Atmospheric Archives: Gender and Climate Knowledge in Colonial Tasmania

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ABSTRACT

There is a rich cache of letters detailing the production of climate knowledge at Tasmania's Hobart Observatory in the early nineteenth century. By contrast, a mere handful of sentences survive in the written record to describe the production of climate knowledge outside the Hobart Observatory, in Tasmania's north-east. In this paper, I confront the question of what to do with these unbalanced archival remains. I draw on the work of social and cultural historians as well as historians of colonialism and science to advocate a three-pronged methodology for approaching the problem of the unbalanced atmospheric archives. The application of this methodology, I show, reveals the way gender relations shaped the way atmospheric knowledge was both produced and used by historical actors in colonial Tasmania.

KEYWORDS

Aboriginal, women, climate, knowledge, observatory

Nearly a decade ago, the historian Mark Carey surveyed the existing scholarship on climate history and argued for the need for more social histories of climate. In particular, he showed, 'there have been very few gender histories of climate for any period or world region'.[1] Since Carey made this case, several important studies have highlighted the role of exceptional women such as Joanne Simpson who defied contemporary expectations and exclusions to

1. Mark Carey, 'Climate and history: a critical review of historical climatology and climate change historiography', *Wiley Interdisciplinary Reviews: Climate Change* **3** (3) (2012): 243.

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participate in atmospheric research.[2] In 1949, Simpson became the first woman in the United States to receive a Doctor of Philosophy degree in meteorology. Few studies, however, have yet examined the impact of not only sexed bodies but also gender relations – that is, the way the identities of and the relationships between women and men have been conceived – on the making of atmospheric knowledge.[3] Even fewer have examined the interaction of gender with other categories of power such as race and class.

Part of the difficulty with writing such histories is a matter of sources. Take the case of colonial Tasmania.[4] There is a rich cache of letters detailing the production of atmospheric knowledge at Tasmania's Hobart Observatory in the early nineteenth century.[5] In 1840, British authorities established the Observatory in the south-east corner of the island colony, on the banks of the River Derwent (see Map 1). The letters that passed through the Observatory survive in the vaults of the British National Archives and the Tasmanian Archives. They number into the hundreds and include both the in- and outgoing correspondence that travelled by ship to and from the Observatory over more than a decade. The cursive handwriting and the wear and tear of shipboard passage makes some of the words difficult to decipher. But, with careful reading, a myriad of details emerges from the pages including the observations and ideas of the Observatory's director, Joseph Henry Kay, in his own words.

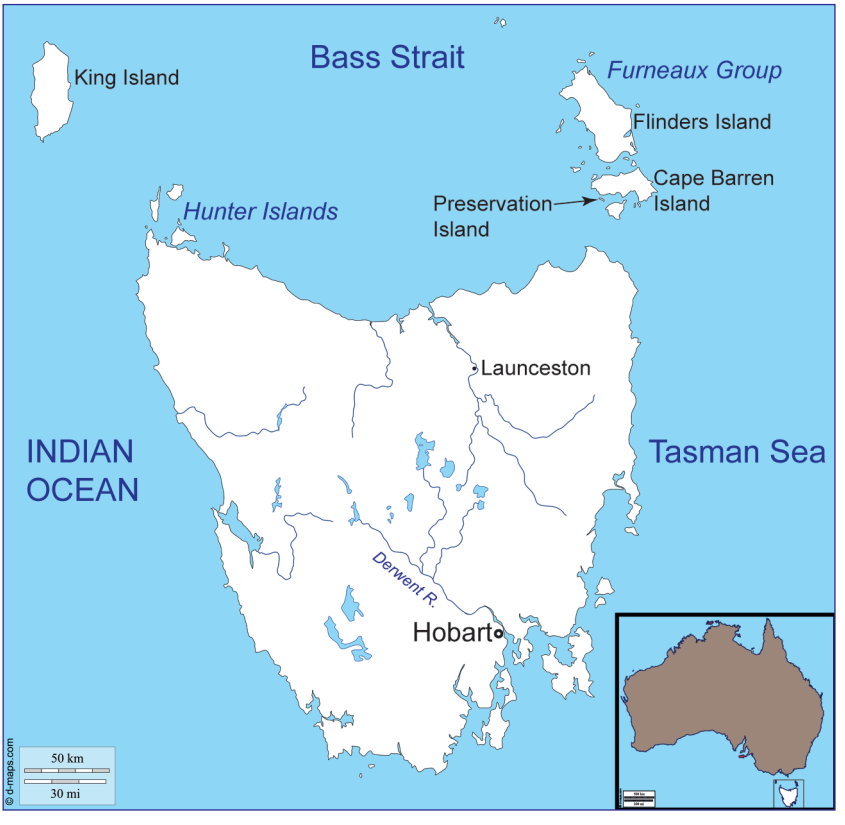
By contrast, a mere handful of sentences survive in the written record to describe the production of atmospheric knowledge outside the Hobart Observatory, in Tasmania's north-east. In the pages of a colonist's journal, reference is made to the atmospheric knowledge of Aboriginal peoples. The sentences do not offer a firsthand account. Indeed, they do not even offer a secondhand account. They come from a visitor who recorded hearing that the white men of the area utilised the atmospheric knowledge of Aboriginal peoples, most likely women. The words that make up these sentences are easy enough to decipher; they have been transcribed from the original journal into

2. See, for example, Sarah Dry, *Waters of the World: The Story of the Scientists Who Unravelled the Mysteries of Our Seas, Glaciers, and Atmosphere – and Made the Planet Whole* (London: Scribe, 2019), ch. 5; James Rodger Fleming, *First Woman: Joanne Simpson and the Tropical Atmosphere* (Oxford: Oxford University Press, 2020).

3. Some important exceptions include Georgina H. Endfield and David J. Nash, ' "Happy is the bride the rain falls on": climate, health and "the woman question" in nineteenth-century missionary documentation', *Transactions of the Institute of British Geographers* **30** (3) (2005): 368–386; Georgina H. Endfield and Carol Morris, '"Well weather is not a girl thing. Is it?" Contemporary amateur meteorology, gender relations and the shaping of domestic masculinity', *Social and Cultural Geography* **13** (3) (2012): 233–253; Mark Carey et. al., 'Glaciers, gender, and science: A feminist glaciology framework for global environmental change research', *Progress in Human Geography* **40** (6) (2016): 770–793.

4. Tasmania was known as Van Diemen's Land in this period. In this paper it is referred to by its current name, Tasmania, in order to avoid confusion. In 1856, the British government changed the name of Van Diemen's Land to Tasmania.

5. The Observatory was also known to contemporaries as the Rossbank Magnetic Observatory.



Map 1. Map showing the location of Hobart in Tasmania's south-east as well as some of the islands of the Bass Strait in the north-east.

an edited volume. Yet for all their typed precision, the sentences contain none of the names of the atmospheric knowledge producers in Tasmania's north-east and no record of their observations and ideas in their own words.

What to do with these unbalanced archival remains? For historians trained in reverence for the documentary archive, there is a temptation to seize upon the abundant.[6] It would be easy to tell a story of colonial Tasmania's atmospheric knowledge production – of the production of knowledge about atmospheric happenings such as the development of storms and seasonal patterns of rainfall and temperature – based solely on the letters that poured in and out of the

6. On historians' ongoing predilection for the documentary archive, see John R. McNeill, 'Peak Document and the Future of Historical Research', presidential address delivered at the 134th annual meeting of the American Historical Association, New York City, 4 Jan. 2020. Transcript available at https://www.historians.org/about-aha-and-membership/aha-history-and-archives/presidential- addresses/john-r-mcneill.

Hobart Observatory.[7] In this story, the atmospheric knowledge that circulated in Tasmania's north-east would be relegated to a short paragraph or footnote indicating an archival dead-end. Yet, as feminist and postcolonial scholarship has long shown, there are problems with writing histories that elevate actors in proportion to their archival remains. Such an approach risks reproducing the contemporary power dynamics which gave some voices a greater platform than others and which treated some voices as more worthy than others of being documented and archived in state institutions.[8]

In the case of atmospheric knowledge, a particular risk of writing histories based solely on the more abundant archives of observatories is that nineteenth-century ideas of who counted as an expert are taken as a given rather than critically examined. Observatories were spaces that largely excluded women and non-European men in colonial Tasmania as well as many other parts of the nineteenth-century British Empire.[9] Within formal scientific networks and institutions, it was European men who were most often charged with handling precision instruments such as barometers and thermometers and using these instruments to produce knowledge about atmospheric happenings. But just because observatories were spaces largely reserved for European men does not mean that the atmospheric knowledge of other historical actors was not valued by contemporaries outside the observatory. Nor does it mean that the men who worked in the observatories always felt like, or were treated as, experts.

In this paper, I draw on the work of social and cultural historians as well as historians of colonialism and science to suggest a three-pronged methodology for tackling the problem of the atmospheric archival imbalance. First is the use of robust speculation, which enables the archives to be pushed to their limits. This approach draws on the work of the cultural historian and literary scholar, Saidiya Hartman. 'Every historian of the multitude, the dispossessed, the subaltern, and the enslaved is forced to grapple with the power and authority of the archive and the limits it sets on what can be known, whose perspective matters, and who is endowed with the gravity and authority of historical actor',

7. In this paper I use the terms climate, weather and atmosphere interchangeably in order to convey the fluidity with which these categories were used by contemporaries. On the value of not assuming a 'trans-historical' meaning for climate, see Sarah Carson, 'Atmospheric happening and weather reasoning: Climate history in South Asia', *History Compass* **18** (12) (2020): e12640.

8. State surveillance in the form of documenting and archiving the private lives of women could also be an expression of contemporary power dynamics. See, for example, Natalie Harkin 'Weaving the colonial archive: A basket to lighten the load', *Journal of Australian Studies* **44** (2) (2020): 154–166.

9. Katharine Anderson has noted how race was at once seen as part of the problem and the solution of observation work in colonial India. On the one hand, 'British racial arrogance' mediated attitudes towards Indian meteorological observers; on the other, Indian observers were employed to take observations in locations considered unhealthy for Europeans. Katharine Anderson, *Predicting the Weather: Victorians and the Science of Meteorology* (Chicago: University of Chicago Press, 2005), pp. 279–280.

writes Hartman.[10] Part of Hartman's strategy for grappling with the limits of the archive is to confess the silences of the sources and to fill those silences with speculative arguments that express doubts and possibilities.[11] Following Hartman, I do not provide certainty where there is none but am instead candid about the level of certainty that can be ascribed to the different possibilities left open by the archival silences.

Second is the use of contemporary Aboriginal accounts and testimony. This method is sometimes labelled 'upstreaming' and it carries the risk that Aboriginal peoples are represented as timeless and unchanging from one moment in time or place to the next.[12] Yet the risks associated with upstreaming are reduced when less focus is placed on trying to fill gaps in the historical record than on trying to draw out the full significance of what remains. This involves contextualising sources produced by colonists within recent anthropological, archaeological and astronomical research conducted by or in collaboration with Aboriginal peoples. This method resonates with what the historian of science Sujit Sivasundaram has called 'cross-contextualisation'. 'While it is common to complain about the scarcity of sources stemming from a non-European perspective', Sivasundaram observes, 'this methodology [cross-contextualisation] allows us to see what happens when a European source is surrounded by other voices'.[13] In this paper, such voices include that of the Aboriginal elder Aunty Patsy Cameron, who is a direct descendant of the Aboriginal leader from Tasmania's north, Mannalargenna, and a historian of the Coastal Plains people.

The third part of the methodology involves another type of cross-contextualisation. This is the method of reading the abundant archival remains alongside the scarce rather than in isolation. This method takes up Sivasundaram's suggestion 'to experiment with divorcing sources from their usual sites of contextualization so as to take them to quite different contexts, at a distance from their obvious authors and readers'.[14] Reading Kay's letters from the Hobart Observatory in the context of the journal sentences scribbled down in the is-

10. Saidiya Hartman, *Wayward Lives, Beautiful Experiments: Intimate Histories of Social Upheaval* (London: Serpent's Tail, 2019), p. xiii.

11. Saidiya Hartman, 'Venus in two acts', *Small Axe* **26** (2008): 1–14; Hartman, *Wayward Lives.* Hartman calls her approach to the silences of the archives 'critical fabulation'. A part of this method, which is not adopted here, is Hartman's use of 'close narration, a style which places the voice of narrator and character in inseparable relation'.

12. On the method of upstreaming and its risks, see Richard White, *The Middle Ground: Indians, Empires, and Republics in the Great Lakes region, 1650–1815* (Cambridge: Cambridge University Press, 1991), p. xiv; Pekka Hämäläinen, *The Comanche Empire* (New Haven: Yale University Press, 2008), pp. 13–14.

13. Sujit Sivasundaram, 'Science and the global: On methods, questions and theory', *Isis* **101** (1) (2010): 154.

14. Sivasundaram, 'Science and the global', 154. For Sivasundaram's own application of this methodology, see Sujit Sivasundaram, *Waves Across the South: A New History of Revolution and Empire* (London: William Collins, 2020).

land's north is not an obvious methodological move. Although the sources are roughly contemporaneous and each engage with the same theme of atmospheric knowledge, the two sources were not produced with each other as intended audiences. Most of the letters that came out of the Hobart Observatory were destined for authorities in England, while the journal was a more private affair. And yet analysing the former in the context of the latter helps to 'shift our sense of balance', as Sivasundaram writes.[15] By applying this three-pronged methodology to the archival remains, it is possible to draw a picture of some of the ways gender relations have impacted human-atmosphere interactions.

THE SENTENCES

First, the sentences. In the journal entries of George Augustus Robinson, a handful of sentences record that some newcomers sought out Aboriginal peoples' knowledge of the atmosphere. In 1829, Robinson secured the government-sponsored job of trying to 'conciliate' the Aboriginal Tasmanians who resisted the British colonial invasion. The mission took Robinson on a series of six expeditions between 1829 and 1834 in which he traversed much of Tasmania. During an expedition of 1830 and 1831, Robinson observed that 'the aborigines have considerable knowledge of the signs of the weather and had attained to such celebrity that my people, i.e. white men, would consult them on this subject'.[16] Robinson recorded that Aboriginal people had taught white men, for example, that 'if the clouds or scud fly swiftly along it is a sign, they say, there will be no rain'.[17] They also taught them to look to the moon: 'if a circle is round the moon it's a sure sign of bad weather, plenty of wind; if light clouds appear it is a sign of fine weather'.[18]

Although Robinson did not record exactly who he meant by 'white men' and 'aborigines' when he made these observations, there are several reasons to believe he was referring in particular to the men of Tasmania's sealing communities and to the Aboriginal women of the Coastal Plains people. First, Robinson was travelling where the sealers lived in Tasmania's north-east when he recorded the way newcomers relied on Aboriginal peoples' knowledge of

15. Sivasundaram, 'Science and the global', p. 154.

16. George Augustus Robinson, *Friendly Mission: The Tasmanian Journals and Papers of George Augustus Robinson, 1829–1834,* N. J. B. Plomley (ed.) (Hobart: Quintus Publishing, 2008), p. 334.

17. Robinson, *Friendly Mission*, p. 334.

18. Ibid. Brian Plomley, a scientist and editor of George Augustus Robinson's journals, has written a short piece about the references to Palawa knowledge of the atmosphere contained in Robinson's journal. He does not examine the full range of atmospheric knowledge contained in the journals or the significance of this knowledge for newcomers. Brian Plomley, 'Contacts with the Tasmanian Aborigines', in Eric K. Webb (ed.) *Windows on Meteorology: Australian Perspectives* (Collingwood: CSIRO Publishing, 1997), pp. 42–45.

the atmosphere. Sealers had visited the small islands of the Bass Strait since the late 1790s, when hundreds of them in dozens of crews moved into the area.[19] In the rush to profit from the seal's skin and oil, hundreds of thousands of seals were slaughtered. The skins of about 57,560 seals produced a profit of £303,046 in 1803.[20] By the following decade, however, over-exploitation meant that it was no longer profitable for entrepreneurs to hunt in the Strait. From the 1810s, the large, organised crews were replaced by colonists who settled on the islands and continued to hunt on a smaller scale.[21] These men, as Patsy Cameron has observed, did not call themselves 'sealers' but rather 'eastern straitsmen'.[22]

Second, it was Aboriginal women from the Coastal Plains people who had the most sustained contact with these straitsmen. The Coastal Plains people were the Aboriginal peoples who occupied the coastal margins and open plains of north-east Tasmania for at least 8,000 years before the newcomers arrived.[23] In the 1820s, numerous Coastal Plains women went to live with straitsmen on the islands of the Bass Strait (see Map 1). In the historian Lyndall Ryan's estimate, there were about a hundred women and fifty men living in the Bass Strait in 1820.[24] In 1840, one of the straitsmen, James Munro of Preservation Island, reported that there were about 25 clanswomen and twenty straitsmen living in the eastern Bass Straits islands.[25] Most of these women moved to the islands because they had been the subject of complex negotiations between straitsmen and male Coastal Plains leaders who sought to trade goods and establish strategic kinship ties with the straitsmen. The women who lived with the straitsmen gave themselves the title 'Tyereelore' or island wives. The title, Cameron explains, 'was not just a name; it distinguished these women as a specific group who not only clearly acknowledged their new role and status in their new environment, but also associated them with belonging to a precise geographic location'.[26]

Third, the gendered divisions of labour amongst the Coastal Plains people meant that it was the women who most likely had the atmospheric knowledge

19. Lynette Russell, *Roving Mariners: Australian Aboriginal Whalers and Sealers in the Southern Oceans, 1790–1870* (Albany: State University of New York Press, 2012), p. 104. See also James Boyce, *Van Diemen's Land* (Carlton, Victoria: Blank Inc., 2009), ch. 1; Rebe Taylor, 'Savages or saviours? – The Australian sealers and Aboriginal Tasmanian survival', *Journal of Australian Studies* **24** (66) (2000): 73–84; Lyndall Ryan, *The Aboriginal Tasmanians* (St Lucia: University of Queensland Press, 1981), ch. 3.
20. Boyce, *Van Diemen's Land*, pp. 15–19.
21. Ryan, *The Aboriginal Tasmanians*, pp. 67–69.
22. Patsy Cameron, *Grease and Ochre: The Blending of Two Cultures at the Colonial Sea Frontier* (Launceston: Fullers Bookshop, 2011), p. 97.
23. Cameron, *Grease and Ochre*, pp. 2–4.
24. Ryan, *The Aboriginal Tasmanians*, p. 69.
25. Robinson, *Friendly Mission*, p. 457.
26. Cameron, *Grease and Ochre*, p. 89.

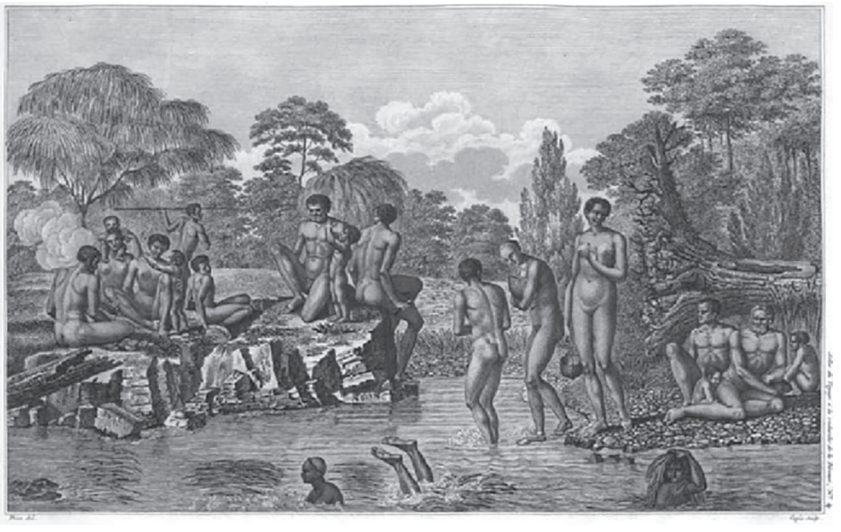


Figure 1. Aboriginal women diving for shellfish, crayfish and seaweed, as depicted by French explorers. Aboriginal Life Pre-Invasion, State Library of Tasmania, https://www.utas.edu.au/library/companion_to_tasmanian_history/A/Aboriginal%20life%20pre-invasion.htm (accessed 12 Dec. 2019).

most applicable to maritime island life. In Coastal Plains society it was the women rather than the men who had the stronger link to the sea.[27] While Coastal Plains men hunted for game in the grasslands, woodlands and wetlands off the north-east, the women harvested seafood such as crayfish, oysters and mussels along the coastal margins. They also swam to offshore islands and rocky outcrops in order to hunt seals and mutton birds. Coastal Plains women, Cameron writes, 'were renowned for their strength and skills as superior swimmers and divers. Braving the cold, often turbulent and shark infested waters, they remained submerged for long periods of time to harvest the marine resources' (see Figure 1).[28] While it is not possible to know for certain whether the atmospheric knowledge recorded by Robinson was particular to women in Coastal Plains society, the Coastal Plains women's maritime-oriented responsibilities were tasks that benefitted from a close understanding of the development of winds and storms at sea, including the ability to anticipate these events.

The use of clouds and the appearance of the night sky as ways of accessing information about the weather and climate were and continue to be common methods amongst numerous groups of Aboriginal peoples. As Karlie Noon, a Gamilaraay woman and astrophysicist, has explained: 'Indigenous people [in

27. Ibid., p. 42.
28. Ibid.

Australia] use moon haloes as storm predictors, since ice crystals indicate high moisture levels in the atmosphere. The crispness of the halo and number of stars between the moon and the halo helps determine the amount of moisture in the air and how soon the storm is going to hit'.[29] In other parts of Australia, star scintillation or twinkling is also used as an indicator of changes in the weather and especially wind patterns, as wind movement high up in the atmosphere is a primary cause of such scintillation.[30] Drawing on such contemporary evidence is not to say that Aboriginal peoples all used clouds and the appearance of the night sky in the same way across time and space. But reading Robinson's short journal entries in light of such insights helps to draw out the full significance of the fragmented picture he left behind.

For the straitsmen, the ability to forecast changes in wind and precipitation patterns was a prized skill. Such a skill was critical to knowing when it was safe to take out boats to hunt seals and to move between the islands of the Bass Strait and further afield. Some of the methods Coastal Plains women used to forecast changes in the weather would have been familiar to at least some of the straitsmen. The ex-sailors amongst the men, for example, would have likely been familiar with the association of certain cloud formations with particular types of weather conditions. Luke Howard, the British atmospheric observer who developed a classification system for identifying clouds, observed that mariners were keen and often accurate observers of cloud formations. It was this knowledge, Howard argued, that 'renders the predictions of the Philosopher … less generally successful than those of the weather-wise Mariner or Husbandman'.[31] For example, the expression 'sky red in the morning is a sailor's sure warning, sky red at night is the sailor's delight' was tied to observations of the appearance of the upper-atmosphere.[32]

29. Anna Salleh, 'Karlie Noon: Reaching for the stars', *ABC News,* 21 Oct. 2016, https://www.abc.net.au/news/science/2016-10-22/reaching-for-the-stars-from-the-wrong-side-of-the-tracks/7947188?topic=a&nw=0 (accessed 25 May 2019)

30. Duane Hamacher, 'Indigenous use of stellar scintillation to predict weather and seasonal change', *Royal Society of Victoria* **131** (2019): 24–33. See also Duane Hamacher, 'Identifying seasonal stars in Kaurna astronomical traditions', *Journal of Astronomical History and Heritage* **18** (1) (2015): 1–23.

31. Luke Howard, *The Climate of London, Deduced From Meteorological Observations, Made in the Metropolis, and at Various Places Around It*, 3rd ed. (London: Harvey and Darton, 1833), pp. xxxix–xl.

32. Richard Inwards records other examples of sailors' weather lore such as 'when scattered patches or streaks of nimbus come driving up from the south-west, they are called by the sailors "Prophet Clouds," and indicate wind'. See Richard Inwards, *Weather Lore: A Collection of Proverbs, Sayings, and Rules Concerning the Weather* (London: W. Tweedie, 1869), pp. 41, 60. For other examples, see also George Adams, *A Short Dissertation on the Barometer, Thermometer, and Other Meteorological Instruments: Together with an Account of the Prognostic Signs of the Weather* (London: R. Hindmarsh, 1790); M. Waldeck, 'Natural prognostics of the weather', *Quarterly Journal of the Society for Literature and the Arts* (1827): 501 – 502.

Yet, even if the straitsmen were familiar with some of the Coastal Plains women's methods for knowing the weather, they could not match the depth of the women's experience of observing the behaviour of the atmosphere in northern Tasmania. Compared to Coastal Plains people, straitsmen were recent arrivals to the region. The warning provided by a red sky in the morning, for instance, was based on observations made in the British Isles and was most reliable in such places where weather systems tended to come from the west.[33] Robinson's comment, moreover, that Coastal Plains peoples' knowledge had attained much 'celebrity' indicates that the straitsmen believed that these women had a superior ability to understand and predict changes in the weather such as the development of a storm. This knowledge could be lifesaving in the Bass Strait where a combination of shallow water, opposing currents and southerly winds can produce treacherous conditions, including waves of up to eleven metres high. In the fifty years between the beginning and the middle of the nineteenth century, there were over sixty ships wrecked in the Strait.[34]

Another entry in Robinson's journal suggests that Palawa women taught the straitsmen yet another method for predicting changes in the atmosphere. This was that of using the behaviour of plants and animals to predict seasonal shifts in the weather. When Robinson asked Coastal Plains women of northern Tasmania when the mutton birds (*Ardenna tenuirostris*) would 'come in', they showed him a lightwood tree (*Acacia implexa*) that was nearby. 'When that tree was in blossom', they said, 'the mutton birds would be in'.[35] The creamy yellow blossom of the lightwood indicated the approach of the warm weather that brought the mutton bird back to the southern hemisphere from its northern hemisphere migration. This method of using plants and animals as indicators of atmospheric change was common amongst Aboriginal peoples on mainland Australia too.[36] It was a method that involved patient and sustained observation in order to understand which species of plants and animals were most sensitive to variation in the atmosphere.

Again, this understanding of seasonal atmospheric changes was likely women's knowledge because of the gendered division of labour amongst the Coastal Plains people. Mutton bird hunting in Coastal Plains society was women's work and it required a close understanding of shifts in seasonal weather

33. The Met Office, 'Red Sky at Night and Other Weather Lore', https://www.metoffice.gov.uk/weather/learn-about/weather/how-weather-works/red-sky-at-night (accessed 4 March 2020).

34. Department of the Environment and Energy, 'Australasian Underwater Cultural Heritage Database', https://www.environment.gov.au/shipwreck/public/maps/shipwreck-map-search-load.do;jsessionid=9CF01AFF47A47D98C86837051484A9DA (accessed 18 Nov. 2019).

35. Robinson, *Friendly Mission*, p. 667.

36. See, for example, Philip A. Clarke, 'Australian Aboriginal ethnometeorology and seasonal calendars', *History and Anthropology* **20** (2) (2009): 79–106; Deborah Rose, 'When the rainbow walks', in Eric K. Webb (ed.) *Windows on Meteorology,* pp. 1–6. See also Fred Cahir, Ian Clark and Philip Clarke, *Aboriginal Biocultural Knowledge in South-Eastern Australia* (Clayton South, Victoria: CSIRO Publishing, 2018).

patterns. It was the women who predicted the timing of mutton bird egg laying, which meant that it was also the women who decided when and where families would travel in order to camp close to the mutton bird rookeries. Atmospheric knowledge was also tied to the women's work of harvesting swan eggs. In the case of the swans, women had to watch for and try to anticipate the arrival of heavy rains as it was such inundations rather than a more general seasonal shift that governed the timing of the swans' egg laying.[37]As Cameron observes, 'the Coastal Plains clans depended on the knowledge and skills of the women to monitor the birds' activities. Exact timing was crucial, as too late after laying and the resource would spoil'.[38]

Knowing when seasonal weather patterns would shift as well as the accompanying changes those shifts brought in animal and plant life was valuable knowledge for the straitsmen in northern Tasmania. As sealing depleted the once abundant seal populations, it was only on Kangaroo Island that the trade in seal skins continued to boom in the 1820s.[39] On the smaller islands of the Bass Strait, as well as Tasmania's northern coast, straitsmen turned to other sources of profit and subsistence to compliment the reduced trade in seal skins and oil. This included hunting the migratory mutton birds and selling the feathers, oil and meat from the birds to colonists in the port town of Launceston on the north coast.[40] Coastal Plains women's understanding of the atmospheric shifts that would bring these birds to Tasmania, as well as the advanced indications of those shifts provided by particular plants such as the lightwood tree, was therefore critical for straitsmen and crucial to their economic survival and management of resources throughout the year.

Some details in the picture of atmospheric knowledge exchange remain obscured. In particular, it remains uncertain whether colonists from beyond the Bass Strait islands sought out Aboriginal women's atmospheric knowledge. The practice was likely particular to the gender and economic relations that developed between Coastal Plains women and straitsmen. It was on the islands that these two groups of peoples 'developed a way of life that combined their abilities, knowledge and customs, which enabled them to survive and thrive', as Cameron writes.[41] Such relations became a near impossibility on the Tasmanian mainland by the 1830s. From 1824 to 1831, the Black War was waged between colonists and the Aboriginal people. Despite their fierce resistance, the War decimated the Aboriginal peoples of Tasmania.[42] The purpose

37. Cameron, *Grease and Ochre*, pp. 12–13.
38. Ibid.
39. Taylor, 'Savages or Saviours?, 73.
40. Ibid.
41. Patricia Cameron, Grease and Ochre: The Blending of Two Cultures at the Tasmanian Colonial Sea Frontier. (Masters Thesis, University of Tasmania, 2008), p. 131.
42. On the social history of the war as well as its impact on Aboriginal peoples and colonists alike, see Nicholas Clements, *The Black War: Fear, Sex and Resistance in Tasmania* (St Lucia, Queensland: University of Queensland Press, 2014).

of Robinson's expeditions to north-east Tasmania in 1830 and 1831 was to try to gather and exile the surviving Aboriginal peoples to Flinders Island. By the time the director of the Hobart Observatory arrived in Tasmania in 1839, the communities of the Bass Strait continued to survive and thrive, but the Aboriginal peoples exiled to Flinders Island were being ravaged by disease.[43]

THE LETTERS

Next, the letters. Read 'at a distance', in the context of the confident production of Coastal Plain's women's atmospheric knowledge, the trepidation with which Joseph Henry Kay sometimes handled precision instruments as well as the fragility of the instruments themselves is thrown into starker relief. Trepidation and fragility are not themes usually used to characterise the production of atmospheric knowledge in Australia.[44] Usually, the men who handled precision instruments are presented as confident and in control. They are presented as men who were robust, self-assured and determined. Charles Todd, for example, is often hailed for his hard work in laying South Australia's telegraph lines and for his innovative use of telegraph stations to communicate atmospheric observations.[45] And like the men who handled them, precision instruments have also tended to be treated as sturdy and unflappable pieces of European science in Australia. The experience of Kay at the Hobart Observatory shows how these characterisations reflect the ideal of the nineteenth-century observer and not necessarily the reality.[46]

Kay was born in London in 1815. While both his father and brother were architects, Kay pursued a different career. He joined the navy when he was twelve and in 1839, by the age of 24, was part of a major expedition to determine the existence of an Antarctic continent, to find the South Magnetic Pole and to map the earth's magnetic field – the so-called 'Magnetic Crusade'. To help meet the latter goal of the crusade, the expedition's leader, James Clark

43. Cameron, *Grease and Ochre*, p. 118.

44. For an important exception, see Simon Schaffer, 'Easily cracked: Scientific instruments in states of disrepair', *Isis* **102** (4) (2011): 706–717. Schaffer's pioneering research on broken precision instruments called attention to the importance of examining instruments' 'states of disrepair' and included an example taken from colonial Australia.

45. See, for example, Tony Rogers and Judy Ferrante, *The Weatherman from Greenwich: Charles Todd – 1826 to 1910* (Adelaide: South Australian Meteorological Association, 2017); Denis Cryle, *Behind the Legend: the Many Worlds of Charles Todd* (North Melbourne: Australian Scholarly Publishing, 2017).

46. On the masculine ideal of the nineteenth century observer in Britain, see Bruce Hevly, 'The heroic science of glacier motion,' *Osiris* **11** (1996): 66–86. Hevly describes how nineteenth-century field sciences such as glaciology favoured 'direct action, lonely commitment, and manly risk'.

Ross, established a network of observatories across the globe.[47] Hobart was the expedition's launchpad for reaching Antarctica as well as one of the proposed locations for a magnetic observatory. In 1840, the Hobart Observatory was hastily erected on the banks of River Derwent.[48] When the rest of the expedition sailed south for Antarctica, Kay was left behind and placed in charge of taking daily magnetic and meteorological observations with the help of two ships' mates.[49]

The atmospheric data that Kay collected were meant to serve two interrelated purposes. One was to help improve the understanding of the proposed relationship between magnetic and atmospheric variations. The other purpose was to contribute to knowledge of how winds and storms operated at sea.[50] Such knowledge was invaluable in the early nineteenth century, when wind still provided the main source of energy that connected Britain with its empire. The 'force and frequency of storms', one contemporary speculated, 'may have some connexion with the law of magnetic intensity'.[51] In an indication of the importance of not only the magnetical but also the meteorological work, Kay was given over twenty pages of instructions on how to use precision instruments to observe atmospheric variables.[52] Some of the instruments used to make these observations can be seen in an 1842 painting of the Hobart Observatory. The painting's prominent display of the instruments on tripods and tree stumps conveyed the message that even in this outpost of empire, European methods of observation had arrived (see Figure 2).

Yet not captured in the painting was the difficulty Kay faced in wielding precision instruments with confidence and accuracy in colonial Tasmania. Kay's outbound correspondence reveals that instrument breakages and faults were common at the Hobart Observatory. In 1843 Kay struggled, for example, to complete the wind column of his meteorological tables because of a faulty anemometer: 'I wish some good breeze would blow our anemometer away some

47. Ronald Green, 'Kay, Joseph Henry (1815–1875)', *Australian Dictionary of Biography*, http://adb.anu.edu.au/biography/kay-joseph-henry-2288 (accessed 10 Oct. 2019). For the details of the magnetic expedition, see Edward J. Larson, 'Public science for a global empire: The British quest for the South Magnetic Pole', *Isis* **102** (1) (2011): 34–59; John Cawood, 'Terrestrial magnetism and the development of international collaboration in the early nineteenth century', *Annals of Science* **34** (6) (1977): 551–587.

48. James Ross Clark, *A Voyage of Discovery and Research in the Southern and Antarctic Regions During the Years 1839–43, Vol. 1* (London: John Murray, 1847), pp. 108–109.

49. The National Archives at Kew (hereafter TNA), BJ 3/27: Letters concerning colonial observatories, 1839–49, letter from the Admiralty to Edward Sabine, 26 Oct. 1843.

50. Larson, 'Public science for a global empire', 37; Cawood, 'Terrestrial magnetism', 568–570.

51. William Reid, *An Attempt to Develop the Law of Storms by Means of Facts, Arranged According to Place and Time; and Hence to Point out a Cause for the Variable Winds, with the View to Practical use in Navigation* (London: John Weale, 1838), pp. 415–416.

52. For the meteorological instructions, see the Royal Society, *Report of the President and Council of the Royal Society on the Instructions to be Prepared for the Scientific Expeditions to the Antarctic Regions* (London: Richard and John E. Taylor, 1839), pp. 41–64, 69–77.

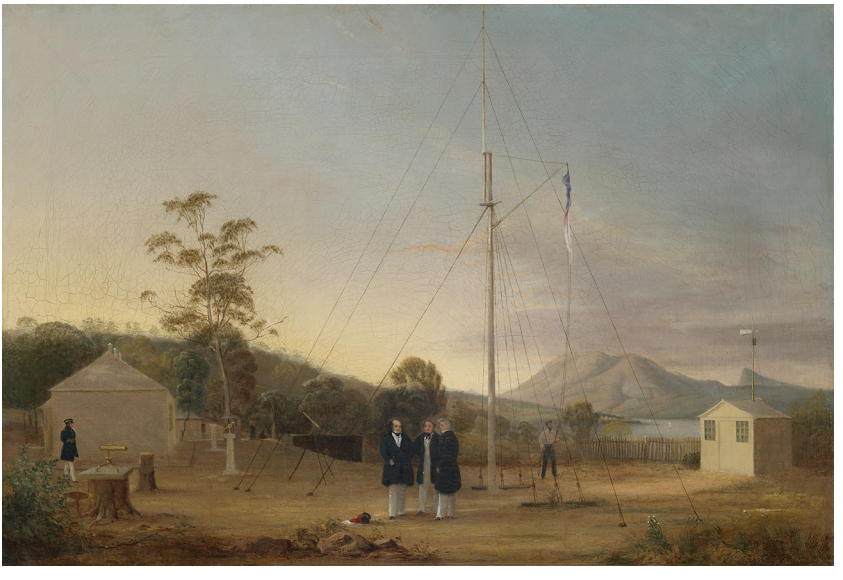


Figure 2. The three men in the centre of the painting are, from left to right, John Franklin, James Clarke Ross and F.R.M. Crozier. Joseph Henry Kay stands to the far left. Thomas Bock (1790–1855), 'Rossbank Observatory, Hobarton' (1842), oil 54.9 x 80.4. Presented by the Scott Polar Research Institute, Cambridge, 1948. Collection: Tasmanian Museum and Art Gallery (AG241).

day or at least that portion of it, which is supposed to represent the strength of the wind. It is truly a sorry affair and I have given up all hopes of making it gee'.[53] Three years later, Kay was still battling the anemometer. 'I have quite given up the idea of registering the force of the wind by Anemometer', he wrote, 'because the pressure plate is a total failure and with all my efforts I cannot make it act properly'.[54] And it wasn't just the anemometer that Kay found faulty. His correspondence brims with descriptions of various thermometers with broken stems, faulty seals, disconnected mercury and large index errors.[55]

Instrument breakages were a frustrating problem for Kay because of his separation from the men who could help him repair them. Even at the Greenwich Observatory, just outside London, faults with instruments were not uncommon. From Greenwich, however, the trip to central London's premier

53. TNA, BJ 3/44: Letters to Sabine from J.H. Kay at the Hobarton Observatory 1841–1850, letter from Kay to unknown 29 March 1843.

54. TNA, BJ 3/44: Letter from Kay to unknown, 7 May 1846.

55. See for example TNA, BJ 3/44: letter from Kay to Sabine 1 Oct. 1850, letter from Kay to Sabine 8 Sept. 1851; TNA, BJ 2/7: Letters to Ross from J.H. Kay at the Ross Bank Observatory in Van Diemen's Land 1841–1845, letter from Kay to Ross, 10 Aug. 1844.

instrument makers such as John Newman was not more than ten miles. By the mid-nineteenth century there were nearly 500 instrument makers inside London and over 300 in cities outside the capital.[56] But these numbers did little to help Kay in Tasmania. Kay's instruments were issued by the Admiralty and whether they came from London or Manchester they still had to cross 12,000 miles of ocean to reach him. Such distances made Kay acutely aware of the fragility of his instruments and the isolation of his post: 'It amuses me to see in the Greenwich Observatory when the same thing happens [instrument breakages] … they immediately send for Mr. Newman'. 'I wish there was a Mr. Newman in Hobarton', Kay wrote, 'directly an instrument goes wrong here – or is broken – we are done for.'[57]

When new and replacement instruments were sent to Kay in Hobart, he worried about whether they would survive the voyage to Australia. Sometimes instruments arrived intact such as in September 1843 when Kay was able to acknowledge the receipt of a hygrometer and dry and wet bulb thermometers made by Newman in London. All arrived safely, Kay reported, 'from being properly packed'.[58] The same could not be said of a new actinometer that had been sent to replace one that broke in the colony in 1844. Nearly four years after Kay reported the breakage, the new actinometer for measuring the intensity of radiation had arrived but it had been 'sent in such a state' that Kay could not 'make any of it': 'It fell to pieces', Kay reported, in his assistant's hands.[59] With the arrival of the broken actinometer, Kay described 'the mortification of knowing that we cannot get it replaced in under a year, unless some more Instruments are already on their way out – and all the observations will be lost which might have been made'.[60]

Another source of worry for Kay was the difficulty of communicating with the men who could advise him on how to use and make observations with his instruments. For the first three years of the Hobart Observatory's existence, Kay received no direct correspondence from his advisors in London including the superintendent of the magnetical and meteorological data drive, Edward Sabine. In January 1843, Kay confided to the Observatory's namesake, James Clark Ross, that he wished 'Col. Sabine had occasionally, even once, condescended to notice our observatory'.[61] Over a year later Kay conveyed the same message: 'As yet we have not heard one word from England – and you may imagine have been a little anxious to do so.'[62] Sabine had in fact written to

56. A.D. Morrison-Low, *Making Scientific Instruments in the Industrial Revolution* (New York: Routledge, 2016), ch. 1.
57. TNA, BJ 2/7: Letter from Kay to Ross, 10 Aug. 1844.
58. TNA, BJ 3/44: Letter from Kay, 10 Sept. 1843.
59. TNA, BJ 2/7: Letter from Kay to Ross, 10 Aug. 1844; TNA, BJ 3/44: letter from Kay to Sabine, 7 March 1848.
60. TNA, BJ 3/44: letter from Kay to Sabine, 7 March 1848.
61. TNA, BJ 2/7: Letter from Kay to Ross 8 Jan. 1843
62. TNA, BJ 2/7: Letter from Kay to Ross, 10 Aug. 1844.

Kay three times between 1841 and 1843, but it was only Sabine's third letter that finally reached Kay in late 1844.[63] Such multi-year delays between the dispatch and receipt of correspondence meant that instructions for instrument use and methods of observation reached Kay after he had already conducted thousands of observations. Kay only learnt in September 1845, for example, that he should have been recording wind direction by letters such as NNW for north-northwest.[64]

Kay was anxious that the issues he had with his instruments would tarnish his reputation. By the mid-nineteenth century, the enforcement of strict standards for observing precision instruments was common. Yet, as historians of science have shown, the perceived ability of an instrument user to meet these standards was sometimes based not only on skill but also social status.[65] As a lieutenant rather than a captain or Greenwich trained observer, Kay had a lower social status that many of his colleagues – a status reflected in Kay's peripheral positioning in the painting of the Observatory (Figure 2). This status meant that the issues Kay had with his instruments threatened to reflect badly on him as an instrument user. To help protect his reputation and that of his observations, Kay sent letters to Sabine in which he described the way he handled instruments in minute detail. In August 1846, for example, he drew a picture for Sabine of a broken thermometer with a long description of how the cause of the breakage lay with the maker and not himself. Part of the stem of the thermometer, Kay insisted, 'has been cut too short by the maker'.[66]

Yet even as Kay worked to protect his reputation, he also started to believe that the work was below his own status as a man and as an educated officer. In 1846, Kay described his health as 'much impaired' and his mind as 'much disarrayed' because of 'the excessive drudgery' of taking instrumental observations. 'No one can imagine', Kay argued, 'until they have tried it, what it is to keep up hourly observations for such a length of time.'[67] There can be little doubt that Kay's work was tiring and monotonous. But there were also connotations of both class and gender in Kay's complaints. To describe his grievances, he used words that were associated with women's work and the work of manual labourers: 'I am more than ever of the opinion of the unfitness

63. TNA, BJ 3/44: Letter from Kay to Sabine, 25 Sept. 1844. Correspondence sent to Sabine in July 1841 and Aug. 1842 from the physicist Humphrey Lloyd also appears to have been much delayed in reaching Kay, see Tasmanian State Archives, NS 37/1/76: Rossbank Magnetic Observatory Extracts from Letters of Lt. J.H. Kay, Extracts as Memoranda from the Correspondence about the Observatory and Instruments.

64. TNA, BJ 3/45: Copies of out letters from the Magnetic Department to the Hobarton Observatory 1842–1862, letter from Riddell to Kay 12 Sept. 1845.

65. Heinz Otto Sibum, 'Reworking the mechanical value of heat: Instruments of precision and gestures of accuracy in early Victorian England', *Studies in History and Philosophy of Science* **26** (1) (1995): 73–106.

66. TNA, BJ 3/44: Letter from Kay to Sabine 10 Aug. 1846.

67. TNA, BJ 3/44: Letter from Kay to unknown, 27 May 1846.

of officers (educated men) for the drudgery of these observatories', he wrote.[68] Kay's remarks reveal some of the tensions inherent in the nineteenth-century ideal of the male precision instrument wielder. It could be hard to be a robust and self-assured contributor to atmospheric knowledge when, perched on the edge of empire, instruments broke and support faltered.

Contributing further to Kay's frustrations was the tension between the demands of producing imperial atmospheric knowledge on the one hand and more local knowledge on the other. The guiding purpose of Kay's post was to help produce knowledge that could be abstracted from time and place, knowledge that could contribute to the understanding of whether there was a universal law governing the relationship between the earth's magnetic field and its atmospheric phenomena. In the earlier years of the Observatory, Kay was excited at being part of such a global imperial project. He described the satisfaction he felt at being 'one link in the chain of valuable results which must follow from such a widely spread and well connected system of observation, as is now pursued'.[69] But as the years wore on, and a universal law remained elusive, Kay began to doubt whether anyone would read, let alone make any use of, his data.[70]

At the local level, there was likely some truth to Kay's dispirited assessment. In 1852, Kay produced a table for the Royal Society of Van Diemen's Land showing the mean monthly and annual amount of rain that fell at Hobart over a twelve-year period. For the readers of the Society's proceedings, the table gave a useful indication of the seasonal distribution of rain within a year as well as an indication of how some years were wetter or drier than others.[71] But when the observations were compared with rainfall measurements recorded in northern Tasmania in 1849 it was obvious, as one colonist noted, how much 'rain falls in varying quantities at points not far distant from one another'.[72] While this insight was valuable in itself, it also exposed the limitations of Kay's data for colonists living in other parts of Tasmania. Kay's data could reveal seasonal patterns of rainfall peculiar to Tasmania's south-east where the Observatory was located, but not for other parts of the island. Away from the Hobart Observatory, in places such as the island's north-east, it was more local, situated knowledge that held out practical utility for colonists – knowledge such as that held by the Coastal Plains women.

68. TNA, BJ 3/44: Letter from Kay to unknown, 27 May 1846.
69. TNA, BJ 3/44: Letter from Kay to Sabine, 25 Sept. 1844.
70. TNA, BJ 3/44: Letter from Kay, 8 Sept. 1851. The observations gathered during the Magnetic Crusade did, however, help to reveal that the earth's magnetic field fluctuated in time with that of the sun. See Dry, *Waters of the World*, p. 130.
71. Joseph Henry Kay, 'Meteorological tables', *Papers and Proceedings of the Royal Society of Van Diemen's Land* **2** (1852–1853): 303–304.
72. James Barnard, 'Observations on the statistics of Van Diemen's Land for 1849', *Papers and Proceedings of the Royal Society of Van Diemen's Land* **2** (1852–1853): 33.

CONCLUSION

Gender is an essential category of analysis for understanding past human-atmosphere interactions. Yet understanding the range of its effects requires methodological innovation. The archival remains of atmospheric knowledge making, particularly for the nineteenth century, are skewed toward the rich paper trails of colonial observatories. The voices of those who were excluded from the observatory and its associated institutions are harder to find and are often only heard through the words of others. While it is possible to read gender in the abundant archival remains of colonial observatories, this is an approach that risks missing the insights provided by the scarcer archival sources or reducing those insights to a footnote. In this paper I have drawn on the work of social and cultural historians as well as historians of colonialism and science to advocate a three-pronged methodology for approaching the problem of the unbalanced atmospheric archive. This is a methodology that embraces the conjectural mode while being candid about uncertainty; that surrounds the scarce archival remains with other voices; and that reads the abundant archival remains in the context of the scarce.

In the case of colonial Tasmania, this methodology has revealed that gender relations shaped the way atmospheric knowledge was both produced and used by historical actors. The gender relations that prevailed in the island's north-east helped to ensure that it was the Aboriginal women of the Coastal Plains people who were treated by a particular group of colonists as the experts on atmospheric happenings. In the island's south-east, gendered expectations of male expertise were confounded by the material conditions of the distance that separated the Hobart Observatory from the British Isles as well as the patterns of weather that visited Tasmania. These findings reveal the value of looking beyond the abundant records of colonial observatories in order to understand the varied nature of nineteenth-century ideas of atmospheric expertise.[73]

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73. On the need for more spatially diverse histories of meteorology, see Martin Mahony and Angelo Matteo Caglioti, 'Relocating meteorology,' *History of Meteorology* **8** (2017): 1–14. As Mahoney and Matteo note, 'tracing more subtle interactions between different knowledge systems, and recovering voices expunged from institutional archives, will require methodological innovation'.