the environment in general. Mackenzie's System proved inaccurate and unconvincing to scientific readers and the public at large, but he did make the conceptual leap from point-source weather to regional and global climate.[29] Mackenzie was essentially reversing the thinking of Early Modern and Enlightenment-era weather watchers. From roughly 1660 to the middle of the 18th century earlier weather watchers like Robert Boyle and John Locke attempted to hold up weather and meteorological observation as a mirror in which one could supposedly view the broader harmony of natural laws. Essentially they wanted to use weather observations to validate preexisting philosophical conceptions of how the universe worked, and in this effort they were largely frustrated.[30] Mackenzie, however, entered the Cold Decade without any apparent allegiance to a philosophical or scientific theory of how weather and climate worked. The desire to understand the anomalies of the Cold Decade motivated him to fashion such a theory that would validate his years-long efforts in weather watching. His theory would vindicate him, not the other way around.

Case Study: Luke Howard and the "Barograph Clock"

Among the weather-watchers of the Cold Decade, the one who came the closest to a professional was the learned Briton called Luke Howard. A chemist by trade, he owned a large firm that manufactured pharmaceutical chemicals for industry and retail druggists. Successful as he was at this profession, his true passion, like George Mackenzie, was the observation and investigation of weather phenomena. Howard was most famous for the paper he presented in 1802 to the Askesian Society—which he helped found—setting forth a classification of cloud types and introducing into meteorology the classic nomenclature of *nimbus*, *stratus*, and *cumulus*.[31] He also kept meticulous weather observations which became more sophisticated when in 1814 he acquired a device he called a "barograph clock" from the estate of its creator, Scottish watchmaker Alexander Cumming. The barograph clock Howard acquired was a copy of the device Cumming built for King George III in 1765. It was a barometer equipped with a pen that recorded atmospheric pressure readings over time on colossal ring-shaped graphs, each one taking a year to complete; they were as much works of art as scientific documents. The barograph data formed the backbone of Howard's multi-volume study *The Climate of London*, published in 1818.[32]

[28] "An Account of the System of the Weather of the British Islands, Discovered by Lieut. George Mackenzie," *Blackwood's Edinburgh Magazine* IV (October 1818-March 1819): 86.
[29] "Art. VII, The System of the Weather of the British Islands," *The British Critic, New Series* XVII (Jan.-June 1822): 510.
[30] Daston, "Unruly Weather," 233-35.
[31] Cox, *Storm Watchers*, 13-15.
[32] Luke Howard, *Barometrographia: Twenty Years' Variation in the Barometer in the Climate of Britain, Exhibited in Autographic Curves, with the Attendant Winds and Weather, and Copious Notes Illustrative of the Subject* (London: Richard & John E. Taylor, 1847), first page, penultimate and last page; Luke Howard, *The Climate of London, Deduced from Meteorological Observations Made in the Metropolis and at Various Places Around It* (London: Harvery & Darton, 1833), *passim*.

Howard, like Mackenzie, began searching for patterns in the weather data he collected. The "Cycle" he explicated in *The Climate of London* was much less ritualistic and mathematical than Mackenzie's, but Howard's result was at least functionally similar. He suggested that climate patterns fell into a 17-year cycle, with average temperature of seasons being one important correlating factor. The key to recognizing the Cycle was the year 1816, whose extremes provided Howard the most prominent point of reference.

> The year 1816, which was the coldest of the Cycle, appears to have had its parallels in 1799 and 1782; and now there is every reason to conclude, from present appearances, that the warm temperatures of 1806 will re-appear in 1823; which will probably be the warmest, and 1833 the coldest, *upon the whole year*, of a Cycle of seventeen years, beginning with 1817.[33]

Ostensibly Howard did not endeavor to explain the climate of any place other than London. However, the cosmic and planetary dimensions of this thinking are still evident in *The Climate of London*, albeit less explicit than those of Mackenzie or Jefferson. Howard collected a large array of environmental anecdotes in *The Climate of London*, most from newspaper media: reports of earthquakes, volcanoes, lightning, atmospheric oddities and celestial events from all over the world, far-removed from London. For example, he remarked upon a supposed connection between meteors and an earthquake in South Africa, the early onset of winter 1810 in Siberia, and seismic/volcanic activity in Venezuela in 1812.[34] He did not explain how these events affected the climate of London, but the fact that he included them demonstrates his belief in the interconnection of global weather and climate phenomena—a belief that perhaps he simply assumed his readers would share. Essentially, Howard transitioned from the local layer to the cosmic/planetary one without discussing anything in between. That he felt he did not need to make the connection explicit is telling, as it reflects an instinctive appreciation of the relevance of local conditions to broader processes.

Howard also asserted that the Moon had considerable influence on terrestrial climate, affecting rain patterns, barometric fluctuations and temperatures. The year 1816 was again important in leading Howard to this conclusion. Breaking down mean temperature readings according to phases of the Moon, he declared that the orbit of the Moon during 1816 "appears to have had *a wet and dry side*, as regards the Moon's influence on…our climate."[35] Nevertheless, he refrained from placing any one factor at the determinative center of his Cycle, as Mackenzie had done with his tallies of wind direction. Consequently, Howard's Cycle is much vaguer than Mackenzie's System, and he equivocated about it, frankly admitting that he could be wrong and that only future observations could determine if it had any validity.[36]

After the Cold Decade ended Howard continued to refine his theories of lunar influence on climate. In 1841 he submitted a paper to the Royal Society of London, setting forth a new iteration of the Cycle which he had by then revised to 18 years, and in which he now began to include solar radiation.[37] This long preoccupation, as well as that of explaining the climate of

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[33] Ibid., I:43-44..
[34] Ibid., II:96, 125, 168-69.
[35] Ibid., II:155, 183.
[36] Cox, *Storm Watchers*, 15.
[37] Luke Howard, "On the Proportions of the Prevailing Winds, the Mean Temperature, and the Depth of Rain in the Climate of London, Computed Through a Cycle of Eighteen Years, or Periods of the Moon's Declination,"

London, was rooted in the events of the Cold Decade. As with Mackenzie and Jefferson, this decade, and especially the year 1816, were important motivators and clarifiers of Howard's lines of thinking. For all three men, the Cold Decade was a lens that brought their existing environmental consciousness into especially clear relief.

Weather Watchers and the State of Meteorological Science

In an era before institutionalized research, scientific specialization and formal degree programs, who "counted" as a meteorologist in the 1810s was largely a matter of opinion. Some scientific writers expressed the opinion that, well-meaning as they may have been, weather watchers were not helping advance the science of meteorology. In a lengthy 1818 article surveying the condition of the discipline, the *Edinburgh Review* seemed to be rebuking weather watchers—especially those like Mackenzie who spun elaborate webs of unsupported theory—when its anonymous author lamented:

> Every person possessing a slight tincture of physical science, conceives himself qualified to speculate concerning the phenomena of weather, in which he feels a deep interest; and hence, a very flimsy and spurious kind of philosophy, however trifling and despicable it may appear in the eyes of the few who are accustomed to think more profoundly, has gained currency among certain classes of men, and engendered no small share of conceit. Meteorology is a complex science, depending on so many subordinate principles, that require the union of accurate theory, with a range of nice and various observations, as to have advanced very slowly towards perfection.[38]

This sentiment was shared across the Atlantic as well. In reviewing another "System"-like book on atmospheric phenomenon by another weather watcher—British physician and future phrenologist Thomas Ignatius Maria Forster—a New England journal identified "the rise of water into the atmosphere and its return to earth" as a prime example of a scientific process crucial to the understanding of meteorology that was as yet unexplained. The reviewer remarked "this department of science is encumbered with many loose opinions, and some fanciful and inadequate hypothesis, which retard rather than assist the inquirer in his investigations." In other words, weather watchers were holding back the discipline, or even skewing it from its proper course.[39]

This arguably cogent criticism notwithstanding, the weather watchers nonetheless filled a void. The public's interest in and demand for meteorological and climatological information and analysis grew over the course of the Cold Decade, especially in its second half. Before 1810 it was relatively rare for major newspapers in the United States or Great Britain to devote significant space to weather-related matters such as daily or weekly temperature or precipitation records; by 1820 many newspapers were regularly doing so.[40] The *Philadelphia Register and*

Abstracts of the Papers Printed in the Philosophical Transactions of the Royal Society of London IV:300 (April 29, 1841).

[38] "Polar Ice, and a North-West Passage," *Edinburgh Review* XXX, no. LIX (1818), 5.

[39] "Review: Researches about Atmospheric Phenomena by Thomas Forster," *New-England Journal of Medicine and Surgery, and Collateral Branches of Science* 6 (Jan. 1817), 1-11.

[40] *See, e.g.*, "Miscellaneous: The Weather," *The Monthly Visitant; or, Something Old*, August 1, 1816, 1-2; "Meteorological: From the Philadelphia Union," *Niles' Weekly Register*, August 15, 1818, 14; "Meteorology: The

National Recorder, for example, in March 1819 gave several column inches to Josiah Meigs—former President of the University of Georgia and then currently Commissioner of the U.S. General Land Office—to present a panoply of meteorological data collected by U.S. Land Office clerks in Detroit and Savannah. The data was exactly the kind in which the weather watchers reveled: temperature and barometric statistics, winds and precipitation. "If such observations are continued," Meigs wrote, "as I hope they will be, for a few years, much interesting knowledge of the meteorology of our country will be effected."[41] Similarly, *Niles' Weekly Register* of Baltimore devoted seven pages the same year (1819) to tables of weather data compiled at Chillicothe, Ohio by weather watcher Samuel Williams over the previous two years. Williams noted temperature, wind direction, cloud cover and cloud type day-by-day from July 1, 1817 to June 30 of the following year, and in explanatory statements and marginalia commented on storms, vapors in the atmosphere, moon haloes, the ripening of peas and strawberries, and provided a boastful description of his thermometer which was imported from London.[42]

Across the Atlantic, another example of the demand for and saturation of meteorological news content comes from the *Naval Chronicle*, essentially the trade journal of the British Royal Navy. The "Meteorological Register," a systematized table of barometric pressure, temperature data and descriptions of weather events in Covent Garden, London, made its first appearance in this publication during the summer of 1815. By the end of the *Naval Chronicle's* publication run in 1818, the Meteorological Register had become much more detailed and elaborate, and notably adopted and enthusiastically endorsed the cloud classification system of weather watcher Luke Howard. The weather content of the *Naval Chronicle* had become, by the end of the Cold Decade, a cornucopia of the same expansive obsessions as those that consumed the weather watchers: large tables of weather readings, historical comparisons, narratives on the character of seasons and the coming of crops, ruminations on polar ice, sunspots, earthquakes and "cavities" in the atmosphere, sprinkled with the dropped names of presumed experts and casual citations to philosophical journals.[43] The increasing presence of meteorological data in both American and British media is evidence that the study of weather was creeping out of the parlors and gardens of private citizens and into the public mind.

This demand for meteorological data fits into the context of the evolution of public thought on weather, meteorology and climate throughout the 19th century. At what might be termed the ground level, popular almanacs, which contained astronomical and astrological information, agricultural and practical environmental tips and often made rudimentary attempts

Weather," *National Register*, August 7, 1819, 8. For weather reporting early in the decade, *see, e.g.*, "State of the Thermometer," *American Register*, Vol. 7, 1810, American Periodicals 135.

[41] Josiah Meigs, "Meteorological: Detroit, Savannah," *Philadelphia Register and National Recorder*, March 27, 1819, 1. Meigs's writings were part of a larger project—ultimately unsuccessful in his lifetime—to convince the U.S. government to establish a protocol for systematic and uniform weather observation and data collection. Fleming, *Meteorology in America*, 17-19.

[42] Samuel Williams, "Meteorological Register," *Niles' Weekly Register*, February 20, 1819, 15.

[43] "Meteorological Register," *The Naval Chronicle for 1815; Containing a General and Biographical History of the Royal Navy of the United Kingdom* XXXIII (Jan.-June 1815) 56; "Meteorological Register," *The Naval Chronicle for 1816; Containing a General and Biographical History of the Royal Navy of the United Kingdom* XXXVI (Jul.-Dec. 1816) 175, 349, 438, 516; *The Naval Chronicle for 1817; Containing a General and Biographical History of the Royal Navy of the United Kingdom* XXXVII (Jan.-Jun. 1817) 373, 80-84, 145-52, 174; "Meteorological Register," *The Naval Chronicle for 1818; Containing a General and Biographical History of the Royal Navy of the United Kingdom* XL (July-Dec. 1818) 163.

at weather forecasting, were a staple literature of the period, especially in the United States.[44] At a higher level, that of scientific thinkers and writers who tended to think of themselves as gatekeepers of the discipline of meteorology, demand was high for consistency and standards in empirical weather observations, and this demand grew over the 1820s and 1830s.[45] By the Victorian era the development of the telegraph (beginning in the late 1830s) and widespread data sharing via transatlantic cables (1850s) sparked the establishment of predictive weather forecasting, which Katharine Anderson argues is the defining feature of truly modern meteorological science.[46] The growth of public demand for meteorological information during the Cold Decade helped prepare the landscape for these developments.

Conclusion: The Weather Watchers and Environmental Consciousness

The weather watchers conceived of the environment as existing in two distinct but interrelated layers: a local layer of crops, occupational activities and point-source weather conditions, and a broader planetary or cosmic layer encompassing broader trends of climate as well as global and celestial occurrences. My characterization of the weather watchers' environmental consciousness as dual-layered has significant commonalities with the observations of worldview within climate and weather history in general—for instance, Lorraine Daston's examination of Early Modern naturalists and their attempts to illuminate broadly-applicable natural laws (essentially, the cosmic layer) through observation of point-source weather phenomena (the local layer).[47] Clearly the dual-layered view was not exclusive to weather watchers nor to the Cold Decade. Although the experience of weather watchers during a single decade cannot be divorced from the continuities they shared with pre-1810 and post-1820 experience, the Cold Decade with its clearly visible weather anomalies and its positioning within the context of the history of meteorology provides an interesting lens through which to view this dual-layered environmental consciousness.

The weather watchers were undoubtedly a product of their age. Thomas Jefferson, George Mackenzie and Luke Howard were neither the discoverers of new processes and phenomena nor the architects of new forms of scientific thinking. But despite their limitations, shortcomings and conceits, they filled a void in public discourse that was seeking answers to the riddles posed by the anomalies of the Cold Decade. They attempted to explain what many people believed was inexplicable, and in doing so demonstrated, if nothing else, an admirable audacity.

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[44] *See, e.g., Dedham Pocket Almanac and New England Calendar for the Year of Our Lord 1812* (Dedham, NH: H. Mann, 1811).
[45] Janković, *Reading the Skies*, 161-67.
[46] Katharine Anderson, *Predicting the Weather: Victorians and the Science of Meteorology* (Chicago: University of Chicago Press, 2005), 1-7.
[47] Daston, "Unruly Weather," 235-36.

Environmentally Conscious: What Does it Mean? There are a variety of terms used to describe the kinds of guidelines, behaviors and laws that refer to minimizing harm to the environment. These terms, which you may have heard in various contexts, include environmentally friendly, environment friendly, eco-friendly, nature-friendly and green. Companies will often use such terminology to describe their goods and services or people might identify themselves and their lifestyles by using one of these terms. Environmentally friendly lives can be achieved at the individual level, the community level a Julie Arblaster, Australian climatologist at The Centre for Australian Weather and Climate Research in CSIRO. David Archer, American professor of oceanography at University of Chicago. Svante Arrhenius (1859-1927), Swedish, greenhouse effect.[4].Â Judith Curry American climatologist and former chair of the School of Earth and Atmospheric Sciences at the Georgia Institute of Technology.