

## Article

# Climate Delusion: Hurricane Sandy, Sea Level Rise, and 1840s Catastrophism

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**Abstract:** The existential global threat of inundation of the world's low-lying port cities necessitates a radical shift in the dominant climate framework of sustainability and resilience to include catastrophism. Scientists and social scientists of the industrial crisis decade of the 1840s, arguably the Anthropocene's historical origin, offer a model for theorizing twenty-first century catastrophe in both geophysical and social terms, as in the case study of Hurricane Sandy presented here.

**Keywords:** climate change; catastrophism; sea level rise; Hurricane Sandy; the 1840s; the Anthropocene; Friederich Engels; Joseph Adhémar

## 1. Introduction

In the summer of 2015, I vacationed with my family on the New Jersey Shore. Unfortunately, we selected exactly the portion of beach that the Army Corps of Engineers had reached in its post-Hurricane Sandy restoration project. In late October 2012, Sandy formed as a hurricane in the Caribbean, before wheeling north along the Atlantic seaboard as a massive, highly unusual “superstorm” with wind gusts of 90 mph. In the aftermath of the devastation, Governor Chris Christie, his eyes on a White House bid, vowed to rebuild every inch of Jersey's battered coast. Almost three years later, the Army Engineers had established a ship-sized barge a few hundred yards out to sea from our beachside apartment. From 6:00 in the morning until sundown, its industrial engines dredged sand from the seafloor via a pipeline onto the shore, where bulldozers shifted it noisily about, like infant giants building sandcastles. Our beach holiday lay in ruins.

Climate change set the table for Sandy. Historically high sea surface temperatures intensified the winds and increased rainfall by 35%, while 6 inches of sea level rise over the last century meant that Sandy's destructive surge rode in at greater loft, enough to flood the subway stations on Manhattan's low-lying southern tip. By the time Sandy's fury was spent, an average of 40 feet of beachfront had been swallowed up along the entire 150-mile Jersey Shore. About 350,000 homes were damaged or destroyed, while losses stood at \$75 billion in the United States alone (Trenberth et al. 2015).

Urged to rescue the New Jersey beaches claimed by Hurricane Sandy, Governor Christie committed \$5 billion to dredging 30 million cubic yards of Atlantic Ocean seafloor back to shore. His aim was twofold: to guarantee the native claim of all New Jerseyans to a towel's length of summer sand; and to protect the billions worth of beachside properties reliant on bulky dunes to repel future Sandys. However, with the beaches “restored”, at best, to their pre-hurricane state, a future Sandy will wreak equivalent havoc. In the hands of the Army Corps—the engineers responsible for the breached levees of New Orleans—the Jersey Shore restoration project involved no sustainable prospectus. An engineering ethos has thus far shaped coastal urban protection in the developed world. However, engineering, as we know it, is inadequate to deal with the actual threat posed by sea level rise in this century.

What my frazzled family and I bore witness to that summer weekend was an epic, taxpayer-funded display of climate delusion. In this essay, I will explore the pathologies of climate delusion, while arguing the case for the necessity of catastrophism in a renovated and progressive climate

discourse. Hurricane Sandy is, in one sense, an overdetermined case study and parochial to the United States, but its purpose here is illustrative rather than comprehensive—one model of the disastrous urban coastal inundation events already underway globally and whose impacts cross hemispheric and national boundaries. The essay concludes with reflections on the crisis decade of the 1840s—a historical proscenium for the Anthropocene and its multiplying climate disasters. Two notable catastrophist thinkers of that decade, Friedrich Engels and Joseph Adhémar, offer exemplary repudiations of status quo delusion with regard to social and physical systems, respectively.

## 2. Hurricane Sandy and the Critique of the Anthropocene

Climate delusion is all the more dangerous for not being climate denialism. Denialism—allowing for the grotesque exception of the Republican Party in the United States—is no longer acceptable discourse in polite circles in the West and Asia. Climate denial is a viral, deadening nihilism, but climate delusion possesses a deadlier irony: it is perfectly consistent with acceptance of climate change science, with sincere dismay about climate change, even with climate activism. However, climate delusion refuses to accept catastrophic reality, and without a catastrophist paradigm, all climate politics are deluded.

Catastrophism has long been taboo in climate policy and education circles, particularly in the United States. The enormous attention paid to the 2019 book, *The Uninhabitable Earth*, by climate journalist David Wallace-Wells, was not due to any originality of its content but, rather, the novelty of a mass market non-fiction book entertaining worst-case scenarios from the established climate science literature. The coming years will tell whether the Wallace-Wells' catastrophist rhetoric becomes standard bestselling fare or remains an outlier to mainstream climate discourse.

*The Uninhabitable Earth* notwithstanding, for most of the twenty-first century the only refuge from the mainstream media-loop of climate denial/delusion has been climate science itself, in the stilted prose and earnest graphs of hundreds of papers spread across the specialist journals in the field. It is a discursive field mostly unattractive to academic humanists, let alone media narrators low and high (climate science does not lend itself to metaphor or verse—data does not orate). It would be wrong to label climatologists themselves as catastrophists, collectively. It is the papers themselves that speak a catastrophic vernacular. For a public dizzied by climate delusion—for whom climate salvation is one Elon Musk daydream away—only climate data captures, fleetingly, the physical systems of the Earth as they lurch out-of-control toward a distant post-carbon equilibrium, fitfully tracked by numbers—by a mathematics that slips our imaginative hold.

A family friend was directly impacted by Sandy. He lost a shore house in Brick, New Jersey, and his elderly mother barely escaped with her life. For him, Sandy was visceral and traumatic and will never be forgotten. This is true for hundreds of thousands of people in the Caribbean and in New Jersey and Long Island. However, the United States (U.S.) national media has largely forgotten Hurricane Sandy. The psychological impact of an extreme weather event on those outside ground zero is intense but shallow and abbreviated. Among the general public in the United States, increased reporting of weather disasters such as Sandy has likewise produced a form of disaster fatigue or amnesia. This amnesia is, by definition, not conscious or willful but systemic, institutionalized, and cultural. A hurricane is camera-ready climate change, but the market appetite for a catastrophic spectacle is insatiable. "Saturation" coverage does not extend to the clean-up—the camera crews are packed up and long gone.

Moreover, what is true of a U.S.-based event, such as Sandy, is true *a fortiori* for climate calamities beyond its borders, particularly in Asia, such as Typhoon Haiyan in the Philippines, which occurred in the same twelve-month period and involved more than twenty times the casualties but received only a fraction of the media coverage. Locally, a weather disaster retains its affective power, but, beyond the disaster zone, the event lapses into the permanent twilight of vanished reality—a trauma without a living memory attached. Similar to the greater phenomenon of climate change to which it belongs, Sandy, not to mention Typhoon Haiyan, is viewed as an irrecoverable outlier event, a catastrophe without catastrophism—just the Army Corps of Engineers gaily piping acres of ocean floor onto empty vacation beaches.

Hurricane Sandy as a disaster narrative—played out on cable television in real time—banked on the mesmerizing effect of the hurricane’s week-long evolution, climaxing in the landfall moment on the Atlantic seaboard. The images of devastated shore neighborhoods and flooded Manhattan subways constituted the extreme weather “money shot”, as it were. This narrative arc was a developed world human artifact—produced by the Weather Channel and CNN—whose distortions mirrored the interests of its U.S.-based viewership. Sandy’s landfall in Haiti, Jamaica, and Cuba belonged to the suspenseful prequel of the week-long coverage. From a physical point of view, of course, the hurricane followed no cable news formula. Its hurricane strength winds actually dropped during its northward course, though its size increased. Furthermore, for the disaster-struck communities in the Caribbean, Sandy had passed by the time Christie ordered a mandatory evacuation of the Jersey Shore. In Haiti—the worst hit island—54 people were killed, and tens of thousands of homes were affected. Roads and bridges were washed away, and 90,000 hectares of crops were lost. Haiti is the poorest country in the western hemisphere and had been devastated by a terrible earthquake two years earlier. It is difficult to name a human community more vulnerable to a violent climate change event as was Haiti to Hurricane Sandy in October 2012.

Social historians Andreas Malm and Alf Hornborg cite the example of Sandy—and its disproportionate impacts on Haiti and the New York/New Jersey area—as an example of the “differentiated vulnerability” of nations in the age of climate change (Malm and Hornborg 2014). Climate change—expressed in weather catastrophes—is a hemispheric political actor with no respect for nation state boundaries. However, Hurricane Sandy highlighted the close correlation of climate change and global inequity. In the aftermath of Sandy, New Jersey called in the National Guard and pumped billions of dollars into restoring beaches, while thousands of Haitians were left homeless and endured crippling shortages of food, water, and medicine. Given the same extreme conditions, the misery of global warming will be overwhelmingly inflicted upon poor, under-resourced populations in the global south.

Malm and Hornborg’s reference to Sandy is part of their larger argument against Anthropocene Studies, published in the inaugural issue of *The Anthropocene Review* in 2014. For Malm and Hornborg, Anthropocene discourse represents an unwelcome intrusion of the physical sciences into the critical domain of social science and the humanities. Theorists of the Anthropocene, they argue, favor coarse-grained, deep-time narratives, emphasizing human species’ evolution from hunter-gatherer communities to sedentary agriculture to recent industrialization, with an exponential increase in environmental impacts at each developmental stage. This species-level narrative homogenizes humanity, with no recognition that industrialization, most particularly, was shaped and monetized by a core of North Atlantic nations at the expense of the global southern periphery—exploited for its material resources, cheap labor, and unprotected markets. Through the multi-millennial lens of the Anthropocene, these subaltern populations disappear from view.

Malm and Hornborg’s dispute with Anthropocene Studies belongs to a familiar post-colonial critique of first-world environmentalism. What we witnessed with Hurricane Sandy was not a new historical phenomenon—the global threat of climate change—but, rather, the latest episode in a centuries-old tale of European globalization. With a sleight of hand characteristic of bourgeois grand narratives, the Anthropocene flattens the nuanced history of “culture and power”, of global inequity, and of differentiated responsibility and suffering into a planetary drama that quietly forgives all carbon debts.

Significantly, however, support for the Anthropocene paradigm has come from post-colonial writers themselves. In his famous “Climate of History” article of 2009, Dipesh Chakrabarty argued that the geological scale of climate change alters the baseline terms for critique (Chakrabarty 2009). Theorizing that climate change demands a species-level category of human agency and a “deep time” elucidation of world history, Chakrabarty insisted, moving forward, on both fine-grained historical differentiation and a planetary, deep-time consciousness, but his critics, including Malm and Hornborg, have caricatured his argument as binary, involving a zero-sum choice between “critique” and “science”.

Chakrabarty's call for a new climate change critical paradigm has been echoed by, among others, the Indian novelist Amitav Ghosh in a recent series of lectures published under the title *The Great Derangement: Climate Change and the Unthinkable* (2016) (Ghosh 2016). Ghosh writes that China enjoyed the benefits of coal for hundreds of years before James Watt's invention of the steam engine. Nineteenth-century Burma was a petrostate. Industrialization was not a grand plan enacted upon an inert global south. Steam-powered mechanization and shipping were opportune technologies to further Britain's inchoate economic agenda of capital accumulation and enabled only a temporary brutal supremacy of the West over major power rivals India and China, who have, since the late twentieth century, caught up rapidly. The argument for "differentiated responsibility" still holds, Ghosh argues, but "the complexity of the carbon economy's genealogy holds a lesson also for those in the global south who would draw a wide and clear line between 'us' and 'them' in relation to global warming" (p. 114). Malm and Hornborg's simple dichotomy of the industrialized north and impoverished global south risks reiterating a colonialist narrative in which white Europeans, for better or worse, must always be the active agents, the central players.

Ghosh makes a related point regarding the slipperiness of agency in the age of climate change: global-scale environmental degradation, including climate change, has been a catastrophic outcome of industrialization but was never its purpose. It is "the unintended consequence", Ghosh writes, "of the very existence of human beings as a species". Responsibility is differentiated, yes, but is also a shifting, complex product of time, opportunity, infrastructure, and resource endowment. Historical time, in particular, refracts and expands. Liberal historiography emphasizes the technological turning points of modernity—be it the Watts steam engine or the nuclear reactor. However, in the revisionist terms of Anthropocene Studies, for the Industrial Revolution to occur at all required cultural antecedents—in technology and social organization—stretching back thousands of years. "Every human being who has ever lived", says Ghosh, "has played a part in making us the dominant species on this planet... The events of today's changing climate... represent the totality of human actions over time" (p. 115).

Much of current writing on the "long" Anthropocene is occupied with detailing this contingent, even chaotic "deep time" evolution. A "flattening" discourse? For Chakrabarty and Ghosh, the field of Anthropocene Studies presumes the co-dependence of human and natural systems and a critical realignment commensurate with the existential, species-level threat posed by environmental systems collapse. Through the funhouse mirror of the Anthropocene, the human agent is distorted, elongated, by turns outsized and infinitesimally tiny, at times unrecognizable. By contrast, the Malm and Hornborg critique of the Anthropocene seems, itself, anthropocentric. Indiscriminate geophysical forces—and the chaos they bring—are invisible to a rhetorical regime where human government is the first principle and sole unquestioned truth.

### 3. Catastrophism and Sea Level Rise

Amitav Ghosh calls climate change our "Great Derangement"—an apt catastrophist epithet for our time. In the nineteenth-century natural sciences, French catastrophism, embodied in Cuvier, stood opposed to the British gradualist school of Hutton and Lyell, which insisted that the key to the past lay in the present—that the materials and processes of the Earth, if not its superficial appearances, were constant over geological time. However, catastrophism is once again ascendant in the Anthropocene sciences. Under a climate change regime, the future will *not* look like the past. In fact, our present is already a "no-analogue state", as Earth scientists term it (Steffen et al. 2004). The mind-bending challenge for climate change science, for climate change policy and politics, and for climate change critique is to articulate the ever-shifting baseline of this no-analogue world we inhabit.

For example, from the official response to Sandy—or Malm and Hornborg's article—one would not know that the northeast coast of the United States is, in fact, a "hotspot" for rapid sea level rise in this century. In the words of one recent study, "the long-term viability of hundreds of coastal municipalities and land currently inhabited [sic] by tens of millions of persons hang in the balance" (Strauss et al. 2015). Storm surges, such as Sandy, are not, in fact, the principal threat in coming decades, when rising seas will bring a host of low-elevation locations within the reach of ordinary

tidal flooding. According to a frightening, recently published historical analysis of tide gauges, parts of the urbanized coast of New Jersey can expect 70–100 tidal floods annually as early as 2030 (Dahl 2017): roads washed away, homes and businesses flooded, daily life at a standstill—*once a week*. Inland from the coast, neighborhoods of Philadelphia will face tidal flooding once a month and Washington, D.C., *twice weekly*. Long before they sink below actual sea level, these cities will face chronic flooding at high tide. However, none of them, including New York, is prepared for an inundation greater than a one-in-100-year storm, calculated according to a twentieth-century baseline.

With the exception of Holland's low-lying ports and London, no major city in the developed North Atlantic world has begun planning for sea level rise (SLR) beyond a meter. Meanwhile, with ever-rising waters and increased ocean temperatures, the chances of a Hurricane Sandy-magnitude event on the Atlantic seaboard of the United States have risen to 50% in the next decade. Major coastal protection infrastructure—for example, the Thames Barrier—typically requires 30 years of lead time. With no engineering fix beyond pumping sand, the east coast of the United States lies utterly exposed.

The *economic* infrastructure of the densely urbanized coast is similarly unprepared, arguably already breached. Because flooding is the most common, and expensive, form of natural disaster in the United States, flood insurance of coastal properties is left to the federal government. Hurricane Sandy added \$6.25 billion to the liabilities of the National Flood Insurance Program, already deeply in debt following the *annus horribilis* of 2005, when Hurricanes Katrina and Rita struck the Gulf Coast. With an estimated \$1.1 trillion in assets exposed to a stormier climate and higher seas, the future of the Federal Government as a coastal insurer is limited. When the collapse of the coastal property market comes, it is likely to be precipitous and will have drastic flow-on consequences. One study predicts that more than 13 million Americans will be displaced from the coast by six feet of SLR in this century, precipitating the greatest demographic upheaval in the country since the Great Northward Migration of African Americans in the early twentieth century (Hauer et al. 2016).

The clear and present danger presented by SLR on the Atlantic seaboard exemplifies the shifting baseline for “differentiated vulnerability” in the climate change era. Objects in the mirror are closer than they appear. Intolerable levels of risk—and tipping points of economic resilience—will be crossed in the lifetime of a single house mortgage in New Jersey or Florida. Climate change's shifting baseline means that the industrialized North Atlantic cannot be considered uniformly secure relative to the global south. Differentiated vulnerability exists *within* the developed world. The United States faces an order of magnitude greater exposure to SLR than Europe. This fact has no geopolitical cause. It is not a product of hemispheric or intra-hemispheric power relations. It is a geophysical happenstance of climate change—an example of the raw contingencies that climate change critique must recognize. A social science of climate change cannot be kept pure of the natural sciences; its shoreline defenses will inevitably be breached.

The example of U.S. vulnerability to SLR in the near term also shows how pulling at a single thread of climate change science alters the human impact narrative entirely. Under each scenario, national and global maps must, quite literally, be redrawn. What would 13 million coastal refugees mean for the inland urban regions of the United States? (Hauer 2017) How would coastal collapse scenarios in the United States and Asia impact the economies of Britain and the European Union? In this sense, all “upper-end” scenarios—in the thick tail of climate change risk—tell the same story: catastrophe. This is not alarmism. It is the coolest possible actuarial assessment—the very opposite of delusion.

What would 2-m SLR mean for Asia? At 2 m, 1.8 million square kilometers of global coastline will be swallowed up, most of it in Asia. About 2 billion of the world's current 7 billion people live within 60 miles of Asian coasts, in the direct path of rising seas or of retreating populations displaced by forced evacuation (Hanson et al. 2011). The stress on hinterland refugees, let alone area government services and international aid agencies, will be intense and overwhelming. Worse still, many cities in the low-elevation coastal zone are sinking. Nothing better exemplifies Chakrabarty's point about the convergence of geology and the human than the subsidence of Asia's coastal cities. Rapid urbanization—involving mass landfill and the drawdown of local aquifers—depresses the land

relative to sea level. For several South East Asian megacities—Bangkok, Jakarta, and Ho Chi Minh City—the rate of subsidence will *actually exceed* the rate of SLR, dramatically reducing the time before they sink below sea level.

However, the IPCC “upper limit” projection of SLR is, by definition, highly unlikely, yes? Not necessarily. Here lies the chilling intervention made by a suite of SLR papers published in the late 2010s. The IPCC’s reports of 2007 and 2013 focused misleadingly on SLR as a global average, when the majority of the world’s highly populated, low-elevation coasts—80%—face rising seas at the upper limit of 2 m. Why is SLR disproportionately higher at the coasts? Local SLR, as opposed to a global average, follows a complex spatial pattern. Both the dynamic redistribution of ocean mass under climate change and the gravitational effects of melting ice sheets and glaciers deposited in the ocean favor higher coastal SLR (Kopp et al. 2014).

Accordingly, the 2 m “worst case” scenario for SLR is a very possible world in 2100 or before. Robert Nicholls, of the Tyndall Centre for Climate Change Research, calls this scenario for what it is: “catastrophic” (Nicholls et al. 2011). An SLR of 2 m, concludes a study by Svetlana Jevrejeva at the University of Liverpool, “will lead to the displacement of 2.5 million living in low-lying areas in Miami; 2.1 million in Guangzhou; 1.8 million in Mumbai; and more than 1 million each is [sic] Osaka, Tokyo, New Orleans, New York, and Ho Chi Minh City” (Jevrejeva et al. 2016). The Jevrejeva paper is pure catastrophism, at every line. What is perhaps most unsettling to climate change orthodoxies—and their delusions—is that the list of inundated cities and their refugees makes no distinction between developed and developing worlds. On her list, Miami sits adjacent to Mumbai, New York City to Ho Chi Minh City. The tightly coupled ocean–atmospheric system of our globe has no respect for national borders or GDP. Poorer cities of the global south will suffer the worst, first. However, the threshold beyond adaptation will quickly be crossed at all latitudes, bringing chaos to the developed world. As with most climate change impacts, SLR is not reversible on any meaningful human timescale. No engineering solution or political remedy will be available. In the blunt prediction of another recent paper, “the adverse impacts of sea level rise... [will] be experienced by hundreds of future human generations and require abandonment of coastal megacities” (Clark et al. 2016). SLR will redraw the world map and script humanity’s future on it.

#### 4. Abandonment or “Managed Retreat”?

“Abandonment” is a chilling, catastrophist word. Unsurprisingly, it has generated its own neutered bureaucratic translation: “managed retreat” (Hauer et al. 2017). “Managed retreat” is the preferred climate euphemism for mass refugeeism, as it potentially affects more than 1 billion people in 136 port cities around the globe (Neumann et al. 2015). “Managed retreat” nevertheless quietly concedes that the battle for mitigation of carbon emissions will be lost and that we have entered, or blundered into, a high-risk, high-cost era of adaptation to climate change. Resilience will not be sufficient. Even well-resourced coastal communities in the developed world will not survive. From retreat to abandonment is but a semantic half-step—a subtle darkening of inflection. The mainstream environmental rhetoric of resilience takes us to the borders of the known world but not beyond. Evacuation, abandonment, and mass refugeeism—a world outside the borders of the known—this is the catastrophist tale that the data on SLR actually tell.

Climate Central is a prominent non-profit climate research and communication group based in Princeton, New Jersey. With the aid of CGI, it has produced a set of images of inundated cities based specifically on the data that has emerged from the post-IPCC 2013 SLR literature. Climate Central’s motives are obvious: hardly one person in a million will read an SLR paper in the *Proceedings of the National Academy of Sciences*, but Hollywood-quality images of flooded cities that capture the same data have viral potential.

Figure 1 shows Miami Beach, envisioned by Climate Central, under normal high tide conditions at 2 °C of warming. Equilibrium SLR scales linearly with temperature, but on shorter, decadal timescales, the relation between temperature and SLR is non-linear, owing mainly to the unpredictability of the melting of the Greenland and Antarctic ice sheets (Nicholls et al. 2011). This makes for a significant “tail risk” for SLR. The image is a futurist pastiche, with the present-day built



coastline overlaid by a flood line at a specific temperature increase—2 °C—which will certainly be exceeded, but with that 2 °C timeline extrapolated beyond the present century (Levermann et al. 2013). In other words, the complexity of climate models, it turns out, translates imperfectly to a single, spectacular image.



**Figure 1.** Climate Central's depiction of Miami at 2 °C of warming.

Climate Central's image of New York City at 2 °C of warming (Figure 2) shows tourists milling blithely at the junction of Broadway and Wall St. in Lower Manhattan, with only the oncoming shadow of tidal flooding visible at a distance. The "after" image, New York at 4 °C of warming (Figure 3), depicts the same corner as a full-flowing river. The tourists are gone. In fact, the entire population is missing, with suspiciously little evidence of their chaotic departure. The buildings, too, are pristine. How serious are these Climate Central SLR pastiches? Is this the visual language of catastrophism or mere climate porn? Consider the twin images of Mumbai. The dissonance of the 2 °C image (Figure 4) lies once more in the presence of tourists at a landmark already underwater, in a city long since abandoned according to this SLR scenario. This leaves little for the 4 °C image (Figure 5) to do, except to prompt us to wonder what they did with all the bodies. Once more, the multiple interacting factors—time, a built environment, the human population, warming temperatures, and sea level rise—cannot be compressed into a single image or pair of images without significant distortion. Is this acceptable if the image makes its home point?

Regardless of our answer to this question, the Climate Central images suggest an uneasy disconnect between the neo-catastrophist projections of climate science research and the growing climate change bureaucracy, in whose hallways catastrophism sounds like defeatism at best or, at worst, hysteria. A consensus prevails, in the boardrooms of corporate and municipal governance, that our catastrophic climate reality be re-branded for public consumption in the smooth-sounding policy-language of sustainability and resilience. Reading the climate-themed memoranda of university research institutes, government, or the corporate world, one comes away with the impression that climate change is a serious, even epic, global challenge. However, anxiety is overlaid with reassurance. Solutions are here at hand: renewable energies, better infrastructure, walkable cities—a civil rights-styled movement for environmental justice. The desirability of all these cannot



be gainsaid. However, management of the climate crisis is impossible without a catastrophist reckoning. To the extent that mainstream climate policy discourse suppresses catastrophist thinking, it enables our continuing climate delusion and runaway emissions.



Figure 2. Climate Central's image of New York City at 2 °C of warming.

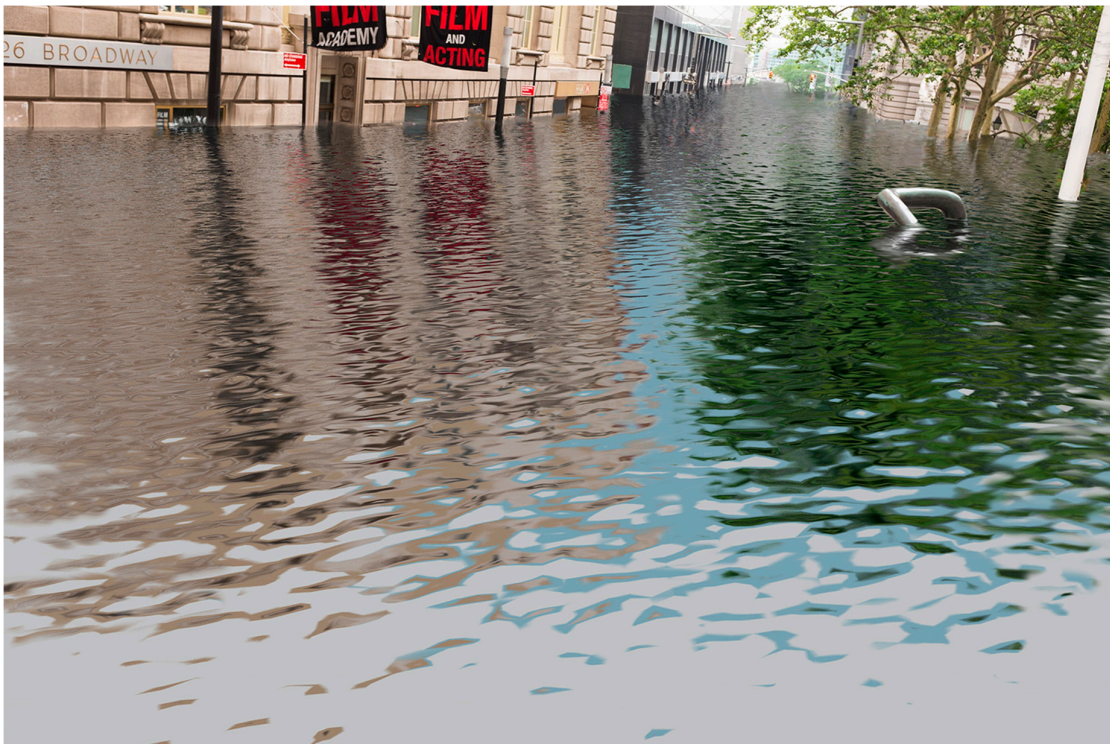


Figure 3. Climate Central's image of New York City at 4 °C of warming.





**Figure 4.** Climate Central's image of Mumbai at 2 °C of warming.



**Figure 5.** Climate Central's image of Mumbai at 4 °C of warming.

## 5. Catastrophism and the Early Victorians

So, how best to penetrate climate denial *and* climate delusion—to convey with full force the near-term reality of, in this case, an unmanaged coastal abandonment that will displace tens of millions of people worldwide? Must we invent a new language of climate reality, or do historical models exist?

Catastrophism, as I mentioned, began as a “deep time” theory in the natural sciences. However, with the emergence of industrial capitalism, the language of catastrophism was quickly adapted to describe the novel social derangements of fossil fuel modernity. The 1840s—a catastrophic decade if ever there was one—coincided with the first measurable impact of anthropogenic carbon emissions on global temperatures, and the beginning of the global warming story. So, doubly propitious.

The field of Anthropocene Studies has been faulted for its preoccupation with historical origins. Did human impact on global ecosystems cross a critical threshold with megafauna extinction during the last Ice Age? With Neolithic niche construction? Or was it substantially later, with the scale-up of farming two millennia ago or the global biological perturbation of the Columbia Exchange? All are critical to the “Long Anthropocene”, if I may term it that. However, the Anthropocene proper is quantitative not qualitative—a description of scale. Only the Victorian factory system—scalable and iterable worldwide—meets the Anthropocenic standard.

In a climate-deluded world, global warming science is not taught in schools, but even a half-awake eighth grader can recite the basic narrative of the Industrial Revolution. Its birthplace—and the original source of industrial carbon emissions—was, of course, the north of England. Friedrich Engels, who spent twenty months in Manchester between 1842 and 1844 and wrote his classic *Condition of the Working Class in England* based on his experiences (Engels [1845] 2009), looked back on the six-decade development of the English factory system as “a history which has no counterpart in the annals of humanity” (p. 28). Industrial Manchester—its smoke-spewing factories cheek-by-jowl with hellish slums—represented an unprecedented social organization—a new order of human existence. He marveled at the hectic rapidity of urbanization driven by industrial development, whereby “a country which, a hundred years ago was chiefly swamp land, thinly populated, is now sown with towns and villages, and is the most densely populated strip of country in England... The modern art of manufacture has reached its perfection in Manchester” (p. 54).

Engels’ classic Anthropocene shame narrative sets the terms for the environmental justice scholarship of our own time: “The industrial greatness of England”, he wrote, “can be maintained only through the barbarous treatment of the [factory workers], the destruction of their health, the social, physical, and mental decay of whole generations” (p. 185). With sustained outrage, the book notates the ubiquitous expression of industrialization’s horrors and injustice, from infant mortality statistics to the visibly broken bodies of the factory workers (many of them children) to the demographic apartheid separating bourgeois suburbs from the disgusting and deadly working class slums: “The east and north-east sides of Manchester are the only ones on which the bourgeoisie has not built, because ten or eleven months of the year the west and south-west wind drives the smoke of all the factories hither, and that the working-people alone may breathe” (p. 72). As Mike Davis vividly documents in *Planet of Slums* (2006), the urban slum geography of Victorian Manchester is now the urban geography of the world, with the informal neighborhoods of the ultra-poor increasingly concentrated in coastal megacities, in uneasy proximity to the financial centers and residential enclaves of the elite.

For Engels, who possessed no framework or motive for speculating upon the relation between carbon emissions and global climate change, industrial air pollution belonged to a suite of intolerable “conditions” against which the laboring class was destined to revolt. “The carbonic acid gas”, he writes “passes over the roofs of the city. The lungs of the inhabitants fail to receive the due supply of oxygen, and the consequence is mental and physical lassitude and low vitality” (p. 107). Indeed, 57% of children born in Manchester in the 1840s died before the age of five. The coal smog that smothered Victorian Manchester killed my great-great-grandfather, living in Salford. My great-grandfather, a boy working 12-h days in a factory, remembered the unnatural sound of his labored breathing when he left the house on the morning his father succumbed to consumption. Engels wrote of crowds of just such “pale, lank, narrow-chested, hollow-eyed ghosts... incapable of the slightest energetic expression”—the disposable human refuse of industrial growth.

Engels’ twenty months in Manchester convinced him that the social ecology of the modern industrial city was, as we would say, *unsustainable*. It simply could not last: This “is not a state in which a man or a whole class of men can think, feel, and live as human beings... Is this a state of

things which can last? It cannot and will not last" (pp. 220, 219). In Engels' writing, catastrophism is a language of physical and historical limits—the unsustainable expressed through the tortured minds and wasted bodies of the factory workforce. Catastrophe described the conditions of the new industrial working class but was also endemic to the economic system that literally suffocated them. Every five or six years, the market demand for textiles softened, and manufacturing collapsed, pushing unemployed factory workers toward starvation. These intermittent catastrophes prefigured, for Engels, the inevitable doom of the factory system itself. Peering into the future from the vantage of an unsustainable present, Engels labeled the coming terminal catastrophe "Revolution": "The only possible solution is a violent revolution, which cannot fail to take place" (p. 266).

Engels' critics miss the point in dwelling literally on his failed predictions. Actual revolution was Engels' hope, but "Revolution" served, more penetratingly, as his indispensable figure for the unknown future that lay beyond an unsustainable present. His insight was thus the very opposite of the climate delusion under which we labor today. Needless to say, Engels would have recognized "sustainability" and "resilience" as a rhetoric of apology for business-as-usual capitalism. He understood the necessity of catastrophism and insisted uncompromisingly on its language. During the labor unrest of 1842–1843 in Manchester, Engels witnessed "actions which can be explained only by hatred wrought to the pitch of despair, by a wild passion overwhelming all restraints". Carlyle, whom Engels admired, reached the same conclusion, in oddly ecological terms. Engels quotes from Carlyle's *Chartism* (1840) that the lives of workers must improve "if Europe, or at least England, is long to remain inhabitable" (p. 298).

Catastrophism was, in many ways, the natural language of the 1840s. It came easily to writers of all kinds, including scientists. An obscure Parisian mathematician named Joseph Adhémar counted himself among the legions of Cuvierian catastrophists of that generation. When Louis Agassiz published his controversial *Études des Glaciers* in 1840—in which he argued, based on geological evidence from the Alps, that modern Europe had once sat beneath a mile-high sheet of ice—Adhémar's reading of Cuvier set him on a path to discovering the cause of the remarkable glaciation. He did so without the aid of any meaningful temperature data and only the sketchiest geography of the north and south poles.

A true 1840s catastrophist, Adhémar sought the answer beyond the known world, literally in the stars. Irregularities in the Earth's orbit of the Sun altered hemispheric temperatures on timescales of tens of thousands of years, triggering glaciation and, with it, drastic changes in sea level. Adhémar outlined his astral theory of the Ice Ages in a book whose title, *Révolution de la Mer* (Adhémar 1842–1844), conveys his practical preoccupation with the link between glaciation and sea level. Periodic global flooding—the obverse of glaciation—was an astro-geological certainty:

Let's imagine a continent inundated by a significant mass of water: each part will be submerged in turn... high plateau [sic] and plains, following the general slope of the terrain, will vanish under the water; mountain ranges will peek above the level of the liquid mass, forming capes and promontories, while the intervening valleys will become broad gulfs created by the flood (p. 107).

In his first year in Manchester, Engels witnessed the General Strike of 1842, the first labor revolt of its scope. His documentary analysis of the rise of class consciousness in early Victorian Britain is rightly famous, but Agassiz, Adhémar, and the new "glacial" consciousness of the 1840s loom just as large in the history of the Anthropocene. With the publication of *Études des Glaciers* and *Révolutions de la Mer*, Agassiz and Adhémar together initiated our Holocene awakening: the realization that the current Earth sits, in geological time, between epic glaciations and that we, perforce, are interglacial beings, our civilization tethered to a transitory, "just right" climate.

Engels and Adhémar in the 1840s shared a catastrophist worldview, and each identified forces of world historical transformative power: the factory system and the glacial cycle, respectively. Adhémar described the interplanetary forces that determined long-term temperature and sea level changes on the Earth, whereas Engels documented the rise of the global manufacturing system that was, at that very historical moment, readying to usurp the glacial cycle's control of Earth's climate. Fast forward to the twenty-first century, the human-economic timescale of industrial growth,

measurable in years and decades, has now hijacked the multi-millennial glacial cycle, deferring the onset of the next Ice Age indefinitely. Our future, instead, is shrinking ice, freshwater shortage, and coastal inundation—geological system changes terrifyingly compressed to the human timescale.

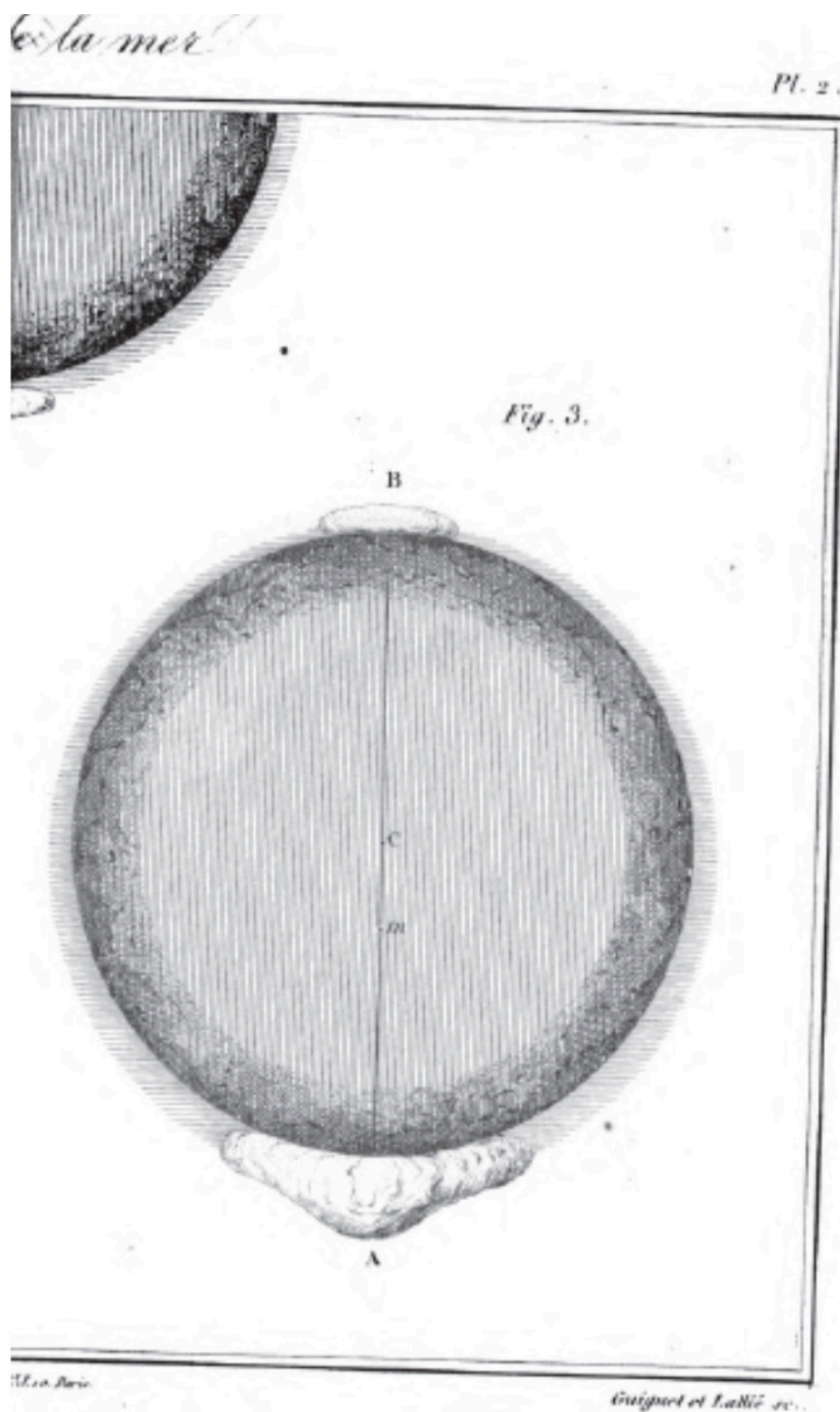
It is difficult to trace the precise mechanics of industrialization's global growth, just as it is the physical mechanics of glaciation. However, these global forces—by virtue of acting upon the *same* globe—have inevitably been brought into relation with each other. This relation is called climate change. Industrialization and climate change have the same inexorable, trans-hemispheric immensity. The globalized factory system will, in time, be an agent of climate change comparable to the glacial cycle itself. Our global human footprint, measured by ecosystem change, is equivalent to an Ice Age.

For much of the time since their publication, Adhémar's and Engels' texts have appeared as very different sorts of achievement. However, in the Anthropocene, world historical time and geo-historical time collide, so Engels and Adhémar speak to us in a common language. Composed concurrently between 1842 and 1844, their texts represent a threshold moment for the Anthropocene. Once Engels had formulated an analytic language for the industrial system and Adhémar his theory of Holocene interglaciation, the precursive terms for Anthropocene Studies had been met. Class consciousness was the social expression of the factory system, just as climate change is its geo-physical expression. Both are idioms of extremity, whose root language is modernity. With one significant difference, perhaps: Engels' text is full of suffering people—victims of the human catastrophe of the factory system. Adhémar's book on revolutionary sea level rise, by contrast, similar to the eerie Climate Central images of flooded cities, literally erases humanity from consideration. The contrast would seem to bear out the warning issued by Malm and Hornborg: critique and science are irreconcilable. SLR is, for Adhémar, first and foremost, a mathematical inevitability.

Similar to Engels, Adhémar has attracted criticism for literal errors in his catastrophic calculations. Reading accounts of the early Victorian Antarctic explorers, Ross and D'Urville, he estimated the South Polar ice cap at twenty miles high (Figure 6). It is easy to see how Adhémar's vision of Antarctica as, at best, a weird ice cream dollop, prompted amused disbelief amongst the professional scientific circles to which he did not belong. However, similar to Engels, Adhémar was correct in the essentials. Glaciation is indeed the foundation of Quaternary Earth system history, while intermittent *de*-glaciation has signaled mass ocean transport and the redrawing of flooded coastlines across the terrestrial planet. As such, Adhémar's unapologetic catastrophism sets a fearless example for us today as we struggle to free ourselves from the sticky webs of climate delusion. The social catastrophism of Friedrich Engels relied on a figurative projection of unsustainability—what he called social "Revolution". Adhémar's catastrophism, by contrast, was utterly literal. When the glaciers melt, the seas rise, and cities drown.

If Adhémar were alive today, he would no doubt first luxuriate in our great bathtubs of global warming data; then, he would sketch simple pictures of a world without ice. Sometimes, the coarse-grained image works best. The Earth at this century's end will not look like Adhémar's ice cream globe, but it will be equivalent in its extravagant difference from the known world. The upcoming "revolution of the sea" will not be televised like Hurricane Sandy or photoshopped by Climate Central. Instead, what familiar world remains will be something rudely analogous to Adhémar's childlike drawing, washed up on a beach somewhere, framed by a viscous foam, and accentuated with microplastics.





**Figure 6.** Adhémar's drawing of the polar ice capin Antarctica.

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## References

- Adhémar, Joseph. 1842–1844. *Révolutions de la Mer*. Paris: Carilian-Geoury and V. Dalmont.
- Chakrabarty, Dipesh. 2009. The Climate of History: Four Theses. *Critical Inquiry* 35: 197–222.
- Clark, Peter, Jeremy D. Shakun, Shaun A. Marcott, Alan C. Mix, Michael Eby, Scott Kulp, Anders Levermann, Glenn A. Milne, Patrik L. Pfister, Benjamin D. Santer, and et al. 2016. Consequences of twenty-first-century policy for multi-millennial climate and sea-level change. *Nature: Climate Change* 6: 360–9.
- Dahl, Kristina. 2017. Sea level rise drives increased tidal flooding frequency at tide gauges along the U.S. East and Gulf Coasts: Projections for 2030 and 2045. *PLoS ONE* 12: e0170949.
- Engels, Friedrich. 2009. *The Conditions of the Working Class in England*. Translated by Florence Kelley-Wischnewetsky. Oxford: Oxford University Press. First published 1845.
- Ghosh, Amitav. 2016. *The Great Derangement: Climate Change and the Unthinkable*. Chicago: University of Chicago.
- Hanson, Susan, Robert Nicholls, Nicola Ranger, Stéphane Hallegatte, Jan Corfee-Morlot, Celine Herweijer, and Jean Chateau. 2011. A global ranking of port cities with high exposure to climate extremes. *Climatic Change* 104: 89–111.
- Hauer, Mathew E., Jason M. Evans, and Deepak R. Mishra. 2016. Millions projected to be at risk from sea-level rise in the continental United States. *Nature: Climate Change* 6: 691.
- Hauer, Mathew E., Jason M. Evans, and Deepak R. Mishra. 2017. Managed Retreat as a Response to Natural Hazard Risk. *Nature Climate Change* 7: 364–70.
- Hauer, Matthew. 2017. Migration induced by sea-level rise could reshape the US population landscape. *Nature: Climate Change* 7: 321.
- Jevrejeva, Svetlana, Luke P. Jackson, Riccardo EM Riva, Aslak Grinsted, and John C. Moore. 2016. Coastal sea level rise with warming above 2C. *Proceedings of the National Academy of Sciences USA* 113: 13342–47.
- Kopp, Robert E., Radley M. Horton, Christopher M. Little, Jerry X. Mitrovica, Michael Oppenheimer, D. J. Rasmussen, Benjamin H. Strauss, and Claudia Tebaldi. 2014. Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites. *Earth's Future* 2: 383–406.
- Levermann, Anders, Peter U. Clark, Ben Marzeion, Glenn A. Milne, David Pollard, Valentina Radic, and Alexander Robinson. 2013. The multimillennial seal-level commitment of global warming. *Proceedings of the National Academy of Sciences USA* 110: 13745–50.
- Malm, Andreas, and Alf Hornborg. 2014. The Geology of Mankind? A Critique of the Anthropocene Narrative. *The Anthropocene Review* 1: 62–9.
- Neumann, Barbara, Athanasios T. Vafeidis, Juliane Zimmermann, and Robert J. Nicholls. 2015. Future Coastal Population Growth and Exposure to Sea-Level Rise and Coastal Flooding—A Global Assessment. *PLoS ONE* 10: e0118571.
- Nicholls, Robert J., Natasha Marinova, Jason A. Lowe, Sally Brown, Pier Vellinga, Diogo De Gusmao, Jochen Hinkel, and Richard S. J. Tol. 2011. Sea-level rise and its possible impacts given a ‘beyond 4C world’ in the twenty-first century. *Philosophical Transactions of the Royal Society A* 369: 161–81.
- Steffen, Will, Regina Angelina Sanderson, Peter D. Tyson, Jill Jäger, Pamela A. Matson, Berrien Moore III, Frank Oldfield, Katherine Richardson, Hans-Joachim Schellnhuber, Billie L. Turner, and et al. 2004. *Global Change and the Earth System: A Planet under Pressure*. Stockholm: IGBP Secretariat.
- Strauss, Benjamin H., Scott Kulp, and Anders Levermann. 2015. Carbon choices determine US cities committed to futures below sea level. *Proceedings of the National Academy of Sciences* 112: 13508–13.
- Trenberth, Kevin E., John T. Fasullo, and Theodore G. Shepherd. 2015. Attribution of climate extreme events. *Nature: Climate Change* 5: 725–30.

