
INTRODUCTION

Weather, Climate, and the Geographical Imagination

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THE INTELLECTUAL HISTORY OF CLIMATE, once perhaps a rather arcane corner of historical inquiry, is now a burgeoning, vibrant field of study. This is, in part, directed by a concern to historically situate contemporary concerns about climate change and by a renewed sense of the importance of historical scholarship in exploring the multifaceted relationships between climate and society. As global temperatures rise under the forcing hand of humanity's greenhouse gas emissions, new questions are being asked of how societies make sense of their weather, of the cultural values that are afforded to climate, and of how environmental futures are imagined, feared, predicted, and remade. The urgency of contemporary debates about global climate change—about efforts to mitigate, to adapt, perhaps to manage and control—do not often leave room for considered reflection about the values that infuse our knowledge and understanding of an object, the global climate, which seems to elude direct sensory experience and to hover somewhere above the scales of conventional humanistic engagement with the world. Yet a growing number of scholars in the humanities and social sciences are embracing weather and climate as sites of inquiry. Some are seeking to supplement, or perhaps to translate and humanize, more dominant scientific renderings of such objects; others to probe more critically, to challenge particular scientific framings of environmental change, or to situate the practices and politics of the atmospheric sciences in wider historical and cultural contexts. While

the ugly residues of past environmental determinisms may have seen climate banished from much humanistic scholarship around the middle of the twentieth century, a renaissance is now underway, and the homogenizing eye of earth system science is being supplemented by a multitude of views of what weather and climate look like, feel like, and mean to people in a mounting diversity of social and cultural settings.¹

In this book we seek to contribute to this new conversation by bringing together a range of voices from history of science, historical geography, and environmental history, each speaking to a set of questions about the role of space and place in the production, circulation, reception, and application of knowledges about weather and climate. In recent years historians of science, buoyed by new historiographical interests in the nature of scientific observation, the politics of expertise, and the cultural import of prediction, have offered important new readings of the historical development of the sciences of climate.² Historical and cultural geographers, throwing off an earlier reticence to engage with climate and all its environmental-determinist baggage, have shone new light on the competing narratives of climate and climate change that animate political and cultural worlds.³ At the core of this scholarship on climate is a renewed attention to the geographies of knowledge about phenomena—weather and climate—that are themselves inherently spatial. Weather, although a product of globe-spanning dynamics, is always experienced in place, while the idea of climate has historically operated at a range of spatial scales, from the microclimate of the body, through claims about the climatic character of nations, to the notion of a global, and perhaps fragile, climate system. As horizons of expectation about climate and its changes have stretched into the far future, conceptions of regional climatic difference have given way to temporal concerns for the steady—or perhaps erratic—evolution of the global climate system under human forcing. Yet despite new understandings of the power of human agency in shaping the weather, climate still plays a powerful, sovereign role in its imagined capacity to fundamentally shape human geographies of violence, economic prosperity, and environmental vulnerability.⁴ Understanding this lineage not only of climatic determinism but of climatic expectation more broadly is a critical historical task with urgent contemporary resonances.

The contributors to this volume collectively develop the concept of “geographical imagination” to address the intersecting forces of scientific knowledge, cultural politics, bodily experience, and spatial imaginaries that shape the history of knowledges about climate. In recent years the concept of geographical imagination has come to be read both as a way of describing particular suites of knowledge-making practices and as a way of describing much broader modes of

comprehension and experience, where the conditions “of both the known world and the horizons of possible worlds” mingle in imaginaries of space and place.⁵ The geographical imagination may be said to occupy a space between objective reality and subjective experience, where perceptions of the real and the imagined shape each other to produce influential, widely circulated, and enduring sets of knowledge and expectation—or (rendered in different theoretical terms that we develop below), geographical imaginaries shape, and are shaped by, the materials, practices, discourses, and places through which they are produced. Our aim is to critically reconsider the role of knowledges, experiences, and expectations of weather and climate in the shaping of particular geographical imaginations and to interrogate the material, cultural, and environmental geographies through which such knowledges have been produced, circulated, and put to work in human dealings with climate, at a range of spatial scales. We first review the importance of geographically and sociologically interrogating “knowledge” about weather and climate and how such knowledges have generated particular kinds of imaginations. We then loop back to examine how these imaginations have also, in turn, shaped specific knowledge-making practices themselves.

GEOGRAPHIES OF KNOWLEDGE

Scientific knowledge-making, like any other realm of human activity, has its geographies. Science proceeds in and through space and participates in the construction of cultural and political geographies by which human interactions with the nonhuman come to be known, understood, and governed. The claim that scientific knowledge is “a geographical phenomenon” is the organizing principle of a growing body of scholarship which stresses that to understand the cultural and epistemic authority of science means understanding the spatial practices by which scientific knowledge is produced, by which it circulates, and that shape its reception and interpretation.⁶ Over the last three decades, historians and geographers of science have cemented a “spatial turn” in the study of scientific culture, with concepts such as space, place, network, and circulation now canonical members of the science studies lexicon.

Numerous origin stories might be told about this spatial turn. In many respects it is the logical outcome of early, post-Kuhn work on the social practices of scientific knowledge-making, which made the decisive argument that the production of universal truths could not be explained simply by appeal to those truth claims’ own correspondence to an external reality. Figures like those pushing the Strong Programme in the Sociology of Scientific Knowledge (SSK) argued that the success or failure of different knowledge claims was not reducible to their facticity but, rather, was a function of social relationships and modes of persuasion.

David Bloor's "symmetry principle" called for sociologists to use the same analytical tools to explain both right and wrong knowledge; and fine-grained studies began of the social constitution of scientific worlds—their structuring by social hierarchies, group identities, and power relations.⁷ In the 1980s inheritors of this tradition offered new historical sociological analyses of the spaces of scientific knowledge production, examining how the social relationships that structured scientific knowledge-making were expressed in spatial arrangements—for example, in the exclusion of certain groups from the "gentlemanly" settings of early modern laboratories, in the designation of authoritative witnesses to laboratory practices, and in the spatial extension, through the enrolment of certain "literary technologies," of networks of virtual witnesses to scientific discovery.⁸

These spatially inflected historical sociologies of science, which Richard Powell situates in a "socio-spatial" school of history of science, proceeded alongside the development of new ethnographic approaches to studying the making of scientific knowledge.⁹ Laboratory ethnographies produced influential new theories of the webs of human and nonhuman relationships and agencies that shaped scientific practice and of nonhuman agency in the networks through which entities were tied together in the lab, and subsequently mobilized in the wider world.¹⁰ If the lab was a peculiarly local place, carefully set apart from the world yet in regulated dialogue with selected parts of it, new theories of "science on the move" sought to complement analysis of this localization with analysis of science's spatialization, of the making-mobile of scientific ideas, artefacts, technologies, and tools.¹¹ The Latourian model of circulating "immutable mobiles" has been particularly influential in emphasizing the agency of science's inscriptions—images, graphs, texts—as solid, unchanging artefacts that belie the social contingencies of their production and act to effectively transfer scientific ideas and epistemic authority across space through ever-expanding actor-networks.¹² Yet this model has been critiqued for its "imperialistic language" of enrolment, expansion, and solidity, and for its "oddly realist bow towards bigness" in its evaluation of what makes a successful network.¹³ It stands in need of "decolonisation and demasculinisation" as a model of how science transforms the material and social world.¹⁴ Work in the postcolonial tradition of science studies has perhaps done the most to unsettle the material and semiotic formalism of actor-network theory (ANT), as well as to challenge the historiographical shortcomings of "diffusion" models of scientific expansion more broadly.¹⁵ Postcolonial science studies position colonial spaces as (of course) sites of domination, appropriation, and control but also as sites of contestation, hybridization, and exchange, where scientific knowledge developed out of the sort of intercultural encounters and disputes that ANT and diffusionist historiographies fail to capture.

Recent scholarship on the relationships between climate, empire, and colonialism has started to shed more light on these questions of how science traveled and on the role of the sciences of climate in the imagination and production of colonial space. British colonialism has been a particular focus. Australia and New Zealand were among the first places where meteorology and climatology were quickly institutionalized within colonial government structures, answering “the calls of colonialism and modern science to know and categorize, and in so doing, control environments.”¹⁶ Institutionalized observations began to challenge imported understandings of a set of Australasian climates that might resemble those of home or that could be anticipated to vary with clockwork regularity.¹⁷ Organized meteorology began to displace understandings of local climates that passed between indigenous inhabitants and incoming settlers in the contact zones of colonization, yet there is evidence that Maori meteorologies may have persisted as intercultural modes of weather anticipation well beyond the arrival of European instruments, charts, and predictions.¹⁸ In South Asia, surgeons associated with the East India Company were by the late eighteenth century developing new understandings of atmospheric dynamics on land and at sea, and their exchanges with colleagues in Australasia were broadening the geographic scope of atmospheric vision and conjecture.¹⁹ Yet such actors were not simple agents and champions of imperial power. Many were openly critical of British rule in India and elsewhere, and by the mid-nineteenth century their successors were vocal advocates of forest conservation to protect local climates from the apparently desiccating effects of both indigenous and colonial timber extraction, even if subsequent conservation laws performed their own hardening of imperial control over people, space, and natural environments.²⁰ Katharine Anderson’s description of Indian meteorology and climatology as it became more concertedly institutionalized in the late nineteenth century offers more direct echoes of the enrolment of the sciences into the structure and functioning of colonial states in Australia and New Zealand. Meteorology offered a model of the centralized operation of a vast network of disciplined human subjects, of a new symbiosis between science and state, while the vastness of the Indian empire offered British meteorologists the kind of synoptic field of vision with which their American counterparts were blessed.²¹ While continuing to piece together a picture of global climate oscillations, Indian colonial meteorology also held out the prospect of naturalizing the famines that shook the empire in the late nineteenth century, in describing natural causes that might displace nascent arguments about the state’s ultimate responsibility for the death by starvation of millions of Indian citizens.²²

Meteorology and climatology undoubtedly functioned as tools of empire, but we now have enough historical evidence to refute notions that they were sciences

that simply diffused from the metropole and that their relationships to imperial power were straightforward. Deborah Coen, for instance, has emphasized how the patchwork structure of the Habsburg Empire and the pluralism of Habsburg science encouraged climatic thinking across scales and an appreciation for difference and complexity rather than centralized uniformity.²³ Imperial “peripheries” also produced meteorological knowledge claims that were not pale imitations of metropolitan science but that were original and distinctive and, in many cases, enduring.²⁴ They were produced by a diverse cast of actors with complicated relationships to colonial states and subjects, and in a range of spaces—observatory, the field, medical posts, army offices, and ships—that demand a more detailed appreciation of the historical geographies of weather observation and climatic thought. Although in this book we remain largely Anglophone in context, chapters in this volume by Ruth Morgan, Georgina Endfield, Meredith McKittrick, and James Kneale and Samuel Randalls diversify the cast of characters that populate our meteorological histories, rendering colonial and postcolonial spaces as sites of knowledge hybridization and situating the production and circulation of climate knowledges within multifaceted circuits of cultural exchange, economic transaction, and imperial ambition. Alongside chapters by Katharine Anderson, Martin Mahony, and Simon Naylor and Matthew Goodman, they also point to the diverse material culture of meteorological knowledge production, recalling Gregory Cushman’s work on the shaping of meteorological knowledge (in his case hurricane prediction), not just by rival social groups but by assemblages of matter and media—meteorological guidebooks onboard sailing vessels, newspaper cuttings pieced together in storm scrapbooks, the rubber and copper of undersea cabling.²⁵ Turning to ANT insights on the agency of matter and mobile inscriptions in the functioning of chains of translation can help refashion our understanding of the history of meteorology, where hagiography and stories of linear progress are surprisingly dominant. Beyond pioneering individuals, histories attuned to the spatial and material cultures of meteorological practice can offer a more nuanced picture of human societies’ efforts to come to terms with weather and climate.

Self-styled literature on the geographies of science has not often sought connections with the postcolonial, and neither has a lot of related work across STS on science and globalization.²⁶ The coupling of cultural and political-economic critiques of scientific imperialism that postcolonialism offers nonetheless has important implications for understandings of globality in science. While in both ANT and postcolonial approaches, globality is viewed as the achievement of multiple local transactions and accomplishments, the postcolonial sensibility arguably offers better resources for thinking through the cultural and economic

forces that have produced different kinds of globality in different times and places.²⁷ The historiography of meteorology and climatology often shapes up as the history of how those sciences became global—in the sense of their achievement of reliable, robust knowledge of global processes and of the capacity to predict the behavior of those processes into the future.²⁸ Such work has offered important historical depth and nuance to our understanding of the rise of climate and weather modeling, and of the institutional and cultural politics which shaped that rise. But this work also arguably internalizes a broader historiographical fetishization of a recent break to globalization, which positions the pursuit of globality in science, politics, economics, and culture as a uniquely postwar, twentieth-century phenomenon.²⁹ Of course, the transformations of the postwar world were intense and far-reaching, to the point where the marker of the dawn of the Anthropocene—the global “age of humans”—is likely to be set at 1950. Yet our histories of global ambitions and practices must do more than narrate teleologies of twentieth-century globalism and must work to identify sites of hybridization and resistance, and to uncover how the global, as an object and a condition, exists in different forms in a variety of historical locations.³⁰ For the history of the sciences of weather and climate, this means supplementing stories of the triumph of mid- to late twentieth-century scientific infrastructures and institutions with stories about how global space has been imagined, worked with, traversed, and brought into being in different times and places. Jon Oldfield has offered a much needed corrective to histories of European and North American constructions of global climate by focusing on how a distinctive global climatology emerged and evolved in tsarist and Soviet Russia, shaped by an “ecological” approach to understanding the links between climates, societies, and natures that situated climate as a multi-scaler object nested within broader intellectual models of global ecological order.³¹ Likewise Coen has shown how Habsburg climate scientists’ appreciation of the importance of scaling provides an important corrective in rethinking contemporary assumptions that scale is something newly important to the global climate problems of the later twentieth century.³² Unquestionably, more non-Anglophone examples would extend this range of stories even further. In this volume, Anderson offers a picture of historically situated globalities in the interwar period, pointing to distinctive cultural anxieties about the place of the human in the unruly spaciousness of the globe and in emerging, globe-spanning technological networks of observation, navigation, and control.³³ Adamson too adds complexity to our understanding of past imaginings of climate as global system, describing the imperial infrastructures—technological and bodily—through which new claims about the interconnectedness of a variable climate were made.

This is a project that demands closer attention to the spaces of meteorological knowledge production, from the globe down to the microgeographies of observation and back again. The observatory has recently emerged as a key site for historians of science who are concerned with making connections between the regulated spaces of scientific observation and the networks that established new claims to globality in the nineteenth century.³⁴ Astronomy could be described as the “pattern science” of the nineteenth century, a model of discipline, coordination, and exactitude to which lesser fields such as meteorology were compared and to which their practitioners aspired.³⁵ The expansion of astronomical and magnetic observatories in Europe and in European colonies was motivated both by the search for new understandings of terrestrial and heavenly forces and by the more mundane tasks of accurate timekeeping and reliable navigation.³⁶ In the British Empire, the observatory emerged as both an icon of Western reason and civilization, a space set apart from the world yet also a model for that world’s ideal functioning (Naylor and Goodman, this volume). By keeping time, easing navigation, and exemplifying imperial order the observatory quite literally “made the Empire tick.”³⁷

Like the observatory, the field has become a space of increasing interest to both geographers and historians of science. As Robert Kohler has influentially argued, the field occupies a curious position between laboratory and landscape.³⁸ It is a space that exceeds control, troubles any attempt at demarcation, and yet functions as a resource of empirical authority against the fabrications of the laboratory or the abstractions of theory; of empirical authenticity against the purifying practices of the more rarefied spaces of science.³⁹ This notion of authenticity has often been tightly coupled with discourses of heroic masculinity and self-sacrifice in the name of knowledge.⁴⁰ The field can be read as a space onto which imperial and modernist designs were projected, and from which resources, knowledge, and cultural capital were extracted.⁴¹ If lab studies were about demonstrating local specificity, study of the scientific field focused on the uses of the field in cultural, imperial, and global histories.⁴² But the field can also be read as a space where gestures of cultural projection and economic extraction could not always be so confidently executed, being read instead as a space of complex encounters, of exchange, and of contestation over modes of knowledge-making and extraction.

Field practices of mapping, surveying, observing, collecting, expeditioning, and even experimenting each have their own spatialities, and the question of place can figure differently into their historical analysis.⁴³ Yet while much history of field sciences has focused on the horizontal gestures of scientific mobility and landscape surveillance, an emerging interest in the vertical—as a dimension of

movement, vision, and practice—“takes us away from human habitation into depths and heights in which no one lives (for long) yet that are vital to global economy and polity.”⁴⁴

In disciplines such as meteorology and climatology, looking up involves looking at objects and processes that are irreducibly mobile and lively, rather than objects that are tied to particular places. The “field,” then, often becomes a moving assemblage of people, place and practice, rather than a static and well-defined arena of scientific surveillance.⁴⁵ So while much recent history of the field sciences has been concerned with the borderlands between laboratory and landscape, the historical study of weather and climate offers the scope to examine the borders between observatory and field, to reconsider the practices of purification and exclusion meant to lend precision and reliability to observation, and to rethink the field as a thing always on the move, and thus always subject to redefinition—both by its actors and by its historians. Mahony’s chapter speaks to these borderlands in the case of late colonial agricultural developmentalism and contestations over the place of meteorological observation in an experimental field site whose social, material, and climatic unrulinesses highlight the difficulties involved in taking meteorology out of the observatory and navigating the tensions between regulated experimental space and the multiple meanings, uses, and functions of the field. Anderson (this volume) paints a similar picture of meteorological practice “in the wild,” bound up with diverse material infrastructures and cultural discourses pitting technological modernism against the troubling unruliness of oceanic space.

Corporeality has often been missing from, or unevenly present in, our spatial histories of science. We read of bodies excluded from experimental space and of bodies on the move as vehicles of traveling knowledge, but the body as site and object of scientific practice has, understandably, been rather restricted to the history of medicine and the sciences of life and human difference.⁴⁶ The effects of climate on alien bodies has been a prominent feature of the imaginative geographies of empire and travel. “Managing the transition of the body through different climates” was a key concern of early European expansion, as imperialists “sought to make tropical climates safe for white settlement.”⁴⁷ Diverse material cultures and practices for dealing with tropical extremes were developed, with European bodies emerging as both objects and instruments of inquiry in an emerging discourse of “acclimatization,” that for many in the nineteenth century was *the* paradigmatic colonial science.⁴⁸ Yet efforts to scientifically study the effects of climates on human bodies were never far from efforts to make moral judgments about the inhabitants of faraway places, whether climate was positioned as an *explanans* of racial difference and inferiority or as a cause of bodily,

intellectual, and moral decay among those who found themselves dwelling in new atmospheric environments. Powerful “moral climatologies” can be read from histories of climatic thought, wherein the contours of climatic variation were drawn alongside the imagined contours of human difference.⁴⁹

Two chapters in this volume concern the emergence of the body and the bodily atmosphere as a distinctive space of scientific practice, whether through the biometeorological body of early twentieth century Hippocratic revivalism (Livingstone), or within the body of Ellsworth Huntington, enlivened by the ozonated New England air, living proof of his own determinist philosophy (Fleming). The relational spaces of body, atmosphere, and microclimate have emerged in histories of this determinism, and also in studies of the creation of anthropogenic microclimates in architectural practice.⁵⁰ Throughout the colonial and Cold War eras, concerns about healthy, liveable climates reached into the homes of the hot and stuffy, the dark and cold, and architectural studios and government planning offices became new sites where meteorological and climatological expertise came into contact with the designers and engineers of space. As Daniel Barber suggests in this volume, it is through architecture and planning that we can perhaps see most clearly how knowledge and imagination of weather and climate have reshaped the spatialities of everyday life, from the design of homes, offices, and factories to the planning of entire towns and cities. In an era of global climate change and new discourse about designer climates at all scales, it is therefore appropriate that the final section of this volume foregrounds unique branches of climatology, organized around the human body and its place in architectural space that emerged through new hybridizations of knowledge, space and practice.⁵¹

Knowledge-making practices came to inspire particular imaginations of the climates of the world. The experiential body generated geographical imaginations of pathological climates. The ships collating climate observations and the insurers tallying lost lives generated data that created maps of weather and climate risks around the world, with maps and routes then judged and even priced accordingly. The specific contexts, politics, and sites within which North American, European, or Soviet climate science was produced, for epistemic, managerial, or geopolitical ends, shaped important and enduring imaginations of the nature of climate and its changes at a range of spatial scales. Knowledge-making practices came to shape imaginations of the world’s climate(s), but these imaginations themselves also shaped and directed practices of making empirical or theoretical knowledges of weather and climate. The notion of “geographical imagination” can help us get at this coproduction of knowledge, practice, and imagination and to render it in new, spatial terms.

THE GEOGRAPHICAL IMAGINATION

Stephen Daniels suggests that the geographical imagination is shaped by and through discourses and practices, encompassing both geography as a discipline and as articulated in sites beyond the discipline.⁵² It draws on previous concepts of imagination, particularly the idea of the sociological imagination in reference to C. Wright Mills. For Mills, the sociological imagination was a particular way of looking at and thinking about the world; in other words, it inspired and was a central part of what the discipline of sociology did and contributed to knowledge.⁵³ Within geography, the term “imagination” has similarly been proposed as an approach to inspire and engage students and even schoolchildren with a mode of inquiry that is explicitly geographical in nature.⁵⁴ In other words, to think like a geographer means being aware of the geographically specific nature of spaces and places, knowledge and practices.

We use the notion of geographical imagination in a dual sense—both to describe a particular analytical attention to spatiality that we seek to bring to the history of meteorology and climatology, and to situate these atmospheric knowledges within broader suites of knowledge, experience, and expectation that, historically, have shaped how actors have comprehended the world and how they oriented their actions toward it. Sociologists have recently turned to the notion of imagination to analyse the work performed by widely shared imaginaries of desirable futures in the ordering of social life in the present.⁵⁵ Our use of imagination supplements this focus on time and futurity with an emphasis on place and spatiality. It emphasizes that in any given field there will always be multiple imaginaries in circulation, precisely because each imagination will be geographically situated, but some of these are more politically powerful than others, and some will travel further (that is, they are more “mobile” in Latourian terms).⁵⁶ We suggest the existence of a multiplicity of geographical imaginations that intersect, interact, work with, and create friction between other imaginations.⁵⁷ Indeed, as in the work of Annemarie Mol, it is often the frictions that produce the most interesting insights into how imaginations and practices shape each other.⁵⁸ That imaginations are produced in and through experience and practice proves that they are place-based, which means they are not global except in their reach. We therefore need to attend more closely to the sites through which imaginations are produced, whether these are, for our purposes here, ships, insurance offices, or meteorological stations. The geographical nature of imaginations also calls attention to the central importance of exploring imaginations beyond the classic scientific sites of the Global North and to illustrate how some imaginations circulate more freely than others

in spaces beyond conventionally defined scientific metropolises. In sum, the geographical imagination—as both a thing to be studied and an analytical stance—enables us to understand how and why some of the knowledges identified in the previous section circulate more readily than others. Interrogating these imaginations is a core contribution of this volume to the history of meteorology and climatology.

One important area where the geographical imagination has been regularly studied is through the historical lens of empire and imperialism. “Imagined geography,” for example, was invoked by Edward Said to explore how territories are understood in ways that often re-present knowledge of them as universal rather than partial or situated.⁵⁹ To name just three examples in this tradition: Denis Linehan has explored Irish accounts of missionaries in Africa arguing that there existed a particular Irish imagination of Africa as a racialized space, which nonetheless oscillated between imperial and emancipatory ideals through a complex assemblage of ideas, materials, and practices; Georgina Endfield and David Nash likewise show how imaginations of Africa as a pestilential space shaped missionary engagements with it, in bodily practice and discourse; and Diana Davis has shown how French colonial desertification narratives came to shape interventions in environmental policy that marginalized the “destructive” Maghrebi pastoralists.⁶⁰ In each case, whether the notion of imagination is explicitly invoked or not, there is a sense that dominant discourses and practices are produced from specific places and knowledges, and despite their frequent presentation as universal are in fact distinctly partial, and based as much on experience and preconceived ideas or theories as on verifiable empirics. As Dee Mack Williams has noted in the case of desertification in Inner Mongolia, Chinese policies to switch local people from nomadic lifestyles to settled agriculture, accompanied by supporting land policy changes, have enhanced the destruction of the remaining areas as herders competed to graze animals on the remaining unclaimed land. With further desertification this was heralded as evidence of the need for stronger land management.⁶¹ Thus, geographical imaginations come to shape practices and these practices in turn further reenforce dominant imaginations. Discourse and practice, narrative and materiality, come together to create, support, and maintain dominant geographical imaginations.

Scholarship has thus drawn attention to the fact that many powerful geographical imaginations are produced from within authoritative centers of calculation, often about “periphery” regions.⁶² But this should not lead us to think that imaginations are only produced within these centers or draw on expertise only from the center. As the previous section highlighted, there has been considerable work to expand and decenter our geographies of knowledge to also

consider knowledge produced within the Global South, and through processes of cultural encounter and exchange. Imaginations are produced in a great variety of spaces. In the case of Nordic indigenous groups, for instance, the defense of their own geographical imaginations as a vector of resistance to imposed, managerial imaginations provides an opportunity to set out culture and territoriality on their own terms.⁶³ That being said, the risks of co-option are considerable and these imaginations can come to reenforce an unchanging, pure indigenous essence that perpetuates power dynamics and constrains indigenous peoples to live in ways consistent with certain imaginations (both internal and external) of their lifeworlds. As Bjørn Sletto has pointed out, these imaginations of an essential indigenous environmental ethic have created new forms of eco-governmentality and self-surveillance.⁶⁴ Imaginations, even when considered diversely, work within particular power geometries that those imaginations are not fully able to change or to enforce. In other words, we argue that there is a continual tension or friction between different imaginations. The work of Mara Goldman et al. gets closest to this in discussing the multiple ontological politics of drought, with Maasai drawing on different forms of knowledge compared to formally trained scientists.⁶⁵ What drought becomes is shaped within different forms of scientific practice but is inspired by—in the case of the Maasai—more geographically specific criteria than in the case of the climate scientists.

Work on geographical imagination has also inspired a focus on creative practices and writing where geographical imaginaries circulate with and through images, poetry, music, and objects.⁶⁶ Peter Hulme's work is perhaps best known for exploring the literary geographical imaginations of Cuba that circulate through maps and novels.⁶⁷ It is the steamy atmosphere conjured by Joseph Conrad that evokes a particular imagination of tropical Africa as a wild landscape, and it is through specific but very different fourteenth-century lenses that the travelogues of Marco Polo and Ibn Battutah are constructed.⁶⁸ In writing about popular news coverage, Gordon Winder and Michael Schmitt claim that the deaths of Mahatma Gandhi and Indira Gandhi were represented through the lens of postwar politics by the *New York Times*, which orientalized India as a space of violence that was rapidly changing under the onslaught of globalization and American diplomatic power.⁶⁹

Literature and the written word have therefore been central to many accounts of imaginations, but words by themselves are not the only aspect to receive analytical attention. Geographers have explored the role that images play in shaping geographical imaginations too, not least the representation of particular climates as ideal for travel or rest.⁷⁰ As Kneale and Randalls' chapter highlights, maps of the world divided into risks by insurance companies became easy

representational devices that enabled insurers to quickly demarcate the pricing of risk; and as Anderson's chapter shows, and as Edwards has also illustrated, imaginations of "the global" come to be drawn through images and schematic diagrams that imagine climate as a particular kind of spatial scale (see below).⁷¹

This connection between the imaginative and the visual has inspired a whole series of works in imaginative geographies that draw on ideas of creativity, enthusiasm, and practice to show that imaginations can be reimagined and re-materialized to engender new forms of political and social engagement and foster different ways of being and acting in the world.⁷² As Bill Howie and Nick Lewis put it: "If geographical imaginaries are not just socially produced but also socially productive, then this productivity can be both studied and shaped."⁷³ In this book we highlight how geographical imaginations became productive of particular kinds of relations in the past. Although it is not the specific goal for most of the chapters in this book, we hope that consideration of these relations might also inspire introspection on the role that current imaginations play in contemporary matters of concern such as climate change or air pollution.⁷⁴ Historical research into geographical imaginations therefore is not just a passive account of past imaginations but a call to a particular kind of political historical genealogy where we strive to show how social and natural relations are reconfigured in ways that frequently enhance some interests at the expense of others.

One way in which some interests are advanced over others is through the geographical reach of particular imaginations. If all imaginations are local but some circulate more freely than others, then thinking through the spatial scale of imaginations becomes important. What appear to be global imaginations are nested in particular sites of knowledge and experience. This is perhaps not better illustrated than in Sheila Jasanoff's account of an Indian environmentalism that cast the "spaceship earth" image in a rather different light to the triumphalist technological environmental reading that it is frequently given in the United States, where it played into a particular kind of Cold War politics. As Jasanoff puts it: "much work has to be done to make the representations look as if they are the right way of characterizing the world."⁷⁵ A global view of the earth from space could equally inspire a technological utopia of the ability to control the planet's systems as much as it might indicate a small, fragile planet.⁷⁶ The phrase "think globally, act locally" embeds this geographical imagination in the heart of sustainable living. But by focusing on the global scale in contemporary climate change for instance, perhaps the challenge has been the loss of local connection and the dominance of a particular kind of ponderous global policy negotiation.⁷⁷ Likewise, statements of global knowledge or global problems come to shape the possibilities and restrict the potentialities of local knowledge and practices.⁷⁸

Global geographical imaginations can easily translate into power relations that centralize authority and decision-making within global spheres or organizations.⁷⁹ Part of what we seek in this book is to highlight the local practices that have legitimated and enabled the generation of widely circulating knowledges and imaginations, without losing sight of the fact that these imaginations are produced from within specific networks and are partial, specific, and multiple. As Francis I, Emperor of Austria, stated: “There is no affair that a priori and according to general principles could be called large or small; matters are only large or small in comparison to and in relation to other things.”⁸⁰

Finally, we must remember that geographical imaginations are not only produced—but consumed. A particular representation of the tropics as dangerous space only maintains its validity as a powerful imagination if those reading it actually adopt it. As Sarah Radcliffe has pointed out, we should not make the mistake of thinking that everyone reads texts or images in the same way, as though an explicit geographical imagination can be conveyed linearly from one person to another.⁸¹ Rather, people translate ideas through other imaginations, as situated within their own experience and practices. As Victor Savage has argued, as European travelers experienced the tropics, they began to challenge a universal view of the dangers of the tropics and, rather, rearticulated danger on much finer geographical scales.⁸² In an inverse of this process, Endfield’s chapter demonstrates how widely circulated imaginations of healthy South African climates were challenged by the bodily experiences of migrants. In the consumption of geographical imaginations of weather and climate, it is important to acknowledge the ways in which imaginations were contested, challenged, or simply ignored. The biography of Ellsworth Huntington is perhaps instructive here, given that his work had relatively less influence within the academic discipline of geography than we might expect (see Fleming, this volume).

We therefore argue that the concept of geographical imagination provides a powerful tool with which to interpret accounts of knowledge-making practices in the history of meteorology and climatology. Knowledge is generated and circulated not just by and between formal scientists but also through networks encompassing field practitioners, ship captains, insurance clerks, and political ideologues. Instances and examples of meteorological knowledge production, we suggest, are always situated within a broader discursive field, where they serve to either construct, reinforce, or challenge dominant imaginations not just of the atmosphere but of spaces of human and nonhuman life, of political domination and contestation, and of technological ambition. Our focus on the coproduction of atmospheric knowledges with broader geographical imaginations helps us interpret how and why popular ideas of weather and climate can outlast even

prominent scientific rebuttals of these ideas. Imaginations, in other words, help us understand better the historical transformations in approaches to weather and climate and provide insights of relevance to those struggling with making climate change real today.

OVERVIEW OF THE BOOK

The book is organized into three sections. Section I, “Spaces of Observation,” builds on existing work on the histories and geographies of the observatory and field sciences in order to offer a new picture of how weather and climate have been sensed, observed, and understood in diverse spatial settings and with diverse scalar ambitions. Simon Naylor and Matthew Goodman explore the emergence of a network of colonial observatories in the mid-nineteenth century, and the place of those observatories in the development of new regional, national, continental, and imperial geographies of meteorological and climatological knowledge. In examining the cultural and material politics of observational science, the authors situate the observatory as a key site in the furtherance of British imperial progress, civilization, and educational reform. George Adamson furthers their analysis by examining the work of Gilbert Walker, director general of observatories in early twentieth-century India. Adamson shows how Walker’s statistical construction of new climatic oscillations was enabled by the kinds of imperial networks described by Naylor and Goodman. Adamson reflects on the implications of these globe-spanning statistical constructions as a new kind of spatial imagination that is difficult to place within conventional historiographies of climatology’s progressive globalism. In the next chapter, Katharine Anderson examines how, even as the technological march of the twentieth century seemed to render the entire globe subject to surveillance and control, distinct anxieties circulated around certain atmospheric and oceanic spaces. Interpreting the history of the weather ship as a story of cultural anxieties about technology and the immensity of global space, Anderson situates the evolution of meteorology’s spaces of observation within wider imaginaries of the place of human beings within rapidly evolving technological networks and persistently unruly environments. Finally, Ruth Morgan reminds us that, historically, spaces of weather observation are not just products of colonial networks and technological conquest. By examining the knowledge networks through which the Leeuwin Current off the coast of Western Australia has been made known, she shows how local fisherpeople, colonial meteorologists, and national and international research bodies have interacted, through various economic, political, and ecological projects, in the production of a distinctive set of imaginations of the Australian climate. Protagonists in each of these chapters worked toward a (re-)scaling of climate by

moving from local knowledge networks to an understanding of global climate systems, albeit in a multiple rather than a singular form.

In the chapters of Section II, “Horizons of Expectation,” the authors examine how imaginaries of weather and climate have been shaped by different practices of knowing and inhabiting tropical environments. These practices connected scales and brought understandings of climate closer together with cultural, economic, and political ambition. Here, the climate being referenced is not simply that of global climate systems but, rather, a more tangible climate in which local knowledge and experience continued to matter; exceptions and individual variety were as important as understandings of connected, global systems. James Kneale and Samuel Randalls examine how life assurance companies constructed particular imaginative geographies and cartographies of climatic risk, which cannot be understood without reference to contemporary late nineteenth- and early twentieth-century debates about the links between climate, race, and hygiene. Georgina Endfield investigates how the climates of South Africa were mobilized as rhetorical tools to tempt the emigration of British women to the colonies. Although claims about healthful climates—ripe for domestic settlement and imperial improvement—were often dashed, the case provides an important new window onto the gendered politics of climatic knowledge and expectation. Staying in the same region, Meredith McKittrick explores debates around rainmaking in early twentieth-century South Africa, arguing that a racialized discourse of scientific modernity was used to distinguish the “superstitious” practices of black African rainmaking from a surprisingly robust and persistent set of practices and discourses about artificial rainmaking in white farmer and scientific circles. Focusing on the deployment of the notion of “artificiality” as a form of cultural boundary work, McKittrick shows how projects of atmospheric knowledge-making become bound up with broader—and in this case heavily racialized—projects of state-making. Finally, Martin Mahony describes how the meteorological controversies surrounding Britain’s infamous postwar “groundnut scheme” in colonial Tanganyika reveal competing conceptions both of climate-society relationships and of what reliable knowledge of tropical climates looked like. A new confident developmentalism saw meteorological expertise sidelined, and when the rains failed to come, efforts were made, as in McKittrick’s case, to artificially improve the climate—to save the scheme upon which rested, for many of those involved, the fate of British imperialism in a postwar world. Together, these chapters show the diverse material, epistemic, and spatial practices through which expectations of climate have been fashioned, and the effects of such expectations and imaginations in the world-making practices of colonialism, finance, development, and state-making.

In the final section, “Atmospheric Entanglements,” attention turns more concertedly to how relationships between climates and bodies, ecologies, and societies have been conceived in different contexts. The scale of climate emerges as one of connection, as the body or the building becomes an experimental site for enabling and thinking through a broader climatology. Experiences of average weather—the climate of a place—remained relevant while protagonists developed more universal claims about why these climates mattered. David N. Livingstone unravels the links between Hippocratic notions of climate, health, and place, a nascent “biometeorology,” and the biopolitics of eugenic thought. Examining the reemergence of the body as a site of climatic inquiry in the early twentieth century, he shows how a set of diverse intellectual conditions converged around new conceptions of the links between climate and health, in a fashion that not only deepened the “pathologisation” of certain places and environments but also has resonance with present-day debates about the links between climate change and future human health. James R. Fleming follows with an exposition of Ellsworth Huntington’s ideas about the links between atmospheric ozone and human health and productivity. Digging deeper into the intellectual landscape described by Livingstone through the figure of the controversial Yale geographer, Fleming positions Huntington’s revitalized climatic determinism in the context of a curious interwar debate about “biophysics, biocosmics, and biocracy” and provides further analysis of the situated—and yet in some ways enduring—character of this particular variant of the geographical imagination. Finally, in a rather different context, Daniel Barber examines the intersections of modernist architecture and local-scale climate knowledges through the postcolonial lens of Rio de Janeiro. Rather than the body, as with Huntington’s concern, it is the building’s connection to climate that shapes Barber’s story. He looks at how, through a series of design experiments, modernist architectural techniques that were developed in Europe and North America were reworked according to local climatic and sociopolitical conditions. This new climate-centric architecture created new means of encountering climate as something emergent and mediated, a protean feature of manufactured space. Barber’s contribution suggests that the study of climate and architecture can enrich our understanding of a particular strand of the geographical imagination, building on the work of Peter Sloterdijk concerned with the evolution of designerly ways of knowing and constructing climatological and atmospheric spaces.⁸³ The spaces of cities and buildings are imagined and engineered as much as the bodies that inhabit them. All three chapters in this section thus speak to the central importance of exploring climates at all scales, beyond global ones.

Finally, we are joined by Mike Hulme who offers reflections on the foregoing case studies and argues for their relevance to present-day debates about the place of scientific knowledge in societal engagements with the phenomenon of anthropogenic climate change. While notions of climate vary between chapters—in section I being more related to the idea of climate systems and in sections II and III the average weather of a place—geographical knowledges and imaginations produced and enabled connections between the local and the global in multiple and heterogeneous ways. Indeed, the structure of this book resists a historiographical tendency to go from the local and the particular to the universal and the global, preferring to emphasize that place and space matter for the production, circulation, and utilization of all forms of knowledge. This, as Hulme and also Coen point out, is vital to remember and think through in the context of present-day concerns.⁸⁴