Redeeming Belgian Science:
Periodic Phenomena and Global Physics in Brussels, 1825-1870

Kevin Donnelly
kevin.donnelly@alvernia.edu
Alvernia University

Introduction: a nation at the margins of science

In 1864, at the age of 68, the renowned Belgian astronomer, statistician, and all-around *savant* Adolphe Quetelet published a strange compendium on two topics which might seem to have little relation to one another: a history of Belgian science and a survey of what Quetelet called "periodic phenomena," a wide-ranging survey of natural and meteorological data that he had been collecting for over three decades. The book, *Histoire des sciences mathématique et physique chez les belges*, devoted most of its 500 pages to the former subject: the rise and fall of scientific progress in a region which had, since the Middle Ages, been the subject of division, stagnation, benign neglect, active exploitation, and little in the way of homogeny in language, ethnicity or religion. In his triumphalist narrative, Quetelet explained that *les belges* had begun as "primitive" and "brave" people who were "far from having" the "intelligence" and "industry" of the later state.[1] The reason for their rise, he argued, had been contact with foreign neighbors and that the "notable advance" of his country occurred because of the "many relations with foreign nations…which left their marks on our ancestors."[2] Indeed, international collaboration in science was nearly synonymous with progress in *Histoire des sciences*, as events as distant as the 100 Years War demonstrated: when the King of France sought to take possession of Belgian lands from Phillip Artevelede, Quetelet claimed that the "agitation of spirits was extreme and not conducive to the development of science."[3] And so it went throughout the years, as internationalists like Charles V, born in

[1] Adolphe Quetelet, *Histoire des sciences mathématique et physique chez les belges*, new ed. (Brussels: Muquart, 1871), 18. All translations from the French are my own unless otherwise noted.
[2] Ibid., 43.
[3] Ibid., 50.

Quetelet's hometown of Ghent, led scientific advances while the disasters of the Napoleonic Wars brought ruin to his home region.

As a general point, few would argue with Quetelet that international collaboration in the sciences is best accomplished in times of peace, and Quetelet was not the first nor the last Belgian to make the case for internationalism in science.[4] Henri Pirenne, the noted Belgian nationalist historian, had in fact made the case that Belgium was a "nation of borders," which inevitably shaped the culture and ideas of the country.[5] As an internationalist, Quetelet was certainly no different from many other propagandists like Humboldt and Herschel in the heady years of nineteenth-century international collaboration. Yet what makes this history so interesting is the plan Quetelet appended to his history of Belgian science: a 100-page programmatic and methodological treatise on collecting data on "periodic phenomena," a topic broad enough to include shooting stars, meteorological events, terrestrial magnetism, wind and sea currents, and a handful of other natural phenomena. In fact, Quetelet listed 12 "*genres* of observation" which had "occupied me since the beginning of my career," none of which, it might be noted, was related to either classical astronomy or statistics, the two fields in which Quetelet is best known today.[6] Though clearly important in retrospect, why was such work included as a capstone to, or even justification of, Belgian science? What connected wind-speed calculations and temperatures readings in the 1850s to the disastrous invasions and occupations that marked the history of the Low Countries? Why did Quetelet not champion Belgian accomplishments in fields such as astronomy, which he taught, or physics and mathematics, topics he focused on as an editor of an international journal?[7] And, perhaps most interestingly for the later development of meteorology, how did a figure like Quetelet, an early Laplacian determinist trained in the French Positivist tradition, come to see the inchoate field of "periodic phenomena" as the best hope for a Belgian scientific revival?

This paper will argue that the answer to these questions can be found in the project to collect data on periodic phenomena itself, particularly within the geographical, historical, and political contexts of the Low Countries. As Quetelet learned in attempting to create a nascent scientific movement in Belgium, the data of periodic phenomena, and what he would later call global physics, was far better suited for a small and politically marginalized country than a field like astronomy, which required significant financial resources and international clout in order to make new discoveries. Quetelet, who had studied and taught in institutions created during both the

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[4] For a good overview of internationalism in science during periods of war, see Elizabeth Crawford, "The Universe of International Science, 1880-1939," in *Solomon's House Revisited: The Organization and Institutionalization of Science*, ed. Tore Frängsmyr (Canton, MA: Science History Publications, 1990). For later Belgians who focused on internationalism, see Alex Wright, *Cataloging the World: Paul Otlet and the Birth of the Information Age* (Oxford: Oxford University Press, 2014) and Lewis Pyenson and Christophe Verbruggen, "Ego and the International: the Modernist Circle of George Sarton," *Isis* 100, no. 1 (2009): 60-78.

[5] Henri Pirenne, *La Nation belge* (Brussels: Guyot, 1899), 3.

[6] Quetelet, *Histoire*, 377.

[7] In the 1820s, Quetelet had published *Astronomie populaire* and *Astronomie élémentaire* based on his lectures at the Athénée de Bruxelles and had been the editor for 11 years of *Correspondance mathématique et physique.*

era of Hapsburg benevolent neglect and the far more destructive Napoleonic occupation, sought smaller projects for the new nation of The United Kingdom of the Netherlands (1815-1830) and later Belgium (created in 1830). As will be seen, the geographic location of such a project was ironic, as Quetelet's earliest research came from Brussels, a city that while geographically situated in the center of Europe was often at the margins of scientific life.[8] It was here that Quetelet inverted traditional methodological imperatives in his efforts to create a national scientific project founded on internationalism.

Though much work remains to be done on Quetelet's project to assemble data on periodic phenomena, the focus here will be on research Quetelet conducted in Brussels as well as a selection from a wide range of methodological papers spanning over three decades.[9] As will be seen, the only consistency in this work is Quetelet's insistence on international collaboration. For example, in *Histoire des sciences*, the last item on Quetelet's list of 12 "*genres* of observations" was what he called a "united project of weights and measures across different countries." Such a plan was indeed accomplished at the 1853 International Maritime Conference in Brussels, a meeting now recognized by the Intergovernmental Panel on Climate Change (IPCC) as the moment when coordinated meteorological observations began.[10] Reporting a decade after the event to the Académie Royale de Belgique on the conference's success, Quetelet left little doubt about its importance for Brussels. The goal of the conference was nothing less than to "perfect meteorology and global physics and to search for the laws which rule the great natural phenomena," and Quetelet believed it a great triumph that the meeting was being held in a city that had contributed so little to previous science, one just kilometers from his birthplace in Ghent.[11] Though dreamed up by the American naval officer Matthew Maury, the meeting was held in Brussels because of the respect Quetelet had gained for international collaboration, and he was unanimously elected president of the conference for his indefatigable efforts to bring researchers together.[12] It was an endorsement of the new science that Quetelet had been cultivating for decades – decentralized, multifocal, and international – and one that had its ultimate roots in the particularities of the Low Countries and Brussels. At a celebration of his life 200 years later, Quetelet was credited by a fellow Belgian with "extracting us from mediocrity and elevating us to international

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[8] On the larger move away from "classical probability," see Lorraine Daston, *Classical Probability in the Enlightenment* (Princeton, NJ: Princeton University Press, 1988), Gerd Gigerenzer, Lorenz Krüger, and Mary S. Morgan, ed., *The Probabilistic Revolution, Volume 1: Ideas in History* (Cambridge, MA: The MIT Press, 1987), Ian Hacking, *The Emergence of Probability: A Philosophical Study of Early Ideas and Probability, Induction and Statistical Interference* (Cambridge, UK: Cambridge University Press, 1984), and Theodore Porter, *Trust in Numbers* (Princeton, NJ: Princeton University Press, 1995).

[9] The best source for this work remains "Bicentenaire de la naissance d'Adolphe Quetelet (1796 – 1874) fondateur de l'observatoire de Bruxelles," *Bulletin Astronomique de l'Observatoire Royale de Belgique* 11, no.1 (1996): 1-114.

[10] Hervé le Treut et. al, "Historical Overview of Climate Change Science," in *Climate Change 2007: The Physical Sciences Basis,* ed. S. Solomon et. al (Cambridge, UK: Cambridge University Press, 2007), 100.

[11] Adolphe Quetelet, "Sure la météorologie et la conférence maritime tenue à Bruxelles," *Bulletin de la Académie Royale de Belgique* 20 (1853): 29.

[12] Adolphe Quételet, *Notice sur le Capitaine M. F. Maury, Associé de l'Académie Royale de Belgique* (Brussels, 1874).

recognition."[13] Periodic phenomena, it seems, did provide the antidote to the instability and stagnation that had hindered previous Belgian science.

A focus on data collection for periodic phenomena at the Brussels Observatory can help contribute to the early history of meteorology by demonstrating how the historical weakness of Belgium – the lack of a powerful and unified nation-state – became a strength for the new science. Indeed, in contrast to the vision in *Histoire des sciences*, many of the most important statistical insights from this period came about *because* of the chaotic early years of the observatory and the marginal status of the Catholic Low Countries. Earlier visions of international scientific collaboration in astronomy were dominated by the powerful observatories in Greenwich and Paris, but meteorology and climatology were sciences that demanded international collaboration and could not be judged by just one or two locations. Indeed, in the middle of the nineteenth century, the overabundance of star charts and ephemeris led many people to question the need for so many locations of scientific reportage.[14] Simon Newcombe at the US Naval Observatory, for example, complained that most star catalogues produced by observatories were "unnecessary," but that would likely carry on due to "national pride."[15] As J.A. Bennet has noted of the era's observatory fever: "utility alone could scarcely have excused the duplication of effort brought about by more and more observatories."[16] Observatories then were at the same time powerful sites of nationalism and ostentation,[17] and Quetelet imagined periodic phenomena as the means through which a marginal observatory could contribute to the new sciences. Hence his enthusiasm in combining periodic phenomena with the historical legacy of Belgium in *Histoire des sciences*: the 1853 International Maritime conference – a perfect marriage of bureaucracy and statistics – was where the peripheral city of Brussels could become the center of the meteorological world, a first step in the creation of what has been called "infrastructural globalism" on which much of meteorology and climate science were built.[18]

While recent work in "relocating" the sciences has focused on localities far from Europe,[19] relocating meteorology to the geographical *center* of the Western European metropole may provide a corollary contribution: a suggestion that the work at the Brussels observatory and the

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[13] Robert André, "Adolphe Quetelet, Académicien," in *Actualité et Universalité de la Pensée Scientifique d'Adolphe Quetelet: Actes du Colloque Organisé à l'Occasion du Bicentenaire de sa Naissance* (Brussels: Académie Royale de Belgique, 1997), 23.

[14] See the many complaints found in Kevin Donnelly, "On the Boredom of Science: Positional Astronomy in the Nineteenth Century," in *The British Journal for the History of Science* 47, no. 3 (2014): 479-503.

[15] Simon Newcombe, *Reminiscences of an Astronomer* (Boston: Houghton Mifflin, 1903), 62.

[16] J. A. Bennett, "The English Quadrant in Europe: Instruments and the Growth of Consensus in Practical Astronomy," *Journal for the History of Astronomy* 23 (1992), 2.

[17] For the ways in which many observatories overcame this limitation, see Charlotte Bigg, David Aubin, and H. Otto Sibum, eds., *The Heavens on Earth: Observatories and Astronomy in Nineteenth-Century Science and Culture* (Durham, NC: Duke University Press, 2010).

[18] Paul N. Edwards, "Meteorology as Infrastructural Globalism," in Osiris 21 (2006): 229-250, 230. For the expanded arguments, see Paul N. Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge, MA: The MIT Press, 2010).

[19] Kapil Raj, *Relocating Modern Science: Circulation and the Construction of Knowledge in South Asia and Europe, 1650-1900* (New York: Palgrave Macmillan, 2007).

subsequent "infrastructural globalism" created in Belgium helped to push meteorology away from its deterministic roots, where Laplacian laws and positivistic philosophies of science had been a burden for early meteorologists.[20] A recent history has claimed that determinism functioned as a "chimera" that had inhibited the field because "there [was] no superhuman forecasting demon with unlimited observational power and unlimited dynamical knowledge."[21] One of the best recent histories of meteorology similarly described the "passing away of the belief in the determinacy of atmospheric behavior" as "momentous" for the science.[22] In what follows, I hope to show one way in which the determinism problem was eroded: rather than imagining periodic phenomena as a secondary feature of a pre-determined atmosphere, Quetelet's work in Brussels helped to see it as autonomous phenomenon. It was not coincidental, I argue, that this movement came from outside the major capitals of European science.

In tracing how the unique dynamics of *Bruxellois* data helped to foster a new form of international collaboration while subsequently helping to challenge meteorology's determinism problem, I begin with Quetelet's earliest work on periodic phenomena which he directed from his position as Royal Astronomer at the Brussels Observatory. Though the observatory was a great triumph, some of Quetelet's most important ideas on causation came while he was waiting out construction delays, bureaucratic wrangling, and the 1830 revolution that gave birth to modern Belgium. For close to a decade, Quetelet was in fact forced to look to demographic statistics in Brussels instead of astronomical data, a formative period that would later shape his thinking on periodic phenomena. The second section then examines Quetelet's work in *physique du globe*, where he sought to separate meteorology from the more rigid Laplacian sciences. Notably, Quetelet began to make these distinctions in response to the practical needs of his observatory and demographic statistics as much as any deeper philosophical considerations or lessons from astronomy. Rather than the direction one might imagine, where meteorological insights were built from reflection on astronomical conditions, Quetelet inverted the positivistic arrow, using *social* data to influence his thinking on the weather, which in turn led him to divorce it from the movements of the heavens.[23] In the third section, I return not only to the International Maritime Conference of meteorologists in 1853, but another conference held the same year in Brussels: the first International Statistical Conference. Most observers at the time believed the future of meteorology lay in the replication of astronomical work, and few at either conference would have

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[20] David Aubin has particularly noted how the observatory helped redefine the idea of science. See David Aubin, "A history of observatory sciences and techniques, " in *Astronomy at the Frontiers of Science*, ed. Jean-Pierre Lasota (Dordrecht, 2011): 109-21, 115.

[21] James Rodger Fleming, *Inventing Atmospheric Science: Bjerkens, Rossby, Wexler and the Foundation of Modern Meteorology* (Cambridge, MA: The MIT Press, 2016), 25. For how mathematicians worked out this problem, see Ian Roulstone and John Norbury, *Invisible in the Storm: The Role of Mathematics in Understanding Weather* (Princeton, NJ: Princeton University Press, 2013).

[22] Frederick Nebeker, *Calculating the Weather: Meteorology in the 20th Century* (New York: Academic Press, 1995), 188.

[23] As Porter has shown, Quetelet's work was part of a larger movement in which many of the physical and natural sciences adopted the tools of the social sciences, rather than the other way around. Theodore M. Porter, *The Rise of Statistical Thinking 1820-1900* (Princeton, NJ: Princeton University Press, 1986).

recognized the importance of the statisticians for the future of meteorology. In the conclusion, I suggest that even Quetelet, one of the few men in Europe who could speak with authority on both scientific bureaucracy and probability models, had little idea how important the combined work was for the meteorology of the future. Even his triumphant *Histoire des sciences mathématique et physique chez les belges* could not have predicted the eventual outcome: that his adopted hometown of Brussels would become one of the principal locations for the work of something called climate science.

Waiting for the observatory: the methodological lessons of the Brussels city registry

Though simple geography might suggest that Belgium would emerge as a central location for European science, Quetelet's initial plans to create an international standard for global measurements – a plan necessary to modern meteorology and climate science – began at the margins. Though the nearby University of Louvain had been a center of significant research in the early modern era, the city of Brussels had been absent for most of the major significant scientific developments in the seventeenth and eighteenth century, and Quetelet's history of his region's numerous struggles since the Middle Ages has largely been confirmed by subsequent histories. The pioneering collection *The Scientific Revolution in National Context*, for example, makes almost no mention of Brussels or the Low Countries.[24] Neither do histories of the region itself spend much time on science.[25] Histories of meteorology do often acknowledge Quetelet's contributions, but because he worked prior to the "unified" era of twentieth-century meteorology, he is usually relegated to brief pre-histories of one element of meteorological thought, where the "organizational transformation" of observational work took place.[26] Even when he began to secure government support in the 1830s, he was forced to travel to Paris, London, and several German states in order to see how observatories worked.[27] Though Quetelet had good reason to project a limited view of scientific success in order to secure government patronage for his many institutional projects, his vision of the Brussels region as a backwater for science is largely confirmed by most of his contemporaries and later historians.

In spite of this history, Quetelet's own contributions to Belgian meteorology have been well established due to the centrality of the Observatoire Royale de Bruxelles, his primary office of data collection for much of the 1840s and 1850s. As Fabian Locher has recently shown,

[24] While parts of modern-day Belgium are mentioned, the French-speaking region is largely absent even from Harold J. Cook, "The New Philosophy in the Low Countries," in *The Scientific Revolution in National Context*, ed. Roy Porter (Cambridge, UK: Cambridge University Press, 1992): 115-149.
[25] E. H. Kossmann, *The Low Countries, 1780-1940* (Oxford: Clarendon Press, 1978). The more recent work by Paul Arblaster, *A History of the Low Countries*, 2nd ed. (New York: Palgrave Macmillan Press, 2003) barely mentions science beyond Vesuvius.
[26] Nebeker, *Calculating,* 11-22.
[27] Liliane Wellens-De Donder, "Les Premières Voyages Scientifiques de Quetelet et la Fondation de l'Observatoire Royale de Bruxelles," *Bulletin Astronomique de l'Observatoire Royale de Belgique* 11 (1996): 95-104.

Quetelet's work after the observatory was finished was concerned almost exclusively with the field of *physique du globe*, especially terrestrial magnetism, meteorology, and other earth sciences that fell under the rubric of periodic phenomenon.[28] A mid-twentieth century report on Quetelet concluded that while the Belgian was best known as an astronomer and statistician (a point which remains true today), his "work in meteorology…was certainly superior to his work in mathematics and astronomy."[29] Stephen Stigler has also sought to describe Quetelet's *physique sociale* as something closer to "social meteorology" than social physics, with meteorology simply replacing physics or astronomy as the model science.[30] And while many recent works that deal with the history of the science begin with the meteorological synthesis of the 1950s and 1960s, when the data collectors, theorists, and forecasters made "meteorology…a unified, physics-based, and highly computational science," the importance of nineteenth century work has been highlighted in "pushing data" into the forefront.[31] In what might only be a slight overstatement, one history of Quetelet's meteorological work concludes that "for close to 50 years, Quetelet was the personification of climatology and meteorology in Belgium."[32]

While historians are right to emphasize the importance of Brussels and Belgium in the instauration of a new era of data collection, less attention has been paid to the particular historical circumstance of this region in creating a vision of science as a large-scale collaborative data-collecting effort.[33] In particular it is worth noting that many of the concepts of data collection and causation Quetelet developed were done *prior* to the observatory being built, a time when he was forced to make do with social and demographic data. Such a daunting international project – the standardization of tables and measurements across nations – in fact had quite humble beginnings. Beginning in 1832, after nearly a decade of obstinate government administrators, faulty equipment, and the occupation of his office by revolutionaries waving the tri-color, Quetelet had to wait nearly a decade to finally occupy his offices at the newly constructed observatory.[34] In this section, I show why this history matters for Quetelet's interrelated thinking on data-collection, causation, and his methodological approaches to periodic phenomena and global physics.

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[28] Fabian Locher, "The Observatory, the Land-Based Ship and the Crusades: Earth Sciences in European Context, 1830-50," *The British Journal for the History of Science* 40, no. 4 (2007): 491-504.

[29] Louis Dufour, "Quelques Considération sur l'Œuvre Météorologique de A. Quetelet," in *Ciel et Terre* 64 (1948): 58-71, 58.

[30] Steven Stigler, "Adolphe Quetelet: Statistician, Scientist, Builder of Intellectual Institutions," in *Actualité et Universalité de la Pensée Scientifique d'Adolphe Quetelet: Actes du Colloque Organisé à l'Occasion du Bicentenaire de sa Naissance* (Brussels: Académie royale de Belgique, 1997): 47-61.

[31] Nebeker, *Calculating*, 3.

[32] Gaston R. Demarée, "Adolphe Quetelet (1796 – 1874): Précurseur du Réseau Belge d'Observations Climatologiques," in "Bicentenaire de la Naissance d'Adolphe Quetelet (1796 – 1874) fondateur de l'observatoire de Bruxelles," *Bulletin Astronomique de l'Observatoire Royale de Belgique* 11 (1996): 41-51, 41.

[33] An exception to this general rule is Theodore M. Porter, "The Mathematics of Society: Variation and Error in Quetelet's Statistics," *British Journal for the History of Science* 18 (1985): 51-69. Porter specifically locates Quetelet's thinking in the context of the political revolution.

[34] Henri van Boxmeer, "Le rapport d'Adolphe Quetelet sur la Formation d'un Observatoire dans les Provinces Méridionales du Royaume des Pays-Bas," in "Bicentenaire de la Naissance d'Adolphe Quetelet (1796 – 1874) Fondateur de l'Observatoire de Bruxelles," *Bulletin Astronomique de l'Observatoire Royale de Belgique* 11 (1996): 107-113.

When Quetelet began thinking about an observatory in the early 1820s, he was often coy in explaining the project to King William I of the United Kingdom of the Netherlands (in which the modern country of Belgium existed from 1815 until 1830). Appealing to William's concerns about the legitimacy of his rule, Quetelet initially claimed the institution would aid in helping the Catholic Low Countries modernize to the level of their northern neighbors.[35] To make this argument, he stressed the importance of the dominant positivist science of astronomy, explaining to William that a proper account of the fixed order of the stars would lend a similar harmony and stability to his reign.[36] Yet in his arguments with government ministers, Quetelet encountered significant obstacles to a plan for an observatory focused on astronomy. As one minister wrote to Quetelet in 1825, citing the costs of such a project: "What great discoveries can one reasonably hope to make in astronomy? Can one claim to make a better catalogue of the fixed stars than we currently have? For these reasons, I do not know if science would profit much from the erection of a great observatory."[37] Quetelet's response was to claim that while it may be true that astronomy promised few new discoveries, the true extent of the possibilities of an observatory could only be learned *after* it was built; the institution would have to precede the scientific justification.[38]

Quetelet's creative explanation proved true in the long run, and he was able to get approval for funding the observatory in 1825, but the observatory proved a failure in both its astronomical and symbolic functions.[39] Not only did the Belgian revolution of 1830 end William's reign, but the largest observatories in Paris, Greenwich, and Königsberg had by this time already started to dominate the reigning field of positional astronomy. Yet rather than the hindrance Quetelet imagined, the tumultuous era of 1820s and 1830s Belgium proved surprisingly fertile for Quetelet's thinking on statistics and data collection, as construction delays, a lack of financing, and the 1830 Belgian revolution meant he had to look elsewhere for data. In fact, rather than theorized in the modern confines of a first-rate observatory, Quetelet's first conclusions about law-like behavior emerged from the only place where he knew statistics could be found: the birth entries in the Brussels city registry.[40] Here, Quetelet discovered surprising and revelatory connections between the progressions of the seasons and human procreation, the power of averages, and the importance of large-scale data, ideas he would later apply to periodic phenomena.

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[35] The majority-Protestant Netherlands had just incorporated the Catholic provinces of Belgium, which had been part of the Hapsburg Netherlands for centuries before being conquered by the French in the Napoleonic Wars. For the full story of Belgium's long history of occupation, see Pirenne and Kossman.

[36] For the best account of Quetelet's efforts, see A. Collard, "Le Centenaire de la Création de l'Observatoire Royale de Bruxelles," *Ciel et terre* 42 (1926): 209-23 and M. A. Demoulin, "Adolphe Quetelet, Fondateur de l'Observatoire Royale de Belgique," *Bulletin Astronomique de l'Observatoire Royale de Belgique* 2 (1935), 1-3. See also Chapter 3 of Kevin Donnelly, *Adolphe Quetelet, Social Physics and the Average Men of Science* (Pittsburgh: University of Pittsburgh Press, 2016).

[37] Collard, "Le Centenaire," 215.

[38] Ibid., 216.

[39] Dufour, "Quelques Considérations."

[40] Adolphe Quetelet, "Mémoire sur les Lois des Naissances et de la Mortalité à Bruxelles," *Nouveaux Mémoires de l'Académie* 3 (1826): 496n.

In one notable example from 1826, after just a few tables of data, Quetelet noted that births in Brussels were at their highest in February and lowest in July, year after year, and the progression between the peaks and troughs were continuous. Not only did this seem to indicate a powerful connection between the seasons and human action, but the data could also be made to fit a normal sine curve, one as consistent as Fourier's for heat transfer. Quetelet had met Fourier in Paris three years earlier, but Quetelet's main "discovery" here was to be the rare mathematician and astronomer looking over bureaucratic statistics with an eye towards patterns; those usually looking at the data were administrators, and those who knew the sinusoid wave were usually engaged in other projects. Even more, when he looked at the mortality records in the same registry, they were identical, following the same progression from February to July. As he explained in a paper first delivered to the Académie Royale, the numbers confirmed that, in Quetelet's mind, "the laws which rule" in nature can be "extended" onto the "human species."[41] While the modern researcher might note that this correlation of birth and death rates might rely heavily on the high mortality for children after their birth, for Quetelet it was confirmation that the actions of the weather and people were tied to each other through natural laws.[42] It was a first step in approaching the laws of the weather from the perspective of human behavior rather than as a second-order feature of astronomical laws.

Therefore, in disseminating his "Instructions pour l'Observateurs des Phénomènes Périodique," one of the first methodological texts for studying meteorology, Quetelet explained why the collection of local data from observatories was necessary for studying a global system: the Brussels data had indicated that large-scale data revealed hidden patterns. Because periodic phenomena were ultimately based on the Earth's "annual orbit," the former method of observing these phenomena "individually" was no longer sufficient: observers "had generally neglected to study (periodic phenomena) in their entirely, or to search to find the laws of dependence and correlation which existed between them."[43] It was a vision of nature that was positivist in its determinism but also practically helpful for the director of a small observatory. The "Instructions" contained a vision that looked inward and outward, as each piece of data could both explain, and be explained by, a global system. Unlike astronomy, where more than a few positional readings would be superfluous, periodic phenomena meant collecting data on a larger scale. What was needed then was both simple in its articulation yet daunting in practice: "a system of simultaneous observations, established on a grand scale."[44]

By this point, Quetelet had created a seeming rationale for the widespread collection of meteorological data, but had not yet articulated anything like an autonomous climate. Instead, he still envisioned a hierarchical world of astronomical, meteorological, and social data. For example, the first lines of "Des Phénomènes Périodiques," published nearly 30 years after the "Instructions,"

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[41] Ibid., 496.
[42] Ibid., 500.
[43] Adolphe Quetelet, "Instructions pour l'observation des Phénomènes Périodiques," in *Bulletin de l'Académie royale des sciences, des lettres et des beaux-arts de Belgique* 9 (1842): 65-96, 65.
[44] Ibid.

in fact asserted *only* the importance of the lessons of astronomy, opening with the claim that "the movement of celestial bodies" was the key to understanding all periodic phenomena. In particular, it was the sun that stood as the prime mover of nearly all phenomena on earth. As Quetelet wrote of the periodic phenomena of daily climate: "this star in effect seems to be their protector and the principal agent in their life."[45] In particular this was due to the influence of daylight, which Quetelet believed to be "perhaps the most important phenomenon."[46] Finally, he insisted: "One can see in astronomy, above all in the observations of the two great heavenly bodies which strike our attention, which contain the origins of all which merits occupying us in our studies."[47] Quetelet's positivism and faith in astronomy seemed to be set.

Yet the lessons Quetelet had learned while collecting social data continued to influence his writing on periodic phenomena. While the climate might ultimately depend on the movement of the sun, Quetelet cautioned his prospective global observers in the earlier "Instructions" to note that there were *two* classes of periodic phenomena, a distinction he drew from his earlier work in statistics: "One pertaining to the physical and natural sciences and "The other which falls under the domain of statistics and concerns mankind living in his social state."[48] Such a distinction between what we might now call the natural and social sciences might seem bizarre in the context of a document meant to train people how to record wind speeds and temperatures, but it is a reminder that Quetelet's work in collecting meteorological data was not simply about conducting second-order astronomy. Quetelet in the 1840s was still best known for investigating population statistics, and his landmark 1835 work *Sur l'homme* was exclusively dedicated to this latter "domain" of periodic phenomena. Though the wealth of data provided in that two-volume study was a minor sensation in England and Germany, Quetelet oddly dubbed social statistics irrelevant to his project to study the climate: "Natural periodic phenomena," he noted, "are in general independent of social periodic phenomena."[49] Yet in spite of this assertion, as the next section demonstrates, Quetelet did import these concepts into his work on natural phenomena. Though his institutional priorities and education in astronomy and mathematics may have led him to distance his more professional observatory work from his early dabbling in social data, the lessons from the latter continued to endure.

Inverting the Positivist Hierarchy: The Creation of a Global Physics

As seen in the previous section, the particular constraints of Belgian politics and history had forced Quetelet to approach meteorology and periodic phenomena from a unique methodological

[45] Adolphe Quetelet, "Des Phénomènes Périodiques en Général," in *Bulletin de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique* 17 (1864): 229-326, 247.
[46] Ibid., 235.
[47] Ibid., 253.
[48] Quetelet, "Instructions," 68.
[49] Ibid.

perspective in Europe. Rather than be able to direct a grand observatory, and study simultaneously astronomical and meteorological data, Quetelet for a decade mined the available collections of Brussels and Belgium population statistics to discover his first laws and theories about large sets of data. On the one hand, it was a success, as his (in)famous ideas of the "Average Man," the Quetelet Index (later renamed the Body Mass Index), and social physics were all in place by 1835. It was these projects that garnered Quetelet the later title of "father of statistics" and where most of his current renown resides. Yet as also seen in the previous section, Quetelet abandoned social data as soon as he could, retaining many features of the positivism he had learned in the Napoleonic schools of his youth and continued to see astronomy as the highest form of science. In this section, therefore, I examine how this apparent paradox manifested itself in the creation of a new project called global physics, an early vision of an independent climate that grew out of Quetelet's work in periodic phenomenon and social data. By examining several papers from 1840 to 1870, I investigate how, in spite of occasional deterministic rhetoric, Quetelet's ideas about global physics relied as much on theories gleaned from the social data of Brussels as those from astronomical theory and observation. In fact, by 1870, it will be seen that Quetelet was explicitly using social physics as a guiding metaphor for global physics, upending the position that weather must be studied as a function of astronomical laws.

To see just how interconnected Quetelet's natural and social data were, it is important to note that one of his first statements on what we might call climate – and what he called global physics – occurred in a series of letters dedicated to the applicability of probability theory to "the moral and political sciences." Just four years after the "Instructions," Quetelet stressed the importance of periodic phenomena and expressed a powerful vision of a global weather system in a letter to Prince Albert entitled "De causes variables périodique." His topic was the relationship between "the march of the seasons" and human actions. Of all the natural phenomena, Quetelet noted, "the most remarkable were certainly those which obeyed the laws of periodicity."[50] So strong was this law, that "the succession of the seasons and the days" was able to "modify simultaneously the entire globe and all the living beings." This was not merely the grand total of singular actions; rather, Quetelet claimed that "periodic phenomena constituted a common life outside of the individual life." This "succession of phenomenon" demonstrated "the most striking harmony" and it was only necessary for the eye "to seize it in its entirety" rather than in isolated glimpses.[51] Here was the early indication of a completely interdependent climate which could apply the lessons of astronomical work to all periodic phenomena on earth and one as positivist in spirit as the introduction to "Des Phénomènes Périodiques."

In spite of the rhetoric of harmony, the letter was concerned far less with what astronomy could explain about periodic phenomena than what periodic phenomena could tell mankind about itself. The letter was included as part of Quetelet's *Lettres sur la théorie des probabilités aux*

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[50] Adolphe Quetelet, *Lettres à S.A.R. le Duc Régnant de Saxe-Cobourg et Gotha: Sur la Théorie des Probabilités, Appliquée aux Sciences Morales et Politiques* (Brussels: Hayez, 1846), 203.
[51] Ibid., 205.

sciences morales et politiques, and Quetelet made sure to point out the relevance of periodic phenomena to the intellectual and moral acts of mankind:

> It is the singular condition of mankind and its societies that the virtues and vices, the disorders of the heart and of intelligence and the political commotions, are influenced more or less by the distance from the sun to the equator and the elevation of this star above our horizon![52]

Here again was a form of climactic determinism that might seem worthy of Montesquieu, yet Quetelet's boldest language betrayed a much subtler form of thinking about the relationship between mankind and climate developed elsewhere in his work. Global physics in fact shared many of the same qualities as *social* physics, Quetelet's science of man developed 15 years earlier. The foundation of Quetelet's science, *Sur l'homme*, had already emphasized that the actions of society could be modified by governments because the actions of human beings could be separated into "natural" and "perturbing" causes, which meant that the environment in which people lived could be altered to avoid crimes, poverty or even disease.[53] Quetelet had been supported in this by work in France to link cholera to population density, where public hygienists had shown that reducing the number of people living in one house could severely cut the risk of contracting a disease.[54] Virtues and vices might be influenced by the position of the sun, but the study of mankind revealed that man could intervene between himself and the climate, and that societies were not fated to a certain kind of politics or morality based on latitude.

The concept of natural and perturbing causes drawn from *physique sociale* found their way into global physics in several works, but Quetelet discussed them most at length in a little-known 1853 work on periodic and non-periodic phenomena, where he explained how temperature was "determined" by "constant" and "variable" causes, synonyms for the natural and perturbing forces he had used earlier.[55] As Quetelet noted, if the angle of the sun "alone regulated the temperatures of the year, each day," we would see the same temperature each year on the same date.[56] Yet the fact that average temperatures changed significantly from year to year required investigation beyond the constant cause of the earth's position relative to the sun and into the "thousands" of "perturbing forces" that caused such fluctuations. While such a project to disentangle all of the causal links of the weather seemed impossible, Quetelet was buoyed by the ability of probability theory in *physique sociale* to reduce the collective impact of perturbing forces. Quetelet had

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52 Ibid.
53 Adolphe Quetelet, *A Treatise on Man and the Development of his Faculties* (Edinburgh, 1842), 6.
54 Kevin Donnelly, "Social Physics or Social Disease: Villermé, Quetelet and Cholera 1832," in *Royalists, Radicals, and les Misérables: France in 1832*, ed. Eric Martone (Newcastle: Cambridge Scholars Press, 2013).
55 Adolphe Quetelet, "Mémoire sur les Variations Périodiques et non Périodiques de la Température," *Mémoires de l'Académie royale de Belgique* 28 (1853), 1.
56 Ibid., 5.

investigated supposedly individual behavior like suicide in the 1830s, where he realized that suicide could neither be the result of a social law (natural) nor a simple collection of individual acts (perturbing). Similarly, temperature fluctuations and periodic phenomena could be explained through a combination of "natural" and "perturbing" causes.

> All perturbing causes, which are by themselves neither constant nor periodic when considered individually, sometimes act in one sense or another, but their effects become fixed over time and disappear in the calculation of the general average.[57]

Here, Quetelet was able to show that large-scale changes in weather and other natural phenomena could not be second-order features of astronomical laws. As with apparently free human acts like childbirth and suicide, the arbitrary nature of the weather could be normalized though calculating "probable error," and Quetelet speculated that "one could see that non-periodic variations could proceed with remarkable regularity."[58] What this meant in practice was that any investigation of global physics meant that hundreds or thousands of additional "causes" must be sought to explain regular features like temperature increase or decrease. Quetelet even used the bell curve to explain how law-like behavior in the weather could mimic the hidden patterns in human behavior. Global physics, one of the first nineteenth-century articulations of something like a worldwide climate, could be interrogated using the same tools as social physics. As seen below, Quetelet would expand on this idea, eventually making social physics into the model for global physics.

The strongest influence of social physics on the articulation of an independent climate system can be found in Quetelet's1861 magnum opus on climate, *Sur la Physique du globe*, which brought together nearly everything he had done in his career. Quetelet began by making his first distinction between meteorology and global physics – subjects that had often been interchangeable in previous works, but which were not "sufficiently separated" – because they required "different methods of observations." After noting that there are higher and lower parts to the atmosphere, Quetelet defined meteorology as "phenomena which occur in the (lower) part (of the atmosphere) which is constantly agitated" while *physique du globe* concerned the "phenomena known to our earth and to the higher part of the atmosphere."[59] What this meant in practice is that the messy and localized work of recording and predicting the weather could be separated from the more global and rigorously law like behavior of global physics, and while the daily records of meteorology maintained an importance, it was largely excluded now from global physics.[60]

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[57] Ibid., 6.
[58] Ibid., 9.
[59] Adolphe Quetelet, *Sur la Physique du globe* (Brussels: Hayez, 1861), 7.
[60] Such a distinction may push back the earliest dates for a "professional climatology" by a few decades. Edwards, for example sees 1883 as the year in which "climate could also be understood as purely physical phenomena, independent of other ecosystems." Edwards, *A Vast Machine*, 63.

Given modern categorizations, it might seem odd that Quetelet began *Physique du globe* with temperatures, a subject that had previously belonged to the messier world of meteorology. Yet Quetelet had acquired a generation's worth of temperature data in Brussels since the founding of his observatory, and the data seemed to reveal patterns of behavior and regularity that might fit more easily under the lofty title of global physics. To begin with, the temperature continued to behave in ways that resembled Fourier's sinusoid waves for heat transfer and the fluctuation of births in Brussels. The average temperature difference in Brussels had been largest in January, but gradually and uniformly "diminished until August and September." In fact, "the averages of the minimum and maximum of each day, as well as each month, for 25 years" showed similar regularity.[61] Here, Quetelet displayed his knowledge of probability theory, categorizing deviations from the average as "error," as in a chart which showed that there was more error to be found in winter than in summer.

As transformative as this work was, Quetelet reserved his most remarkable comments for two papers published in the last years of his life. In "Loi de périodicité de l'espèce humaine," Quetelet in fact completely inverted the methodology of 30 years prior, arguing that research on climate should begin by studying man: "variations in temperature often follow exactly the same laws as those found in human height."[62] If this were not enough to install man as the measure (or at least the metaphor) for all things, Quetelet had two years earlier written that "it is easy to see at the present time that material laws are infinitely more changed by the intervention of man in general" than by individuals.[63] What exactly Quetelet meant by "material laws" is not exactly clear – it is not a common usage in his work – but even so, the comments above would seem to be a complete repudiation of the positivistic vision of passive human beings subject to the timeless movement and intensity of the sun's rays. Whereas at first he had been astonished to see that the data of the Brussels city registry looked like a sine wave, now he implored his researchers to study the weather as if it were as pattern-like as human behavior. Though simple inconsistency and muddled thought can never be ruled out, it does seem that the influence of social data – particularly that collected in Belgium – influenced Quetelet's thinking on global physics, and helped his fellow researchers envision the weather as a more complex problem than merely second-order astronomy. As seen in the next section, however, Quetelet's own goals in establishing global physics were far more provincial than such lofty claims for his ideas might indicate.

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[61] Quetelet, *Sur la Physique du Globe*, 10.
[62] Adolphe Quetelet, "Loi de Périodicité de l'Espèce Humaine," *Bulletin de l'Académie royale des sciences, des lettres et des beaux-arts de Belgique* 30 (1870): 358-368.
[63] Adolphe Quetelet, Statistique "Progress des travaux statistiques" *Bulletin de l'Académie royale des sciences, des lettres et des beaux-arts de Belgique* 28 (1868): 192-207, 196.

Brussels revived: bureaucrats and statisticians at the 1853 International Maritime Conference and the International Statistical Congress

Though Quetelet's comments and instructions on how to envision the climate may have contributed to re-conceptualizing climate – his articulation of an independent global physics occurred at the height of meteorology's determinism problem – this was never his main concern. Rather, global physics offered a way for Quetelet to connect his observatory to the worldwide network of scientists in a way that would have been impossible in astronomy. As he had consistently argued, the path forwards for national redemption in science was through international coordination. Though the route from his early advocacy for an observatory to redeem Belgian science had taken many paths, he was always driven by a desire to integrate his home country into international institutions. In this section then, I show how Quetelet's desire to promote Belgian science led to a powerful confluence of government administrators and statisticians in his hometown of Brussels, resulting in the first agreements on international standardization of temperatures, a crucial moment in the history of climate science. It may have been a coincidence that Quetelet's overlapping concerns – institutional bureaucracy and numbers – would combine in 1853 to such a powerful effect, but it was no accident that both groups came to Brussels.

In fact, the roots of both conferences went back over a decade. In defending his global physics in 1840, as well as justifying his own work at the observatory, Quetelet had offered a fairly prophetic vision for the future sciences of climatology and meteorology. He claimed that global physics "has become its own world. It will take centuries of observations to elucidate the hundreds of phenomena already found within it, to measure with all the required precision, and to discover the laws which rule it."[64] In the same report, Quetelet also told government officials that "there is perhaps no science which demands association more imperatively than meteorology."[65] Two years later, Quetelet repeated the importance of "being in contact with the scientific world in as many ways as possible," in order to "execute a vast research plan" on global physics.[66] Here was the guiding methodology of global physics – not an idealized positivist vision of how science operated but a practical plan to justify the existence of an observatory in a marginal scientific nation.

Getting the right numbers was not easy, however, and Quetelet expressed just how important collaboration would be in his 1842 "Instructions" on periodic phenomena:

> The observations demanded are so numerous and so fatiguing and they require the collaboration of so many people that it has hardly been possible to find more than

[64] Adolphe Quetelet, "Rapport Décennal des travaux de l'Académie Royale," *Bulletin de l'Académie royale des sciences, des lettres et des beaux-arts de Belgique* 7 (1840): 271-342, 12.
[65] Ibid., 17.
[66] Adolphe Quetelet, "Rapport sur l'État de l'Académie en 1842," *Bulletin de l'Académie Royale des Sciences, des Lettres et des Beaux-arts de Belgique* 9 (1842), 5.

> four or five observatories in Europe that can conduct them with a full understanding.[67]

The "Instructions" would help, but more formal coordination of observers would be necessary for advancements in periodic phenomena. The answer came a decade later in 1853 in two large gatherings held in Brussels: the International Maritime Conference and the first Statistical Congress. In the history of meteorology, the Maritime meeting has been noted an as an important, if ultimately failed, attempt to create an international system of measurements: it had helped establish the United States as a leader in climate science but was quickly overtaken by more mature and coordinated international groups.[68] Yet contemporary impressions were more sanguine. Matthew Maury, the controversial organizer of the conference, had good things to say about the receptiveness of the Belgian government (as well as Quetelet, who was named president of the conference after Maury declined), and the conference showed that it was possible for state governments to assemble for matters other than war or peace. Quetelet later noted that at this time "the people are united in sending their representatives for science, as they had in politics."[69]

The goal of the conference was simple: "to perfect meteorology and global physics and to search out the laws which rule these great phenomena."[70] To do this, Maury had hoped to create a large system of coordinated temperature measurements. He had initially hoped that they would discuss land observations as well as oceanic observations, but reported back home that countries had only agreed to use their navies.[71] Understanding that the "vast surfaces of the seas" could be broken into sections through lines or "meridians" and "parallels," Maury suggested that the ideal would be to place "a fixed observer, charged with collecting observations of hourly temperatures" in each "compartment." Of course, observatories of the sea would be nearly impossible, so Maury conceded that "fixed observatories" were not absolutely necessary and could be replaced by "floating observatories" supplied by the different navies of the world.[72] The coordinated observations could give "knowledge of the direction of the wind at different times of the year, the currents, the depths of the seas, their temperatures, etc." Such a program allowed Maury to comment that "we gather here in a spectacle which one will vainly hope to find a historical precedent."[73] The process of rigorous international collaboration on global physics that Quetelet had predicted a decade earlier had begun.

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[67] Quetelet, "Instructions," 55.
[68] James Rodger Fleming, *Historical Perspectives on Climate Change* (Oxford: Oxford University Press, 1998), 42 and Treut, "Historical overview," 100.
[69] Quetelet, "Sur la Météorologie," 29.
[70] Ibid.
[71] Maury's comments on the conference can be found in the "Introduction" to Matthew Maury, *Explanations and Sailing Directions to Accompany the Wind and Current Charts* (Harris, 1858): iii-xii.
[72] Quetelet, "Sur la météorologie," 29.
[73] Ibid., 30.

Agreement was one thing, coordination another. Just as Quetelet had provided detailed guidance for observing periodic phenomena, the larger aims of the conference were to correct the mistakes of observers and impose more rigorous accounts of data collection. After 15 days of deliberation, some preliminary steps were agreed upon. Primarily, "instruments must be compared and standards recognized in a way that error can be determined with exactitude." This had not been a problem for the loosely connected meteorologists in Europe, but national armed forces had a habit of independence, and the conference organizers recognized that mass coordination of data and error correction would be a slow process. Therefore, minimum guidelines were set so that naval observers would note "the position of the ship, the current, the level of the barometer, the temperature of the air and water one time per day; the strength and direction of the wind three times per day (4 am, noon, and 8 pm); and the variations of the (magnetic) needle when it can be observed." Even this basic level would "permit in their whole a system of global and oceanic observations" which "covered the entire surface of the globe in a vast scientific network which will not let any phenomenon of importance pass."[74] Through the Maritime conference, Quetelet had helped to spread the idea of a system of vast observations meant to reduce error, reproducing his early instructions on periodic phenomena on a grand scale.

Aside from Quetelet, however, none of the delegates to the first significant conference on meteorology would have been described primarily as *savants*. In reviewing the list, the eclectic group of thinkers and professionals were, like Maury, either "national officers" of their respective navies or administrators and institutional directors. The makeup contrasted sharply with the delegates to the other large meeting in Brussels in 1853: the Congrès Internationale de Statistique. Here, Quetelet noted the opposite: there were no bureaucratic representatives to be found, only *savants*.[75] Quetelet had first experienced the importance of conferences while traveling in Germany, and after co-founding the Statistical Section of the British Association, promoted the idea of an international meeting at the Great Exhibition in London in 1851. In particular, the support of Prince Albert – to whom Quetelet had dedicated *Physique du globe* and composed his *Lettres sur la probabilités* – helped Quetelet organize the 1853 meeting. Quantitative statistics had taken off in England, and Quetelet lauded the "rank assigned to statistics in the most advanced country in the world" and "the tribute which has been accorded this science."[76]

The 1853 statistical congress was only the first step in relocating the international statistical establishment to Brussels, much of which remains there today. After the Third Statistical Conference was held in London, it was agreed that the Belgian Commission Central de Statistique (CCS) "would be invited…to receive and to coordinate the documents which will be sent by the different parties of Europe." The director of the CCS, Xavier Heuschling, noted that the first congress in Brussels essentially served to unify international statistics, and that "the sciences of

[74] Ibid., 32.
[75] Adolphe Quetelet, *Congrès International de Statistique* (Brussels: Hayez, 1873), 3-5.
[76] Adolphe Quetelet, " "Sur la statistique générale des différents pays," *Bulletin de l'Académie Royale de Belgique* 8 (1841), 14.

observation only form themselves slowly."[77] Probability and statistics at this point still bore the mark of their lowly origins in the sciences of man, and despite the conference participants like Whewell, Farr, Herschel, Babbage, and Quetelet, the conference said little about the natural sciences, instead creating three sections: 1) General Statistics, which covered basic population figures, mortality, etc.; 2) Production and Consumption; and, much to Quetelet's delight, 3) Intellectual and Moral statistics. Quetelet's vision of a science of man based on rigorous observation and quantification was taking place, even if that level had yet to be attained in meteorology.

In contrast to the struggles of the International Maritime Conference, the statistics meeting was a tremendous success. Russia pledged full support from the "imperial government," while *savants* from across the continent chimed in about the possibility of statistics joined with governmental support. It was noted that "men of science" were equal to those of "a different title: administrative statisticians." A Professor Ackersdyk of Utrecht remarked that "the people who occupy themselves with statistics are not ordinarily specialists in a particular branch, but rather embrace science in its entirely." M. Denziger, Professor of Statistics in Würzburg, agreed that the "grandiose" interdisciplinary conference represented "the spirit of our age" because "we attend still to something more than statistics." Nothing would be possible without "national bureaus of statistics" Denziger admitted, and the head of the statistical commission in Lyon claimed he was "very convinced that we can only have good statistics with the support of the agents of governments."[78] In a capstone to the meeting, which must have pleased Quetelet, a professor from the University of Göttingen identified the model country for the intermingling of government and statistics: "Belgium has so left other countries in the distance in matters of official statistics that it is with complete reason that the initiative for the beginning of the general interest in statistics was taken by this country."[79] He hoped the "revolutions of this congress" would give a "powerful impulse" to future meetings of the world's scientists, a hope that has been more than met in the past 150 years.

In comparing the attendees and the meeting records, the dual 1853 conferences reveal several surprising aspects of early meteorological and climatic research. The Maritime Conference, ostensibly organized to discuss a science that had been perceived as just one step removed from astronomy, attracted few scientists, was discussed largely at the level of bureaucracy, and led to almost nothing besides an agreement to meet more often. The Statistical Congress, however, including the once-controversial idea of intellectual and moral statistics, held the attention of some of the greatest scientific minds of nineteenth-century Europe, and developed a far more organized and significant plan of international organization. The use of probability, essential to modern modeling techniques of climate science today, also took form in the series of conferences based on the Brussels meeting and helped the young science of quantitative statistics overtake qualitative

[77] Xavier Heuschling, "Congrès internationaux de Statistique, Rapport sur la Belgique, 1855-1867," *Bulletin de la Commission Centrale de Statistique* 11 (1868), 3.
[78] Ibid., 7-10.
[79] Ibid., 12.

statistics as the preferred path for the social sciences. To conclude from this limited though instructive confluence of ideas, the great hopes for a meteorology derived from astronomical methodology and theory had been overshadowed by the methods for a quantitative science of man that only twenty years earlier had not even existed. The very statistical concepts Quetelet had sketched out in Brussels in the 1820s and 1830s, ideas he likely never would have developed had he been given a first-rate observatory, turned out to be the most enduring. In helping organize the two foundational conferences in meteorology and statistics in Brussels, Quetelet demonstrated that government support for international collaboration of scientific data was essential and that his own country had a prominent role to play. Not only had his work in global physics helped to define a new field of research, but he had redeemed the scientific reputation of his country as well.

Conclusion

The dual conferences and the resulting international collaboration may best explain Quetelet's decision to link the history of the Belgian people to the statistics of periodic phenomena described in the introduction to this paper. The decision to focus on these observations at the exclusion of the great positivistic sciences of astronomy, physics or chemistry had indeed brought Brussels back into the center of European scientific life. What Quetelet may not have realized, however, is that his home region may have in fact benefited *because* of its many struggles. The revolution and construction delays in creating the observatory had led him to the Brussels city registry for data, where he first started formulating the statistical "laws" that would lead to international prominence. The superfluous nature of his observatory in astronomy also meant that Quetelet had to look elsewhere for data, which first tied him into the international meteorological networks. Finally, the always perilous state of Belgian and *Bruxellois* political stability led him to link his country's fortune to others through science, which resulted in two major conferences taking place in the same year in his adopted hometown. And throughout it all, Quetelet's many ambitious and fledgling efforts to collect data led to seeing climate as independent, the near opposite of the goal he had initially set out to accomplish.

Quetelet's program to separate a global climate from the messy business of daily meteorology and the methodological imperatives of astronomy, as well as his borrowings from an inchoate science of man sketched out hastily with data from the Brussels data registry, might seem notable. But it might also be argued that this work was as a historical curiosity, one rightfully bracketed out from traditional histories of meteorology. Yet Quetelet was far from being isolated from other Europeans studying climate, and his impressive number of contacts and simple geographic location made him among the most connected men of science of the nineteenth century. Quetelet had spent decades at the head of the observatory, edited the continental publication *Correspondance mathématique et physique*, was Secrétaire Perpetual of the Académie Royale de Belgique, and was a member of hundreds of international organizations. Such a wide-ranging project to study climate was of course not the result of a single individual, but Quetelet's plan to submit meteorological and statistical data to the judgement of international bodies is indicative of the kind of science often practiced in Belgium, one that took on profound consequences in the larger metropoles of European science and polity.[80] Quetelet's work in creating international statistics – driven largely by the meteorological data from the Brussels Observatory – has been noted as being "attentive to the spirit of the age," and Eric Brian has linked the "invention" of "international science" to the desires for stability in Europe.[81] Brian has further highlighted the importance of Belgian statesman like Quetelet and Xavier Heuschling in the foundation of administrative statistics, noting that the international conferences of the kind began in Brussels may have been more formative for the discipline than the technical and mathematical work done by Galton and others.[82]

Whatever the weight of his contributions, Quetelet's work is a reminder that the formulation of the idea of a global climate was not simply an application of higher-order scientific methodologies to a new field of research, nor was it a simple cumulative process of collection and evaluation of data; rather, it occurred in part because of the practice of overturning long-held methodological imperatives through the importation of new analytical tools developed to make sense of administrative data. It was not always the intellectual challenges of understanding a climate system or the unimpeachable impress of nature that caused Quetelet to look towards the first international gathering of meteorologists, or to envision a global physics based on social physics. Instead, Quetelet developed his ideas of global physics in tandem with his plans for large collaborations of scientists to rescue Belgian science, and it would be a mistake to view collaborative, global, data-driven science as being a fully-formed idea that was then shared with the larger scientific community. Historians of science have long stressed that institutions and ideas develop simultaneously, and Quetelet's work on global physics and his development of the 1853 meetings are just a few examples of many on how theory can emerge from praxis, though an ironic one given how far Brussels was from the center of scientific discourse. That it allowed scientists to imagine a new relationship between mankind and the climate in the nineteenth century makes the story all the more interesting.

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80 For the importance of the Belgian region and the statistical conferences on internationalism, see Nico Randeraad, "The International Statistical Congress (1853-1876): Knowledge Transfers and Their Limits," *European History Quarterly* 41, no.1 (2011): 50-65, John L. Heilbron, Nicholas Guilhot and Laurent Jeanpierre, "Toward a Transnational History of the Social Sciences," *Journal of the History of the Behavioral Sciences*, 44, no.2 (2008):146-60 and Jean-Guy Prévost and Jean-Pierre Beaud, *Statistics, Public Debate and the State, 1800-1945: A Social, Political and Intellectual History of Numbers* (London: Pickering & Chatto, 2012), 49-62.

81 Zoltan Kenessey, "Quetelet and the Beginning of International Statistics," in *Actualité et Universalité de la Pensée Scientifique d'Adolphe Quetelet: Actes du Colloque Organisé à l'Occasion du Bicentenaire de sa Naissance* (Brussels: Académie Royale de Belgique, 1997), 155 and Eric Brian, "Transactions statistiques au XIXe Siècle," *Actes de la Recherche en Sciences Sociales*, 145 (2002): 34-46, 36.

82 Eric Brian, "Statistique Administrative et Internationalisme Statistique Pendant la Seconde Motié du XIXe siècle," *Histoire & Mesure* 4 (1989): 201-224.