Geographers, Stats-men and Sages: Approaches to Climatology in Britain post-1945

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In the year 2000 the UK conservation charity the Woodland Trust launched the Nature's Calendar Survey, a project that encourages members of the public to log observations of annual natural phenomena, such as the first blackthorn blossom. The study of the times of these recurring natural phenomena in relation to climate, known as phenology, dates back to at least the eighteenth century in Britain.[1] Now with 15 years of data and nearly 50,000 people across the United Kingdom participating, the Nature's Calendar Survey has successfully resurrected an amateur tradition not in existence in the UK at the national scale, since the Royal Meteorological Society discontinued its national phenological network in 1948. The Nature's Calendar Survey, and the wider citizen science movement it is part of are now not only engaging the public and amateur groups with science, but are giving these interested parties a participatory role in contemporary scientific research.[2] As important actors in the scientific, political, and public domains of climate change discourse have failed to agree on the existence, causes and solutions to anthropogenic climate change, scholarship in the humanities has increasingly begun to emphasise the importance of such a reconnection between cultural and public understandings of climate and professional climate studies.[3] A clearer understanding of the diverse perspectives of climate across time and space—climate's "elusive identity"—is imperative for meaningful progression in addressing the societal implications of anthropogenic climate change.[4]

Today what is recognised as climatology, especially in popular and media discourses, is a discipline focused on regional, hemispheric and global modelling of climate, and particularly, climatic change. Focused on climate projections at the large-

[1] T.H. Sparks and P.D. Carey, "The Responses of Species to Climate Over Two Centuries: An Analysis of the Marsham Phenological Record, 1736-1947," *Journal of Ecology* **83** (1995) 321-329.
[2] A. Lawrence, "The first cuckoo in winter: Phenology, recording, credibility and meaning in Britain," *Global Environmental Change* **19 (**2009) 173-179.
[3] M. Hulme, *Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity* (Cambridge: Cambridge University Press, 2009); V. Janković and C. Barboza (Eds.), *Weather, local knowledge and everyday life* (Rio de Janeiro: Mast, 2009).
[4] J. R. Fleming, "Climate, Change, History," *Environment and History* **20** (2014): 577.

scale and reliant on computers and satellite technology, this incarnation of the discipline which emerged in the latter half of the twentieth-century is often opaque and inaccessible to the lay person.[5] As mainstream climatology today becomes ever more complex, numerical, abstract, and homogenised in its approach, it is increasingly important for historians to highlight the connections and lineages of these modern methods to earlier antecedent ways of understanding climate and climatic change.

Modern climatology relies on a conceptualisation of the Earth that considers its climate as a single global physical system. The coalescence and popularisation of this idea was a protracted international endeavour, which began in the late nineteenth-century and was still ongoing into the 1950s.[6] Although the focus of this paper is the United Kingdom, I aim to situate UK developments within this international context. Histories of meteorology often present the development of the discipline during the twentieth-century as one characterised by the emergence of three distinct sub-fields, bounded by their methodological approaches: forecasting (applied meteorology), physical (theoretical meteorology), and empirical (climatology).[7] Whilst in this paper I do not contest this reading, I hope to show that it is only part of the picture. A greater understanding of the discipline can be gained by also exploring the interaction between the above three approaches, other non-professional approaches, and antecedent methods no longer widespread today. In doing so, we can address Jim Fleming's recent call for climate histories with a "focus on the diversity of agency and the inclusion of formerly excluded or subaltern groups."[8]

Therefore, this paper focuses on types of climatology that were prevalent before the emergence of computer- and satellite-led modelling of the 1950s and beyond. I hope to provide a snapshot of various activities in post-war Britain that were understood at the time as climatological study. The paper focuses on three loosely bound groupings of practitioners, defined largely by their methodological approaches, backgrounds, and institutional affiliations. The sages of my title encompass those working in an amateur tradition with no formal meteorological training, who, despite the formalisation of amateur networks in the second half of the nineteenth-century, continued to approach the study of climate in a folkloric tradition informed by local, traditional knowledge. Throughout the paper I use the term 'amateur' to mean both those who practice meteorology as a past-time and those that have no formal education in the field. However as we shall see, for a nascent and professionalising discipline such as climatology, the boundary between amateur and professional, or trained and self-taught, is not always clear. The stats-men of my title are those who sought to empirically record the climate. By the post-war period, they often had some level of meteorological training and were working as part of formalised professional or amateur networks. This grouping includes most climatologists working at the UK's national meteorological service, the Meteorological Office (MO), who were engaged in the compilation of data and its application using simple statistical techniques for location specific enquiries. The

[5] P. N. Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge, Massachusetts: The MIT Press, 2010): Introduction.
[6] J. R. Fleming, *Historical Perspectives on Climate Change* (New York, Oxford University Press, 1998).
[7] F. Nebeker, *Calculating the Weather: Meteorology in the Twentieth Century* (San Diego: Academic Press, 1995); Edwards 2010, 61-82.
[8] Fleming 2014, 582

geographers of my title, while sharing a common tradition, training and background with many of the stats-men, were a small contingent of formally trained climatologists who had begun to consider climate in a more dynamic, regional and temporally sensitive manner. Although heavily reliant on compiled climatological data, this group of climate researchers were beginning to develop more analytical approaches, creating coded or standardised data series and connecting their research to the latest theoretical understandings of atmospheric dynamics.

Rather than considering these groups as contemporaneously defined entities, I encourage the reader to view these groupings as fluid and overlapping. The groupings function as an analytical tool to elucidate what is a transitional and historically messy period in climatology's history. This paper shows that despite their disparate approaches, rather than thinking of the 'geographer, the stats-men, and sages' of my title as three distinct spheres, these practitioners did not act in isolation, and their approaches to climate study interacted with and influenced each other.

Finally, I hope this paper will provoke reflection on how all of these approaches to post-war climatological study are still relevant for contemporary climate studies and connected public debates. Suggesting, that despite contemporary climatology's reliance on modelling, satellites, and computer technology, earlier ways of knowing the climate have not disappeared completely, but rather have been subsumed into the tacit knowledge base of contemporary approaches.

Knowing Your Climate: Folklore and amateur observers

I am going to begin with some of the folk traditions and amateur observers who are often on the fringes of the history of science. Many people during the post-war period, especially those in rural occupations in the UK, although usually having no training in meteorology, did have a strong understanding of their local climate and prevailing weather conditions.[9] Whether determined by their own direct observations, local community knowledge or proxy observations, such as sheep coming down into the valley ahead of a snow storm,[10] such an understanding of one's immediate environ was imperative to a rural community's success. Inextricably bound up in this local understanding of climate was a canon of weather and climate related folklore. Many of these traditions and sayings were recorded and popularised by nineteenth-century figures such as the Reverend Swainson and Richard Inwards.[11]

Tensions between popular weather lore and emergent natural philosophical understandings of the weather had first been explored by the Quaker meteorologist Luke Howard at the end of the eighteenth century.[12] However, that such folkloric traditions were still fashionable in the latter half of the nineteenth century is evident through mining

[9] A. Hall and G. Endfield, "Snow Scenes: Exploring the role of memory and place in commemorating extreme winters," *Weather, Climate and Society* (Forthcoming).
[10] Harry Mawson, 1996: Transcript FS, *Ambleside Oral History Archive*.
[11] C. Swainson, *A Handbook of Weather Folklore* (Edinburgh and London: William Blackwood and Sons, 1873); R. Inwards, *Weather Lore* (London: W. Tweedie, 1869).
[12] J. Golinski, *British Weather and the Climate of Enlightenment* (Chicago: University of Chicago Press, 2007): Chapter 2; V. Janković, *Reading the Skies: A Cultural History of English Weather, 1650-1820* (Manchester: Manchester University Press, 2000). For more on Luke Howard see Sean Munger's paper in this issue.

engineer and keen folklorist, Inwards' position as joint editor of the Quarterly Journal of the Royal Meteorological Society, a post he held for twenty years.[13] As the discipline further professionalised in the first decades of the twentieth century a clearer gap between the scientific approach to understanding the weather and antecedent oral traditions of weather lore grew significantly.[14]

Yet despite this schism, by 1950 Inwards' *Weather Lore* first published in 1869 was in its 4th edition, and to date has never been out of print. Likewise the Reverend Swainson's 1873, *A Handbook of Weather Folk-lore* was reprinted throughout the twentieth century. Both texts, typical of a slew of similar publications in the period, are extremely comprehensive and wonderfully poetic in their content.[15] The proverbs in both are regionally specific, with many in the more UK focused *Weather Lore* being specific to single regions, counties or even towns, despite the relatively small landmass of the British Isles. Further, in Inward's *Weather Lore* not all of the sayings or passages are ancient folklore, in between verses from the Bible, excerpts from Shakespeare and traditional rhymes, are passages attributed to more recent nineteenth century figures such as the Anglican cleric and writer Sydney Smith. Most notable of these contemporary contributions are a plethora of rhymes, rules and observations attributed to Admiral Robert Fitzroy, an early proponent of weather forecasting and the founder of the UK Meteorological Office.[16]

The local specificity of these collections and the inclusion of contemporary lore in Inward's *Weather Lore*, highlights that such texts were not archaic tomes kept alive for purely linguistic or nostalgic reasons. Rather it suggests that in the first decades of the twentieth-century, weather lore was still a functional contemporary practice in Britain. However, the varying attribution and age of the sayings in Inwards', and other similar collections, alerts us to the wildly varied accuracy of such traditions. The text of these weather proverb collections makes no distinction between accurate rules of thumb or prediction, and speculation, hearsay, or poetic verse.

Despite the continued professionalisation of meteorology, during the first decades of the twentieth-century amateur meteorology remained a popular pursuit with the growing British middle classes.[17] Alongside the latest publicly accessible writings on meteorology, across Europe amateurs often incorporated local weather lore and folkloric traditions into their understanding of the local climate.[18] By the interwar period and in the years following the Second World War, the most proactive amateurs had begun adopting techniques from professional meteorology, and were using data of past weather conditions to find analogous weather patterns and tentatively forecast the weather.[19]

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[13] "Mr. Richard Inwards," *Nature* **133** (1934): 603; K. Anderson, *Predicting the Weather: Victorians and the Science of Meteorology* (Chicago: University of Chicago Press, 2005): Chapter 2.
[14] K. C. Harper, *Weather by Numbers: the genesis of modern meteorology* (Cambridge MA: MIT Press, 2012): 84-90.
[15] Golinski 2007, 70
[16] M. Walker, *History of the Meteorological Office* (Cambridge: Cambridge University Press, 2012): Chapters 2 and 3.
[17] Janković 2000; G. Endfield and C. Morris, "Exploring the role of the amateur in the production and circulation of meteorological knowledge," *Climatic Change* (2012) 69-89.
[18] S. Strauss, "Weather Wise: Speaking Folklore to Science in Leukerbad," in S. Strauss and B. Orlove (Eds.), *Weather, Climate, Culture* (Oxford/New York: Berg, 2003).
[19] E. G. Bilham, *Here is the Weather Forecast* (London, Golden Galley Press Ltd, 1947).

A few, such as brothers John and Dennis Bartlett, who used empirical methods to make long-range forecasts, had even begun to earn a living from their knowledge of the weather.[20] Although describing themselves as "professional weather consultants" and using methods based upon those used by both the British and US militaries, the certainty that the Bartlett brothers attached to their long-range forecasts, was at odds with academic and national meteorological service meteorologists in the period.[21] In their endeavours the Bartlett's were following in an age old tradition of weather sages and charlatans, albeit under the veneer of a modern, numerical, pseudo-scientific methodology.[22]

The difference between the Bartlett brothers' approach and that of scientific meteorologists in the period is highlighted by comparing their book, *Signpost to the Weather*, published in 1949, with another popular book of the period, *Here is the Weather Forecast*, written by the head of the central forecasting station at the MO, Ernest Bilham.[23] In Bilham's book there are just five pages towards the end of the text dedicated to long-range and seasonal forecasting. He discusses the approaches and describes the results from using empirical correlation methods as generally not "commensurate with the expenditure of labour."[24] Despite the efforts of a new generation of meteorologists such as Jerome Namias, who was then Chief of the Extended Forecast Division at the U.S. Weather Bureau,[25] Bilham's assertion that seasonal, long-range forecasting was not yet a viable endeavour, was at the time the accepted position at the British MO. Contradicting this position, in *Signpost to the Weather* the Bartlett brothers began a whole chapter dedicated to long-range forecasting, by asking: "Is it possible for the amateur to get any idea of the weather several weeks, or even months, in advance? The answer to this question is: Yes!"[26]

It would be easy for practitioners today to consider the Bartlett brothers as quacks, but the content of the rest of their book, with a third section solely dedicated to teaching people about the British climate, reveals that to do so would miss the wider context in which they were writing. Whilst their methods and confidence in their long-range predictive ability may have been at odds with academic meteorologists, their dedication to encouraging members of the public interested in the weather to learn more about the UK climate is very much in keeping with wider trends in the popularisation of science in the period.[27] By the post-war years, the type of amateur observers both the Bartlett brothers and Ernest Bilham were trying to encourage through their books, were an integral and well-established component of efforts aimed at an improved understanding

[20] *The experts say 1: Your weather for the holidays* available online at the British Pathé Archive.
[21] D. Bartlett and K. Bartlett, *Signpost to the Weather* (London: Edward Stanford Ltd, 1949): iii.
[22] J. R. Fleming, *Fixing the Sky: The checkered history of weather and climate control* (New York: Columbia University Press): Chapter 3.
[23] D. Bartlett and K. Bartlett, *Signpost to the Weather* (London: Edward Stanford Ltd, 1949); Bilham 1947; Meteorological Office, *Annual Report* (London: HMSO, 1947).
[24] Bilham 1947, 204
[25] F. Nebeker, *Calculating the Weather: Meteorology in the 20th Century* (San Diego: Academic Press, 1995): Chapter 10. Also see Magnus Vollset's paper in this issue for more on the efforts of Norwegian meteorologists at extending forecasts.
[26] D. Bartlett and K. Bartlett, *Signpost to the Weather* (London: Edward Stanford Ltd, 1949): 91.
[27] P. J. Bowler, *Science for All: The Popularization of Science in Early Twentieth-Century* (Chicago: University of Chicago Press, 2009).

of the British climate and the mechanisms controlling it. I now briefly return to phenology, the study of times of reoccurring natural phenomena in relation to climate; an area where amateur observers were central in efforts to understand the climate more thoroughly.

Since 1875 the Royal Meteorological Society had maintained a volunteer recorder network, compiling statistics and publishing an annual report detailing natural annual occurrences. After receiving criticism of the reliability of the observations and questions over the cost of running the network, the Royal Meteorological Society decided to discontinue the phenological report in 1948.[28] The prominent climatologist, geographer and former president of the society (1945-46), Professor Gordon Manley, was critical of the decision, commending the co-ordinator of the network, Major Gunton, for his "remarkable accomplishment," adding how he appreciated the effort even more because of his background as a geographer.[29] Manley was a vocal proponent of amateur involvement in climatology and later, in 1953, he unsuccessfully campaigned to get the phenological network resurrected and taken over by the newly formed Nature Conservancy.[30]

Recording the Climate: Data collection and the empirical tradition

In 1939, with the prospect of war on the horizon, the MO had officially incorporated research into the everyday remit of their staff, and established a Meteorological Research Committee in 1941.[31] During the war, the MO expanded greatly, and by 1945 the now substantial Climatology Division saw itself being called upon for more than just the provision of data as had more traditionally been the case. Most notably, during 1942 and 1943 climatological research informed the creation of a government fuel restriction scheme, which split the nation into three based on historical temperature records, separating Scotland, England north of a line drawn from the Wash to the River Mersey, and the remainder of England and Wales.[32]

Despite the discontinuation of the phenological network in 1948, during the post-war years the professional meteorologists of the MO were still heavily reliant on amateur observers. By 1947 the climatology branch at the MO was relying on nearly 5,000 climatological rainfall stations run by private observers on a voluntary basis. The data from these amateurs, who showed "great public spirit" in collating their observations, informed both climatological research and the development of applied services and advice at the MO.[33]

[28] The Royal Meteorological Society (RMets), "Report of the council for the year 1948," *Quarterly Journal of the Royal Meteorological Society* (1949) 199-214.
[29] RMets, "Report on the phenological observations in the British Isles for October 1946 to September 1947," *Quarterly Journal of the Royal Meteorological Society* (1948) 168-172.
[30] The National Archives (TNA): FT 3/308 Phenological observations.
[31] Meteorological Office, *Annual Report* (London: HMSO, 1939); Air Ministry, *The Second World War 1939-1945: Meteorology* (London: Air Ministry, Air Historical Branch, 1954): Chapter 30.
[32] TNA: BJ 5/119 Ministry of Fuel: supply of meteorological forecasts of temperature; A. Hall, *Risk, Blame and Expertise: The Meteorological Office and extreme weather in post-war Britain* (Manchester: University of Manchester doctoral thesis, 2012): 99-103.
[33] Meteorological Office, *Annual Report* (London: HMSO, 1947)

In these initial post-war years the number of applied services being supplied by the climatological sections of the MO increased greatly. In addition to the provision of data for established enquiries such as upper air observations for aircraft manufacturers, by the early 1950s the Climatology Division was supplying climatological information to businesses and government departments in connection with water supplies, flood problems, agricultural and industrial research, health issues and town planning and transport.[34]

In responding to these enquiries, the MO scrutinised their statistics and data for analogues, barometric trends, periodicities, symmetry points and general correlations. Thus, these methods which had been applied piecemeal across MO branches over the previous decades were formally adopted by the newly established department.[35] Despite this growth in both research and climatological applications, we must remember that in the immediate post-war years, climatology at the MO was still defined by what it was not. The jurisdiction of the newly established climatological branches was described in annual reports as, "everything that falls outside the scope of synoptic meteorology and forecasting."[36] The marginal position of climatology within the MO, reflects the wider international history of the field in relation to the rest of meteorology; having long struggled to gain widespread respect and authority.[37] It wasn't until 1958 with the separation of climatological services and climatological research into two distinct branches that climatology at the MO found a clear place within the institutional structure of the organisation. With this split, climatological research at the MO, led by R.G. Veryard, who was also the chair of the World Meteorological Organization's Commission for Climatology, began to focus on upper atmosphere, large-scale and global scale phenomena.[38] This shift in scale of climatological study was influenced by developments in dynamical meteorology, the rapid advancements being made in electronic computing, and a renewed international interest in geophysical systems, influenced by the International Geophysical Year (1957-58).[39]

The MO weren't the only people advising the government and industry on climatology at the time. There were a small number of British academics spread across university geography departments who were also often consulted. For example, in 1949 guidance on housing and planning in the UK was published, which relied heavily not only on MO advice, including research by Ernest Bilham, but also on the views of academic climatologists, referencing several works including those by Gordon Manley, then professor of geography at Bedford College, London.[40] The few academic and

[34] Meteorological Office, *Annual Report* (London: HMSO, 1956); A. Hall, "From the Airfield to the High Street: The Met Office's Role in the Emergence of Commercial Weather Services," *Weather, Climate and Society* (2015) e-view.
[35] C. K. M. Douglas, "Reviews of Modern Meteorology 4: The evolution of 20th-century forecasting in the British Isles," *Quarterly Journal of the Royal Meteorological Society* (1952) 1-21.
[36] Meteorological Office, *Annual Report* (London: HMSO, 1939); Meteorological Office, *Annual Report* (London: HMSO, 1947)
[37] Edwards 2010, 63-80. See also Magnus Vollset's paper in this issue.
[38] TNA: AIR 2/14909 World Meteorological Organisation Commission for Climatology; Meteorological Office, *Annual Report* (London: HMSO, 1959)
[39] Fleming 1998, Chapter 9; Edwards 2010, Chapter 5
[40] TNA: HLG 71/28 Relationship between site development and climatology, 1948-1951.

research climatologists employed in the UK in the post-war years are the last group I now turn to.

Understanding the Climate: Geographers and statistical analysis

Climatologists in Britain were few in number, most likely numbering less than ten at any point in the years 1945-50. My focus here shall be on the two most prominent British climatologists in the period. Firstly, the aforementioned Gordon Manley, who after periods lecturing at Durham, Birmingham and Cambridge, became the first professor of geography at Bedford College in 1948. He remained there until 1964 when he left to found the Environmental Sciences Department at the University of Lancaster.[41] Secondly, Hubert Lamb, who at the time was working in the climatological department at the MO in the long-range forecasting research division and would go on to found the Climate Research Unit in 1972 at the University of East Anglia.[42] Although often not primarily considered a geographer, Lamb had studied the subject as an undergraduate at Cambridge and geographical thinking would remain a central feature of his approach to climatology throughout his career.[43] Both were familiar with consulting and working on applied government research. At this time Lamb was an employee at the MO while, from the mid-1950s Manley held a MO research grant to investigate London's meteorological records, and during the same period he was involved with ongoing work with the Ministry of Fuel and Power on the effect of temperature on fuel.[44] However, rather than focussing on the smaller, applied aspects of their work, I want to highlight some of the new climatological approaches and techniques that these two figures developed, which are emblematic of the broader methodological developments climatology underwent in the post-war years.

By exploring the analytical methods that Manley and Lamb began to employ in the post-war years, we can see that they were important figures who bridged the traditional empirical 'stamp-collecting' approach of climatologists as the compilers of meteorological observations, and the modern global computer modelling of climatologists today.[45] Other British figures that played a bridging role between the descriptive climate statistics tradition and the emergent field of climate dynamics include MO Assistant Director of the Climatological Division, Charles Brooks and the identifier of the link between anthropogenic carbon dioxide production and climate change, Guy Stewart Callendar.[46] However, both Manley and Lamb also had roles as public intellectuals, helping to maintain connections between professional climatologists, amateur networks and the wider public. Both founded university departments dedicated

[41] G. Endfield et al., "Gordon Valentine Manley and his contribution to the study of climate change: a review of his life and work," *WIREs Climate Change* (2015): 2
[42] Walker 2012, 403
[43] J. Martin-Nielson, "Ways of knowing climate: Hubert H. Lamb and climate research in the UK," *WIREs Climate Change* (2015): 2.
[44] TNA: BJ 5/303 Researches into past weather of London: publication by Professor Gordon Manley; Gordon Manley Collection: Cambridge University Library, Ms Add 8386/17.
[45] Edwards 2010, 61-82.
[46] C. E. P. Brooks, *Climate Through the Ages* (New York: R. V. Coleman, 1926); J. R. Fleming, *The Callendar Effect: The Life and Work of Guy Stewart Callendar (1898-1964)* (Boston: American Meteorological Society, 2007).

to the study of the natural environment in a societal context, Manley wrote a weekly column in the *Manchester Guardian*, regularly featured on both regional and national radio, and founded the Royal Meteorological Society's popular public facing journal *Weather* in 1946,[47] whilst Lamb contributed 24 articles to this publication, alongside numerous letters and features on a wide range of subjects in newspapers such as *The Times*.[48]

At a time when methodological developments which required ever larger data sets, computing resources, and more advanced mathematics were increasingly separating professional climatology from amateur and folkloric traditions, through their public profiles and work with organisations like the Royal Meteorological Society, both Manley and Lamb helped to maintain links across the three groups outlined in this paper. In this capacity they acted as important mediators, translating and communicating information across the increasingly disparate networks.

In their research both were strongly influenced by international researchers, notably the US based, German pioneer of climatological statistical analysis, Helmut Landsberg, and by a host of Scandinavian climatologists and meteorologists, including Sweden's Hans Ahlmann and Denmark's Leo Lysgaard.[49] In addition to these international figures, Lamb and Manley worked amongst a small network of UK based research climatologists. Most were based at the MO, where researchers were now beginning to advance earlier models based on geographical variation, using the latest mathematical and statistical meteorological methods.[50]

Throughout his career Manley worked on a vast array of problems, from the extent of the last glacial maximum to snow in London. He is most commonly remembered, especially by climatologists today, for his meticulous work creating the Central England Temperature (CET) series, which he first published in 1953.[51] The CET is the longest continuous record of instrumental surface temperatures in the world, with daily measurements going back to 1772 and monthly means going back to 1659. It is compiled from a vast array of climatological records that Manley collated and standardised over several years, giving an average temperature for a roughly triangular area covering the centre of England between Bristol, Lancashire and London. The CET series quickly became a central component of climatological study and is indicative of wider developments in the field, as study progressed from the local and individual compilation of data to larger standardised and applied uses of meteorological

[47] Endfield et al. 2015, 7-8

[48] For example: H. H. Lamb, "Malta's Sea Breezes," *Weather* **10** (1955) 256-264; H. H. Lamb, "A voice in Europe," *Times* (23 June 1984): 9; H. H. Lamb, "Britain's worsening winters," *Times* (30 Jan. 1971): 12.

[49] Manley's work on snow and glaciation in the British Isles was heavily influenced by Ahlmann's work on glaciation and climate in Scandanavia, e.g. G. Manley, "Snowline in Britain," *Geografiska Annaler*, 1939, 31, 179-193. Whilst Lamb highlighted Landsberg's interest in his research and encouragement as integral to the development of his career, see H. Lamb, "Helmut Erich Landsberg, 1906–1985," *Climatic Change* **9 (**1986) 265-266.

[50] The career of Charles Brooks typifies these developments at the MO; after publishing the widely cited *Climate Through the Ages* in 1926, Brooks went on to champion mathematical arguments to support historic climatic variation. See C. E. P. Brooks, 1926 and C. E. P. Brooks and N. Carruthers, *Handbook of Statistical Methods in Meteorology* (London: HMSO, 1953).

[51] J. A. Steers, "Gordon Manley 1901-80," Transactions of the Institute of British Geographers **5 (**1980) 513-517.

observations. Updated by Manley in 1974, today the series is maintained by the Hadley Centre at the MO and is used to calibrate proxy records of climate change.

In the early 1950s Lamb was working on many similar issues to Manley. In 1950 he published a paper introducing the Lamb Weather Type, which when combined with a 1972 follow-up paper, would go on to become his most cited work.[52] The system, which classified synoptic weather based on variations in surface pressure across the British Isles, like Manley's CET series, can be seen as indicative of the shift that climatological research was undergoing in the period. This shift saw the large amounts of data being collected not only standardised, but also manipulated, analysed and applied to larger climatological questions. Together, Lamb and Manley were important in helping the discipline begin seriously considering climate over larger regional and hemispheric scales, and in considering climate change over time. Lamb was particularly important in bringing to light the possibility that climate may vary and change at the human timescale.[53]

Statistical analysis and manipulation of climatological data, as advocated and practiced by Manley and Lamb, continued to increase through the 1950s. In the second half of the decade, computerized systems using punched card technology became commonplace in the Climatological Department at the MO.[54] By the end of 1957, the World Meteorological Organization, via the Commission for Climatology, was selling similar microcards containing meteorological data collected during the International Geophysical Year (1957-58).[55] However, as computing capability continued to increase, the empirical climatological tradition was progressively replaced by climatological study focused on global climate monitoring and modelling.[56] Whilst such an approach was more physical and theoretical in its nature, it relied as much on statistical approaches, as championed by Manley and Lamb, as it did upon Guy Stewart Callendar's now seminal, but then still contested, 1938 paper on the artificial production of carbon dioxide.[57]

Whilst Manley and Lamb can both be viewed as progenitors of global climate studies and climate modelling, we must also be clear on where their views on both the utility of numerical methods, and the issue of anthropogenic climate change lay. Whilst their post-war work was both in academic and public realms crucial in progressing and promoting dynamic climatology, as the practice of climate modelling emerged, both Lamb and Manley held reservations about man's ability to predict climate on any meaningful scale. Lamb left the MO in 1970 to set up the Climate Research Unit at the University of East Anglia. Leaving in response to what he saw as the overreliance of the MO on computers and numerical methods. Manley also eventually became disillusioned

[52] H. H. Lamb, "Types and spells of weather around the year in the British Isles : Annual trends, seasonal structure of the year, singularities," *Quarterly Journal of the Royal Meteorological Society* **76 (**1950) 393-429; H. H. Lamb, "British Isles Weather types and a register of daily sequence of circulation patterns, 1861-1971," *Geophysical Memoir 116* (London: HMSO, 1972); H. H. Lamb, *Through All the Changing Scenes of Life: A Meteorologist's Tale* (East Harling, Norfolk: Taverner Publications, 1997).
[53] J. A. Kington, "Hubert H. Lamb – a review of his life and work," *Weather* **63** (2008) 187-189.
[54] Meteorological Office, *Annual Report* (London: HMSO, 1956).
[55] TNA: AIR 2/14909
[56] For example see Gilbert Plass' mid 1950s creation of a computer model of infra-red radiative transfer in Fleming 1998, 121-122.
[57] G. S. Callendar, "The Artificial Production of Carbon Dioxide and its Influence on Temperature," *Quarterly Journal of the Royal Meteorological Society* **64 (**1938) 223-240; Fleming, 2007: Chapter 5.

with the number of studies that were not based on firsthand scientific study, and stuck by his climate history methods whilst most around him were adopting environmental modelling methodologies.[58] Although Manley was reticent to be drawn on anthropogenic causes of climate change and Lamb's position on it changed throughout his career,[59] both were pioneers of climatological study that was culturally situated and connected. Both understood climate as a boundary issue and believed the future of climatology lay in interdisciplinary boundary work. This willingness to work with, amongst others geologists, historians, and local expertise such as that held by farmers, has had a lasting influence, and can be felt in the inter- and multi- disciplinary approaches of climate studies today.[60]

Conclusion

The ever-increasingly technical and technology-reliant methods being adopted by climatology in the post-war years seem at first to be completely divergent from some of the earlier traditions introduced in the first half of this paper. However, through small glimpses of interactions via organisations such as the Royal Meteorological Society, we see how the newly emergent climatological approaches and their professionalised proponents remained in touch with amateurs and earlier traditions of climatological study. Despite climatological study in the period being heterogeneous and varied in approach, the discipline in Britain managed to maintain a connection between the amateur and the professional. In this respect, Gordon Manley stands out as a unique character, writing his column in the *Manchester Guardian* at the same time he was working on the complicated statistical compilation of the CET series.

Today, despite scientific consensus on the threat posed by anthropogenic climate change, potential solutions have failed to gain widespread public support and consequently meaningful political action has been limited. In response to this disconnect between scientific knowledge and societal action, academics are increasingly highlighting the importance of cultural aspects of climate knowledge. Much of this academic work shows the important role particular, specific, and local perspectives of climate can have in connecting communities to the often abstract scientific study of anthropogenic climate change. In light of such developments, scientists such as Manley and Lamb, who were consistently progressive and critical in their approach to climatological study, whilst always remaining aware of larger societal debates, should be seen as important figures that can help to inform current debates.

Despite the rise of global-scale climate compilation and modelling, it is not only academic climatologists like Manley and Lamb who have a notable legacy; weather sayings, lore, and folk traditions still persist and form an integral part of many regional

[58] R. A. S. Ratcliffe, "Meteorologist's Profile – Hubert H Lamb," *Weather* **47** (1992) 263-266; Endfield et al. 2015, 10

[59] In recent years climate sceptics have popularised the idea that Lamb was a prominent early climate change denier. However Janet Martin-Nielson (2015) shows that Lamb's position on anthropogenic climate change was much more nuanced, encompassing concerns about the reductive approach of modellers, the potential for large errors with predictions, and the lack of integration of climate models with other approaches to climate decision-making.

[60] T. D. Davies, "Guest Editorial – Hubert Lamb," *Weather* **53** (1998) 200; Martin-Nielson, (2015); L. Veale and G. Endfield, "The Helm Wind of Cross Fell," *Weather* **69** (2014), 6-7.

identities in Britain. Further, the rise in popularity of the citizen science movement has once again seen amateur networks revitalised and put to work doing real scientific research.[61] In addition to the Woodland Trust's, Nature's Calendar Survey, referred to in the introduction, the distributed computing project Climate*prediction*.net is now using the idle time of over 30,000 personal computers to run ensemble climate models, alongside engaging participants in education on the role of computer models in climate change research.[62] At the MO, applied climatological services continue to be developed under the World Meteorological Organization's "national framework" and are increasingly being applied to regional, national, and even international scales.[63] Finally, while both Manley and Lamb's approach to statistical climatological work may have been superseded, the compilation of data series, both from observed, and subsequently proxy records, has only continued to increase in importance. Today, the techniques and series developed by climatologists in the post-war period, including Lamb's weather types and Manley's CET series, are foundational elements of climate modelling and climatology more generally.[64]

[61] T. Gura, "Citizen Science: Amateur experts," *Nature* **493 (**2013) 259-261.
[62] "Climate*prediction*.net," http://www.climateprediction.net/, accessed 16/07/2015.
[63] See the MO's Climate Services online at http://www.metoffice.gov.uk/climate-service-uk, accessed 16/07/2015.
[64] D. Conway and P. D. Jones, "The use of weather types and air flow indices for GCM downscaling," *Journal of Hydrology* **212** (1998) 348-361; J. R. Knight et al., "Climate impacts of the Atlantic Multidecadal Oscillation," *Geophysical Research Letters* **33** (2006) 1-4.