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Introduction

Adeline Johns-Putra

Climate is not just weather but weather observed, measured, and recorded – a composite of meteorological events as they are correlated, compared, and contrasted over time and space. Climate is, as Paul Edwards puts it, 'the history of weather – the average state of the atmosphere over periods of years, decades, centuries, and more'.[1] Although such codification aims at accuracy and transparency – the production of data that throws up historical patterns that in turn aid forecasting – it is also, in some sense, an act of mediation. The discernment of structures, cycles, and paradigms emphasises order as normal and highlights disorder as remarkable. Pattern and predictability are what render this information useful. In the words of the climatologist F. Kenneth Hare, 'Climate is the ordinary man's expectation of weather . . . Climate is made up of the succession of weather events he has learned to expect, and to resign himself to.'[2]

Weather and/as Climate

If the patterns of climate emerge through records over time, statistically as well as narratively, then, one could say, climate emerges discursively – indeed, as Mike Hulme puts it, '*climate* is an idea invented in the human mind'.[3] The discourse of climate is not simply the kind of studiously 'objective' observation and measurement one tends to associate with climatological data; it encompasses the history, possibly as old as human civilisation, of attempts to apprehend and describe patterns in the weather. These attempts include, then, both ostensibly neutral observation and the embellished, affectively charged descriptions one might call literature – along with all the forms of description in between. Climate, as weather

[1] Paul N. Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge, MA: MIT Press, 2010), p. xiv.
[2] F. Kenneth Hare, 'The Concept of Climate', *Geography*, 51 (1966), 99–100.
[3] Mike Hulme, *Weathered: Cultures of Climate* (London: Sage, 2017), p. 16, original emphasis.

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documented, necessarily possesses an intimate relationship with language, and through language, to literature.

Early historical records of human activity, which in ancient societies would depend on or respond to weather, almost always involve some climatic observation. The Hindu Vedas, among the earliest sacred texts still in existence, contain discussions of weather cycles, some of which provided the basis for the *Rtusamhāra* ('The Garland of the Seasons') (fifth century CE), a chronicle of love through the seasons, written by the Sanskrit poet Kalidasa.[4] Ancient Chinese court records include details of, among other things, extreme meteorological events; they thus constitute a unique data bank for the emerging field of Chinese climate history.[5] One of the oldest chronological histories, *Chunqiu* ('The Spring and Autumn Annals'), covers a period from 722 to 481 BCE and comprises brief, month-by-month observations of such things as natural climatic disasters and celestial phenomena. The famous *Shi Ji* ('Records of the Grand Historian') (*c.* 94 BCE) by Sima Qian offers a comprehensive set of narratives of states and leaders, whose contexts include references to seasons and their weather.[6] Meanwhile, ancient Greek texts provide both phenological information and philosophical reflections on climate. In the first category, one might include the *parapegmata* or almanacs, with their records of seasonal changes in the weather, the night skies, day lengths, and so on, for primarily functional purposes such as agriculture and fishing. There also exist descriptions of climate, and the need for farmers to work in sympathy with it, in Hesiod's *Works and Days* (*c.* 700 BCE). In the second category, one encounters the Hippocratic *Airs, Waters, Places* of about the fifth century BCE, and Aristotle's *Meteorology* (or *Meteorologica*) written in the second century BCE, with their reflections on the significance of meteorological phenomena and, in both cases, the possible link between air, health, and national character.[7] In ancient Greco-Roman culture, in other words, there are attempts to record, understand, and predict weather

[4] Murali Sivaramakrishnan, 'Ecopoetics and the Literature of Ancient India', in John Parham and Louise Westling (eds.), *A Global History of Literature and Environment* (Cambridge University Press, 2017), pp. 68–9; Kalidasa, 'Rtusamhāram (The Gathering of the Seasons)', in *The Loom of Time*, trans. Chandra Rajan (New Delhi: Penguin, 1999), pp. 103–35.

[5] Ka-wai Fan, 'Climate Change and Chinese History: a Review of Trends, Topics, and Methods', *WIREs Climate Change*, 6 (2015), 225; J. Q. Fang, 'Establishment of a Data Bank from Records of Climatic Disasters and Anomalies in Ancient Chinese Documents', *International Journal of Climatology*, 12 (2006), 499–519; Zhu Kezhen, 'A Preliminary Study on the Climatic Fluctuation during the Last 5000 Years in China', *Scientia Sinica*, 16 (1973), 226–56.

[6] Zhu, 'A Preliminary Study'.

[7] David Bowker, 'Meteorology and the Ancient Greeks', *Weather*, 66.9 (2011), 249–51; James Rodger Fleming, *Historical Perspectives on Climate Change* (Oxford University Press, 1998), 11–12.

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patterns. Alongside this, there occur attempts to discuss climatic conditions in different parts of the world: *klima*, after all, means inclination, and refers to the idea that climate depended on the angle of the sun and thus on latitude, on the basis of which Ptolemy, in the second century CE, posited the existence of fifteen climatic zones at different latitudinal bands around the globe.[8]

In even the earliest iterations, then, what one might think of as literature (that is, imaginative writing aimed at entertaining as well as informing) is the expression of a world in which weather, more than just the mere instantiation of divine or natural caprice, is climate inasmuch as it accedes to or diverges from stable, predictable patterns. It would be too simple, then, to suggest of pre- and early modern writing that climate is the proper subject of objective record and weather the domain of literature. From ancient literature onwards, we find recorded the effects of weather in both extraordinary and everyday terms. Certainly, from classical to Renaissance literature, dramatic weather events abound in literature, whether Homer's storms or Shakespeare's, but predictability and familiarity, too, have their affective dimensions; we see this in seasons poetry, through the ages and in various cultural traditions, where seasonal characteristics are linked to stock feelings, expressions, and subjects. In the literary – and, indeed, human – imagination, day-to-day climatic stability and unusual weather events are inextricably linked as two sides of the conceptualisation of climate as fundamentally stable (or at least as stable *in loco*, with geographical variations).

In the history of climate, the Enlightenment and what has been called its 'quantifying spirit' bring major developments. These are nothing less than the advent of climatological science, or what Theodore Feldman has described as the proper development of meteorology's two branches of 'weather observation' and 'climatology' (that is, the 'analysis of observations for weather patterns').[9] This formalisation of weather as climate through empirical, longitudinal recording and analysis aligns more clearly dramatic, one-off weather events with literary discourse, on the one hand, and observations of climate stability with scientific discourse, on the other.

Even so, the distinction between an affective response to climate and an objective description of it in early Enlightenment meteorology is not hard and fast. Eighteenth-century meteorology reiterates the classical

[8] Edwards, *A Vast Machine*, p. 29.
[9] Theodore Feldman, 'Late Enlightenment Meteorology', in Tore Frängsmyr, J. L. Heilbron, and Robin E. Rider (eds.), *The Quantifying Spirit in the Eighteenth Century* (Berkeley: University of California Press, 1990), pp. 145–6.

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interest in the psychological and cultural significance of climate. As Vladimir Janković describes it, meteorological study at this point 'was based on a conjunction of ideas drawn from several cognitive provenances: Greco-Roman natural philosophy, Elizabethan and Tudor paraphrase of that knowledge, and an interrelated set of beliefs derived from astrology, magic, and weather folklore'.[10] That is, it operated within a framework of classical theories, including Aristotelian and Hippocratic determinist notions about 'quality of air', 'health and national character', supported by folk knowledge.[11] As James Fleming writes, 'Enlightenment thinkers apprehended climate and its changes primarily in a literary way. They compared the ancient writings to recent weather conditions, linked the rise and fall of creative historical eras to changes in climate, and promoted a brand of climatic determinism based on geographic location and the quality of air.'[12] This is not to say, however, that empirical observation did not occur. Janković elaborates on how '*qualitative* and *descriptive*' observation dominated the popular practice of weather diary-keeping in eighteenth-century England, itself born of the seventeenth-century practice of maintaining regional geographical records, or chorography.[13] And yet, such record-keeping should not be thought of as 'scientific' in the way of technical or statistical discourse. By and large, it remained concerned with extraordinary, rather than ordinary, weather and astronomical events (in the tradition of Aristotle's *Meteorologica*, with its concern with meteors and other 'things on high'), and was couched in 'ordinary rather than "technical" language'.[14] Weather diary entries resembled 'personalized *narratives* of extraordinary, striking, or rare phenomena'.[15] Meteorological philosophy was primarily concerned with the influence of climate on individuals and society, while meteorological observation focused on personal descriptions of dramatic climatic incidents. Both revolved around individual experiences of weather.

The Climate of Enlightenment

A more profound shift to continuous and longitudinal weather observation occurred towards the end of the eighteenth century. Feldman describes this as a drastic turn in the 1770s towards '[o]rganized meteorology' in scientific

[10] Vladimir Janković, *Reading the Skies: a Cultural History of English Weather, 1650–1820* (Manchester University Press, 2000), p. 15.
[11] Fleming, *Historical Perspectives*, p. 11. [12] Ibid., p. 12.
[13] Janković, *Reading the Skies*, pp. 34, 7–8. [14] Ibid., p. 34. [15] Ibid.

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societies and networks across Europe.[16] As Janković explains, while the idea of a sudden 'transformation' is deceptively simple, one can nonetheless point to the gradual giving way of one empirical approach – the 'qualitative reportage of extraordinary weather events' – to another – 'the quantitative measurement of a "weather-continuum"'.[17] The meteoric tradition traceable to Aristotle, with its preoccupation with extraordinary weather, was replaced by an underlying impulse towards codifying orderly climatic patterns, emerging from a combination of natural theology with its understanding of 'an orderly system of laws' and the 'tradition of weather prognostication' with its desire for 'forecasting'.[18] Moreover, local, chorographical observation no longer existed in isolation, but took its place on 'a spatio-temporal grid – its nodes corresponding to the measurements made at remote observational posts'.[19] At first, comparative discussions of regional climates emphasised the Hippocratic notion that climates – particularly local atmosphere – determined cultural characteristics.[20] The immediate impetus behind such ideas was transatlantic colonisation, which, depending on political perspective, either confirmed notions about the relatively stable and thus civilising effects of European climates with regard to North America,[21] or supported American patriotic efforts to incorporate America's 'warmer, less variable, and healthier climate' into an 'integral component of a Republican ideal'.[22] As the nineteenth century progressed, however, the great 'climate debate' created the demand, at the instigation of Benjamin Franklin and Thomas Jefferson, among others, for climate data, and thence the expansion of climate observation networks in the USA, Europe, and Russia.[23] At the same time, the concept of isotherms, first developed by Alexander von Humboldt in 1827, would allow data about local climatic phenomena to be scaled up into larger – even global – images of climatic zones; in 1852, Humboldt's colleague Heinrich Wilhelm Dove published the first isothermal map of the entire planet.[24]

The shift from qualitative to quantitative, from local to comparative, was undergirded by an interest in climate as system: 'Scrutiny of local weather . . . mattered only to the extent to which atmospheric "unity" manifested itself in a locale . . . The culture of "country airs" lost out to the physics of planetary circulation.'[25] Meteorology moved away from an

[16] Feldman, 'Late Enlightenment Meteorology', p. 154. [17] Janković, *Reading the Skies*, p. 36.
[18] Ibid., p. 130. [19] Ibid., p. 35. [20] Feldman, 'Late Enlightenment Meteorology', pp. 155–6.
[21] Jan Golinski, *British Weather and the Climate of Enlightenment* (University of Chicago Press, 2007), pp. 170–202.
[22] Fleming, *Historical Perspectives*, p. 32. [23] Ibid., pp. 33–44.
[24] Edwards, *A Vast Machine*, p. 31. [25] Janković, *Reading the Skies*, p. 11.

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interest in the 'superficial correlations' between 'weather patterns, agriculture, and disease' towards an emphasis on 'interior forces that govern their relations'.[26] The professionalisation of climate science and the understanding of climate as a physical system increased apace in the twentieth century. The 'spatio-temporal grid' became, in Edwards's words, '*a climate knowledge infrastructure*', as 'separate systems' in different countries 'linked their data reporting through loosely coordinated international networks'. Moreover, as the complexity of the climate system became obvious, climatology came to be about climate modelling as opposed to the mere collection of climate data. This led to the 'long and painful process of *infrastructural inversion*' in the 1970s, as climate scientists deconstructed the world's disparate data collection methods in order to standardise them and to achieve global comparability.[27]

Alongside this, in literature through the course of the nineteenth century and into the twentieth, several trends might be discerned. Imaginative responses to striking climate phenomena are unavoidable in the context of the 'Year without a Summer', which produced a concern with catastrophic and apocalyptic imagery in European Romanticism. Through the century, sophisticated evocations of climate determinism also occurred. One might think of Emile Zola's meticulous – indeed, almost chorographic – detailing of local milieu and its effect on individual and familial character in his Rougon-Macquart novels or of Joseph Conrad's description of psychological declension in tropical climes in *Heart of Darkness*.[28] Such a concern with place and climate looks ahead to twentieth-century genres as diverse as Scandinavian crime fiction and Latin American fiction, particularly magical realism.[29] At the same time, a very different preoccupation with climate emerged at the end of the nineteenth century. In its overt engagement with science, science fiction appropriated science's growing knowledge of the workings of global climatological and ecological systems as materials for both setting and plot, discernible, for example, in the Arctic geo-engineering plan to adjust the tilt in the Earth's axis and thus its climate in Jules Verne's *The Purchase of the North Pole* (*Sans dessus dessous*)

[26] Feldman, 'Late Eighteenth-Century Meteorology', p. 175. [27] Edwards, *A Vast Machine*, p. xvi.
[28] See, for example, Jessica Tanner, 'The Climate of Naturalism: Zola's Atmospheres', *L'Esprit Créateur*, 57 (2017), 20–33; Jessica Howell, *Exploring Victorian Travel Literature: Disease, Race and Climate* (Edinburgh University Press, 2014), pp. 137–63.
[29] See, for example, George R. McMurray, 'The Role of Climate in Twentieth-Century Spanish American Fiction', in Janet Pérez and Wendell Aycock (eds.), *Climate and Literature: Reflections of Environment* (Lubbock: Texas Tech University Press, 1995), pp. 55–65; Gary S. Elbow, 'Creating an Atmosphere: Depiction of Climate in the Works of Gabriel García Márquez', in Pérez and Aycock, *Climate and Literature*, pp. 73–81.

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of 1889, and in the global cooling on Mars that brings about the invasion of Earth in H. G. Wells's *The War of the Worlds* (1897).[30]

Climate science – particularly, climate modelling – in the twentieth century brings on the most revolutionary information of all. An understanding of the workings of planetary climate developed in tandem with an awareness of the growing problem of global warming. As Edwards explains, the 'climate knowledge infrastructure' culminated in the Intergovernmental Panel on Climate Change (IPCC) and a concentration of scientific investigations into the phenomenon of anthropogenic climate change towards the end of the century.[31] With this came the attendant possibility in the twenty-first century that its effects are significant enough to warrant the identification of a new geological epoch, the Anthropocene. In the age of climate change, the physical impacts of changes in global climate are recognisable not merely as a question of meteorological and ecological concern, but also – because these are dire in terms of loss and damage to human and non-human species – as having profound political and social effects. With these effects have come the need for a collective emotional, ethical, and psychological response, including literary engagements with climate and climate science. This has brought back into focus the affective dimensions of climate, highlighting just how tenuous the line is between the scientific and imaginative discourses of climate.

Climate, Time, and Space

To discuss the history of climate and literature, up to and including the Anthropocene, simply as an Enlightenment splitting off of scientific quantification from matters of affect, is to miss some of that history's finer points. To be sure, it is now a critical commonplace that scientific questions of climate occur at a very different spatio-temporal scale from the individual concerns of the literary. Climate criticism now abounds with observations on the scalar 'derangement' brought on by the unprecedented spatial and temporal dimensions of the climatic phenomena described by climatology.[32] Yet, it is much less often pointed out that the temporal

[30] Jules Verne, *The Purchase of the North Pole* (London: Sampson Low, 1890); H. G. Wells, *The War of the Worlds*, ed. David Y. Hughes and Harry M. Geduld (Bloomington: Indiana University Press, 1993).
[31] Edwards, *A Vast Machine*, pp. xvi–ii.
[32] See, for example, Timothy Clark, 'Derangements of Scale', in Tom Cohen and Henry Sussman (eds.), *Telemorphosis: Essays in Critical Climate Change*, vol. 1 (Ann Arbor: Open Humanities Press,

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challenge of understanding climate – and climate change – is of a different order from any of the spatially oriented difficulties of comprehension; indeed, the discursive history of climate and time is distinct from that of climate and space.

Of course, we experience weather, corporeally and psychologically, in a way that is both immediate and individual, that is, in terms of time and space together. Also, climate is weather quantified over regular intervals and between different locales, that is, it is understood and expressed within the parameters of time and space together. Indeed, that very quantification of climate was enabled by pre-modern advances in the conceptualisation of time and space – namely, the ability to measure climate was made possible by the invention of what Nicholas Carr calls the 'intellectual technologies' of the clock and the map, respectively.[33] 'What the map did for space', notes Carr, 'the mechanical clock did for time'; both map and clock 'translate[d] a natural phenomenon into an artificial and intellectual conception of that phenomenon'.[34] Advances in cartographic and horological thought together enabled climate science, both 'global space' and 'universal time' eventually becoming crucial to modern climatology.[35]

As Enlightenment climate science progresses, literature evolves to record the spatial, even global, dimensions of climate, but struggles to apprehend its temporal dimensions. In the nineteenth century, as we have seen, both individual, corporeal experiences of weather and local observations of regional climates are joined by a notion of climate as a planetary phenomenon. In tandem with this, the formal characteristics of narrative fiction develop in that century into high realism – that is, they are refined into a particular method that invokes characters' psychological experiences while, at the same time, putting these into play with engaging settings and plots.[36] This dynamic between the two levels of engagement of affect and

2012), pp. 148–66; Amitav Ghosh, *The Great Derangement: Climate Change and the Unthinkable* (University of Chicago Press, 2016).

[33] Nicholas Carr, *The Shallows: How the Internet Is Changing the Way We Read, Think and Remember* (London: Atlantic, 2010), p. 44.

[34] Ibid., p. 41.

[35] Edwards, *A Vast Machine*, pp. 27–47. Even the ways in which climate translates itself into experience is in both dimensions at once. Mark Maslin opens his introduction to climate by invoking that mundane but necessary response to climate – what to wear; for Maslin, one's outfits will 'reflect the climate in which you live and how it changes throughout the year'; *Climate: a Very Short Introduction* (Oxford University Press, 2013), p. 1. Maslin's description recalls Hare's definition of climate as weather rendered predictable – specifically, it echoes Hare's assertion that, for the average person, a knowledge of climate means that 'there is a limit to the indignities that the weather can put upon him, and he can predict what clothes he will need for each month of the year'; Hare, 'The Concept of Climate', 99–100.

[36] Fredric Jameson, *The Antinomies of Realism* (London: Verso, 2015), p. 16.

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story – what Fredric Jameson calls '*roman*' and 'récit' – allows the novel to develop, in Jesse Oak Taylor's words, into a 'climate model'. For Taylor, the novel is capable of making the reader feel or perceive the effects of climate on both individual and geographical spaces: 'Reading novels . . . involves the kind of suspended and associative thinking necessary for modelling the experience of climate as an aggregation of atmospheric effects.'[37] Taylor makes a case, furthermore, for the realist novel's capacity to enlarge the reader's experience to encompass the global, since any realist novel's 'storyworld' must potentially and hypothetically include the entire world, in order to retain its status as realism.[38] Certainly, it is on the same basis that the world-building of science fiction novels, which operate on realism's principles of internal coherence, are able to invoke planetary climatic systems. The conventions of literature, it seems, develop to capture the enlarged spaces of climate – from the individual to the regional to the global.

The formal study of climate science introduces the global to individual and local scales of experience, which literature – most obviously, the novel – accommodates. But literary convention is rather more stretched by climatic conceptions of time. Alongside individual and local timescales (that is, human lifetimes and historical epochs), climate science and, particularly, this century's concerns about climate change bring into purview not just individual and local but geological durations of time. It is, then, not the climatological expansion of the concept of time as universal time that is at stake here – universal time is a function of a global sensibility and thus a matter of rendering time as spatially simultaneous. What matters as climate science turns its gaze to climate systems and climate change is not the apprehension of time as universal, as a function of the apprehension of space as global, but the ability to expand time frames and durations. Concerns about the long-term effects of human activity on climate – and, in turn, the effects on human life of the climate thus changed – have reconfigured ideas of *longue durée* beyond that of historical grand narrative or individualised struggle, into supra-human views of the ecology and evolution of species, the human species amongst them.[39] To be sure, narrative literary form is not incapable of imagining time above and beyond the human. In Frank Kermode's estimation, narrative is predicated on an analogy between the prosaic sense of time as the day

[37] Jesse Oak Taylor, *The Sky of Our Manufacture: the London Fog in British Fiction from Dickens to Woolf* (Charlottesville: University of Virginia Press, 2016), p. 14.
[38] See Chapter 2 by Taylor in this volume.
[39] Dipesh Chakrabarty, 'The Climate of History: Four Theses', *Critical Inquiry*, 35.2 (2009), 197–222.

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to day (or *chronos*) and the cosmological sense of it as human destiny (*kairos*).[40] Yet, kairotic time goes hand in hand with theological conceptions of the human, and hence its manifest destiny is human apocalypse, revelation, and renewal. The geological or evolutionary time of climate change, in contrast, demands a reckoning with non-human destiny, a reckoning that the still ubiquitous forms of literature, such as fiction and poetry, are only now beginning to perform.

Origins, Evolution, Application

This volume proceeds in three sections. The first part, 'Origins', explores some of the fundamental questions arising out of the discursive condition of the concept of climate. The first two chapters grapple with questions of time and space, respectively. In Chapter 1, Robert Markley considers the capacity of literature, particularly fiction, to depict not just experiential time but historical time, and, indeed, not just historical time but – with the advent of awareness of weather as climate – its incarnation as climatological time. In Chapter 2, Jesse Oak Taylor discusses fiction's intimate relationship with climate in spatial terms; Taylor shows how the novel's emotionally charged, literary atmosphere functions much like a meteorologically determined, literal atmosphere. It affects the psychologies and physiologies of individuals, and thus replays for the reader the experience of not just individual, experiential weather but geographical, regional climate. The chapters that follow explore some pre- and early modern literary texts that are both responses and contributions to the conceptualisation of climate. In Chapter 4 Daryl Lehoux discusses climatic concepts in classical Greek culture and literature, from Ptolemaic geographical divisions of the world into climatic bands of latitude (or *klimata*) to medical and anthropological considerations – such as those of Hippocrates – of climate determinism. Classical concepts of latitudinal *klimata* – and thus what zones might be habitable – extended well into the Middle Ages. P. S. Langeslag, in Chapter 5, contrasts the idea of climatic zones with two very different examples of medieval climatology: Icelandic and Greenlandic literature that details the effects of harsh sub-arctic climates on human activity and religious apocalyptic scenarios that warn of climatological degradation before the end of the world. Tess Somervell, in Chapter 3, chronicles seasons literature from the classical age to the

[40] Frank Kermode, *The Sense of an Ending: Studies in the Theory of Fiction* (1967; Oxford University Press, 2000), p. 47.

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