



H-Environment

H-Environment Roundtable Reviews

Volume 8, No. 6 (2018)
<https://networks.h-net.org/h-environment>

Publication date: December 12, 2018
Roundtable Review Editor:
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Dagomar Degroot, *The Frigid Golden Age: Climate Change, the Little Ice Age, and the Dutch Republic, 1560-1720* (Cambridge: Cambridge University Press, 2018). ISBN: 9781108419314.

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Introduction by Melanie A. Kiechle, Virginia Tech

As we face climate change, is there any hope? My students, dismayed by the history they have learned and alarmed by the news they read, ask this question at the end of every environmental history course I teach. I do not have a good answer for them—until now, that is. **Dagomar Degroot** has written a history that will let me offer my students some comfort. As it explores and explains the nuanced relationship between climate change and the success of the Dutch Republic, *The Frigid Golden Age: Climate Change, the Little Ice Age, and the Dutch Republic, 1560-1720* teaches us that societies can survive and even thrive in the face of climate extremes. Degroot accomplishes this feat by drawing upon textual sources common to all historians—letters, intelligence reports, diary entries, and ship logs—which he integrates with scientific reconstructions of the past. Bringing science and history together in this way enriches both fields of inquiry and is a compelling example of how humanists and scientists can learn from one another.

Of course, scientists and historians often work at different scales. Degroot navigates these scales not only to reveal the connection between global climate and local weather events in the Low Countries, but also to ruminate on how historians might think about the relationship between the short, local scale of human actions and long-term, global climate changes. The key challenge is where to locate and how to discuss causality. Degroot encourages historians to borrow probability from scientists, and to openly discuss the probable causality of numerous factors in specific events. Degroot has more to say about this approach in his response to the roundtable, so please read on.

The reviewers in this roundtable also seized on the hope that Degroot's book offers, even as they asked probing questions about methodology, approach, and how far we should extend this optimism. In what quickly emerged as a common theme, **Nicholas J. Cunigan** begins by noting that the focus on social prosperity is a new direction in climate history. As a historian of relations between indigenous peoples and the Dutch West India Company, Cunigan draws on his subject expertise to suggest what including religion might have added to *The Frigid Golden Age*, and to recognize that this history is as ominous as it is hopeful—while the Dutch prospered, others suffered. **James Bergman** follows this point by discussing resilience and repression in the Little Ice Age. A historian of science who studies the generation and use of climate data in the twentieth century, Bergman asks about the limits of the climate reconstructions that Degroot employs. Bergman also wonders what happened on the periphery of the Dutch empire, and if we can use Degroot's history to think about environmental justice on a global scale.

Early modern historian **Katrin Kleemann** continues the conversation by highlighting the many contributions that Degroot has made through his interdisciplinary work before focusing on a specific group of actors and their

possible understanding of climate change. When considering the rich documentation that previous generations kept about the weather, can historians talk about a climate change consciousness? **Thomas Wickman** rounds out the conversation with his reflections on the field of climate history. As a scholar of people in cold climates, Wickman deeply appreciates Degroot's recognition that people react to similar conditions in vastly different ways—and suggests that more historians should look for exceptions, as Degroot has, for what they can teach us about the past. There are many stories yet to tell.

Before turning to the first set of comments, I would like to pause here and thank all the roundtable participants for taking part. In addition, I would like to remind readers that as an open-access forum, *H-Environment Roundtable Reviews* is available to scholars and non-scholars alike, around the world, free of charge. Please circulate.

Comments by Nicholas J. Cunigan, Calvin College

Social Prosperity: A New Direction in Climate History

Since its inception, climate history has largely focused on the negative consequences of climate change on societies across the globe. Historians have linked changing climate and extreme weather to societal crises, catastrophe, and collapse. This trend has highlighted the impact of extreme weather on agriculture, harvest failures, famines, and disease. Geoffrey Parker's *Global Crisis* is the most well-known example of this decades-long tradition.¹ Historians such as Georgina H. Endfield have reframed the discussion by focusing on societal adaptations and resilience during times of abnormal climate regimes.² Degroot builds on the work pioneered by these and others while advancing the field in important new directions. Rather than focus on societal vulnerabilities, Degroot explores the beneficial consequences of the Little Ice Age on Dutch business, warfare, and cultural expressions during the republic's seventeenth-century Golden Age (5-6). This is a much-needed and welcomed departure from the typical declensionist narratives of climate history.

The Frigid Golden Age is essential reading for anyone interested in pursuing research in the field of climate history. Throughout the book, Degroot offers guidance, suggestions, and mini-lessons on how to merge the human archive of written records with the natural archive of climate science, insisting along the way that climate historians must be cautious in drawing connections between statistical trends and human events (17). Degroot, meticulous in his own methodology, applies this logic most fully in his analysis of Dutch seventeenth-century winter landscapes. He argues that while it might seem obvious to draw connections between the weather of the Little Ice Age and the winter landscapes of Dutch painters like Hendrick Avercamp, these connections are not as straightforward as they might appear (263-268, 276). Instead, Degroot rightfully insists that historians must "contextualize how each artwork was created" (266). In doing so, he highlights the possibilities as well as the limits of connecting climate change and weather to the past.

Degroot adeptly contextualizes his analysis of the impact of climate change and weather on the Dutch Republic within the cultural, socioeconomic, and political structures of the time. In doing so, he avoids falling into the trap of climate determinism and instead shows the capacity of weather to limit or expand human choices (16). This contextualization shines in Degroot's analysis of the impact of

¹ Geoffrey Parker, *Global Crisis: War, Climate Change and Catastrophe in the Seventeenth Century* (New Haven, CT: Yale University Press, 2013).

² Georgina H. Endfield, *Climate and Society in Colonial Mexico: A Study in Vulnerability* (Malden, MA: Blackwell Publishers, 2008); Georgina H. Endfield, "The Resilience and Adaptive Capacity of Social-Environmental Systems in Colonial Mexico," *Proceedings of the National Academy of Sciences* 109 (2012): 3676-81, <https://doi.org/10.1073/pnas.1114831109>.

changing wind patterns on naval battles and movements during the Dutch-Anglo Wars and Glorious Revolution. Shifting wind patterns would eventually provide the Dutch navy with an advantage over the English, but as Degroot writes, “[c]limate changes...were a catalyst for, but rarely a cause of, military victories and defeats” (195). Degroot’s ability to contextualize weather within the “big structures that give shape to human history” make his work relevant to a wide audience that extends beyond climate historians (16).

Degroot pairs his argument that the Little Ice Age was an active agent in Dutch Golden Age history with a conviction that the complexity of human-climate interactions belies straightforward relationships. Throughout, Degroot tempers his conclusions by insisting that weather “may have” impacted things as wide ranging as the cost and timing of road maintenance (145), Dutch understandings of nature (149), the mutinies of Spanish troops (168), and Golden Age literature (285) to name a few. Degroot rightly cautions readers from drawing a clear line of causation. Yet, in repeatedly deploying a modal sentence construction, Degroot risks leaving readers with an impression that the significance of climate change and weather on human events is open-ended and speculative. How can climate historians untangle the connections between climate and human events in a way that moves away from conclusions of “probable causality” towards conclusions of greater certainty, while also recognizing the limitations of the field (17)? Greater certainty will surely require more work to be done in the fields of historical climatology and climate history. Degroot is at the forefront of a new wave of interdisciplinary scholars capable of navigating the sciences and humanities in fluid, novel, and dynamic ways. In order to ensure this wave continues and expands, a broader acceptance amongst humanists and perhaps insistence upon collaborative scholarship is needed.

Degroot acknowledges his temptation to write a more expansive book that might have covered more ground while sacrificing depth (9). And one cannot fault Degroot for reigning in this temptation; however, the religious attitudes and differences of Dutch Catholics and Protestants seem notably absent in Degroot’s analysis of Dutch cultural responses to the Little Ice Age. In his discussion of seventeenth-century witch-hunts, Degroot highlights Dutch Reformed pastor Balthasar Bekker’s biblical exegesis that led him to the conclusion that scriptural references to witches were in fact figurative allegories of sin (289). Bekker found support for his views amongst the “enlightened” public, but his local Amsterdam consistory and the public Church received his interpretation with hostility and demanded he be stripped of his ministry.³ One is left wondering how a deeply religious people like the Dutch registered, interpreted, or responded to the changing climate around them and to what extent Dutch Protestants exhibited the same “pragmatic attitude” that Degroot finds “typical of Golden Age culture” (297).

³ Jonathan I. Israel, *The Dutch Republic: Its Rise, Greatness, and Fall 1477-1806* (New York City: Oxford University Press, 1995), 925-927.

Degroot concludes *The Frigid Golden Age* with an ominous and prescient warning. “[E]ven moderate climate changes helped shape the course of human history, and what our future has in store is anything but moderate. If we are not careful, warming may eventually overwhelm even our best efforts to adapt to it” (309). Just days before I sat down to write this review, the Intergovernmental Panel on Climate Change (IPCC) released their assessment report on the impact of 1.5- and 2.0- degrees Celsius warming above pre-industrial levels. Since the earth’s climate has already warmed one degree since this period, the world is only one-half degree away. The assessment offered a sobering portrait of the risks global societies face even if humans curtail the roughly 50 billion tons of CO₂ released into the atmosphere each year. In light of this report, perhaps the most pressing lesson Degroot offers is that even “moderate climate changes can have very unequal consequences for different societies” (308). Climate historians should and must provide examples of how past societies fared as a result of changing climate. These will include narratives of crisis, collapse, adaptation, and resiliency. Now, thanks to Degroot, we can also learn something about how societies prospered. If the Dutch Republic prospered during the Little Ice Age while much of the world descended into a global crisis, who will prosper and who will suffer today?

Comments by James Bergman, Temple University

Resilience and Repression in the Little Ice Age

As I finish this comment, a headline appeared on the *Atlantic's* "Citylab" newsletter: "The Dutch Can't Save Us from Rising Seas."⁴ The article referred specifically to the hydraulic expertise that has made the Dutch famous and may be in greater need as sea levels rise, but I've been mulling over the role of the Dutch in dealing with climate change since reading Dagomar Degroot's *Frigid Golden Age*. Degroot's book captured my imagination for two reasons. First, he skillfully translates regional and global patterns to local landscapes, seascapes, and cityscapes. By introducing a third dimension—the atmosphere—to the study of hybrid landscapes and waterscapes, he creates an environment that is, to use a word Degroot frequently uses, *dynamic* in the short term and long term. The second reason Degroot's work is so suggestive and fertile is that it examines a story of prosperity in the face of climate change. He is careful not to let his account minimize the threat of climate change in the Anthropocene—the Little Ice Age, for all the havoc it wrought, was the result of less than a degree Celsius of cooling, versus the 1.5-C or more warming we have in store. In fact, the book communicates the urgency of climate change all the more clearly by using the Dutch Republic as a case study in resilience. Degroot's Dutch republic was not just culturally prolific, or rich, or powerful, but agile in its adaptations to a changing climate. In addition to soil, water, roads, dikes, and canals, Degroot considers rain, snow, ice, and wind, and he considers them alongside trade routes, ship design, and community rituals, all important factors in Dutch resilience. Degroot contrasts his success case with Geoffrey Parker's success case, Japan, which did just about the opposite of the Dutch, turning inward, cutting off trade, and imposing a rigidly autocratic social and political system.⁵ Degroot's sympathies clearly reside with the Dutch, as do mine, if given this choice. At the same time, there are numerous reasons to think of the Dutch case as a cautionary tale.

After a concise but careful exposition on the Little Ice Age and the science and sources he uses to reconstruct the local weather of the period, Degroot considers the impacts of cooling through in three different points of influence: commerce, war, and culture. The strongest and most interesting part, to my mind, is his consideration of the impacts of the Little Ice Age on transportation networks and the circulation of commodities. In Degroot's analysis, water, wind, and ice blend with the construction of low, sturdy ships, the warehousing of surplus grain stocks

⁴ Billy Fleming, "Why the U.S. Can't Approach Climate Adaptation Like the Netherlands," *CityLab*, October 17, 2018, <https://www.citylab.com/perspective/2018/10/the-dutch-cant-save-us-from-rising-seas/573079/>.

⁵ Dagomar Degroot, *The Frigid Golden Age: Climate Change, the Little Ice Age, and the Dutch Republic, 1560-1720*, n.d., 304; see also Geoffrey Parker, *Global Crisis: War, Climate Change and Catastrophe in the Seventeenth Century*, First Edition edition (New Haven: Yale University Press, 2013), 484–506, <https://ebookcentral.proquest.com/lib/templeuniv-ebooks/detail.action?docID=3421144>.

in case of crop failure, and the consolidation of overseas ventures to better absorb risk. Dutch mercantile prowess is an old story, but by weaving in year-to-year changes of wind direction, ice mass, and precipitation, Degroot adds a far greater precariousness and complexity to the commercial empire of the Dutch Golden Age. He redistributes the agency from the Dutch, themselves, to the changing ice, water, and wind that physically embodied, and often impeded, the trade relationships the Dutch cultivated.

In the second part, a history of the eighty years and Anglo-Dutch wars, Degroot reminds his readers that commercial prowess has often been backed up by considerable military power. Once again, though, Degroot's focus on climate immerses us in much more than military strategy. We learn of the ways in which Dutch landscapes were militarized during sieges, the advantages and disadvantages of rainfall and flooding during sieges, and the decisions the Dutch made to flood the fields of their own citizens to gain advantages. Naval battles, as well, were a mixture of calculating the probabilities of different wind directions and having a bit of luck. This is one case in which the answer was, indeed, blowing in the wind.

Considering that commerce and warfare were often mutually constitutive in the seventeenth century, I wonder how Degroot might situate Dutch prosperity in the broader history of globalization, exemplified by the work of scholars such as Immanuel Wallerstein and Kenneth Pomeranz.⁶ Degroot has made a conscious choice to focus on the Dutch Republic, its shipping routes, and its expeditions, rather than its "often brutal expressions of Dutch commercial might."⁷ This was likely necessary to make his case for the importance of climate and for the many ways in which climate change's effects are refracted through human choices. He is right that Geoffrey Parker's invaluable global survey of the Little Ice Age is too broad for the kind of in-depth analysis Degroot wanted to do. But is there still a way to go in-depth while still considering adaptation to climate change in multiple nodes in the Dutch trading network? In *The Great Divergence*, Kenneth Pomeranz finds that, to account for the divergence in economic development between Western Europe and the rest of the world, networks of coercion and exploitation had to be considered in addition to internal economic factors, and a variety of comparative approaches had to be taken to understand diverging paths of development.⁸ The Dutch were not the only colonizers, of course, but it is worth going deeper into two comparisons, first, how Dutch coercion differed from other states, and second, what adaptation to climate change looked like from the standpoint of their trading "partners," particularly those in the East Indies.

⁶ I am thinking, specifically, of Immanuel Wallerstein "Protection Networks and Commodity Chains in the Capitalist World-Economy" in *Frontiers of Commodity Chain Research*, Jennifer Bair, ed. Stanford, CA: Stanford University Press, 2009, pp. 83–89 and Kenneth Pomeranz, *The Great Divergence - China, Europe, and the Making of the Modern World Economy* (Princeton: Princeton University Press, 2001).

⁷ Degroot, 8.

⁸ For more on different approaches to comparative analysis, see Pomeranz, 5, 10.

What would the history of the Dutch Republic in the Little Ice Age look like if told from its periphery, rather than its core? What would it look like if we thought less about the consequences of climate change to a particular locality, and thought more about the consequences of climate change for global environmental justice? Although Degroot credits dynamism and versatility for Dutch prosperity, he also mentions that Dutch merchants controlled the Baltic Grain trade and profited handsomely from grain shortages elsewhere in Europe; they encouraged cash crop monocultures in Indonesia and later seized control of regional trade routes in the Indian Ocean; and they flooded their own fields for military advantage.⁹ These events beg the question: How often did coercion of these types hinder opportunities for Dutch trading partners to adapt to climate change? To paraphrase another innovator and beneficiary of a dynamic economy, the Dutch Republic moved fast and broke (quite a few) things. Would a global history of the Dutch Golden Age look like a success story or another cautionary tale?

The third part of the book is the weakest of the three parts—it is certainly the shortest—but it is still fascinating and opens a whole new set of questions. Degroot examines the many cultural manifestations of the Little Ice Age in the Dutch Republic. He is appropriately cautious about ascribing too much causal influence to climate when Dutch culture was actually far more complex. Paintings of icy landscapes may have been influenced by climate change, but Degroot warns that much of it had to do with public demand for particular genres of paintings and metaphorical imagery that was employed in painting. But, if you will forgive the pun, Degroot paints with too broad a brush in this third part, especially in his tantalizing efforts to tease out a consciousness, among the Dutch, of the long-term cooling of the climate. He certainly hints at this question earlier on in the book. He asks whether shipmasters, merchants, and naval commanders “perceive[d] that weather patterns changed over decades,” and he suggests that they did.¹⁰ But he tackles the issue head-on in the third part by identifying references to long-term weather changes in a variety of sources—diaries, letters, paintings, and, most intriguingly, water level tables. He finds that observers “developed an understanding of meteorological variability that was precise enough to be a rudimentary form of climate history.”¹¹

Degroot has uncovered a fascinating element of climate history, and it is a testament to his archival prowess that he has found this treasure trove of observations from a variety of sources, and that these sources were probably not all sitting in the same archive, much less in a folder labeled “Weather.” But could Degroot have gone further in teasing out the meaning of these weather observations? What did it *mean*, for the Dutch in the seventeenth century, that the climate was changing? Degroot’s frustration with the often sparse mentions of weather in the correspondence of merchants and ship captains is apparent and shared by his readers. At the same

⁹ Degroot, 126, 304–305, 172.

¹⁰ Degroot, 247.

¹¹ Degroot, 257.

time, these silences are, themselves, fascinating and deserve more attention. Why, for instance, would seventeenth-century observers be interested, at all, in chronicling decadal trends in the weather? The answer depended greatly on who was noticing the change, who they were writing to, when they were writing, and whether they had an interest in making their observation known or in keeping it to themselves.

First, there is the question of what kinds of people recorded and transmitted knowledge about the climate, and what their interests were in doing so. We see that literate Dutchmen often recorded their impressions of their changing climate, painters painted icescapes, and “Ice Cultures” developed in response to particularly cold winters. But more geographic and social differentiation seems to be warranted, here. Sailors, even captains, might not have recorded their observations about climate change, given that sailors, according to historian Margaret Schotte, were fiercely independent and resistant to surrendering their tacit knowledge to those who might gain an advantage over them.¹² Over the course of the seventeenth century, Schotte notes, logbooks became increasingly standardized and used by government officials, VOC authorities, and scholars to discern better routes and broad trends in weather, among other things.¹³ As Degroot mentions, the VOC had a vast treasure trove of ships’ logs by which they could decide, for instance, how to standardize routes to the East Indies. But the recorders of the logs, themselves, would never be recognized as interpreters of long-term trends.¹⁴ When considering the knowledge of the Dutch authorities about the weather, it is more useful to determine how these observations of long-term trends circulated in social and political networks.

The other question one might ask is whether there was an incentive to resist recording or circulating observations. As Anya Zilberstein has noted, ideas about climate were often economically and politically contingent.¹⁵ It was in the interest of explorers, boosters, and merchants to portray a climate as favorably as possible, and it may have been in the interest of merchants to be mute about potentially hazardous climate change that could dampen investment or encourage the stockpiling of grain in other localities. This is not to mention the increasing commodification of knowledge during the Dutch Golden Age that Daniel Margócsy examines in his book.¹⁶ This meant that weather knowledge may have had a price attached to it, and that, as with spices or grain, profit depended on the careful control of trade through Amsterdam. When examining weather observations, we

¹² Margaret Schotte, “Expert Records: Nautical Logbooks from Columbus to Cook,” *Information & Culture: A Journal of History* 48, no. 3 (August 29, 2013): 285, <https://doi.org/10.1353/lac.2013.0015>.

¹³ Schotte, 298.

¹⁴ Schotte, 285.

¹⁵ Anya Zilberstein, *A Temperate Empire: Making Climate Change in Early America* (Oxford University Press, 2016).

¹⁶ Dániel Margócsy, *Commercial Visions: Science, Trade, and Visual Culture in the Dutch Golden Age* /, n.d., <https://ebookcentral.proquest.com/lib/templeuniv-ebooks/detail.action?docID=3038620>.

should not only consider individual observations, but also networks of knowledge production and their political economy.

In writing about the Dutch republic, and by adding a new layer—the atmosphere—to the waterscapes and built environment for which it was so famous, Degroot also added new contingencies, and occasional haphazardness, to the economic and political history of the seventeenth century. More importantly, however, Degroot has put forward a bold contention that we have much to learn from success and prosperity in the face of uncertainty, and that we can learn from a place without resorting to sentimentality or celebration. Additionally, and most importantly, he has laid out a path toward understanding the role of climate in globalization over the *longue durée*, a role that is at the very heart of our political discourses on the Anthropocene.

Comments by Katrin Kleemann, Rachel Carson Center/LMU Munich

Thriving in the Face of Climate Change—Lessons from the Little Ice Age

The early modern period was characterized by crises. Religious conflicts, social unrest, wars, harvest failures, commodity price shocks, famines, and bouts of diseases shaped this time. Extreme weather, made more likely by the climate change that was the Little Ice Age, played a substantial role. The Little Ice Age was a period of cooling that caused glacial surges around the globe and lasted from the thirteenth to the nineteenth century. It triggered weather extremes that affected millions. It was not a period of constant cold, it was heterogeneous and also saw mild winters and hot summers, but overall it saw a greater extreme of colder seasons with less predictable weather. This was particularly true for two of the coldest periods, the Grindelwald Fluctuation (1560-1628) and the Maunder Minimum (1645-1720), both of which Dagomar Degroot focuses on in his book *The Frigid Golden Age*.

As Degroot puts it, “[t]he concept of global crisis gives us a powerful device to make sense of the traumatic early modern period and provides a clear warning for our future” (p. 304). Previously, many environmental histories have focused on societal disasters or even collapse triggered by the unpredictable and unstable weather of the Little Ice Age. Millions of people lost their lives—but not all communities and societies collapsed during the Little Ice Age. Many survived: some by chance; some by developing a sort of resilience to the change in average weather; most by a combination of both. Degroot breaks with the assumption that the Little Ice Age only spelled crisis for societies around the globe and, instead, sheds light on how some thrived. Overall the population of the Dutch Republic seemed to do particularly well during these two cold spells, which almost perfectly coincide with the Dutch Golden Age (1590-1715).

The Low Countries were no stranger to being challenged by their environment; the coastal regions were located roughly two meters below sea level and land had to be protected from storms, storm surges, and flooding by draining and by building and maintaining dikes. In this regard, the Little Ice Age was perhaps just another “damaging environmental circumstance” the Dutch had to face and endure (p. 304). Interestingly, the Low Countries did not only battle the elements during this time but were also at war for most of this period: The Eighty Years War was raging on from 1568 to 1648 and the Anglo-Dutch Wars took place between 1652 and 1688.

Degroot takes his readers on a journey that spans the globe: from the Low Countries on the North Sea, to the icy shores of Novaya Zemlya in the Arctic Ocean, all the way to the warm waters around Batavia in the Dutch East Indies. The book covers climate, weather, war, trade, nutrition, transportation, ecosystems, and colonialism. He traces climate change from the global to the local level. He uses a wide range of sources: the analysis of thousands of journeys undertaken by ships of the Dutch East

India Company (VOC) to the study of famous paintings and maps from the Dutch Golden Age to letters and diary entries, to name but a few.

The Frigid Golden Age is itself a highly interdisciplinary book that starts off with an introduction to the latest scientific research and climate reconstructions of the Little Ice Age. It becomes clear that the climate regime is a very complex and at times counterintuitive system that is interconnected on a global scale. The climate is determined by the complex interplay between oceanic and atmospheric currents, solar forcing, volcanic eruptions, and the Earth's orbit. Degroot refers to the state of the different oscillations throughout the book when he explains how a particular climatic regime was influenced by the complex interactions between atmosphere, hydrosphere, cryosphere, and biosphere.

The Little Ice Age saw temperatures that were one degree Celsius below the 1900 to 1960 norm (p. 2). Today we are roughly already one degree above pre-industrial levels. In the field of climate history, it is extremely difficult to define these temperature differences because there is no neutral time when the climate was stable. The further we go back in time, the less reliable the instrumental temperature records are. It all boils down to what the baseline is that one refers to. The baseline is a reference period from which one calculates the deviation of future climate change, whether it be 1720-1800, 1850-1900, or 1900-1960, etc. The baseline is not only important for understanding how much colder the Little Ice Age was, but also in order to understand how much the world has warmed since industrialization began.

This brings us to one extraordinary and fresh aspect of Degroot's work: he asks whether the people shivering through the chilliest phases of the Little Ice Age noticed the decadal level change in weather patterns. Of course, the contemporaries registered whether a winter was extremely cold, but did they also notice the accumulation of extremely cold winters? Degroot asks this question in several chapters and concludes that sometimes they noticed something, "but never more than a vague awareness that the present was unusual in the context of the past" (p. 257). What makes this study special is that he does not just look at the intellectual elite's point of view but includes explorers, whalers, artists, authors, and inventors.

It is, of course, a question that is difficult to answer: It is not possible to conclude that they were aware of climatic change, even when we consider that they invented the ice skate, because "cultural responses to climate change do not require explicit awareness of climate change" (p. 299). Even if, unconsciously, they invented new technologies that helped them cope, endure, and even exploit the weather, we cannot draw a definite conclusion. A fine example of the "when life gives you lemons, make lemonade," was how the commercial value of ice blocks (to store perishables in cellars in a time before the invention of the refrigerator) financed the ice breaking of rivers and lakes to enable transportation in winter. Sleds and skates were used to move around in the frozen world of the chilliest winters of the Little

Ice Age. It is clear, as Degroot points out, that the Dutch were not passive victims of the climate change they endured (p. 138, 276).

It would be very interesting if future environmental histories of the Little Ice Age could examine this question for other societies around the globe. In the face of adverse climatic conditions when one's very survival is at stake, wouldn't anybody become creative trying to protect oneself by mitigating the impending disaster? It would be interesting to see what strategies other groups or societies came up with, whether they were similar to or different from the Dutch example. Interestingly though, this prompts the question of whether today's world population could be described as passive victims considering the ongoing ignorance of scientific consensus? Scientific publications have overwhelmingly proven that human-caused fossil fuel emissions drastically alter the climate and will continue to do so, the most important course of action is to reduce fossil fuel emissions—and yet this does not happen on the scale or with the sort of commitment that is necessary to prevent the worst consequences of anthropogenic climate change.

In his conclusion, Degroot brings the argument full circle to our present, in which climate change is the most pressing matter of our time. In 300 pages, one learns how lives around the world were severely impacted by “modest climate change” of one degree Celsius on a decadal scale. This downturn of “only” one degree Celsius wrought havoc on communities globally. Even the Dutch, who coped well during the coldest periods, still occasionally suffered, with accounts of individuals crashing into frozen rivers or lakes and dying in icy waters, freezing in their homes or in the street, at times being famished and sick, dying on battlefields or drowning in floods caused by ice dams or storm surges.

Today, we are already experiencing more severe and more common heat waves, wildfires, droughts, and flooding. At the end of the century, the population on our planet might well face global average temperatures four degrees Celsius higher than pre-industrial levels. It is almost unimaginable how much worse it could get, compared to the impacts of climate change we have seen illustrated in detail here for societies during the Little Ice Age. Unlike our early modern ancestors, we know what is happening and why. How can we, as historians, communicate the results of our research differently to not only preach to the choir but also reach people outside our circles?

In his book, Dagomar Degroot makes a strong argument for bringing the humanities and the natural sciences closer together to produce interdisciplinary studies that can generate new perspectives. The climate of planet Earth has never been stable. Climate history is a fairly young discipline, itself roughly half a century old. It is an interdisciplinary field that usually looks at topics other scholars have not yet covered and therefore it produces new work with fresh insights on how humans have coped with the climate change in the past that may help us with our current predicament on this warming planet. Degroot points out that historians are rarely involved in the debate about global warming and uses his book to make a very

powerful case that historians should, in fact, be consulted (p. 307). Historians have important insights that should be considered, lessons we can learn from the past in order to be more resilient in the future. In the past, historians have looked only to the past and not to the future, but perhaps today in a rapidly warming world climate historians no longer have that luxury.

Degroot raises an important and often ignored aspect, that might motivate residents of wealthy, developed countries and their leaders to take action as soon as possible: Whereas the Dutch thrived during the Little Ice Age, many of the wealthiest societies did not: Ming China, the Ottoman Empire, the Spanish Empire, and Mughal India all proved to be less resilient than the Dutch. Can lessons be learned from the unraveling of these societies? Perhaps studying these societies not just at their peak but also at their downturn or collapse can show us how much change—climatic or other—can be *too* much to bear? The lesson for today is: Our collective wealth might not protect us from the consequences of anthropogenic climate change (p. 308-309). It is all a question of how many resources we need to prosper, judging from the ecological footprint of most developed countries, we use much more than we have, which will not be sustainable in the long run.

In this context, it is very interesting that Degroot argues the citizens of the Low Countries during the Little Ice Age had a shared experience of the Little Ice Age. That, for instance, on the frozen rivers during fairs men and women from all social backgrounds would mingle (p. 287). Today, perhaps different people across national and social boundaries should foster a shared experience of living in and trying to mitigate the consequences of a warming world. Essentially, “we are all in this together” is the key message of the IPCC’s assessment report on 1.5°C warming that was published in October 2018. Unfortunately, too often climate change still appears to rather be a notion of an abstract future problem that does not seem to affect most people personally. Are there concepts or ideas, developed during this shared experience of the Little Ice Age that we can apply today to the national and even international debate on climate change? Perhaps the shared experience was one of the coping mechanisms that allowed the Dutch to thrive during this time.

Dagomar Degroot “hopes to provide a novel perspective on humanity’s long experience with climate change” (p. 9). With *The Frigid Golden Age*, he certainly managed to do that for the Dutch Republic in the Dutch Golden Age during the coldest parts of the Little Ice Age. Future climate histories can elaborate on the human experience with (hi)stories of climate change in other times and places around the globe.

Comments by Thomas Wickman, Trinity College

Signs of Change in Climate History

What if climate historians checked first for evidence of prosperity during past periods of climatic instability, as a precaution against letting narratives of crisis or collapse become the default? Dagomar Degroot's *Frigid Golden Age* shows that cold temperatures could be a boon for some people in the past. This highly-original book questions a reflex among scholars to assume that chilly times were usually bad for centralized, stratified, agriculturally-based societies. Degroot is not just discussing resilience, which for some climate historians is reduced to a simple assessment of societies' comparative breaking points. Degroot wants to know how people could thrive in the midst of change and why they might welcome conditions that others would call severe or adverse. In some ways, Dutch fortunes from the late sixteenth to early eighteenth century rested on war, colonialism, and economic competition for limited resources. Yet as Degroot explains, Dutch cultural resources also served people well in local communities and within regional relationships of reciprocal benefit.¹⁷

It hardly needs to be restated that climate historians have written much about misery, crisis, catastrophe, and collapse. Geoffrey Parker devotes the bulk of *Global Crisis* to the "fatal synergy" between climate and conflict. It is mainly in the book's final section that Parker considers a combination of historical contingencies and constructive state policies that allowed some people to escape perpetual crisis, even during periods of adverse weather. When better times came for a few nations, Parker argues toward the end of the book, the improved situations resulted partly from a "phoenix effect," in which growth and creativity emerged from destruction. The cumulative impact of that landmark text is to emphasize human vulnerability and suffering due to cooling, even if one of Parker's intentions is to suggest that wise policies can fundamentally change social, political, or economic outcomes during periods of climatic extremes, producing benign rather than fatal synergies.¹⁸

By contrast, Degroot's book addresses beneficial adaptation in the beginning, middle, and end of the story, and introduces nuanced and counterintuitive ways to think about early modern climate history. He periodizes the Little Ice Age with particular attention to the Grindelwald Fluctuation (1560-1628) and Maunder

¹⁷ For my critiques elsewhere of "climate historians' reflexive tendency to tell stories about crisis and collapse," see Thomas Wickman, *Snowshoe Country: An Environmental and Cultural History of Winter in the Early American Northeast* (Cambridge: Cambridge University Press, 2018), esp. 15; Thomas Wickman, "Narrating Indigenous Histories of Climate Change in the Americas and Pacific," *Palgrave Handbook of Climate History*, eds. Christian Pfister, Sam White, and Franz Mauelshagen (London: Palgrave Macmillan, 2018), 387-411.

¹⁸ Geoffrey Parker, *Global Crisis: War, Climate Change, and Catastrophe in the Seventeenth Century* (New Haven: Yale University Press, 2013), xxv, 589 ("fatal synergy"), 612 ("phoenix effect"), 641 ("benign synergy"). As Degroot remarks in his conclusion, Parker also dedicates a chapter to the exceptional case of seventeenth-century Japan.

Minimum (1645-1720). He also points to the unevenness of cooling by season and sub-region, which decisively mattered, for example, for Dutch whalers in Svalbard (60, 78-9). The book well may be praised most for studying climate change as experienced at sea. Degroot assiduously examines ships' logbooks and records of sea tolls for changing volumes, calendars, and routes of navigation. Sea ice presents one formidable limit at sea in Degroot's narrative. But the headline finding in this book is that wind patterns at sea can be historicized within the context of global climate change, and that people's adaptations to the winds (or failures to adapt) changed history. Wind directions and velocities in the Maunder Minimum may have facilitated the Dutch East India Company's voyages to Asia (52, 83, 106). Yet the single most important variable that most affected events in Degroot's narrative is a sudden shift in the wind during a naval conflict. The side that took the weather gage often prevailed (159, 231). More broadly, the book seems to challenge a "terracentric" bias among climate historians studying agrarian communities for whom global cooling primarily caused crop failures or deepened fuel shortages. As Degroot observes, "weather that undermined the supply of useable energy for farmers and pastoralists actually increased how much energy the Dutch could use on their ships" for commerce or battle (18).¹⁹

Degroot narrates events vividly, but without sensationalism, and does so in the service of educating readers about climatic systems. Degroot expects all readers to become scientifically literate—and he oversees that learning process with admirable patience and skill. A list of "Climate Terms" immediately prior to the introduction is well placed (xvi-xvii). The first chapter of the book is an especially useful primer for students who want to understand climate historians' methods and sources. In the remaining chapters, Degroot stands out to me as an author who is always teaching. It is rare in the humanities for an author to pose questions so clearly, continually lay out the data before the reader, and then assess so openly the results, whether those results prove conclusive or ambiguous. In this sense, Degroot is modelling the application of the scientific method to the work of a humanist—a characterization that best applies to chapters two to five, the core of the book. At the same time, Degroot prompts scientifically-literate readers to carefully interpret archival documents and to integrate "big data" with "qualitative accounts of short-term events on a local level" (17). He also integrates nuanced interpretations of maps and paintings, refusing to treat these sources as mere climatological indices. In unifying science and history to explain complex and unpredictable shifts in natural contexts and in human decision-making, Degroot's chronicle shares with John McNeill's *Mosquito Empires* the dual capacity to educate and surprise. Describing harsh preindustrial conditions and assessing the limited knowledge available to past actors, both authors calibrate the balance of power between nature and people in

¹⁹ For a critique of "terracentric" history, see John R. Gillis, *The Human Shore* (Chicago: University of Chicago Press, 2012).

every historical situation, while at the same time demonstrating how quickly people's advantages over each other could turn to disadvantages, or vice-versa.²⁰

Is *Frigid Golden Age* a book for optimists? I pose the question with the students of 2018 and beyond in mind. Does Degroot give undergraduates a way forward, if young people born in the twenty-first century read his book thinking about their own futures? In scrutinizing domestic adaptations and international strategy, Degroot seems to be searching for problem solvers in the past and to be weighing the benefits and drawbacks of increasing connectivity. Cognizant of the foibles of leaders, attentive to the depth of early modern religious conflict, and sensitive to realities of oppression, Degroot nevertheless recovers a useable past in which some people responded pragmatically to unstable or extreme weather patterns. The story is never apocalyptic. I found endlessly interesting Degroot's attention to technologies such as turn and pull ferries (130), ice breakers (138, 292), milk boats (140), sleds (141), skates (142-3, 166), and ice-wagons (291). Heating patents are a wonderful source (291). Some practices and technologies were integral to wars fought at home, including tactical flooding and the construction of star-shaped forts (156, 172). Yet equally important for Degroot was the flexible and thoughtful scheduling of transportation for maximal safety, convenience, and profit.

The final chapter will challenge techno-optimists to think more broadly about culture, memory, and imagination. Degroot unearths rich documents showing how people historicized their own experiences, such as a lengthy poem about the winter of 1666/7 written by the head of the Dutch herring fleet's guild of pilots—and posted to his door (286). As Anya Zilberstein has argued, people chronicled and commented on early modern climate change as it happened, not just accessing collective memory but creating archives and enacting value judgments. Degroot joins Zilberstein in looking for “rudimentary form[s] of climate history” (257). Surely, there are other aspects of ordinary Dutch people's knowledge and coping strategies to be researched further—for example, soldiers' well-timed desertions from military service, women's village-level social strategies in wartime, or Dutch phenology and ethnobotany for cold seasons. By combining a focused study of the Dutch republic from within and a selective examination of the maritime logistics of commerce and war, Degroot largely opts not to address Dutch colonialism's human consequences overseas. Degroot's *Frigid Golden Age* is an invaluable model for scholars doing climate history, but it is hardly the last word, and its publication should create opportunities for scholars of gender, indigeneity, or empire to push forward the research.²¹

²⁰ John R. McNeill, *Mosquito Empires: Ecology and War in the Greater Caribbean, 1620-1914* (Cambridge: Cambridge University Press, 2010).

²¹ Anya Zilberstein, *A Temperate Empire: Making Climate Change in Early America* (New York: Oxford University Press, 2016). For an argument about early climatology, see Sam White, “Unpuzzling American Climate: New World Experience and the Foundations of a New Science,” *Isis* 106:3 (2015): 544-66. For new work on Dutch colonialism in climatic context, see Nicholas Cunigan, “Weathering Extremes: Climate, Colonialism, and Indigenous Resistance in the Dutch Atlantic” (PhD dissertation, University of Kansas, 2017).

Every shift in climate tests people's resilience, whether warmer or colder, wetter or drier, winds blowing more often in one direction or in another, and many local peoples have coped okay with all of the above. Why then have scholars tended to tell so many tales about abundant times for large agricultural societies during stable, temperate periods, followed by downturn if not worse when the weather cooled or droughts occurred? The Roman Climate Optimum in Kyle Harper's *The Fate of Rome* is the latest instance of a warm, wet "optimum" narrated in epic fashion as a prologue to disaster.²² By contrast, Degroot's introduction promises (and the book delivers) subdued analysis of "crisis and opportunity in a changing climate." Degroot's biggest contribution is his clear-headed insistence on the diversity of human response to variable climate. Most climate historians try hard to identify contingency and to resist determinism, but more need to look for divergent values, tactics, strategies, and policies, as applied to all forms of climatic variation.²³ In some schools of history, exceptionalism is taboo. If more climate historians looked for exceptions, including at smaller scales, we might have fewer stories of collapse and more stories of survival, persistence or prosperity. One sign that climate history is thriving as a field will be a greater diversity in the kinds of storylines practitioners use to narrate the past.

²² Kyle Harper, *The Fate of Rome: Climate, Disease, and the End of an Empire* (Princeton: Princeton University Press, 2017). Scholars sometimes use "anomaly" or "period" rather than "optimum" to discuss climatic change in more neutral terms.

²³ For exemplary work in this vein, see Georgina H. Endfield, *Climate and Society in Colonial Mexico: A Study in Vulnerability* (Malden, MA: Blackwell, 2008); Sherry Johnson, *Climate and Catastrophe in Cuba and the Atlantic World in the Age of Revolution* (Chapel Hill: University of North Carolina Press, 2011); Matthew Mulcahy, *Hurricanes and Society in the British Greater Caribbean, 1624-1783* (Baltimore: Johns Hopkins University Press, 2006).

Response by Dagomar Degroot, Georgetown University

People often ask me what lessons I learned while working on *The Frigid Golden Age*. Usually they mean the lessons I took from the history of the Dutch Republic, and I usually have some things to tell them (keep reading!). Yet what I don't say is this: the one that will stick with me the most is that writing a book – any book – is *hard*. I first imagined the rough outlines of the *Frigid Golden Age* in 2007. It took more than a decade until I could finally look down and see the book in my hands. It has been a grueling and profoundly humbling experience, and there were times when I wondered whether it was worth all the effort. These remarkably thoughtful reviews convince me that I opened a conversation worth starting, and perhaps even that I have helped change my discipline in a meaningful way. I would like to begin, then, by offering my utmost gratitude to my reviewers, and to our roundtable editor, Melanie Kiechle.

Each of my reviewers poses questions that challenged me as I wrote *The Frigid Golden Age*, and I am delighted to have the opportunity to answer many of them in this space. Towards the end of my remarks, I will also briefly address how some of my views have evolved since I completed the book, and what a best practice might look like for climate historians in the wake of its publication.

Central to *The Frigid Golden Age* is the idea that we need a new methodology to write climate histories, one that both accounts for the complexity of relationships between climatic and human histories, and gives greater agency to people in the past. Many climate historians have matched broad climatic and social trends on huge scales in time and space. Yet I argue that climate historians should approach a topic by carefully discerning how climatic trends shaped the mean and variability of weather on local scales. Where possible, they should then consider how discrete weather events provoked human responses, again on small scales in time and space. Only after establishing these little connections should they attempt to make big claims about the impact of climate change on human history – if they choose to do so.

James Bergman asks whether it would have been possible for me to write a detailed history of the experience of climate change across the entire Dutch trading empire. Could I have used my methodology to explore, for example, how the Little Ice Age affected the tortured relationship between colonizer and colonized, slaver and enslaved, merchant and market in the “multiple nodes” of the Dutch trading network?

It's a question I often asked myself as I wrote *The Frigid Golden Age*. The answer must begin with the nature of the Little Ice Age, and the attempts of paleoclimatologists and historical climatologists to reconstruct it. First, the cold waves of the Little Ice Age – including the Grindelwald Fluctuation and Maunder

Minimum, which frame this book – likely affected the Northern Hemisphere more than they did the south. Second, climate reconstructions for Europe and China in particular have long been more reliable and precise than those that cover other parts of the world. Research into past climates has deep roots in both places, and some of our best sources for reconstructing past climate change on small scales – tree rings, for example – are either scarce in the global south, or do not register the periods of growth and dormancy that allow us to use them for climate reconstructions.

Climate historians have long had a habit of using data from climate science as though it were objective, impartial, and homogenous. Perhaps many of us collaborate so closely with scientists that we begin to think of ourselves like scientists. Maybe the idea that climate science might be “constructed” strikes many of us as deeply problematic in an era of enduring climate change denial. Regardless, we have too often used the remarkable data that paleoclimatology provides us without thinking like historians of science: without thinking, in other words, about the political and cultural histories and prejudices subtly encoded in that data. While I mention the historical biases of climate reconstructions in *The Frigid Golden Age*, I do think I could have more clearly emphasized what those reconstructions did *not* allow me to do, and why they did not allow me to do it.

In any case, the periphery of the Dutch trading empire in the Southern Hemisphere might not have experienced the temperature trends of the Little Ice Age to the same extent as the metropole in the north, but it has long been hard to know for sure. I certainly did not have the kind of climate reconstructions that would have enabled me to use my methodology to investigate, for example, the impacts of the Little Ice Age on the African slave trade. I did wonder whether I could tie changes in atmospheric circulation to the movement of the West India Company (WIC) ships that transported African slaves. Yet my examination of the Dutch East India Company – the VOC – led me to emphasize circulation changes in the Northeastern Atlantic, far from the African coast.

All of this raises an interesting problem, one that has grown clearer to me since the publication of the *Frigid Golden Age*: the methodology that allowed me to complicate grand narratives in climate history also limited the places, times, and ultimately the historical actors I could study, according to the state of the evolving science. Luckily, the picture is changing now. Climate reconstructions for much of Africa, for example, increasingly permit detailed scholarship on relationships between the Little Ice Age and the slave trade. As I describe elsewhere, early research suggests that precipitation extremes in the early Grindelwald Fluctuation weakened African polities that then fell victim to European depredations, and that subsequent, modest cooling in sub-humid and dry savannah regions helped the slave economy to function with especially ruthless efficiency.²⁴

²⁴ Dagomar Degroot, “Climate Change and Society from the Fifteenth Through the Eighteenth Centuries.” *WIREs Climate Change* Advanced Review. DOI:10.1002/wcc.518

So it may well be that a truly global history of the Dutch trading empire in the Little Ice Age would include more cautionary tales, as Bergman puts it. Certainly, I fully agree with Thomas Wickman: my book is “hardly the last word,” and its best contribution to environmental historiography will likely be to encourage “scholars of gender, indigeneity, or empire to push forward the research.” Indeed, Nicholas Cunigan has lately pioneered research into the role of climatic change on Dutch colonialism in Brazil, and his findings will interest anyone who has read my book. I have lately written about the calamitous impact of Dutch adaptability to climate change on Arctic bowhead whales: sentient animals with their own, often-overlooked agency.²⁵

Still: *The Frigid Golden Age* also reveals that the overall resilience of the Dutch metropole to climate change did not hinge on what happened in the imperial periphery. The book shows that, even before the emergence of the VOC or WIC, and well before the oceanic “rich” trades accounted for a substantial portion of Dutch prosperity, Dutch traders and merchants, artists and farmers responded creatively to new climatic conditions.

I therefore continue to believe that much of the reason for the Republic’s prosperity in the Little Ice Age lies in watery environments closer to the Low countries. Wickman insightfully points out that *The Frigid Golden Age* confronts the “terracentric” assumptions so often made by climate historians. I wish I had thought of using that word! But let me go one step further and say that the book challenges climate historians’ overwhelming focus on rain-fed agriculture. Of course, trends in temperature and precipitation did affect millions across the early modern world by interrupting or shortening growing seasons for staple crops. Yet as *The Frigid Golden Age* shows, this does not account for the entirety of contemporary lived experience. Other ways of making a living – by the Dutch, yes, but perhaps especially by indigenous communities across Africa, the Americas, and Australia – responded to different manifestations of climatic trends in distinct and often surprising ways.

Indeed, I agree that we need more diversity in the stories climate historians choose to tell, and this takes me back to that issue of scale. As I see it, many climate historians craft narratives that connect cooling to social crisis because they consider only the grandest scales in time and space, where the fates of entire continents supposedly wax and wane, where century-scale climatic trends come and go. Until recently, the low precision (or “resolution”) of most climatic reconstructions all but forced historians to work on those scales. Even now, such work retains value, partly because it has permitted more detailed studies, including *The Frigid Golden Age*.

²⁵ Nicholas Cunigan, “Weathering Extremes: Climate, Colonialism, and Indigenous Resistance in the Dutch Atlantic.” PhD diss., University of Kansas, 2017. Dagomar Degroot, “Climate Change, Whaling, and Conflict in the Seventeenth-Century Arctic.” *Past and Present*. Forthcoming.

Yet it is also true that often-surprising relationships between local variations in human and environmental conditions played out in the shadow of big trends. These local stories can reveal much about the creative ways in which people actually confronted and thought about climate change. Recently, innovative scholars have convincingly argued that climate historians should focus on these stories. Yet I hope that *The Frigid Golden Age* shows how local relationships can be fruitfully integrated into global narratives.²⁶ I still believe that big narratives are important in climate history, both because they reveal patterns that we might miss by concentrating on smaller scales, and because they tell stories that resonate outside our discipline. A central challenge in climate history is therefore to integrate history on different scales: the global and the local, the long and short *durée*.

Both Bergman and Cunigan wonder whether *The Frigid Golden Age* might have gone further in exploring what it meant for the Dutch – Protestant and Catholic, elites and commoners – to observe, record, and interpret the weather trends of the Little Ice Age. In fact, the book I originally submitted – at some 220,000 words – included an entire chapter that explored this question. To the eternal gratitude, I’m sure, of many undergraduate students in environmental history, Cambridge University Press asked me to trim some 90,000 words from the total. While my newborn daughter napped, I deleted pages, trimmed citations, and cut figures that represented countless hours of work. It was one of the hardest things I’ve had to do in academia, but it left me with a much more concise and accessible book. However, to retain my meticulous methodology of linking climatic trends to human affairs, I ultimately made the decision to cut that chapter on the meaning of climate and weather for Dutch observers.

The deleted chapter traced how Dutch sailors and settlers encountered distant, variable climates in ways that led them to question long-standing Aristotelian assumptions about the natural world. At the same time, the distinct culture and economy of the Republic created a welcoming environment for artisanal tinkers and early scientists. Weather extremes associated with the Little Ice Age encouraged these observers to develop new means of tracking weather, and to incorporate meteorology within revolutionary, mechanistic cosmologies. One of my arguments – which I will develop more thoroughly in my next book – is that we don’t often pay enough attention to the agency of nature in shaping science.

In any case, the deleted chapter showed how scientific interpretations of weather found an echo in the pragmatic approach to weather shared by many among the illiterate urban poor. Yet supernatural explanations for weather persisted among the literate upper and middle classes, and among both Protestants and Catholics. The rural poor, meanwhile, consulted an ancient blend of magical and religious weather wisdom, especially in the eastern hinterlands of the Republic. Still, secular

²⁶ John Haldon et al., “History meets palaeoscience: Consilience and collaboration in studying past societal responses to environmental change.” *Proceedings of the National Academy of Sciences* 115:13 (2018): 3217.

ideas about weather gradually gained acceptance in Dutch cities, and it was these ideas that encouraged some Dutch observers to track climate change. Ultimately, I argued that diverse understandings of climate, weather, and climate change across the Dutch trading empire together reflected and contributed to the overall resilience of the Republic in the face of climatic cooling.

I believed in this story, but I did not consider it absolutely essential to the core argument of *The Frigid Golden Age*. Perhaps I was wrong; perhaps that assumption had roots in my personal bias towards materialism. In any case, after I cut the chapter, I tried to turn it into a free-standing article. I submitted it to a journal, but the response confirmed what I already suspected: it didn't work as well by itself. With the book behind me, I was eager to turn to new projects, and I had little interest in the article revisions that I needed to undertake. It is gratifying now to realize that this story may still be worth telling, and I thank my reviewers for that insight.

Cunigan considers whether the example of the Dutch can tell us who will prosper and who will suffer in our warming world. Wickman wonders whether I've written "a book for optimists," one that offers "undergraduates a way forward." Katrin Kleemann asks whether millions in the present are passive victims in the face of global warming, unlike my adaptive Dutch. These are precisely the kinds of questions I hoped to provoke while writing *The Frigid Golden Age*. Of course, one does not need to be an environmentalist to write environmental history; curiosity can be motivation enough. Yet climate historians, it seems to me, often feel that they have a special responsibility to make history useful in the present. I am certainly no exception. In this book and in other projects, I have argued that the past can open new perspectives on the great struggle of our time: the fight against anthropogenic global warming. Given the scale and urgency of the challenge we face, I might have chosen a different profession had I felt that history – and historians – have nothing to offer.

Of course, books like *The Frigid Golden Age* can tell us little about what exactly the future has in store for us. Most historians are rightly wary of making predictions on the basis of a distant past, when people and places were very different than they are today. I do believe, however, that my book contributes to present-day debates about global warming by not only presenting some strategies that might work in the face of environmental change, but more importantly by revealing the complexity of relationships between climate and society. While I am deeply concerned about our future, I am also skeptical of studies that, as geographer Mike Hulme eloquently puts it, "reduce the future to climate."²⁷ Projections of our warmer future too often emphasize changes in the variable we can easily predict – warming on a global scale, under various emissions scenarios – but not the variables that are harder to model, such as social, cultural, and economic changes. We have little idea what national

²⁷ Mike Hulme, "Reducing the future to climate: a story of climate determinism and reductionism." *Osiris* 26:1 (2011): 245-266.

economies will look like by 2100, for example. With that in mind, how can we estimate the economic toll of warming by that date, as influential new studies have attempted to do?²⁸ *The Frigid Golden Age* may remind us today that not everything can be quantified; that the future will be surprising, and that we have more agency than we might assume.

Wickman writes that I have modelled “the application of the scientific method to the work of a humanist.” Indeed, just as many scientists have much to learn from the humanities, I believe the humanities – perhaps especially the historical discipline – have much to learn from the sciences. A great deal has now been written on the potential of data from natural archives to reveal previously unimagined truths about the human and natural past. For many parts of the world, this data is now precise enough to unlock a new kind of historical scholarship, one that encourages multi-author collaborations between researchers in very different disciplines. In the past year, I’ve committed myself to organizing more of these collaborations, in addition to the usual historian’s work of writing single-authored books.

Yet I’ve also started to think more deeply about incorporating uncertainty into historical scholarship. In *The Frigid Golden Age*, and especially in my more recent scholarship, I acknowledge the different levels of certainty that I ascribe to different relationships between environments and communities. I weigh the strengths and weaknesses of different sources, and indeed now I would write more about those ship logbooks, owing to the pioneering work of early modern historian Margaret Schotte.²⁹ Yet I have found that scientists are far more comfortable than many historians with such open admissions of doubt. The qualifiers I use in my writing would be right at home in an IPCC report, yet strike some historians as a troubling admission of doubt: a sure sign that an argument needs strengthening.

As I argue elsewhere, that attitude cannot survive sustained work with non-textual sources.³⁰ Connecting trends to events in human and natural realms always involves a certain level of speculation, for the most accurate reading of the past – the one that accounts for the dynamism of the non-human world, or the agency of actors who have left no written trace – is rarely the best-documented. To be honest with ourselves and with our readers, we have to acknowledge the limitations of our sources, methods, and conclusions. In my view, that strengthens, rather than weakens, our scholarship. It has the added benefit of inviting readers into our analytical process, of showing them how we think through possible relationships and reach conclusions, which in turn permits more insightful criticism.

²⁸ “Fourth National Climate Assessment.” Available at: <https://nca2018.globalchange.gov>.

²⁹ Margaret E. Schotte, *Sailing School: Navigating Science and Skill, 1550-1800*. Washington, DC: Johns Hopkins University Press, Forthcoming.

³⁰ Dagomar Degroot, “War of the Whales: Climate Change, Weather, and Arctic Conflict in the Early Seventeenth Century.” *Environment and History*. Forthcoming.

Since the publication of *The Frigid Golden Age*, I've also continued thinking about the shelf life of books in climate history. The paleosciences and the historical discipline move at very different speeds. Paleoclimatic reconstructions of atmospheric or oceanic circulation, for example, can undergo revisions that may not change big, multi-centennial trends, but may still alter the picture on scales that matter for human history. Books on the Little Ice Age that hinge on such reconstructions can – and have – become obsolete in the time between submission and publication, as the state of the science changes. It is, perhaps, a vain ambition to write “future-proof” books in any field, let alone climate history.

Yet I do think there might be a simple best practice that could add to the staying power of most books in climate history. In *The Frigid Golden Age*, I do my best to draw on a large and diverse group of sources to make a big claim. One kind of source – a tree ring reconstruction, for example – might eventually undergo revision, yet it is very unlikely that all will change enough to alter the big picture. I also attempt to fortify every environmental reconstruction with observations of weather – or activities that depend on weather – in textual sources. Of course, historians may understand or approach documents differently with time, and therefore some documents may not record weather as accurately as they seem to. Again, where possible I try to use different and diverse texts to support my interpretations of weather trends. Yet I believe that reconstructions based on observations of weather and weather-related activities are less subject to change than those that make exclusive use of paleoclimatic data. They also reflect the lived experiences of historical actors, which are, of course, the focus of *The Frigid Golden Age*. While I admit that not every publication in climate history can or should follow this approach, I hope it will make my core conclusions less subject to fundamental revision in the years ahead. I will leave it to my colleagues in the environmental sciences and humanities to judge whether I have been successful.

Finally, Kleemann wonders how climate historians might “communicate the results of our research differently,” so that we might “reach people outside our circles.” I should begin by saying that I do think that there is value in preaching to the choir – to those already sold on the science of anthropogenic global warming – because climate history can lead those people to think differently about, for example, the social consequences of warming. Better yet, the emphasis on individual or communal agency in books like *The Frigid Golden Age* may motivate some in the choir to the kind of action that fatalistic narratives – so common in climate journalism – typically discourage.

Yet I also hope that a student or lay person who isn't entirely sold on the science of climate change will be more likely to pick up a book like *The Frigid Golden Age* than one that focuses entirely on the threat of global warming. Climatologist Katharine Hayhoe argues that even those who disagree about climate science can find shared interests that might still lead to lower carbon emissions.³¹ Different stakeholders,

³¹ Katharine Hayhoe, “When facts are not enough.” *Science* 360:6392 (2018): 943.

for example, might find very different reasons to support the construction of a solar polar plant, but the effect on Earth's climate will be the same. I have come to think of history in much the same way. Hardcore deniers of anthropogenic global warming may be impossible for us to reach, but I wonder: can history be a bridge between skeptics and proponents of climate science? Can we use a widespread – and dare I say, bipartisan – fascination with the past to awaken more people to the dangers of runaway climate change? Climate scientists often tell me that to reach a broad audience, sharing data is less effective than telling stories. Maybe we can be the storytellers who lead skeptics to a more accurate understanding of the challenges we'll face in the century to come.

Of course, writing books is not enough. As we all know, academic books, even popular ones, rarely reach a mass audience. Like other academics who double as activists, my approach has long been to make myself available for interviews with journalists, and to submit articles to popular publications. In every interview or publication, I struggle to explain how the past can offer unique perspectives on the injustices of our present, and the perils of our likely future. This can be frustrating work. Journalists can, at times, distort the meaning of our answers, and some of my best articles – submitted during the 2016 election, for example – were never published.

I have therefore found it especially fulfilling to create platforms that allow others to speak with louder voices. I started HistoricalClimatology.com back in 2010 as a personal research blog, for example, but eventually worked with talented colleagues to remake it into a popular website with articles by diverse colleagues in the environmental humanities and sciences. Based on the emails I receive, many of our readers do not visit our site as believers in climate science (though some might leave as converts). In my experience, it doesn't take much technical skill to create and advertise these platforms. They cannot replace other kinds of outreach, and they certainly can't replace books, yet they do provide an easy way for even very junior scholars to create communities and reach beyond our usual audience. In an age when our media is changing as fast as our climate, we need to experiment with new ways of reaching the biggest audiences we can.

About the Contributors

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